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Understanding Consumer Perceptions and Purchase Intentions of Electric Vehicles: An In-Depth Analysis

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Abstract

With the current depletion of fossil fuels and its price hikes, the need of the hour is an alternative source of energy for the vehicles. Electric Vehicles are the solution for the industry as well as for the environment in India. However, the current market penetration of electric vehicles is rather low. There is a need to study the factors influencing the consumer's acceptance of such electric cars. Various factors that influence the purchase decision of car buyers are based on individual perception of dimensions like environmental issues, cost, trust, technological advancement, infrastructure and societal acceptance. The results of the study show that positive environmental effects associated with electric cars along with the no costs of fuel involved happen to be the biggest motivators for the consumer when it comes to purchasing electric cars. On the contrary, cost of the electric car and lack of charging infrastructure happen to be the factors which demotivate adoption of electric cars. Thus, to promote the sales of electric cars the government has to play a leading role by developing satisfactory infrastructure, creating environmental policies, subsidizing the cost of the electric vehicles and providing financial incentives like lower interest rate on car loans and tax reductions on the purchase of electric cars. Through this paper, the potential scope of electric cars in the city of Kolkata will be studied and the consumer perception for same will be analysed.

Keywords: Electric Vehicles, Electric Cars, Consumer Perception, Fuel-Based Vehicles, Environment, Government Policies

Introductory Observations

The gradual and consistent trend of the proliferation of electric vehicles (EVs) in India has recently been observed. The Indian government has set forth ambitious goals to increase the adoption of EVs in the country. A range of incentives and policies have been implemented to promote the utilisation of EVs. The terminology EVs commonly elicits an initial inquiry regarding their definition and distinctive attributes. As conceptualized in the study, electric vehicles, whether hybrid or all-electric, are typically characterised as automobiles that function on electricity instead of conventional fossil fuels like petrol or diesel.

During the decade spanning from 2010 to 2020, there was a modest rise of 10.2 million in the worldwide quantity of automobiles. Nonetheless, this statistic has substantially increased since 2020, whereby the present approximations indicate a global aggregate exceeding 2 billion cars. The consensus is that the automobile represents modern-day civilisation's most pervasive and favoured means of transportation. BCG's analysis indicates significant potential for future advancements in these vehicles. Moreover, their impact on the ecological welfare of the planet will be more far-reaching. The automotive industry in India is positioned as the fifth largest in the world. The Compound Annual Growth Rate (CAGR) is anticipated to be 36%. The Indian state of Uttar Pradesh has registered the most significant sales of electric vehicles, with Karnataka and Tamil Nadu in close pursuit regarding sales statistics.

The current research aims to identify the critical factor influencing the decision to adopt or reject electric vehicles within the study's parameters. Further investigation is

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warranted to examine the factors contributing to the limited adoption of electric cars, despite their potential for long-term fuel savings and efficacy. It seeks to assess the likelihood of consumers switching from traditional automobiles to electric vehicles and determine the time required for this transition. To achieve accurate results, a reliable estimation is necessary. This study aims to ascertain the dominant electric vehicle models' popularity and the extent of consumer awareness regarding them.

Review of Background Literature

The present literature review provides a robust foundation for the study and offers valuable insights into the research gap the study aims to address. For a better understanding, the period of studies before and after 2015 have been bifurcated, as the EV sector made a significant development compared to these two periods.

Studies Post-2015

In their study, Tupe et al. (2021) observed the depletion of fossil resources and their increasing cost. This situation has compelled the automotive industry to explore alternative energy sources for powering automobiles, with electric vehicles emerging as a potential solution to India's economic and ecological challenges. Despite governments implementing EV policies, the market penetration of EVs remains relatively low. Hence, this study aims to investigate the potential market for electric cars in India and evaluate consumer perceptions towards them.

