A Study on Consumer Purchase Behaviour on Electric Vehicles in India

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Abstract -This study explores the factors influencing consumer purchase behavior regarding electric vehicles (EVs) in India. As the Indian government and environmental organizations emphasize reducing carbon emissions and fostering sustainable development, understanding consumer attitudes and preferences towards EVs becomes crucial. Through a combination of surveys and interviews with potential and current EV owners, this research identifies key motivators and barriers affecting consumer decisions. The findings reveal that environmental concerns, long-term cost savings, and government incentives significantly drive consumer interest in EVs. However, challenges such as high initial costs, limited charging infrastructure, and range anxiety persist. This study provides insights for policymakers, manufacturers, and marketers to devise strategies that can enhance the adoption of EVs in India, ultimately contributing to a greener and more sustainable future.

Index Terms: Electric vehicle, Consumer, Purchase Behaviour, India

I. INTRODUCTION

Decreased emissions of toxic and green house gases from automobiles is one of the most pressing issues confronting modern society. This is why federal, state, and sometimes even municipal regulations restrict some types of automobile emissions. Automakers are putting money into fuel-saving technologies because they expect regulations to tighten in the near future [1]. As a result, there has been a rise in interest in electrifying cars, particularly hybrid electric vehicles (HEVs), which might dramatically reduce fuel consumption compared to traditional automobiles (BEVs). To far, regulation has deemed BEVs to be "carbon neutral" owing to their very efficient powertrains and complete absence of tailpipe emissions.

If a plug-in electric vehicle (BEV) is charged using power that is made using energy that does not use fossil fuels, the BEV's usage phase will be completely emission-free. Since 2012, sales of BEVs have increased at a fast pace, with annual growth rates reaching as high as 54%-87%. Many of the top manufacturers in the world have already developed their own BEV model. However, due to battery-related issues such as relatively poor driving range (mainly due to pricing constraints) and extensive charging time, BEVs currently cannot economically compete on a wide scale with fuel-energized autos [2].

This underscores the need of investigating the effects of different design options on energy economy and performance, both for individual powertrain components and for the whole drive system as a whole. One fascinating area of research is the prospect of adapting the drive system's design to a specific use case, followed by an analysis of the resultant effects on energy efficiency and performance. Because of the often confined space for drive system components in vehicles, the trade-off between peak torque and thermal capability for a given size of electric machine is particularly critical [3].

II. ELECTRIC VEHICLE

In the middle of the nineteenth century, electric power emerged as a viable option for propelling motor vehicles, and the advent of the first electric vehicles made it possible to transport people and goods with a level of convenience and ease of use not possible with the fuel-powered vehicles of the day. While cars mostly use internal combustion engines (ICEs) to go about, electric power is still widely used for things like railways and smaller vehicles [4].

Since electric vehicles (EVs) can't rely on any external power sources, their range is directly proportional to the size of their battery packs. Here, the battery's limits are determined by factors such as the vehicle's set-up, the driver's habits and circumstances, the vehicle's location and weather, and the battery's age and kind. When the battery life is over, it takes a lot longer to recharge than it would

for a regular internal combustion engine car. The time required to fully charge a battery pack is variable, depending on factors such as the device's working power level, the charger's setup, and the available charging infrastructure. Electric vehicles are advantageous due to their straightforward design, easy operation, and practicality. These are environmentally preferable since they are silent and emit no greenhouse gases.

Numerous studies have investigated the possibilities of electric vehicles from various vantage points, including technical, economic, environmental, consumer attitude, and purchase intention research. The researchers also showed that there is a significant challenge for EVs to generate suitable markets, at least according to the public's Perception and Acceptance of EVs in India. Moving from a culture that accepts gas-powered automobiles to one that embraces electric vehicles will need for massive promotion and trust-building in the EV market. In spite of this, there is significant resistance to EV (Hoffmann) [5].

III. ELECTRIC VEHICLE INDUSTRY

Although electric vehicles had been in use before to 1918, their popularity swiftly declined with the introduction of the gasoline-powered internal combustion engine. The widespread availability of gasoline-powered vehicles has halted the market's appetite for battery-powered automobiles. However, the idea of adapting EVs for longer distance journeys and an improvement in the government's car maintenance assistance system in 2017 have stoked renewed interest in the industry. There are two factors at play in how people see and use a given piece of technology: the technology's attributes and the people who end up using it. The "innovation diffusion theory" (IDT) and its subsequent adaptations, such as the TOE (Technology organisation environmental); provide an explanation from a management perspective. Usefulness (performance expectation), simplicity of use (effort expectancy), social impact, and enabling circumstances are all factors in the spread of new technologies. The spread of EVs is also heavily influenced by these factors [6].

It is anticipated that the market for commercial vehicles would develop at the highest rate in the EV business. Particularly owing to the rising popularity of electric buses, India and China are driving the expansion of the electric commercial sector. It is projected that electric buses would gradually replace their gasoline-powered counterparts in several nations. Electric commercial vehicle sales will increase as cities continue to switch from buses that run on fossil fuels to those that run on electricity. Electric commercial vehicles are expected to rise throughout the projected period due to the development of e-commerce, logistics, and shared mobility.

Global powerhouses including BYD (China), Tesla (USA), Volkswagen (Germany), BMW (Germany), and Nissan (Japan) now dominate the electric car industry (Japan). To keep up with the rapidly expanding electric car industry, many businesses are focusing on research and development of new products, adoption of expansion strategies, and the formation of partnerships, alliances, and mergers and acquisitions. Growth is anticipated to be greatest in the Asia-Pacific region, followed by Europe and North America. Countries like China, Japan, and South Korea have automotive industries that are particularly focused on technological innovation and the creation of cutting-edge electric cars.

