KEY FACTORS TO ANALYZE THE CUSTOMER ADOPTION OF ELECTRIC TWO-WHEELERS IN INDIA

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ABSTRACT

Global warming is a growing concern across the World. Countries are trying to find different ways to be eco- friendly and with the current depletion rate of fossil fuels and hike in its price, there is a need for a different source of energy to run the vehicles. Electric Vehicles are one of the major consumers of energy, India needs to reduce its energy requirements or find alternative sources of energy. Everybody wants to live in a world that is pollution-free. But, the number of automobile registrations are still increasing. This increased automobile usage will have a negative impact on the environment. Therefore, our modes of transportation need to be environment friendly and sustainable. Electric vehicles are the solution to this dilemma. Electric vehicles can reduce a country's dependence on gasoline. Electric vehicles account only for a small fraction of total vehicles sold in India, the adoption rate is anticipated to grow in the coming future. Many automobile manufacturers have started the production of Electric automobiles. As per industry estimates around 9 million units will be sold in India by 2026-27.

The purpose of this research study is to find out the key factors that play an important role in the Customer Adoption of electric two-wheelers in India. Primary data has been collected by using a structured questionnaire for 300 respondents and was analyzed using data analysis software.

Keywords: EV Adoption, Sustainability, Customer Perception, Environment Friendly, Carbon Credits.

INTRODUCTION

The demand for electric cars (EVs), which make up a tiny portion of all new vehicles sold globally, has grown dramatically in recent years. Although it is still in its infancy in India, electric vehicles (EVs) are transforming the field of road transportation Bjerkan et al. (2016). Global sales of eclectic cars reached 10 million in 2020, making up only 1% of all sales. In 2020, there will be 25 million electric two-wheelers (E2W), mostly because of rising demand in Asian nations Carley et al. (2013). Asia is the largest electric two-wheeler market since countries like India, China, and Japan have expanding economies. More than 80% of car sales in India are two-wheelers, which dominate the country's automobile sector Chéron & Zins (1997).

In order to combat air pollution, the Indian government targets say that 30% of all vehicles sold in India by 2030 will be electric Coffman (2017). In India, 15,119,387 two-wheelers were sold in the years 2020–2021, and 143,837 of those were electric two-wheelers, per SIAM Less than 1% of all two-wheeler sales in 2021 were electric. Despite many government initiatives, the adoption of electric two-wheelers (E2W) is quite low in India Jaiswal et al. (2021). Due to high upfront prices, range anxiety, insufficient charging stations,

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and expensive battery replacement, the adoption rate of electric two-wheelers is declining in India. With 22 of the world's 30 most polluted cities, India is the third-most polluted nation in the world Eccarius & Lu (2020). India is the world's greatest producer of carbon dioxide, one of the main factors in air pollution .The third-highest emitter of CO2 is the transportation industry in India. According to the MOSPI data, the transportation sector accounts for close to 7.5% of India's total carbon dioxide emissions Egbue & Long (2012).

Given that EVs produce 50% fewer greenhouse gasses than gasoline or diesel vehicles, the switch to electric mobility is now necessary to minimize greenhouse gas (GHG) emissions. Adopting EVs is, therefore, the greatest way to combat the dangerous air pollution levels in India's congested cities Almansour (2022). Electric cars can be divided into several types, such as battery EVs, hybrid EVs, plug-in hybrid EVs, extended-range EVs, and fuel cell EVs. Electric motors powered by batteries are typically used in electric two-wheelers. Bicycles, mopeds, scooters, and motorcycles fall within the category of electric two-wheelers. Electric bikes, sometimes known as e-bikes, are common names for electric bicycles. The top speed is less than 20 mph Feng et al. (2018). In India, electric motorcycles and scooters are widely used. Lithium-ion or lead-acid batteries are used in electric two-wheelers Naveen et al. (2014). Hero Electric and Okinawa E2W continued to dominate the Indian market in 2021, generating more than 50% of all sales Hidrue et al. (2011). Since portable batteries can be used, electric two-wheelers are better suited for developing nations like India because they can be charged at home or at the workplace using a conventional wall socket Higgins et al. (2017).

