E-Vehicle: Literature Review

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[Abstract] Electric Vehicle (E- vehicle) has emerged as a boon to the world struggling with disastrous environmental impact of consuming fossil fuel and the contribution of present-day vehicle in pollution is massive. Even scarcity of natural resource and recent hike of fuel prices encourages to look at E- vehicle as an excellent alternative to commute with zero impact on environment. Green energy is the need in the present situation of the world and E-Vehicle adoption gives a big drive to reduce pollution. It is an accepted fact that E-Vehicle has a huge scope and hence calls for appropriate marketing tactics to expand the market by creating awareness of the advantages of owning a E –Vehicle and motivating consumers to make their purchasing decisions. There is need to understand the customer's perception and expectations. This article tries to explore the literature available on E-Vehicle adoption and surface out the consumers perceptions and intensions towards adoption of E-Vehicle.

Introduction

In India, which has the world's second largest road network, road travel is a predominant mode of transportation. With gradual improvement in infrastructure and better road connectivity, 64.4%of all goods transportation and 90% of the passengers in India commute using roadways. The demand for the vehicle is increasing and this explains the growth of automobile industry is India.

Although the automobiles have made the life more convenient, their major disadvantage is that it generates a variety of pollutants. Pollutants released by automobiles also include fugitive fuel and source emissions; the quantity of emissions varies depending on the vehicle type, maintenance, and other factors. Hydrocarbons and carbon monoxide are the most common pollutants in gasoline and gasoline-powered automobiles, while oxides of nitrogen and particulates are the most common pollutants in diesel-powered vehicles. E-Vehicle is solution to this humongous problem to curb pollution.

Electric vehicles are thriving everywhere in the world. The requirements for the present situation are fuel saving and no carbon dioxide emission and adopting green, which result from adopting electric vehicles. In a developing country like India, it's a challenging task to meet customer expectations and provide the required product, keeping in mind the best quality product needs to be made available. The existing products, as well as expected demand, need to be considered. The same point of view the researcher has tried to explore the review of electric vehicle considering different dimensions.

Review of Literature

Garling and Thogersen'sessay (2001), "Marketing of Electric Vehicles," discusses how substituting electric vehicles for traditional ones could reduce local pollutants and greenhouse emissions from the transportation system. They contend that the user of an electric vehicle pays a hefty price for these societal benefits in terms of pricing, availability, speed, and acceleration. The authors believe that to finish the diffusion process, supportive national policies and skilled marketing are required. Based on a consideration of current

and future expected qualities of electric vehicles, as well as a review of data on early adopters, the article outlines a two-phrase strategy for marketing electric automobiles.

Afroz (2015) and his colleagues published a study to investigate how individual values and attitudes influence consumers' purchasing intentions for electric vehicles. Customers from Malaysia are the focus of the study. Individual consequences (ICNs), such as measures of convenience, product size range, and perceived utility, were found to be adversely connected to green purchasing intention in the study (PIN). While consumers consider fuel efficiency, consumption, and comfort of a car when making a purchasing decision, they may choose an electric vehicle if the manufacturer offers a battery recycling facility. PIN has no statistically meaningful link with ECN's environmental impacts.

Craig Morton (2016) and co-authors observed the impact of consumer innovation as well as perceptions of electric vehicle functional capabilities on customer demand for electric vehicles in their study on consumer preferences for electric vehicles. The study proposes a framework for analyzing the impact of consumer innovation and attitudes on electric car functional qualities.

Helmus (2016) explores result and performance metrics to aid policymakers in optimizing the rollout of charging infrastructure; enhancing the business case in his research is a key performance indicator of charging infrastructure. Performance measurement is essential for a successful charging infrastructure rollout and operation. This involves the development of key result indicators (KRIs) and key performance indicators (KPIs), which provide policymakers with data to use in their interactions with stakeholders and projects. To extract appropriate KPIs, a two-step technique was used: first, policymakers' stakeholders were analyzed (resulting in a set of objectives and result indicators), and then these objectives were translated into KPIs and intervention options.

Karwa (2016) in his study comes up with the idea of educating the electric vehicle dealers and providing training. The hurdle to accept electric vehicle is to transfer knowledge from dealer to customer. The dealer sales staff is the main direct contact with the customer. The dealership personnel were able to better comprehend the value proposition of electric vehicles as a result of their regular use, and they were able to engage with potential customers. The service area and the front of the dealership should both have electrical infrastructure installed. Dealership staff should be trained on EVSEs on a regular basis. Multimedia tools and streamlined one-page sales papers that show EV fuel savings, local incentives, and advantages should be included in training.

Nazneen (2018) and co-authors aimed to identify customer perceptions of EV benefits in terms of the environment, car cost, comfort, trust, technology, infrastructure, and social acceptance in their study. Consumers are fully aware of the benefits to the environment. More infrastructure facilities are needed by the government. Governments and manufacturers must invest to shape consumer perceptions and deliver the expected characteristics.