3.1 Current State of the EV Market:

In India, the adoption of electric vehicles (EVs) has lagged behind some other countries; just 1% of newly sales cars in the country are electric. However, sales of electric cars have increased dramatically in recent years, from only 1,200 in 2018 to over 14,000 in 2021 and about 70,000 units through Q3 of 23. By 2030, the Indian government hopes to have thirty percent of all automobiles on the road, and many major automakers have said that they would be bringing electric vehicles (EVs) to the nation soon.

With over 95% of all electric vehicles sold in India falling into this category, the electric two-wheeler market is the biggest in the nation. With fewer than 5% of all electric vehicle sales, the electric car market is still very tiny. The Hyundai Kona, MG ZS EV, Tata Nexon EV, TATA Tiago, and TATA Tigor are the best-selling electric vehicles in India [7].

As to a PwC research, by 2030, 5.06 million cars in India are anticipated to be on the road, making up 30% of all passenger vehicles sold in the nation.

IV. ELECTRIC VEHICLE MANUFACTURERS IN INDIA

4.1 Fully electric cars

As of right now, in India, you may purchase the following types of electric vehicles:

- Mahindra e-Verito
- Hyundai Kona Electric
- MG ZS ev
- Mahindra e2o
- Tata Nexonev 2020
- Tata Tigorev 2019 (only for commercial purposes)

Isro has put a modified Maruti Omni with a solar panel platform on top through its paces as a solar-powered hybrid vehicle. This solar platform's implementation on the vehicle has been deemed "terrible." Among the electric vehicles sold in India, the Hyundai Kona Electric has the longest range at 452 kilometres on a single charge (as reported by ARAI).

4.2 Motorcycles

These businesses have introduced electric bikes to the Indian market:

- Ather Energy
- Bajaj Chetak (currently available in pune and bangalore)
- Emflux motors (to be launched)
- Revolt Motors (rv400)
- Tork Motors (to be launched)
- TVS Iqube (currently available in pune and bangalore)
- Ultraviolette Automotive

4.3 Buses

- The first electric bus in India was introduced in the city of Bangalore in 2014.
- To wit: in October of 2016, Ashok Leyland released an electric bus.
- In January of 2017, Tata Motors introduced the "starbus electric 9m" and the "starbus electric 12m" hybrid electric buses.
- In September 2017, Goldstone Infratech provided 25 electric buses to the Himachal Pradesh Transport Corporation.
- In March of this year, Tata Motors Ltd. sent 25 hybrid electric'starbus' models to the Indian state of Maharashtra.
- The first electric bus service in India, between Mumbai and Pune, was launched on September 5 and is operated by msrtc.

4.4 Mini pick up trucks

The following firms have introduced electric pick up trucks in India:

- Mahindra
- Ecoyan
- Tata motors, ace electric in 2016
- Ashok leyland, dost electric pick up truck
- Croyance automotive, elecro 1.t india first electric cargo light truck

4.5 Heavy duty trucks, semi-trailer and tractor trucks

- As of the month of September 2019, the gurgaon-based company infraprime logistics technologies pvt. Ltd. launched India's first heavy-duty vehicle (tractor-tipper-trailer combination).
- Electric heavy-duty vehicles, semi-trailers, or tractor trucks are not yet manufactured or used in India.

4.6 Rickshaws

In 2015, the Indian parliament enacted a motor vehicles (amendment) law that legalised battery-powered e-rickshaws for use in the country's public transportation system. E-rickshaws are becoming more popular in the Delhi-National Capital Region due to their compact design and manoeuvrability in tight spaces.

Several businesses in India have recently introduced electric auto rickshaws:

- Mahindra
- Kerala Neem G from Kerala Automobiles Limited
- Entice ImpexPvt Ltd (Gatti E-Rickshaw)

4.7 Railways

Kolkata's electric train in 1945 The first electric locomotives were put to service on Indian railroads all the way back in 1925. The government declared on March 31st, 2017, that all of the country's rail lines will be electrified by the year 2022. In India, solar-powered train fleets have been tried and shown to

work. The solar panels on the roof will be used to charge batteries that will power the train's lighting and ventilation systems at night.

4.8 Solar-electric boat

- Aditya , from navalt

4.9 Conversion of old vehicles in to battery vehicles

- E-trio automobiles for maruti wagon and maruti alto

4.10 Hybrid Cars

There are a few different kinds of hybrid vehicles, each using a slightly different mix of battery and gasoline to power the wheels. The following are examples of the hybrid vehicles sold in India:

- Honda Accord Hybrid
- Mahindra Scorpio Intelli Hybrid
- Maruti Suzuki Ciaz
- Maruti Suzuki Swift
- Maruti Suzuki Baleno (Mild Hybrid)
- Maruti Suzuki Ertiga
- Mg Hector
- Mobility Solution Providers
- Toyota Camry
- Toyota Glanza (Mild Hybrid)
- Toyota Prius

V. AWARENESS ABOUT THE EV FOR CONSUMERS

It is important to understand how well informed consumers are about HEVs and PEVs and what variables impact their purchase decisions since these vehicles are still relatively new technologies that are only hitting the general market. In order to better understand and learn about green marketing, the study by Lan et al. focuses directly on HEV and PEV awareness.

