A Study of Select Variables Impacting Buying Behaviour of Electric Cars In India

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Abstract: The automobile industry is currently undergoing a significant transformation in its approach to transportation, primarily driven by increased awareness of climate change and limited resources. The recent resurgence of electric vehicles in the market can be attributed to various factors, including advancements in battery technology and government policies aimed at reducing vehicle emissions. This research focused on examining the factors that influence consumer purchasing behavior regarding electric cars in India. Primary data was collected through a self-administered questionnaire distributed to consumers. The survey sample was selected using a combination of conventional and snowball sampling techniques, drawing participants from the target population. The study and survey took place in the Delhi/NCR region from January to February 2023. A total of 649 questionnaires were distributed, out of which 324 were returned. After analysing the data, 214 fully completed responses were used for further analysis. The findings indicated that financial barriers, concerns about vehicle performance, lack of charging infrastructure, environmental awareness, societal influence, and knowledge of electric vehicles all significantly impact the decision-making process when considering the purchase of electric vehicles.

Keywords: automobile, electric vehicle, barriers, market, buying behaviour

Introduction

In recent years, climate change has emerged as a prominent concern on political agendas worldwide. The impact of global warming is becoming increasingly evident, manifested through rising sea levels, escalating temperatures, and more frequent occurrences of extreme weather events. Governments and policymakers have acknowledged the urgent need to confront this issue and have taken measures to implement policies aimed at reducing greenhouse gas emissions and alleviating the consequences of climate change. An exemplary instance of international collaboration in addressing this matter is the Paris Agreement, which was signed by over 190 countries in 2015. It is crucial that we continue to prioritize the mitigation of climate change and strive towards a sustainable future for future generations.

The mobility landscape within the automobile industry is currently undergoing a notable transformation. This shift can be primarily attributed to the increasing recognition of climate change and the scarcity of resources. As a consequence, industry pioneers are reconsidering traditional modes of transportation, particularly gasoline-powered vehicles. Instead, there is a growing emphasis on adopting sustainable and eco-friendly alternatives like electric and hybrid cars. Additionally, the industry is actively exploring innovative approaches to decrease emissions and enhance fuel efficiency. This evolving outlook underscores the significance of adapting to evolving societal and environmental demands, and the automobile industry is taking proactive measures to spearhead this critical transition.

The resurgence of electric vehicles in the market can be attributed to a combination of factors, including advancements in battery technology and government policies aimed at reducing vehicle emissions. The improved efficiency and reduced cost of producing lithium-ion batteries have played a significant role in the growing popularity of electric vehicles. Additionally, governments worldwide have been incentivizing citizens to transition to electric vehicles by offering tax credits, rebates, and other advantageous schemes. The global movement towards cleaner energy sources and the desire to minimize carbon footprints have also contributed to the increasing adoption of electric cars. As consumer awareness and environmental consciousness continue to rise, electric vehicles are becoming a more appealing choice. Overall, the renewed presence of electric vehicles signals a promising shift towards a greener and more sustainable future.

When comparing electric vehicles (EVs) to internal combustion engine vehicles (ICEs), it becomes apparent that EVs offer significant advantages both in terms of the environment and the economy. One of the most notable environmental benefits of EVs is their ability to produce zero tailpipe emissions, leading to a substantial reduction in air pollution and greenhouse gas

emissions. This reduction in emissions not only minimizes environmental damage but also contributes to the improvement of public health. Moreover, EVs exhibit lower operating costs compared to ICEs, primarily due to their higher efficiency and reduced maintenance requirements. By embracing EVs, we can address the increasing energy demand in a more sustainable manner while also reducing our reliance on fossil fuels. In summary, the transition towards EVs presents a promising opportunity for a transportation future that is cleaner, more sustainable, and economically favourable.

With the increasing awareness of the environmental impact of our actions, the demand for eco-friendly products has grown significantly. However, despite the evident environmental benefits, there are still several obstacles that hinder consumers from fully embracing and adopting these products. One of the primary barriers is the higher cost associated with eco-friendly options compared to their conventional counterparts. Especially during times of financial difficulty, many consumers prioritize affordability over environmental considerations. Additionally, the lack of awareness and knowledge regarding eco-friendly alternatives and their advantages can also impede consumer adoption. Customers may be unaware of the range of available products or how to effectively utilize them. Hence, it is crucial for companies and organizations to persistently promote eco-friendly products and educate consumers about their benefits to encourage broader acceptance. In the context of the aforementioned discussion, this study examined the factors that influence the purchasing behavior of electric cars in India.