Kumar and Padmanabhan's (2019) findings highlight the urgent need to address global pollution and mitigate greenhouse gas emissions. Electric vehicles have been identified as one solution to minimise carbon dioxide emissions from the transportation sector, significantly contributing to greenhouse gas emissions. The Indian government has developed a comprehensive strategy, the National Electric Mobility Mission Plan 2020, to accelerate the global adoption of electric vehicles and integrate them into the domestic automotive industry. However, the transition from internal combustion engines to electric engines in India poses substantial challenges that require careful planning and significant investment in research and development. Establishing a robust charging infrastructure is crucial to alleviate range anxiety, while incentives like tax reductions and exemptions can stimulate demand by encouraging the adoption of electric vehicles.

Kesari and Goel (2019) acknowledge the significant challenges of implementing electric vehicles in India. Nonetheless, they emphasise the importance of a robust government plan to ensure the successful adoption of this technology. Given India's unique topography and demographics, tailored solutions must be developed to address the challenges that may arise. The deployment of electric vehicles in governmental establishments, public transportation such as quadricycles, tricycles and buses and collaborations with firms like Ola, Uber, Swiggy and Zomato are expected to drive the initial growth of electric cars with two- and four-wheelers. However, the widespread acceptance of privately-owned electric vehicles may require 5–6 years.

Arasan and Sivakumar (2018) emphasise the potential pollution reduction and consumer benefits of transitioning from internal combustion to electric engines. Several countries are already implementing this approach to improve their ecological conditions. The researchers considered various alternatives, including industrial, battery-related, governmental and environmental factors, while also addressing challenges such as electric vehicles' cost-effectiveness, efficacy in the Indian context and market demand. The primary focus of electric vehicle deployment in the Indian market is to reduce oil costs and mitigate greenhouse gas emissions. Thus, the government's current priority is to optimise available opportunities and devise effective strategies to overcome obstacles.

Studies Before 2015

According to Kumar and Dash (2013), India could address local power load management issues instead of pursuing an immediate nationwide transformation as a starting point. Encouraging the public to charge their electronic devices primarily at home is recommended. Before making substantial enhancements to the EV charging infrastructure, careful consideration must be given to safety protocols, optimal placement, potential traffic congestion

and demographic factors. The integration and collaboration between the transportation and energy sectors hold significant importance in this regard. The proliferation of electric vehicles is expected to increase through innovative programs and policies, such as providing financial incentives and benefits like tax credits, toll discounts and purchase subsidies to electric vehicle drivers.

Marc (2013) examined the emergence and trajectory of electric mobility, both before and after 2005. The study argued for an upward trend in structured car-sharing and intermodal transportation, which rising oil prices have accelerated. Electric mobility is experiencing substantial development and many advancements are anticipated to become increasingly relevant. Various factors, including changes in infrastructure, mobility patterns, the global automobile market, energy prices, climate policies and the electrical industry, influence vehicle engine technology's progress.

Offer and North (2012) emphasized that the long-term acceptance of electric vehicles depends significantly on the availability of a suitable recharging infrastructure and advancements in battery technology.

Thiel (2012) conducted a comprehensive study on the attitudes and perceptions of drivers in six European countries (France, Germany, Italy, Poland, Spain and the United Kingdom) towards electric vehicles. The research assessed drivers' familiarity with electric cars and their features. The study collected approximately 600 responses from drivers in each country, revealing that European drivers recognise the potential advantages of electric vehicles. However, specific prerequisites must be met to establish them as a reliable mode of transportation.

There needs to be more research regarding how much government participation contributes to infrastructure development and implementing cost-reducing technology in the electric vehicle market. Furthermore, examining the level of trust consumers place in government policies and infrastructure concerning EV market development is crucial.

Research Methodology

The research employed a non-probabilistic sampling approach to ensure a broader demographic representation. Specifically, a convenience sampling technique was utilized to draw conclusions based on factors such as geographical proximity, availability of time for research and respondents' willingness to participate. The sample size in this study refers to the total number of participants who contributed to the survey and can be further categorised into subpopulations based on various demographic variables. In this particular study, the sample size consists of 129 participants. The scope of the investigation is primarily limited to the region of West Bengal, as the objective was to examine the populace in this area thoroughly. The study participants included individuals aged 18–50, encompassing students, salaried professionals and private entrepreneurs.