To gauge Chinese consumers' familiarity with EVs and the factors that go into their purchase choices, [7] conducted a detailed microeconomic analysis. A total of 299 locals of the Nanjing region in China were surveyed for this study. Three different binary regression models are used [7] to examine EV acceptance, purchase timing, and cost. Other factors that impact willingness to purchase and accept a certain price include one's level of education, age, annual income, family size, maintenance costs, and the opinions of one's peers. The findings of this study provide a clear picture of how Chinese customers rate EVs and what influences their purchasing choices. There is a wealth of evidence from studies and anecdotes to suggest that eco-conscious people are more inclined to choose for sustainable modes of transportation.

Multiple studies have demonstrated that the typical consumer knows very little about electric vehicles. For example, just about a third of Californian consumers are aware of incentives and subsidies available for the purchase of electric cars, while only about half of American customers can name a specific plug-in electric car manufacturer and model (Singer). In a survey of people living in metropolitan areas of the United States, Krause found that 63% had a basic misunderstanding of plug-in electric automobiles and that almost all of them were ignorant of the financial incentives that are currently available. According to research by IBM, more than half of drivers questioned understood very little about electric automobiles. Those who have driven electric vehicles in the past have a more favourable impression of them and are more inclined to contemplate buying one in the future [8].

VI. CONSUMER BUYING BEHAVIOR

Over time, the marketing discipline has given increasing weight to the idea of "Buying Behavior." Buying habits are a major influencer on product sales, thus it's crucial to grasp how consumers make decisions. Everyone has boundless desires and is continuously looking for more [9]. This pattern of behaviour is typical across several product categories, including automobile models. This resulted in regular updates to vehicle models and features, which ultimately led to the release of a brand-new model almost every quarter. The market is a vital resource for learning about customer preferences and habits, and for developing products that meet those needs. Only by conducting studies can a business learn about its customers' purchasing habits.The model comprises five steps: the consumer recognises an issue, seeks for information, evaluates and chooses among available options, acts on that assessment, and finally evaluates the purchase's effectiveness.

6.1 Problem Recognition

In this model of customer purchasing behaviour, issue or need recognition comes first. The nicest suit Doug has, for instance, may seem dated to him now. Alternatively, Kathleen may come to the conclusion that her computer is underperforming in comparison to her expectations. The problems you describe are typical of what we face as customers. When we realised there was a difference,

A issue is identified as being between the current condition and an ideal state. We humans are problem solvers; when we identify an issue, we attempt to fix it. Therefore, we agree that action must be taken to address the issue at hand. How, though?

6.2 Information Search

Consumers are more inclined to do research after becoming aware of an issue. Perhaps Kathleen is more likely to read through a personal computer's product description. She starts to pay greater attention to computer-related media, such as commercials and her friends' purchases and talks. Alternatively, she may be more proactive in her search for answers by going to shops, consulting with friends, and reading computer periodicals, among other possible avenues. The customer gains knowledge about the market and the brands that compete in it by researching the products available.

6.3 Evaluation and Selection of Alternatives

How does a customer take in and weigh information about competing brand names? However, there is no uniform criterion that can be used by all customers or even by a single consumer across the board. However, a common viewpoint is that assessments are entirely mental and objective. According to this theory, a customer is making an effort to find a solution to the issue and fulfil his or her need. To put it another way, your customer will be looking for ways in which your product might help them solve their problems. As a result, shoppers seek out goods that include characteristics known to provide these advantages. As a result, the customer perceives each product as a collection of features, each of which may or may not solve the customer's issue and meet the customer's requirement. The differences between the requirements, advantages, and characteristics are crucial. A hierarchical structure may be a helpful method to arrange these connections.

6.4 Decision Implementation

However, in order to put the choice into action, the customer must choose both particular products (brands) and specific outlets (where to buy) to address the issues. As a matter of fact, there are three possible approaches to making such choices: There are three possible orders: 1) both at once, 2) item first, outlet second, and 3) outlet first, item second. The choice of where to shop and what brand to buy often go hand in hand for customers. In the case of personal computers, for instance, our kathleen may choose a few different brands based on her familiarity with each one and the technological characteristics (attributes) they provide. Alternatively, she can choose one or two brands from those sold at the shop she frequents (say, the compusa in her area). After zeroing in on a desired product and store, the shopper goes on to the transaction proper ("purchasing").

6.5 Post-Purchase Evaluation

The decision-making process that came before an acquisition has a substantial impact on how the acquisition is afterwards evaluated. How invested a customer is in making a purchase is directly related. Involvement in the purchase, also known as "the amount of care for or interest in the purchase," defines the depth to which a buyer investigates a product before making a final choice. Although the degree of engagement in making a purchase is seen as a spectrum (from little to extensive), it is instructive to look at two extreme situations. Let's say someone always buys the same thing they always buy (diet Pepsi, for example) (habitual purchase). He or she is less likely to do an in-depth search and evaluation of product information before making a purchase of cola drinks because of the minimal purchasing engagement involved. There would be little assessment of the goods after purchase, and the buyer would likely be highly motivated to buy the same brand again.

The Use of Electric Vehicles: Initiatives and Regulations

Several legislation and efforts have been implemented by the Indian government to promote the usage of electric cars (EVs). The "Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME) programme," which was introduced in 2015, offers incentives to EV customers and promotes industry research and development for EVs. Additionally, the government wants all new cars sold in India to be electric by 2030.