Literature review and hypotheses development

According to the findings of Nataraj (2012), customer satisfaction is significantly influenced by the ease of navigation and the quality of car manufacturers' websites. In the study conducted by Kohli (2020), technological attributes of passenger cars were categorized into four groups: attractive, must be, one-dimensional, and indifferent. Among these categories, the "Auto Gear Shift" system was identified as a must-have attribute.

According to **Panwar (2019)**, there are several significant barriers to the adoption of electric vehicles (EVs) in India. These barriers include India's heavy dependency on fossil fuels, the absence of sufficient lithium reserves, challenges related to grid integration, the potential burden on the grid caused by the increased electricity demand from EVs, and the inadequate infrastructure for charging stations.

In **Tarei's (2021)** study, multi-criterion decision-making tools were employed to identify various barriers to electric vehicle (EV) adoption in India. The study found that technological, infrastructural, financial, behavioral, and external factors contribute to these barriers. Specifically, performance and range of EVs, total cost of ownership, shortage of charging infrastructure, and lack of consumer awareness about EV technology were identified as critical factors influencing the adoption of EVs in India. According **to Bansal (2020**), government policies and investments made by Indian automotive makers are facilitating the adoption of electric vehicles (EVs) in India. Additionally, **Tarei (2021)** suggests that there are interconnected relationships among the barriers to EV adoption in India. To effectively address these barriers, policymakers should prioritize specific high-priority barriers or sub-barriers and allocate resources accordingly.

Financial barriers and buying behaviour of EVs

Financial obstacles play a crucial role in influencing consumers' buying behavior towards electric vehicles (EVs). The higher initial purchase cost of EVs compared to traditional gasoline-powered vehicles is often cited as a major deterrent. Although the overall ownership cost of EVs is typically lower, the upfront investment can pose a significant financial burden for some potential buyers. Moreover, concerns related to the availability and affordability of charging infrastructure further contribute to the impact of financial barriers on EV adoption. However, as the market offers a wider range of EV models and governments introduce more incentives and rebates, the financial barriers associated with purchasing EVs are gradually diminishing. Consequently, consumer behavior is shifting towards embracing more sustainable transportation alternatives. Thus, we propose the hypothesis that financial barriers significantly influence the buying behavior of EVs.

H1. Financial barriers have a significant impact on the buying behavior of EVs.
Vehicle performance barriers and buying behaviour of EVs.

The adoption of electric vehicles (EVs) in the global market is influenced by two interconnected factors: vehicle performance barriers and consumer buying behavior. Performance barriers, such as limited range, lengthy charging times, and high upfront costs, have been identified as significant obstacles that impact consumers' decision-making process. Conversely, buying behavior is shaped by various factors, including consumer awareness, perceptions of EVs, government incentives, and access to charging infrastructure. In recent years, automakers have made efforts to overcome performance barriers by introducing new EV models with extended ranges and faster charging capabilities. Additionally, governments have implemented policies such as tax incentives and subsidies to incentivize consumers to embrace EVs. Nevertheless, further improvements are necessary to address consumer concerns and enhance EV performance, thereby expediting the widespread adoption of EVs. Therefore, we assert that

H1. Vehicle performance barriers significantly impact buying behaviour of EVs

2.3 Lack of Charging Infrastructure and buying behaviour of EVs

The insufficient availability of charging infrastructure poses a significant obstacle to the rapid expansion of the electric vehicle (EV) market. This deficiency is a primary concern for drivers, as it perpetuates range anxiety and impedes widespread EV adoption. Despite the numerous advantages offered by EVs, such as reduced carbon emissions and lower operational expenses, the absence of an extensive charging infrastructure remains a key limiting factor for many prospective consumers. Consequently, automobile manufacturers are confronted with the task of addressing this challenge and devising innovative solutions that incentivize customers to embrace EVs. The purchasing behavior of potential EV owners is heavily influenced by the presence and convenience of charging stations. Thus, the establishment of a comprehensive and accessible charging network is indispensable for the sustained growth and prosperity of the EV market. Therefore, we assert that

