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A REVIEW ON CONSUMER PERCEPTION AND SATISFACTION TOWARDS E-VEHICLES IN HARYANA

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Abstract-
Concurrent environmental concerns are placing trust in the production and sales of electric vehicles. Global sharks like Bosch, AVL, Cummins, and others were drawn to India to produce electric vehicles because of the country's large customer base, semi-trained and skilled technology personnel, and inexpensive labour and manufacturing costs. It is necessary to research the several aspects that influence and effect a consumer's decision to invest in and buy an electric vehicle in order to investigate prejudice attitudes and perceptions towards these vehicles. Buying an electric car is influenced by a number of factors, including perceptions of price sensitivity, performance, infrastructure, environmental difficulties, and affordability. Therefore, the examination of customer attitudes and satisfaction with e-vehicles in the state of Haryana is the main emphasis of this study.

Keywords: Electric Vehicle, Consumer Perception, Consumer Satisfaction, Types of Electric Vehicle etc

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I. INTRODUCTION

The third-largest road network in the world is found in India. India appeared to be a country where road travel was favoured, since more than 60% of the people commuted by private or shared vehicle. Air pollution and global warming are largely caused by conventional automobiles. All cars generate dust from their tyres, brakes, and wear on the road. Compared to typical petrol vehicles, average diesel vehicles have a worse impact on air quality. Nonetheless, compared to electric vehicles, both petrol and diesel vehicles pollute more. Governments began enforcing monetary measures, such road taxes, to deter people from buying and operating more environmentally harmful vehicles. The purpose of the green tax is to incentivize individuals to switch to fuel-efficient and less polluting automobiles and to stop using vehicles that emit pollutants when they re-register them after 15 years of use. Fuel taxes have the potential to encourage the development of alternative fuels and the production of automobiles that are more eco-friendly and efficient. High gasoline prices or a shift in consumer behaviour may offer strong incentives for people to either give up driving altogether or purchase lighter, more fuel-efficient vehicles.
An incentive programme to promote electric and hybrid automobiles is called FAME India Scheme. Its objectives are to encourage electric mobility and provide financial incentives for increasing the manufacturing of electric vehicles and building infrastructure for electric transportation. FAME was introduced in 2015 by the Ministry of Heavy Industries and Public Enterprises to encourage the manufacture and marketing of environmentally friendly automobiles, such as hybrid and electric vehicles. The plan is put forth to set up the infrastructure for charging. The National Electric Mobility Mission Plan (NEMMP) 2020 is a mission plan that outlines the goals and, consequently, the path

forward for the production and quicker uptake of electric vehicles. This plan aims to increase fuel security at the national level, provide reasonably priced, eco-friendly transportation, and help the Indian automotive sector become a global leader in manufacturing.

The Indian auto industry will undergo significant changes as a result of electric vehicles, and as they become more widely used, more innovative business models will emerge. Electric vehicles appear to be more environmentally friendly worldwide, and more people are becoming interested in them over time. Globally, there is a high demand for electric vehicles, and while the US, China, and Europe account for a large portion of global sales, industry insiders view India as a promising market. Since electric vehicles are essentially less expensive to maintain, there has been a consistent interest in electric cars and two-wheelers among the Indian populace in recent years..

The Historical Background

In India, two-wheelers are among the most significant forms of transportation. The first two-wheelers were seen in India in the 1950s. The 350 cc "Bullet," made by the United States' Royal Enfield Company, was ordered by the Indian government in 1955 for use by the Indian Army. The market was opened to new businesses like Rajdoot and Yezdi in the 1970s. Subsequently, Bajaj made its market debut at that same time with "chetak," which brought a newer category of two-wheelers to India: "scooters." Because liberalisation was spreading at the time, the automobile sector was deregulated in the 1990s. There was more rivalry in this industry following liberalisation, and the changes implemented at the time made Indian exports competitive.

In the past, the car industry offered consumers a limited selection of vehicles and options. But as soon as liberalisation occurred, this industry saw a sharp uptick in growth as a large number of foreign companies entered the market as a result of the newly constituted regulations. It was observed that a large number of foreign companies began working with local producers in an attempt to increase their market share by catering to consumer demands. The automobile sector has undergone a transformation and evolution that has not only enhanced its contribution to economic growth.

Current Trends

The car business has advanced significantly since the 1950s, when it could only produce 40,000 automobiles a year. Consumers can now access frequent upgrades and new product launches, and the Indian automotive sector has gradually grown to become a significant player in the global automotive industry. India produced 23 million vehicles in the fiscal year 2021. Aside from this, India is currently the world's biggest producer of two- and three-wheelers, the biggest producer of tractors, and the second-biggest producer of buses. With the possibility of 100% FDI, new production hubs, and improved infrastructure, the electric 2-wheeler market in India has been expanding quickly. India's enormous population presents a huge untapped market for electric 2-wheeler manufacturers, and the federal government is supporting this trend more and more.