It also plans to equip public roadways with charging stations to facilitate this changeover.

Government Initiatives

The Indian government has been promoting the use of electric vehicles (EVs) across the nation via a number of programmes. The Indian government has the following rules on electric vehicles:

The Indian government started the "FAME" project in April 2015 with the goal of promoting the usage of electric and hybrid vehicles (EVs). The programme offers incentives and financial support to manufacturers of electric vehicles, users, and providers of infrastructure for charging them. Additionally, under Section 80EEB of the Income Tax Act of 1961, purchasers of electric cars are entitled to get income tax savings of up to Rs 1.5 lakh. The government reduced the Goods and Services Tax (GST) on EVs from 12% to 5% in an effort to further reduce their cost. The use of electric cars has been further encouraged by several state governments in India by doing away with the need for road tax and registration fees.

To facilitate identification and enable access to dedicated lanes and public charging stations, electric vehicles (EVs) must now wear green number plates, as mandated by the Ministry of Road Transport and Highways. Furthermore, some state governments have created e-mobility initiatives that provide funding and incentives to EV manufacturers, providers of charging infrastructure, and customers.

The main goals of the Indian government's regulations on electric vehicles (EVs) are to boost local manufacture and infrastructure development, reduce prices, enhance accessibility, and make EVs more appealing to consumers. In order to assist these government programmes, banks and other financial institutions are providing loans for electric vehicles at interest rates that are lower than those for automobiles with internal combustion engines.

VII. ELECTRIC VEHICLES AND THEIR BENEFITS

In addition to their beneficial effects on the environment, electric car owners may also experience financial benefits [10]. It is true that the initial costs of electric cars are greater than those of vehicles powered by petroleum. Electric cars are in a stronger financial position in terms of running expenses [11]. Their running expenses are lower than those of gasoline-powered automobiles. Moreover, there are benefits for EV drivers in terms of car taxes. For instance, EV owners in Germany are exempt from paying taxes for a period of five years. Subsequently, the tax rate will range from 11,25 to 12,02 euros. Whether the automobile is classified as a light car or a heavy car will depend on its weight [10]. Electric vehicles have around 50% fewer mechanical components than conventional automobiles [12]. As a result, maintenance expenses are reduced as well since an electric motor doesn't need spark plug or oil changes. As a result, the only maintenance required for electric cars is replacing the shock absorbers, headlights, and other lighting that come with the vehicle [10]. Studies show that compared to gasoline-powered cars, the maintenance expenses are around 40% lower [12]. Furthermore, compared to conventional automobiles, electric vehicles are thought to have a better resale value, which means that their worth will fall less quickly. For instance, a VW Golf of the same year and drive size will have a resale value of around 7.900 Euro, whereas a Honda Civic with a hybrid drive may be sold for about 10.600 Euro [10]. In city traffic, autos use less gasoline than other types of vehicles. This is attributed, among other things, to the energy recovered during the braking process [11].

Additionally, they help provide a more environmentally responsible mode of transportation if the drivetrain is powered by a sustainable source of energy. They don't produce any pollutants as a result [12]. They also contribute to a decreased noise level when compared to conventional automobiles [13].

Governmental help is also provided financially. As a result, a number of official promotional initiatives have been launched. For instance, France provides funding for the distribution of such vehicles by giving each buyer 5,000 Euro. Other nations in Europe adopted this plan as well. Customers in Spain will get the maximum amount—6,000 Euro—while those in Italy will receive 3,000 Euro for their purchase. Japan and other non-European nations bear some of the early expenditures. Accordingly, they will only collect 25% to 40% of the purchase price; the consumer will be responsible for the remaining balance [10]. Limiting the number of gasoline-powered cars that may enter metropolitan cities is another method of reducing carbon emissions. For instance, in order to enter the city core of London, drivers of fuel-powered cars must pay an admission

charge. Car owners will need to pay ten pounds on weekdays in order to access the restricted area. This payment cost does not apply to electric, hybrid, or environmentally friendly cars with emissions under 100 grammes per km. They have unrestricted access to the city core [14]. The advantages of electric vehicles contribute to their growing appeal. Additionally, they gained a green reputation from clients that value ecological features.

7.1 Challenges and Opportunities: EVSectorin India

One of the biggest problems confronting the EV industry in India is the lack of infrastructure for charging EVs. Though several cities have begun to set them up, there are currently relatively few public charging stations in comparison to traditional gas stations. This might put off prospective buyers and make long-distance EV users' lives more difficult. Additionally, the cost of EVs in India is now higher than that of gasoline-powered vehicles, but this is expected to change as local manufacturing and increased production bring down the cost of batteries.

Despite these challenges, there is great promise in India's EV market. The country has the potential to become into a major centre for the production of EV batteries due to its wealth of lithium deposits, which are an essential component of EV batteries.

Many challenges confronting India's electric vehicle (EV) industry are preventing it from growing. The initial expense of EVs is a significant deterrent for many potential buyers. The expense of batteries and other electric components, which are more costly than those in traditional petrol and diesel automobiles, exacerbates this issue. The lack of a robust infrastructure for charging is another major barrier. Because of the lack of charging stations and the amount of time it takes to charge an EV, consumers are hesitant to buy electric cars (EVs). They question whether EVs are practical for everyday use as a consequence.