The sampling unit of the study comprises respondents with diverse demographic characteristics, ranging from students to salaried professionals who have completed the questionnaire. This study aims to gather consumer perceptions of EVs through a questionnaire. The data analysis uses pie charts and bar graphs to present the findings effectively. The study is categorised as descriptive research, aiming to investigate various factors related to EVs, including consumer attitudes towards EVs, the development of charging infrastructure and government policies. The questionnaire utilized in the study incorporates a 5-point Likert scale in select questions to facilitate a more comprehensive understanding of consumer perceptions.

The nature of the data gathered is primary, as it was directly obtained from the participants through an online questionnaire. The study sample predominantly comprises undergraduate and graduate students aged 18 to 25. Secondary data sources, such as journals and analytical reports from consultancy firms like BCG, have been utilized to supplement the study's findings with real-time market scenarios.

Demographic Profile

In the sample of 129 participants, 77 identified as male and 52 as female. Based on the data, it can be inferred that in contemporary developing societies, women have actively engaged in an electric car survey and expressed their perspectives on the topic. This marks a departure from traditional attitudes that were more restrictive in nature. The data indicates that a significant proportion of the participants fall within the age bracket of 18–25 years (69%). The age group of 26–30 had the second highest representation among the respondents, accounting for 13% of the total sample. In contrast, the age group of less than 18 had a lower expression, comprising only 8 percent of the model. In terms of educational background, a majority of the participants (approximately 57%, or 74 individuals) are presently enrolled in a Bachelor's degree program. This suggests that they possess up-to-date knowledge and are familiar with current curricula and market trends, enabling them to provide accurate interpretations. Approximately 15% of individuals are professionals who are actively engaged in pursuing their respective professional courses. As a result, they possess a comprehensive comprehension of the practical functioning of the industry and corporations, enabling them to furnish data based on their practical experiences. The survey results indicate that most respondents, precisely 70.5%, are currently enrolled in college. Additionally, 13.17% of respondents identified as part of the service or salaried class, while 13% reported being professionals in their respective fields. Subsequently, a proportion of 12.9% represents self-employed individuals, while 6.7% and 2% represent professionals and unemployed/retired individuals, respectively. According to the analysis, 74 out of 129 respondents (57.3%) reported not earning any annual income. Approximately 12.4% of the participants fall within the income range of INR 1,00,000–INR 3,00,000, which predominantly consists of individuals who are either employed or self-employed, as depicted in the analyses above.

Key Findings

Based on the data mentioned above analysis, the ensuing findings and subsequent discussions constitute the focal points of this study. Initially, it is possible to summarise the primary factors contributing to the acceptance or rejection of electric vehicles in India.

Table 1: Primary Factors Contributing to the Adoption and Rejection of EVs

Basis	Determinant Factors	Degree of Acceptance/ Rejection
Adoption	Lack of Gasoline Costs	73%
	Positive Environmental Effect	59%
	Low Maintenance Cost	44%
	Charging Points Availability	21%
	High Resale Value	14%
Rejection	Lack of Charging Infrastructure	71%
	Time Taken to Recharge the Battery	66%
	Lack of Variety in Cars	59%
	Lack of Trust in New Technology	51%
	Cost	20%

Source: Authors' Conceptualization based on Field Data Collection.

The table above explains why electric vehicles are restricted in India, despite their potential for sustained fuel conservation and enhanced efficacy.

Table 2: Limited Uptake of Electric Vehicles

Basis	Investigation
Knowledge About EVs	The consumers have significantly less knowledge leading to consumer unawareness.
Source of Information	Consumers don't get much knowledge from E-Magazines/Newspapers. Television and Word of Mouth are also the least compelling.
Consumer Perception of EV Adoption in India	Most consumers believe that full adoption will take 10-15 years.
Government Policies	From the above negative factors, it can be inferred that Government policies are not working effectively.