Monica and Mifzala (2019) investigated customer perceptions in Banglore by learning about their attitudes, feelings, and perceptions. The researchers discovered the level of EV knowledge and the elements that influence client purchase decisions. The majority of buyers are aware of the environmental benefits of electric vehicles. As a result, half of the customers were environmentally sensitive and may like to adopt it. They believe that installing charging stations will aid in the growth of EV sales.

In their study, researchers Helmus and van den Hoed (2019) focused on charging infrastructure with the goal of better understanding important performance indicators for public charging infrastructure. Stakeholder concerns about public charging are considered, using objective and result indicators in their study for charging infrastructure. Over the course of various specified goals, result indicators, performance indicators, and various possibilities are assessed. The formulation of key result indicators and key performance indicators, which provide ideas for communicating with stakeholders and implementing, are required for charging infrastructure performance monitoring.

Based on consumer behavior and consumption trends, this article examines a market research study on consumers' understanding of and buying intentions for electric automobiles. Consumers are less aware of most electric autos, according to researchers Yuhang Shang and Yi Feng (2019), and their purchase intents are rather plain. When it comes to purchasing an electric vehicle, the most significant factors they examine are design, price, and dependability, and in the changing circumstances, they also anticipate good

design, a fashionable look, and high-quality service.

The problems for electric vehicles in India were investigated by authors Rakesh Kumar and Dr. Sanjeevikumar (2019). Customers will have range anxiety as a result of a lack of charging infrastructures at regular intervals on the streets, as the vehicle may not be able to run for long. The battery cell is the most fundamental component of an electric vehicle's battery pack. A battery pack is made up of numerous modules, while a module is made up of several battery cells. The batteries are the most expensive component in electric vehicles. They cost around half of electric vehicles. The electronics that tie the cells of a battery pack together and constantly check the status of each cell is known as the battery management system (BMS). A BMS monitors each cell's temperature, charge-discharge state, and short circuit protection. Selva and Arunmozhi (2020) set out to determine customer perceptions of electric vehicles and the global market, as well as the effectiveness of electric vehicles and their global market. Currently, BEVs (all-electric vehicles) account for 66% of the global EV market. Sales of BEVs are growing faster than those of plug-in hybrids (PHEV). Organizations are working on electric autos to improve consumer awareness and develop new goods. Customers trust their friends and family more than corporation marketing; therefore, this strategy is low-cost and has a greater impact on customers.

Rajper S. Z. (2020) and colleagues analyzed the literature on electric vehicle potential in poor nations. The study looked into electric two-wheelers (E2Ws), hybrid vehicles, and electric four-wheelers (E4Ws). E2Ws are more affordable for developing countries due to their low purchase price and low operating costs. In developing countries with a big number of gasoline-powered two-wheelers on the road, the E2Ws could be a viable answer. E4W deployment in developing countries should be delayed until economies of scale can reduce the different costs associated with E4Ws. Because HEVs are less expensive to purchase than E4Ws, they may proliferate in developing countries.

Ankita Nagpal (2020) attempts to uncover consumer perceptions of electric vehicles in the Indian setting in her study. The study's goal is to look at the elements that influence consumer purchasing intent. Low carbon levels, lower maintenance costs, and government measures to incentivize consumers all contribute to higher purchase intent. Other components that have an impact on the consumer are television advertisements, after-sales service, and the wealth of knowledge and information available on the internet. Increased disposable money, as well as the availability of charging stations and systems, are variables that impact people's decisions to acquire electric vehicles. Beena and Rakesh (2020) investigated current and future trends in electric vehicle production and sales in India, as well as emission standards for India, vehicle standards based on light duty vehicle energy consumption, emission reduction based on global warming for light duty vehicles, and an examination of the EV market. According to the survey, there are numerous barriers to overcome for EV adoption, and customers are eager to reduce pollution and accept the possibilities, but the various costs are significant, so a cost-effective car is expected in India.

Bansal (2021) and colleagues conducted research to learn about Indian consumers' attitudes on electric vehicles and their desire to buy them. They initially estimated Indian customers' propensity to buy electric vehicles with features, such as long range and quick charging times, as well as consumer attitudes toward environmental friendliness and social norms. Consumers are willing to pay an extra Rs. 748 to Rs. 2548 for quick EV charging, Rs. 524 to Rs. 2998 to add a kilometer to a driving range of 200km, and Rs. 7791 to Rs. 51,845 to save Rs. 70 every 100 kilometers, according to their findings.