Other challenges include range anxiety, limited car options, consumer ignorance, and concerns about battery disposal. Range anxiety remains a significant issue despite advances in this area as EVs' limited range makes them seem unsuitable for long-distance driving. Lack of a variety of affordable EV options is another factor limiting consumer choice in the Indian industry. In addition, potential buyers' ignorance about the benefits of electric cars and the technology that powers them affects their willingness to convert from traditional cars. Finally, concerns about the ecology surrounding the recycling and disposal of EV batteries contribute to consumer hesitation. Businesses are working hard to overcome these barriers by developing infrastructure for charging EVs, lowering the cost of EV models, and increasing public awareness of the benefits of EVs.

There are now just a few charge stations available for electric car infrastructure [15]. Over time, a greater number of charging stations have been installed; nevertheless, their visibility is not as great as that of gasoline stations, which are easily identifiable owing to their distinct design. This may result in individuals being unsure about the precise locations of such stations [16].

The widespread use of electric vehicles on the road is hampered by the current shortage of charging facilities. The existing infrastructure for charging will be enough for short range, or the daily commute; but, for longer ranges, flexibility in terms of charging locations—which is provided for conventional cars—is inevitable [15]. This is because there are comparatively fewer electric vehicles than conventional automobiles on the road. Due to the dearth of EV cars on the road, expanding the charging stations is not seen to be viable enough. The usage of such automobiles for longer trips may be prohibited if this investment is not made [12]. Electric cars may only be utilised for routine transportation if a widespread and quick charging infrastructure is available [17]. Securing an infrastructure that is conveniently available for charging is crucial for this transformation.

For it, a mix of public and private charging stations is required. Additionally, the infrastructure for that has to be expanded in locations such as workplaces, supermarkets, and parking lots [18]. Charging for services rendered at work may help companies project a green image, which may draw in new hires or keep existing ones who respect the company's environmental initiatives. In order to combat driving range anxiety, speedy charging station deployment is also crucial [18].

Electric vehicles need to be charged for a minimum of time before they can be driven, whereas conventional automobiles can be filled up with gas in a matter of minutes. Even if it only takes an hour to charge fresh batteries, this is still longer than it takes

to fill up a regular automobile at a gas station. Two things will determine how long it takes to recharge a battery. It is dependent upon the remaining energy in the battery, to start with. Nevertheless, it is contingent upon the chosen charging method. Level 1, Level 2, and Level 3 chargers are distinguished. The level 1 charger increases charging speed by around 8 km/h. It requires no further installation to be used at a regular home power outlet.

It is advantageous to charge the battery overnight since it might take up to eight hours for it to reach its full capacity. The total speed of the level 2 charger is 40 km/h. The chargers for level two are outside. For instance, near grocery stores or places of employment. The fastest way to utilise a charger is the level 3 charger. According to [15], this charging method may add up to 270 kilometres in 30 minutes. Even yet, not many drivers will go more than 80 km each day, thus a slow charger is still appropriate for regular driving. In addition to the restricted selection of charging stations, drivers are also concerned about the duration of charging [15].

The charging condition and energy consumption of electric cars are the two parameters that determine their driving range. Indeed, from the start of the trip, it is evident what the status of charge is. However, a variety of variables, including the usage of the air conditioner, the radio, the navigation system, and driving habits, affect how much energy is used [13]. Drivers may be concerned about this short range since they are used to the freedom that comes with driving traditional automobiles, which can go greater distances and get refilling quickly [12]. Despite the range restriction, the majority of drivers will only need a range of 50–60 km for their everyday commute. When it is taken into account, the automobiles' drawbacks become less severe. Consequently, drivers' anxiety about not being able to get where they're going is inflated [10]. In that instance, buyers who would consider such cars for city driving may be less concerned about range restriction [19].

Drivers who are interested in electric automobiles are also worried about how much they would initially cost. When it comes to expenses, the automobiles are more costly to buy than regular cars [10]. In particular, one of the biggest expensive components is the battery. Should the battery need to be replaced, this would result in higher operating expenses. For instance, a gasoline-powered VW Golf costs around 2000 euros less than an electric Honda Insight [10]. Consequently, a greater price may affect how people feel about those particular automobiles.

As was previously indicated, the original expenditure is eligible for tax breaks, reduced maintenance expenses, and reduced fuel use [10]. Moreover, filling the automobile with electricity is less expensive than refuelling it with petrol.

Taking such factors into account, over time, electric cars will be priced similarly [10]. Consequently, it is only financially advantageous to buy an electric car when taking the long-term expenditures into account [20]. Lower starting costs will result from increased manufacture of electric cars as it enables mass production, albeit this will depend on how popular such vehicles become in the future.

VIII. PROMOTING ELECTRIC VEHICLES (EVS) THROUGH VARIOUS POLICY INITIATIVES

1. FAME Scheme (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles):

The FAME scheme was launched to incentivize the adoption of electric vehicles and their manufacturing in India.

It provided subsidies on electric vehicles and charging infrastructure.

FAME II, the second phase of the scheme, focused on promoting the adoption of electric two-wheelers, three-wheelers, and public transportation.

2. EV Incentives:

Incentives such as tax benefits and subsidies were provided to buyers of electric vehicles to make them more affordable.

Various states offered additional incentives to promote the adoption of electric vehicles.

3. Charging Infrastructure:

The government aimed to establish a robust charging infrastructure across the country. Incentives and support were provided to encourage the development of public and private charging stations.

4. Local Manufacturing:

Policies encouraged the local manufacturing of electric vehicles and components to boost the domestic electric vehicle industry.