H3. Lack of charging infrastructure significantly impact buying behaviour of EVs

2.4 Environmental Concern and buying behaviour of EVs

In recent years, there has been a noticeable rise in environmental concerns, leading many consumers to actively seek eco-friendly alternatives in their purchasing decisions. This shift is particularly evident in the automotive industry, where electric vehicles (EVs) have experienced a significant surge in popularity. EVs are widely regarded as a more sustainable and environmentally conscious option compared to traditional gasoline-powered cars. Consequently, consumers are now prioritizing the environmental impact of the products they buy, including their vehicles. The increasing adoption of EVs reflects consumers' growing awareness of their carbon footprint and their proactive efforts to choose products that minimize their environmental impact. Therefore, we assert that

H4. Environmental concern significantly impacts buying behaviour of EVs

2.5 Societal Influence and buying behaviour of EVs

The impact of societal factors on the buying behavior of electric vehicles (EVs) has garnered increasing attention in recent years. With a growing emphasis on environmental sustainability and the imperative to reduce carbon emissions, various stakeholders including governments, industry players, and consumer advocacy groups are actively promoting the adoption of EVs. Social norms, values, and beliefs regarding the importance of environmental protection, as well as the perceived social status associated with owning an EV, significantly influence consumers' decision-making processes. Additionally, the availability of government incentives, subsidies, and the expanding network of charging stations have made EVs more accessible and appealing to a wider audience. It is evident that societal norms and values play a pivotal role in shaping the buying behavior of EVs, and this trend is poised to continue as an increasing number of individuals embrace environmentally conscious practices and strive for sustainable lifestyles. Therefore, we assert that

H5. Societal influence significantly impacts buying behaviour of EVs

2.6 Awareness of EVs and buying behaviour of EVs

As the popularity of electric vehicles (EVs) continues to grow, it has become increasingly crucial for consumers to possess knowledge about the advantages and disadvantages of this emerging technology. EVs offer benefits such as environmental friendliness and cost-effectiveness, along with a unique driving experience. However, consumers must also be mindful of the limitations of EVs, including restricted range and longer charging times. Consequently, conducting research and

comparing different EV models is essential before making a purchase. Ultimately, the buying behavior of EVs should be driven by informed decision-making to ensure that consumers can fully capitalize on the benefits that EVs have to offer. Therefore, we assert that

H6. Awareness of EVs significantly impacts buying behaviour of EVs

3. Research methodology

Consumer data was collected through a self-administered questionnaire to obtain primary data. Samples for the survey were selected from the target population using a combination of conventional and snowball sampling techniques. The study and survey took place in the Delhi/NCR region between January and February 2023. A total of 649 questionnaires were distributed, resulting in 324 questionnaires being received. Among these, 214 responses were deemed fully complete and were subsequently utilized for further data analysis. To measure the variables of financial barriers, vehicle performance barriers, lack of charging infrastructure, environmental concern, societal influence, and awareness of EVs, an established scale from a previous study conducted by Sriram et al. (2022) was adopted. Exploratory factor analysis and multiple regression analysis were performed using the SPSS software.

4. Data analysis

4.1 Exploratory factor analysis

Exploratory factor analysis is a statistical technique used to identify underlying factors or dimensions in a data set. This technique is often employed in research studies to uncover the underlying structure of a set of variables. The goal of exploratory factor analysis is to determine how many factors are needed to explain the data and what variables are most strongly related to each factor. To explore the factors affecting buying behaviour of EVs, exploratory factor analysis (EFA) technique were used to analyse it. For this study a Principal Components Analysis (PCA) (Tabachnick and Fidel 2012) of the items from the construct was implemented. Factor analysis is performed on the 22 items, using principal component analysis method. Principal components analysis revealed the existence of six components with eigen values above one for analysed groups of respondents. The factor loadings were found satisfactory and uni-dimensionality of each construct was assured.