Shweta Kishore (2021) and others attempted to determine consumer perceptions of electric vehicles in the research article consumer perception of electric cars. According to the study, the majority of consumers prefer environmentally friendly vehicles, with prices ranging from Rs. 5 lakhs to Rs. 10 lakhs. They prefer EVs since they emit less carbon; nevertheless, one of their results was that EVs take longer to charge and have fewer charging stations.

In this study, Varghese (2021) and others investigated consumer perceptions of electric vehicles in India, as well as their purchase intentions. According to the findings, increased awareness leads to EV perception development. Environmental benefits and government programs for environmental improvement are well known among consumers. Consumers believe that the pricing and maintenance costs of an electric vehicle are too high in comparison to other characteristics. They are willing to purchase an EV but believe the cost is prohibitive, although they believe EVs can improve the environment. Consumers

believe that charging stations are scarce and that charging costs are excessive.

Zulfiqar Ali Lashari (2021) and others attempted to investigate aspects influencing consumer intention to adopt EV, including inentive, technological, environmental, and economic benefits. According to the findings, consumers' own attitudes and opinions have an impact on their decision to purchase electric automobiles.

Krishna (2021) attempted to find impediments to EV adoption and consumer perception in his research. According to the study, the following factors influence consumer perception: 1. inability to convert sales: i. vehicle supply and choice, and ii. dealer role. 2. lack of trust in technology: i. autonomous driving, ii. unsafe, iii. unfriendly to the environment, iv. unreliability, v. technological immaturity; 3. adapting to technology: i. purchase and ownership costs, ii. infrastructure, iii. range, and iv. recharge time; 4. wantability: i. the vehicle's soul and personality, ii. repair, iii. culture, iv. a lack of fun, v. the vehicle's appearance and futuristic concept, vi. presentation, vii. sound, viii. emotional attachment, ix. negative image

In his study, Saiful Hasan (2021) attempted to predict consumer intent to repurchase electric vehicles. Consumer satisfaction with EV benefits, such as cost, range, recharge, policy measure, environmental qualities, symbolic attributes, and model availability motivate consumers to repurchase EVs, according to the study.

In their paper "Customer Perception of Electric Vehicles," researchers Parmar and Pradhan (2021) identify consumer knowledge and decision criteria for purchasing an electric vehicle. According to their research, the majority of customers are aware of the internet as a key source of information in addition to television and newspapers. Consumers are motivated by a variety of considerations, including environmental awareness, minimal noise, pricing, and new trends. Electric vehicles should be provided at a lower cost to consumers. Because consumers are less aware of government subsidies, they must be advertised more.

Consumer purchasing intentions of battery electric vehicles in China are identified by Jiang Q., WeiW. (2021) and others. Their research aims to investigate the elements that impact consumers' decision to purchase electric vehicles and to construct a theoretical model of these aspects. Brand identity, brand image, and perceived risk are all factors that influence consumer purchase intentions for electric automobiles. Brand image is influenced by brand recognition, brand awareness, and perceived risk. Brand awareness and identification will have an effect on risk perception. Brand awareness will be influenced by brand identity, but purchasing decisions will not be influenced directly by brand awareness.

Essential hurdles and insufficient charging facilities are addressed for a growing country like India, according to a research article published by Goel and colleagues (2021). They discuss the market penetration rates for electric vehicles, hybrid electric vehicles, plug-in hybrid electric vehicles, and battery electric vehicles. When compared to regular automobiles, hybrid, plug-in hybrid, and electric automobiles can improve fuel economy while significantly increasing the cost of ownership. Purchasers, society, automakers, and governments all profit from their lower petroleum use and increased productivity in the long run. When conventional energy sources are unavailable, the new vehicle-to-grid concept can be used to either deliver power to the grid or charge the battery.

In their study, Singh, Sharma (2021) and others list the benefits and drawbacks of marketing electric vehicles in India. The following are some of the benefits: When compared to internal combustion engines, electric vehicles are more environmentally friendly. Electricity is less expensive than fuel. In comparison to internal combustion engines, electric vehicles require less maintenance. Electric car challenges include electricity supply, electric vehicle cost is higher than regular vehicles, unavailability of charging stations, and shorter range after charging causes consumers to be afraid of long driving. The high cost of electric vehicles is one issue that deters consumers from purchasing them. To address this, the government has promoted the use of electric vehicles in commercial vehicles by offering incentives. However, electric automobiles are still at least 30% more expensive due to imported batteries.

Conclusion

The research review explores the electric vehicle research in a multidimensional approach, which identifies

the different research gaps, which is described as follows: (1) Missing attributes: Consumer potential, purchase range, and likes and dislikes towards features. (2) More Features need to be included, such as charging price, varieties, travel range. (3) price range, expectation towards price, charging price details etc. need to be explored. (6) required to identify customer expectation towards price, customer expectation towards features. (7) EV related attributes were missing; features and benefits were less concentrated. (10) Motivating factors were identified, and more EV-related factors need to be included.

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