5. Battery Swapping Stations:

The government explored and encouraged battery swapping stations as an alternative to charging infrastructure to address range anxiety.

6. Public Transportation:

Policies targeted the electrification of public transportation, such as buses and taxis, to reduce emissions and promote sustainable urban mobility.

7. Research and Development:

Initiatives were in place to promote research and development in the electric vehicle sector to drive innovation and technological advancements.

8. International Collaboration:

India collaborated with various countries and international organizations to share knowledge and experiences in promoting electric mobility.

IX. CONSUMER PERSPECTIVE REGARDING EVS

The attitude of customers towards electric vehicles largely determines the demand for them. Consequently, it's critical to comprehend customer perception by taking those automobiles' advantages and disadvantages into account. Through analysis, it is possible to determine the elements that might influence consumers' decisions to buy electric cars [19].

Acquiring an automobile entails a protracted procedure due to the need for investigation and the impact of customer opinion [21]. As a result, a consumer's decision is influenced not only by the features of the product but also by other variables such as the information required for the consumer to make an informed choice, the car dealer's advice, and the opinions of others in his social circle regarding the product. Due to the mechanical nature of the automobile and the large selection of options, buyers are more likely to seek assistance from friends and family since the car is a more difficult product. As a result, several persons participate in the decision-making process and it is uncommon for one individual to make the choice alone. The decision-making process may be influenced by the vehicle dealer by developing a trustworthy connection with the prospective client, but the decision-making process can also be influenced by the provided expertise [21].

The significance of social surroundings is demonstrated by a Norwegian survey that found that 67% of owners of electric vehicles had at least persuaded one person in their social circle to express interest in those vehicles within the first two years of ownership, and 14% of those owners were successful in persuading three or more friends to purchase those vehicles. However, it should be noted that Norway is the only nation in the EU where plug-in electric vehicles account for 20% of new car sales. The benefits that the government has offered account for the widespread use of these cars in Norway. These advantages include, but are not limited to, free parking spaces, designated lanes on the road for such cars, and no tolls [20].

Additionally, additional elements that may influence the purchase process include fuel efficiency, safety features, and the product's green image. Additionally, it is said that this automobile accelerates quickly even at low speeds and has no gear changes, making for a very comfortable driving experience.

Based on consumer education levels, it can be concluded that highly educated people are more likely to express interest in purchasing hybrid vehicles. Higher socioeconomic class customers are more likely to acquire electric vehicles overall. The preservation of the environment and, therefore, sustainable energy management are the most important factors influencing customers to choose such cars [4]. Conversely, buyers who see such automobiles as status symbols are also drawn to them, in addition to those who have a sustainable perspective.

According to [22], the electric car sector is facing challenges in persuading buyers based only on its characteristics. Some believe that such cars represent a kind of technology that is still in its infancy [22]. Among the obstacles are things like a lack of understanding of new technologies, worries about range restrictions, lengthy charging times, and characteristics that are specific to each user. The purchase process is being adversely affected, particularly by rising beginning costs. Additional factors that have a negative impact on the decision to

buy include, but are not limited to, a lack of knowledge about range, a lack of options, a lack of awareness of the relationship between fuel and energy consumption, the belief that home charging would be too complicated to implement, a lack of knowledge about the positive environmental aspects of those cars, and the financial support provided by the government to EV owners [21]. Numerous research shown that people's knowledge of such cars is often lacking. For instance, only few participants could identify an electric car that plugs in.

Furthermore, it became clear from the participants who were able to identify it that the majority of them would have said the Tesla Model S or the Nissan Leaf, indicating that even those with greater expertise would not be aware of the greater variety of those automobiles. Government incentives for certain autos were unknown to even a few of the participants [23]. It's possible that a restricted driving range is more of a constraint based on perceptions than on actual use. A research conducted in the UK gave roughly 56 families the chance to drive an electric car for a week. The vehicles' driving range was 160 km. According to individuals involved, such cars would be OK to own as a second vehicle. According to [19], 34% of the participants said they would consider such automobiles to be their first car if they had a 240 km range. Furthermore, because there are more gasoline-powered automobiles on the market, a restricted selection of electric vehicles may adversely affect customer perception [24]. As such, incomplete knowledge of their attributes and monetary advantages may lead to an incorrect choice [21]. Out of all the hurdles that have been discussed, customers are most concerned about car charging [4]. However, it must be acknowledged that even more knowledgeable buyers may choose not to purchase an electric vehicle because it does not meet their needs. It states that even knowledgeable buyers may not choose such cars since they may choose cars with different or extra amenities [21].

In fact, when making a purchase, the initial cost matters. Customers would still be willing to spend more, however, if the car's features met their needs and specifications. In particular, buyers who care deeply about the environment are more prepared to pay a premium for such cars despite their restrictions [22, 25].

Additionally, attributes like quick acceleration and reduced running costs over time might favourably impact the choice to buy. Additionally, a few of the previously mentioned UK research participants said that they found such cars' quick acceleration and low noise levels to be beneficial [19].

X.REVIEW OF LITERATURE

Johnvieira, et al., (2021) With the ongoing depletion of fossil resources and price increases, a new energy source to power the car is required. Electric vehicles are being considered by India's car industry as a solution to the country's industry and environment. Despite countries enacting EV legislation, the present market penetration of EVs is very low. The potential scope of electric vehicles in India will be examined in this article, as well as consumer perceptions of them [26].