Due to their zero carbon emissions, electric vehicles have become more and more popular as an environmentally beneficial alternative to gasoline-powered automobiles Kar et al. (2021). Electric two-wheelers are more environmentally friendly, quieter, and more efficient than two-wheelers powered by gasoline Khurana et al. (2020). However, the use of electric motorcycles is still in its infancy, and more study is still needed to see whether consumers will adopt this novel product. The main issues with electric cars are their expensive batteries, short driving distances caused by insufficient charging capacity, and lengthy recharging times. Numerous studies on the customer acceptance of electric and hybrid vehicles have been published. Even Nevertheless, not much research on the adoption of electric two-wheelers has been published. The majority of earlier studies focused on the adoption of electric vehicles, while there were very few studies on electric two-wheelers Konstantinou & Gkritza (2023). It has been discovered that the acceptance of electric vehicles varies across various geographic and economic contexts. The development of an adoption model for electric two-wheelers was the aim of this study Lal (2015). From a survey of the literature, this study determined the elements that influence a person's decision to buy an electric two-wheeler. Using the suggested paradigm, appropriate policies can be created to hasten the purchase of electric two-wheelers Lane & Potter (2007). The companies that offer electric two-wheelers can follow the recommendations of the proposed model. The government's promotion of EV adoption will decrease pollution and the need for foreign oil Li et al. (2017).

LITERATURE REVIEW

The adoption of electric vehicles (EVs) is currently one of the areas that is heavily explored, and many studies have been conducted on this topic. Potential buyers of electric vehicles consider price, driving range, and longer time required to charge the batteries drawbacks when compared to traditional automobiles Lin & Wu (2018). Many previous studies on EV have demonstrated that the following variables influence consumer adoption: Price,

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Charging Infrastructure, Environmental awareness, Social Reinforcement & Perceived Economic Benefits.

Price

Price is a crucial factor when choosing an electric vehicle. The amount of money that customers have to spend on purchases is limited. Products that are inexpensive enable consumers to save money and tend to attract more customers. If a customer's finances are tight and they cannot afford the expensive price of such vehicles, they might not opt to buy an electric vehicle. Batteries and a lack of scale economies are the main reasons why electric vehicles are expensive. If their manufacturing activities are very large, manufacturers can readily gain economies of scale. Traditional goods are in high and sustained demand. As a result, producers cut their prices, but the demand for electric cars is still weak and unsustainable Liu et al. (2019). Another important factor to take into account when buying an electric vehicle is the initial cost Falvo et al. (2014). Financial considerations are always of the utmost importance when clients want to purchase an electric vehicle Powar & Patil (2022).

Charging Infrastructure

The availability of charging stations is essential for electric vehicle owners. Due to the presence of charging infrastructure, customers feel more confident about buying an electric vehicle Prakash et al. (2014). No consumer is able to set up a charging infrastructure at their residence. Therefore, it is essential to upgrade the infrastructure for public electric vehicle charging especially in big cities like Delhi, Mumbai, Bangalore, and Hyderabad. These cities have higher land costs and larger populations Rezvani et al. (2015). These cities, therefore, need a strong charging infrastructure. The creation of a charging infrastructure requires major government expenditure. Governments can offer incentives to the private sector to invest in infrastructure for charging Tarei et al. (2021). Customers will take into account the infrastructure for charging, the compatibility of charge points, and the accessibility of charging stations when deciding whether to buy an electric vehicle. Customers prefer charging stations in public areas, outside of their houses, and outside of their workplaces Verma et al. (2020). The adoption of electric vehicles and charging facilities have started to correlate favorably. Therefore, effective charging infrastructure is crucial for electric vehicles Nilesh (2020).

Environmental Awareness

A person's awareness of environmental problems and concerns is referred to as having an environmental concern Wang et al. (2016). An individual's desire to assist in resolving environmental issues can also be seen in their level of environmental concern. Governments, consumers, and international organizations today place a high focus on environmental issues. Numerous studies have shown that customers' decisions to buy electric vehicles are influenced by their concerns about the environment Xue et al. (2012). Due to the alarming rate at which environmental concerns are increasing, consumers are eager to adopt electric automobiles. Customers that care about the environment and want to reduce their gasoline costs are more inclined to buy an electric vehicle. Customers who are environmentally conscious tend to favor electric vehicles. Environmental considerations are a major element in deciding whether or not to buy an electric vehicle, according to numerous customer surveys carried out globally. The

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use of electric vehicles will solve a number of environmental problems and save a lot of energy. Electric cars are safe for the environment and reduce environmental risks. Environmental protection should rank above energy efficiency for electric vehicle manufacturers.