Source: Authors' Conceptualization based on Field Data Collection.

Given that the present study assesses consumers' inclinations, the viewpoints are summarised in the table below.

Table 3: Adoption and Rejection Bases Explaining Respondents' Inclinations towards EVs

Basis	Determinant Factors	Remarks
Adoption	Level of Consumer Awareness	Most consumers know all the EVs ranging from 10 lakhs to 1.2 Crores.
	Sources of Information	Primary sources of Information are social media and the Internet.
	The transition from Conventional to EVs	Consumers are very optimistic about the future of this sector. Around 70% are ready to switch.
	Likeliness to Buy an EV	Every 2 out of 3 respondents believe their next vehicle will be electric.
	In the context of Indian traffic	Cost savings in long jams in most of the cities in India is an essential factor here.
Rejection	Level of Consumer Awareness	Consumers need to gain more knowledge about the benefits of EVs.
	Sources of Information	Televisions and word of mouth are the minor informative sources here.
	The transition from Conventional to EVs	Every 2 3 respondents are not influenced to transit from conventional to electric vehicles.
	Likeliness to Buy an EV	Around 70% of the respondents are not likely to buy an EV

Source: Authors' Conceptualization based on Field Data Collection.

Discussion

The 129 respondents are categorised under three sections, which are demonstrated as under:

"I am aware of Electric Cars, and I am currently using one or plan to use one shortly."

The current segment comprises 86 participants out of 129 (66.67%). The primary driver for consumer adoption of electric vehicles is the absence of fuel costs, as 73% of the survey participants indicated. This trend is likely influenced by the current inflationary environment and the desire to accrue savings for the future. The "Positive Environmental Effect" emerged as the second most prevalent motivator among the participants in the study. Subsequently, the section titled "Financial Benefits" ensues. There is increasing recognition among consumers regarding the mitigation of climate change, leading to a greater willingness to advocate for this cause. As a result, there is a growing belief that electric vehicles can serve as a crucial component in this effort. Factors such as low maintenance cost, high resale value and availability of charging points are special considerations. Moreover, it is worth considering whether prospective EV consumers know the existing EV models available. Consumer knowledge is crucial for the industry, as a lack of consumer awareness can impede the sector's growth. Based on the advantages above and the preceding analysis, it can be deduced that the EV industry holds a promising future. Furthermore, consumers, regarded as the cornerstone of any enterprise, are willing and motivated to procure EVs despite being cognizant of the existing battery, charging and infrastructural obstacles.

Therefore, upon considering these factors, most consumers (60%) opine that India will require 5–10 years to transition to EVs fully. Additionally, a minority (30%) believe that the challenges above will necessitate a more extended period, possibly 10–15 years, to be resolved.

Approximately 68% of the surveyed consumers have preferred transitioning to an EV. Subsequently, a proportion of 20% fall under the neutral classification and exhibit ambivalent perspectives regarding its future trajectory. The remaining 10% of individuals are comparatively less inclined to transition to electric vehicles, believing the electric vehicle industry will require more than a decade to mature.

"I am aware of Electric Cars, but I have NO intention of using one in the near future."

This segment comprises 41 participants out of 129, representing 31.8% of the sample. Insufficient charging station infrastructure and the imperative of future savings, driven by various controllable and uncontrollable factors, have emerged as pressing concerns. The primary deterrent for consumers in purchasing an electric vehicle is the need for more charging infrastructure, as evidenced by current trends. Among the sample, the second most prevalent De-motivator was "Time to Recharge the Battery" and "Range Anxiety." This was followed by "Lack of Variety of Choices in Car," "Lack of trust in New Technology" and "Cost." The cost of maintenance is minimal.

Approximately 49 percent of consumers believe that electric vehicles do not possess low maintenance costs due to the perceived extended time required for battery charging, which may reduce their overall productivity. Due to the market's underdevelopment and the need for further expansion into small towns and cities, it has been observed that there needs to be more availability of products in this sector. Consequently, a few companies have monopolized the market, resulting in elevated costs.