Yogesh Aggarwal, (2019) Users of scooters who only need to travel short distances may want to consider an EV, while those who need to travel longer distances and currently possess motorcycles like the Hero Splendor may find switching to an e2W challenging. It is quite straightforward to enhance the range of an automobile by increasing the battery size. However, with electric 2Ws, every increase in kWh may offer an additional 30km of range, but the increase in weight is roughly 10kg, or about 10% of the overall weight of the bike. In smaller motorcycles, the weight problem is much more obvious (less than 150cc)[27]

Kesari, et al., (2019)Around the last decade, electric cars have witnessed extraordinary growth all over the globe. The scope and prospects of electric vehicles in India are first discussed in this study. We also go through the government of India's numerous policies and frameworks. Then we look at numerous case studies on the adoption of electric vehicles from across the globe. Finally, we discuss how India might put these tactics into action and profit from them at both the local and national levels[28].

Bhalla, et al., (2018)Electric car development and sales are being pushed by current environmental concerns. The combination of India's professional and semi-skilled technology base, a big customer base, and lower manufacturing and labour costs has enticed practically all major electric vehicle manufacturers and component suppliers, including Bosch, AVL, and Cummins, to launch operations in India. To better understand the commercial success and purchase intentions of electric cars among

Indians, researchers must look at the elements that influence customer acceptability. Individual perceptions on characteristics such as environmental concerns, cost, trust, technological progress, infrastructure, and social acceptability all impact automobile consumers' buying decisions. The findings reveal that environmental concerns and consumer faith in technology are antecedent determinants for perceptions of electric car purchasing, with cost, infrastructure, and societal acceptability providing adoption blowback. Thus, the government must take the lead in promoting electric car sales by developing environmental policies, infrastructure, and subsidised vehicle costs, or by lowering the bank rate of interest[29].

Jin, &Slowik, (2017)This report examines best practises in consumer awareness and outreach for electric vehicles throughout the world. It examines the research on the relevance of customer awareness and provides best practises in electric car markets throughout the world. We chose five case studies for further discussion based on our assessment to assist better understand the main features of effective complete consumer awareness campaigns. Although the focus of this research is on how actions to increase awareness and understanding might influence electric vehicle uptake, we should note that a wide range of promotion actions (e.g., financial and non-financial incentives, charging infrastructure deployment, high model availability, efforts to increase awareness and understanding, and others) are critical to growing the market[30].

Digalwar, &Giridhar, (2015) Using ISM approach, capable of identifying and prioritising obstacles based on their driving force and dependencies It is vital to raise awareness among Indian people, in addition to the government's commitment. Financial restrictions must also be addressed in order to launch market sales[31].

XI.RESEARCH GAP

Electric cars (EVs) are becoming more popular in India, but there are still many questions about how people there buy EVs. To begin, the vast majority of research ignores regional variations in consumer behavior when drawing broad national conclusions. This includes ignoring the reality that local elements like infrastructure, government laws, and consumer awareness varies throughout the nation. Most studies have concentrated on environmental and economic aspects, while psychological ones, such as perception, brand loyalty, and risk aversion, have received less attention. Another area that needs further research is the effect of government incentives and infrastructure improvements on buying choices, especially when looking at the long-term trends. Markets in cities have gotten a lot of research, while those in rural areas, which are home to a sizable population, have gotten very little. There needs to be more research on the impact of technological hurdles on customer desire to buy electric vehicles, such as charging infrastructure, battery life, and range anxiety. Additionally, current research often ignores the significance of environmental awareness and social effects, such as community standards and peer behavior. Little research has focused on post-purchase behavior, which might teach makers and customers a lot about factors like maintenance costs, performance satisfaction, and resale value—all of which are important aspects of long-term ownership. Lastly, there is a lack of research on demographic aspects, namely gender and income-based variations, which affect EV customer choices. If these gaps are filled, we will have a better picture of what is driving and what is preventing the widespread use of electric vehicles in India.

XII. CONCLUSION

The study on consumer purchase behavior towards electric vehicles in India underscores a growing awareness and interest in sustainable transportation solutions. Environmental benefits and cost savings emerge as primary motivators, while infrastructural limitations and initial costs pose significant barriers. To accelerate EV adoption, it is imperative for stakeholders to address these challenges through improved charging infrastructure, financial incentives, and consumer education. Policymakers should focus on creating a supportive ecosystem, while manufacturers need to innovate to reduce costs and enhance vehicle performance. By understanding and addressing the nuanced preferences and concerns of Indian consumers, the transition to electric mobility can be significantly expedited, paving the way for a cleaner and more sustainable transportation future in India.

REFERENCES

[1] Hagman, J., Ritzén, S., Stier, J. J., &Susilo, Y. (2016). Total cost of ownership and its

potential implications for battery electric vehicle diffusion. Research in Transportation Business & Management, 18, 11-17.

[2] Digalwar, A. K., &Giridhar, G. (2015). Interpretive structural modeling approach for development of electric vehicle market in India. Procedia Cirp, 26, 40-45.

[3] Kumar, A., Choudhary, S. K., &Chethan, K. N. (2018). Commercial viability of electric vehicles in India. International Journal of Mechanical Engineering and Technology, 9(6), 730-745.

[4] Tu, J. C., & Yang, C. (2019). Key factors influencing consumers' purchase of electric vehicles. Sustainability, 11(14), 3863.

[5] Li, W., Long, R., Chen, H., &Geng, J. (2017). A review of factors influencing consumer intentions to adopt battery electric vehicles. Renewable and Sustainable Energy Reviews, 78, 318-328.