Table 1. EFA results

Variable	No. of items	α	KMO	TVE%	Standardized Factor Loadings
Financial barriers	8	0.694	0.682	57.82	0.672-0.826
Vehicle performance barriers	6	0.712	0.776	53.43	0.683-0.879
Lack of charging infrastructure	3	0.749	0.761	48.21	0.734-0.842
Environmental concern	3	0.656	0.754	46.11	0.677-0.793
Societal influence	3	0.728	0.746	45.46	0.543-0.801
Awareness of EVs	2	0.694	0.654	44.82	0.621-0.716

4.2 Impact of financial barriers, vehicle performance barriers, lack of charging infrastructure, environmental concern, societal influence, and awareness of EVs on buying behaviour

Regression analysis was employed to examine the influence of various factors, namely financial barriers, vehicle performance barriers, lack of charging infrastructure, environmental concern, societal influence, and awareness of EVs, on buying behavior.

Table 5. Regression analysis

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	81.31	7.687		10.386	0.000
	Financial barriers	.981	0.289	0.228	4.585	0.000
	Vehicle performance barriers	0.423	0.159	0.443	9.220	0.000
	Lack of charging infrastructure	0.139	0.088	0.239	3.495	0.000
	Environmental concern	0.332	0.119	0.424	4.778	0.000
	Societal influence	0.476	0.129	0.376	6.827	0.000
	Awareness of EVs	0.676	0.145	0.425	7.817	0.000
a Dependent Variable: CGPA score						

From table 5, it is found that financial barriers, vehicle performance barriers, lack of charging infrastructure, environmental concern, societal influence, and awareness of EVs significantly impacts on buying behavior of EVs.

5. Discussion and conclusion

In recent years, electric vehicles (EVs) have gained traction as a greener alternative to conventional gasoline-powered cars. However, despite their environmental advantages, there are still several obstacles hindering widespread EV adoption. These barriers encompass financial constraints, vehicle performance concerns, inadequate charging infrastructure, environmental consciousness, societal influences, and limited awareness of EVs. Notably, the financial barrier poses a significant challenge due to the higher upfront cost of EVs compared to traditional vehicles. Nevertheless, there are potential solutions to address this hurdle. For instance, offering incentives and tax credits for EV purchases can alleviate the financial burden on consumers. Additionally, government investments in research and development can drive down EV production costs, rendering them more accessible and affordable to a broader consumer base

Perceptions of limited range and performance in comparison to traditional vehicles have historically acted as a barrier to the widespread adoption of electric vehicles (EVs). However, this perception is gradually changing with the introduction of newer EV models boasting extended ranges and faster charging capabilities. Furthermore, advancements in battery technology are enhancing the efficiency and reliability of EVs. Inadequate charging infrastructure represents another obstacle to EV adoption. Concerns about running out of charge during travel discourage potential buyers from opting for EVs. However, this issue can be addressed through investments in charging infrastructure, including public charging stations and home charging units. Collaboration between governments and private entities can establish a comprehensive network of charging stations that facilitate convenient charging for EV owners.

Environmental concerns also play a significant role in consumer decision-making. Although electric vehicles (EVs) produce zero emissions during operation, the generation of electricity used for charging may still contribute to greenhouse gas emissions. However, the environmental advantages of EVs will be further amplified as renewable energy sources gain

prominence in electricity production. Societal influence poses another barrier to EV adoption, as consumers are influenced by the opinions and behaviors of their peers. If EV ownership is not perceived as socially acceptable, potential buyers may hesitate to make the switch. However, as more individuals embrace EVs, they will become increasingly normalized and socially embraced. Lastly, limited awareness of EVs hinders adoption rates. Many consumers lack familiarity with the technology and the associated benefits of EV ownership. Addressing this barrier requires educational initiatives and marketing campaigns that highlight the advantages of EVs, such as lower operational costs and reduced environmental impact.

Overcoming the barriers to widespread adoption of electric vehicles (EVs) requires implementing effective solutions. One such solution is investing in charging infrastructure to address concerns about range anxiety and ensure convenient access to charging stations. Additionally, offering incentives and subsidies for EV purchases can make them more affordable and appealing to consumers. Educating consumers about the numerous benefits of EVs, such as reduced emissions and lower operating costs, is also crucial in promoting their adoption. By implementing these measures, we can facilitate a faster and smoother transition towards a more sustainable transportation system

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