Our analysis indicates that consumers need more awareness regarding the various models of electric cars. However, it is crucial to consider how consumers obtain this information, as it can facilitate outreach to distant consumers by leveraging underutilised communication channels.

Based on the analysis mentioned earlier and the demotivating factors outlined, it can be deduced that the outlook for the EV industry is unfavourable, as indicated by the respondents. Furthermore, it is noteworthy that consumers, who are fundamental to any company, need more motivation to acquire EVs due to the perceived challenges associated with charging stations and infrastructure.

"I don't know what Electric Cars are."

This particular section of the study yielded a response rate of 1.5%, with only two out of 129 participants providing data. Only two participants expressed unfamiliarity with electric vehicles, citing a lack of interest in automobiles as the rationale behind their response. Furthermore, it is believed that within the framework of Indian traffic, autonomous vehicles may not be the most advantageous option but rather moderately beneficial. As a result, it is projected that India will require approximately a decade to embrace this technology fully.

The preceding text provides an overview of the perspectives held by the two respondents regarding the given scenario. Despite the relatively small proportion of individuals having this viewpoint (1.5%), its potential impact on the country's broader population and, by extension, the world should not be underestimated.

Industries and companies must acknowledge the significance of the individuals who need more awareness regarding EVs, as they need to pay attention to this demographic to ensure their long-term success. The survey in urban areas revealed that 3 out of 200 individuals need to be made aware of EVs, indicating that this knowledge gap is more comprehensive than in rural regions. This suggests that industries should prioritise their efforts towards engaging with the final individual on the planet to supplant fossil fuel-powered automobiles on a worldwide scale effectively.

Managerial Implications

The findings of the present study indicate that the purchasing decisions of consumers who are either inclined or disinclined to buy electric vehicles are primarily influenced by the perceived advantages in terms of environmental impact and financial gains. This will facilitate the assessment of current government policies, as individuals who are discouraged from purchasing vehicles due to concerns regarding cost, durability, safety and insufficient trust in charging stations and batteries indicate that while the government may be addressing these issues, the effectiveness of their implemented practices and policies is inadequate. Consequently, there is a necessity for a shift in these policies.

The research can be undertaken to examine the significance of the government's role. The impact of government involvement can be analysed in various domains, such as incentives and tax exemptions. A potential area of future research is examining the trust factors implicated in the development of EVs. The trust parameter of EVs has yet to be extensively explored in existing literature, indicating a need for a comprehensive investigation.

Therefore, it is recommended that corporate managers prioritise the active involvement of government officials, electric car manufacturers and entrepreneurs. This collaboration is necessary to establish the essential infrastructure and amenities to facilitate the widespread adoption of electric vehicles. It is recommended that measures be implemented to combat pollution levels through the promotion of electric cars and the provision of subsidies for the acquisition of such vehicles. To enhance the production of electric cars, the government should consider relaxing the Foreign Direct Investment regulations and incentivising emerging brands to introduce their models in the domestic market.

Several factors hinder electric vehicle adoption, including inadequate infrastructure, high costs and a lack of trust in emerging technologies. While individuals recognise electric cars' global climate conditions and environmental advantages, these obstacles impede the transition from conventional to eco-friendly vehicles. The current imperative is to promote technological progressions, such as cost reduction of batteries and establish additional infrastructural amenities, such as charging stations.

The education of consumers is crucial in the context of EVs, as the novelty of this technology has left many individuals needing more knowledge regarding its pertinent facts and figures. This hinders their ability to make well-informed decisions regarding the acquisition of electric vehicles, and they may also need to gain more knowledge regarding the various advantages associated with integrating electric cars. Implementing measures to educate consumers regarding the latest technological advancements is imperative to expedite the widespread adoption of EVs.

Conclusive Remarks

The present study sought to attain its objectives by examining the perceptions of consumers and the factors that impact their decision-making process when acquiring electric vehicles. The study aimed to investigate the probability of consumers transitioning from traditional automobiles to electric ones and evaluate their overall comprehension of electric cars. The results offer a theoretical grasp of individuals' viewpoints as consumers and illuminate crucial variables that impact their decision-making process.