[6] Lebeau, K., Van Mierlo, J., Lebeau, P., Mairesse, O., &Macharis, C. (2013). Consumer attitudes towards battery electric vehicles: a large-scale survey. International Journal of Electric and Hybrid Vehicles, 5(1), 28-41.

[7] Taylor, M. (2018). Consumer Behavior and the Plug-In Electric Vehicle Purchase Decision Process: A Research Synthesis.

[8] Morton, C., Anable, J., & Nelson, J. D. (2016). Exploring consumer preferences towards electric vehicles: The influence of consumer innovativeness. Research in transportation business & management, 18, 18-28.

[9] Liao, F., Molin, E., & van Wee, B. (2017). Consumer preferences for electric vehicles: a literature review. Transport Reviews, 37(3), 252-275.

[10] Vieweg,C.(2010).E-Autos:sofahrenwirindieZukunft;alleElektro-undHybridmodelle, Technik, Kaufberatung, Kosten- und Umweltcheck. 1st ed. Bielefeld: Delius Klasing, p. 19- 151

[11] Plechaty,M.(2007).WärmemanagementinKraftfahrzeugen:ChancenzurCO2-Reduzierung; SchwerpunktHybridfahrzeuge. Berlin: mbv, p. 102-216

[12] Arcos-Vargas,A.(2021).TheRoleoftheElectricVehicleintheEnergyTransition:A Multidimensional Approach. 1st ed. Cham: Springer International Publishing, p. 3-53

[13] Egede,P.(2017).Environmentalassessmentoflightweightelectricvehicles.Cham:Springer,

[14] Hofmann,P.(2014).Hybridfahrzeuge:einalternativesAntriebssystemfürdieZukunft.2nd ed. Wien: Springer, p. 59-96

[15] Patel,N.,Bhoi,A.K.,Padmanaban,S.,Holm-Nielsen,J.B.(2021).ElectricVehicles: Modern Technologies and Trends. 1st ed. Singapore: Springer, p. 54-141

[16] MacInnis,B.,Krosnick,J.(2020).ClimateInsights2020:ElectricVehicles.Resourcesforthe Future Journal (5)1, p. 5 – 9

[17] Broadbent, G. H., Metternicht, G., &Drozdzewski, D. (2019). An analysis of consumer incentives in support of electric vehicle uptake: An Australian case study. World Electric Vehicle Journal, 10(1), 11.

[18] Proff,H.,Brand,M.,Mehnert,K.,Schmidt,A.,Schramm,D.(2016).Elektrofahrzeugefürdie Städte von morgen: InterdisziplinärerEntwurf und Test imDesignstudio NRW. 1st ed. Wiesbaden:SpringerFachmedien,p.5-23

[19] Rezvani, S., Dehkordi, G. J., Rahman, M. S., Fouladivanda, F., Habibi, M., &Eghtebasi, S. (2012). A conceptual study on the country of origin effect on consumer purchase intention. Asian Social Science, 8(12), 205-215.

[20] Rezvani, Z., Jansson, J., &Bodin, J. (2015). Advances in consumer electric vehicle adoption research: A review and research agenda. Transportation research part D: transport and environment, 34, 122-136.

[21] National Research Council(2015).Overcoming Barriers to Deployment of Plug-in Electric Vehicles. Washington: National Academies Press, p. 3-4 p.2-30

[22] Jones,A.(2018).TheElectricVehicleandtheConsumer:FromEnvironmentalistsstoInnovators? Social Business, (8)1, p. 29 – 32

[23] Ricardo, 2021, EV-Consumer-Behavior-Report, Inc. Detroit Technical Center Van Buren Twp., MI 48111 USA

[24] Johnvieira, A., Tupe, M. O., & Kishore, S. (2021). CONSUMER PERCEPTION OF ELECTRIC VEHICLES IN INDIA. European Journal of Molecular & Clinical Medicine, 7(8), 4861-4869.

[25] Contestabile, M., Offer, G., North, R., Akhurst, M. M., & Woods, J. (2012). Electric

vehicles: A synthesis of the current literature with a focus on economic and environmental viability. LCA Works, London (Great Britain), June.

[26] Johnvieira, A., Tupe, M. O., & Kishore, S. (2021). CONSUMER PERCEPTION OF ELECTRIC VEHICLES IN INDIA. European Journal of Molecular & Clinical Medicine, 7(8), 4861-4869.

[27] Yogesh Aggarwal, V. G. (2019, September). Indian Electric Vehicles Storm in a teacup. HSBC Global Research, p. 13.

[28] Kesari, J. P., Sharma, Y., &Goel, C. (2019). Opportunities and Scope for Electric Vehicles in India. SSRG International Journal of Mechanical Engineering, 6, 1-8.

[29] Bhalla, P., Ali, I. S., &Nazneen, A. (2018). A study of consumer perception and purchase intention of electric vehicles. European Journal of Scientific Research, 149(4), 362-368.

[30] Jin, L., &Slowik, P. (2017). Literature review of electric vehicle consumer awareness and outreach activities. International Council on Clean Transportation. Available frominternet: https://www. theicct. org/sites/default/files/publications/Consumer-EV-Awareness_ICCT_Working-Paper_23032017_vF. pdf.

[31] Digalwar, A. K., &Giridhar, G. (2015). Interpretive structural modeling approach for development of electric vehicle market in India. Procedia Cirp, 26, 40-45.