Social Reinforcement

The term 'Social reinforcement' is used to describe how friends, family, and neighbors can affect a customer's decision to make a purchase. Every customer wants to get approval from their friends and family before making a purchase. Customers used to base their purchases on the preferences, judgments, and dislikes of their friends and relatives. Customers like to buy goods that are regarded favorably by their friends and family and are socially acceptable. Customers consequently choose whether or not to buy a thing. Customers' purchase decisions are influenced by the actions of others Yong & Park (2017). This social support is a key consideration when deciding whether to buy an electric car or not. Customer purchase behavior and intentions are influenced by social reinforcement. Social reinforcement is therefore essential for ensuring that consumers adopt electric automobiles.

Perceived Economic Benefits

A perceived economic benefit is a very important factor when choosing an electric vehicle. Customers want to weigh the benefits they received from a product against the price they paid for it. Customers are more inclined to buy a product when the advantages outweigh the expenses. This is particularly true when comparing the price of electric and conventional vehicles.

Based on the above discussion, it can be concluded that there are multiple factors influencing the adoption of electric vehicles. The factors discussed in the preceding section that appear to contribute to EV can be summarized in the Figure 1 below.

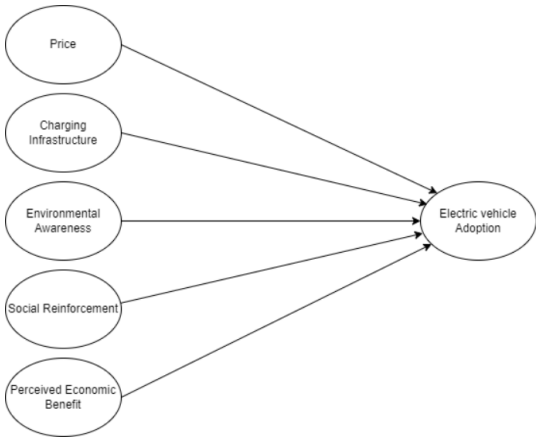

FIGURE 1
CONCEPTUAL FRAMEWORK FOR CUSTOMER ADOPTION OF TWO WHEELERS

RESEARCH METHODOLOGY

A quantitative analysis was done regarding the adoption of electric two wheelers. The platform used to kick start the experiment was Google forms. A form was readied with

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questions related to the factors affecting electric two-wheeler adoption. The factors taken into consideration were - Price, Perceived Economic Benefits, Social Influence, Charging Infrastructure, and Environment Friendly.

The form also had questions regarding demographics such as gender, age, income, as well as education. The questionnaire received 300 responses in total (50 responses were rejected due to authentic issues) 75 percent who filled the form belonged to the age bracket of 21-30 years. We received a similar response from graduates (48.8percent) and post-graduates (46.9percent). Regarding the sex of the audience, we got inputs from 58 percent of males and 41percent of females whereas the remaining 1 percentage did not prefer to say. We also received the highest inputs from students (41percent) amongst professions like service, corporate, business, homemaker Zhang et al. (2014).

The software used to analyze the data collected through the forms was SPSS. SPSS Statistics is a statistical software suite developed by IBM for data management, advanced analytics, multivariate analysis, business intelligence, and criminal investigation. In this particular case, we have made use of factor analysis to understand our data and eventually find out the effect each factor has on the consumer adoption of electric two-wheelers in India. The factors taken into the study are - Price, Perceived Economic Benefits, Social Influence, Charging Infrastructure, and Environment Friendly.

RESULTS

After running factor analysis on the SPSS software, the below results were achieved by the team From the above table we observe that KMO statistics is greater than 0.50 so the factor analysis is significant. This also means the sampling number of 255 is very adequate for the analysis undertaken.

H0: Correlation matrix is not statistically significant
H1: Correlation matrix is statistically significant

From the Bartlett's test we observe that p= 0.000 which is less than α (0.05), so we reject H0 and we accept H1.