The findings of the analysis indicate that the participants of this research exhibited a propensity to shift from traditional automobiles to environmentally sustainable ones, signifying a considerable degree of consciousness concerning the ecological advantages of EVs. Even with the potential benefits of EVs, various obstacles impede their extensive implementation. The impediments encompass inadequate infrastructure, exorbitant pricing and consumer skepticism toward emerging technologies.

The price consideration assumes a crucial role for prospective purchasers of electric vehicles. The study participants indicated a willingness to contemplate the acquisition of electric cars in the future, provided that the requisite infrastructure, including a sufficiently extensive network of charging stations, is put in place. However, the primary challenges in promoting the adoption of EVs among consumers are the high purchase cost, inadequate charging infrastructure and prolonged battery recharge durations.

Additional investigation and implementation efforts are imperative to tackle these obstacles and facilitate the widespread acceptance of EVs. Subsequent research endeavours should prioritise the investigation of efficacious methodologies for surmounting barriers regarding cost, infrastructure and consumer confidence. It is recommended that policymakers, industry experts and stakeholders engage in a collaborative effort to establish programs aimed at improving the accessibility of EVs, broadening the scope of charging infrastructure and educating consumers on the benefits and dependability of electric cars.

By effectively addressing these concerns and fostering consumer confidence in EVs, it is possible to expedite the shift toward sustainable transportation and mitigate the environmental repercussions of traditional automobiles.

Scope for Further Research

Further research is necessary to examine the prospective market for EVs in India and rectify the current deficiencies in understanding. Although preliminary research has indicated a potential market opportunity, further inquiry utilising expanded sample sizes and a broader spectrum of variables is imperative to substantiate these conclusions.

An area of scholarly inquiry that warrants exploration is examining the government's role in promoting the adoption of EVs within the nation. The present study aims to investigate diverse dimensions of governmental intervention, such as incentives, financial assistance, technological progress and infrastructure development, to comprehend their impacts on the uptake and approval of EVs within the Indian consumer market. Through acquiring comprehensive knowledge regarding the consequences of governmental policies and interventions, decision-makers and interested parties can formulate efficacious tactics to facilitate the widespread adoption of electric vehicles.

The pivotal trust factor significantly influences the commercial adoption of EVs in the Indian market. Nonetheless, a conspicuous deficit of confidence in electric cars exists among consumers. Additional inquiry is necessary to address this lack of trust. A thorough investigation may be undertaken to comprehend the variables responsible for the absence of confidence and examine plausible remedies for establishing consumer confidence in electric vehicles. Mitigating barriers to adoption can lead to increased market acceptance by addressing concerns related to trust.

A thorough examination is imperative to comprehensively comprehend the impact of diverse factors on the perception of EVs among consumers and their buying behavior. The present study aims to investigate various individual factors that may influence consumer perception, including but not limited to price, range, charging infrastructure, environmental impact and performance. The research evaluates these factors' relative significance and impact on consumer perception. A detailed analysis that delineates the effects of individual elements on the adoption of EVs can furnish significant perspectives for manufacturers, policymakers and marketers.

Furthermore, it is imperative to acknowledge and tackle the constraints identified in prior research. The absence of a randomised sampling technique has considerably limited the extent to which the findings can be applied to the broader population. Using random sampling methodologies in future research endeavours can guarantee that chosen participants precisely represent the entire populace, consequently augmenting the credibility and dependability of the outcomes. Furthermore, a comprehensive analysis of the influence of demographic differences on the results of the primary investigation is necessary to detect any potential biases and guarantee a holistic comprehension of the factors that affect the adoption of EVs.

A more wide-ranging understanding of the market potential for EVs in India can be attained by conducting additional research in these domains. The results obtained from these investigations possess the potential to guide decision-makers, practitioners and interested parties in devising efficacious tactics to expedite the integration of electric automobiles and encourage environmentally-friendly transportation practices within the nation.

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