Extraction Method: Principal Component Analysis

Standard cut off for extraction is 0.4. From the principle component method all the extraction all the parameters is greater than 40%. So, we can say that factor analysis is significant. If any factor is less than 0.35 then we can exclude that respective parameter.

Parameter so we can say that all factors such as Price, Charging Infrastructure, Perceived Economic Benefits, Environmentally Friendly and Social Influence are significant and cannot be rejected or removed.

Extraction Method: Principal Component Analysis

From the extractions sum of squared loadings there are four factors and the cumulative percentage is greater than 60% still at this stage the factor analysis is significant. From the rotated sum square loading we observed from percentage variance column the first factor accounts for 19.61% variance in the data. The second factor accounts for 17.41%, third factor accounts for 12.63%, forth factor accounts for 12.27%. From the rotation sum squared loading the cumulative percentage cut off is 60%, in our study it is 61.938%. the six factors are still

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significant.

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. The cut off value is 0.5 (50%).

Factor 1: Reduced carbon Impact (0.856), Future generations (0.854), Environment Friendly (0.838) and No fuel (0.715) because all the value are more than 0.5.
We name the factor as Environmentally Friendly.
Factor 2: Price and Charging Infrastructure
Factor 3: Social Influence
Factor 4: Perceived Economic Benefits

Key Findings

From the data obtained above we conclude that there are various factors that affect the customer to make decisions pertaining to the switch of mode of travel (EV) especially when it comes to two-wheeler vehicles. From the Research Study, it can be inferred that the factors that influence customers to buy an electric two-wheeler is majorly - environmentally friendly and also consist of sub-factors which are Reduced Carbon Footprints, Environment Friendly, and No Fuel.

The second factor that influences their decision is the pricing and the cost-effectiveness of these vehicles along with the infrastructure of the country to support these vehicles-concerns related to money and costing and the charging and the care of these vehicles.

The third is the social influence that might be through family, relatives, friends and other circles that either encourage or discourages one to go ahead with buying an electric two-wheeler.

Fourth, the economy of owning an electric two-wheeler, is another important aspect that influences the decision and perceptions of individuals.

Managerial Implications of the Research

The deployment of electric vehicles (EVs) may mitigate major issues such as environmental pollution and dependence on oil as the fuel. However, the current market penetration of EV is still at the nascent stage despite many governments employing dynamic advertising policies. As, EV is the new buzzword and focus of the Governments across the World, companies are targeting a lot of models to the customers to adopt them. This research study will help the marketers, policy makers, manufacturers, researchers, scholars who are pursuing their research in the area of electric vehicles (EV) with special reference to Two Wheelers, which form a major chunk in developing economies.

Scope for Future Study

This research study focused on the two wheelers only, it has not taken into consideration the four wheelers, commercial vehicles that fall under the ambit of Electric vehicles. In the future, extensive research studies have to be undertaken in dwelling more upon the factors that influence in the adoption of EV's in across all segments. The study was carried out in India, where the discussion on electric vehicles has been continuous in the last ten years and where different makes and models have been introduced over time. This has given consumers the opportunity to express themselves using the products available on the market thus facilitating a good research context for these issues. However, the results would be strengthened if studies,

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using EV's or other types of eco-innovations, could be conducted in other empirical contexts as well. It would also be valuable to test whether personality traits, such as the big five, are related to early EV adoption to further the understanding of eco-innovation adoption overall and in relation to interpersonal influence in particular.

CONCLUSION

Since the introduction of Electric Vehicles (EVs) into the consumer market, the most important question has been how to persuade people to adopt this product. This is a very challenging mission for the industry and governments due to the nature of the product. It is a revolutionary innovation which means that it imposes major shifts in driving behavior. The adoption rate however is slowly growing worldwide. Previous studies have shed light on the mechanism in which consumers express willingness to purchase EVs, mainly from the perspective of instrumental attributes (the perceived functional aspects of EVs) and the environmentalism values. We need to return to the main research question of this study: what are the drivers of EV purchase intention? Previous studies have investigated the relationship between environmental values and instrumental attributes with the purchase intention of EVs; however, it is worth extending their research by incorporating more behavioral constructs. New constructs like environmental pollution, and less dependence on Oil were taken into consideration.

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