II. WHAT IS AN ELECTRIC VEHICLE?

The abbreviation for an electric vehicle is an electric vehicle. cars that run entirely or partially on electricity are known as electric cars. Because they require less maintenance due to their fewer moving parts, electric vehicles are less expensive to operate and have a low environmental impact because they consume little to no fossil fuels (diesel or petrol). Although lead acid and nickel metal hydride batteries were once often employed in electric vehicles, lithium ion batteries are currently the industry standard for electric vehicles. They self discharge at a rate of only 5% per month, which means they are far more durable and have exceptional energy retention. Although attempts have been made to improve the safety

of these batteries, problems still exist with them despite their increased efficiency. One such problem is that they are susceptible to thermal runaway, who has resulted in explosions or fires in Tesla model S vehicles, among other incidents. There are four different kinds of electric cars on the market:

- **Battery Electric Vehicle (BEV)**
  They are fully powered by electricity. These are more efficient compared to hybrid and plug-in hybrids.
- **Hybrid Electric Vehicle (HEV)**
  It uses both the internal combustion (usually petrol) engine and the battery-powered motor power train. The petrol engine is used both to drive and charge when the battery is empty. These vehicles are not as efficient as fully electric or plug-in hybrid vehicles.
- **Plug-in Hybrid Electric Vehicle (PHEV)**
  It Uses both an internal combustion engine and a battery charged from an external socket (they have a plug). This means the vehicle's battery can be charged with electricity rather than the engine. PHEVs are more efficient than HEVs but less efficient than BEVs.
- **Fuel Cell Electric Vehicle (FCEV)**
  Electric energy is produced from chemical energy. For example: a hydrogen FCEV.

III. GLOBAL ELECTRIC VEHICLE SCENARIO

Globally, electric vehicle sales rose by 94% between 2011 and 2015, with China, the US, and Europe leading the way. At 40% of the overall cost of production, lithium-ion high density batteries are the most important part of an electric car. The cost of lithium batteries has plummeted from $600 per kWh in 2012 to $250 per kWh in 2017, hastening the adoption of electric vehicles. The market for electric vehicles is speculating that the price would decrease even lower to $100 per kWh by 2024, providing manufacturers with financial advantages. While Chinese companies are acquiring lithium reserves in Bolivia, Australia, and Chile to build a monopoly, India lacks sufficient lithium reserves to manufacture lithium-ion batteries.

Electric Vehicle Status in India

There are about 300 million conventional vehicles that grow at 60000 new registrations / day. There are 70799 traditional fuel stations compared to just 221 Electric Vehicles stations. As per Society of Manufacturers of Electric Vehicles, 354017 units were sold to date. India aims to adopt 31 million Electric Vehicles by 2040. Tata motors recently won the tender for 10,000 Electric Vehicles to replace government vehicles and 4,000 Electric Vehicles chargers. Faster Adoption & Manufacturing of Electric Vehicles (FAME) scheme was formulated in 2015 to incentivize manufacturing of Eco-friendly vehicles. Providing Free Electric Vehicles charging points, community charging stations, regulated rates for charging and battery swapping are some of the incentives planned. Reliable power supply for Electric Vehicles charging stations and alternative energy resources for Electric Vehicles infrastructure are key aspects for the growth of Electric Vehicles industry along with making micro-grids and Renewable Energy Storage part of Electric Vehicles charging infrastructure.

India's goal is to ensure that by 2030 all public transport and 30% of private vehicles are electric. This was one of the key decisions taken in Global Mobility Summit in New Delhi. Transport sector consume 70% of fossil fuels- causing more than 70% of pollution. The Government provides a lower GST at

12% on electric vehicles while levies 28% GST plus cess for petrol and diesel cars [4]. Indian Space Research Organisation is providing latest Lithium-ion battery technology to commercial players via the Automotive Research Association of India. Over 65% of energy demand for road transportation & 35% of carbon emission can be avoided if Indiaimplements an electric mobility future. Reducing carbon emissions would enable India to honour its obligation under the Paris Climate Agreement. As part of building a green economy, India aims for a renewable energy capacity of 185 GW by 2022. India paid 4.14 trillion to buy 201.73 million tonnes of crude oil in 2015-16.

It has been an attempt by the Government of India to transform itself as R&D hub as well as a world-class manufacturing sector. Government established the NATRIP which acts as the connector between the government and the industry. After the year 2005, five research and testing labs have been built. Now, it has also proposed grant testing infra after the year structure in the performance certification of the electric vehicle industry." Approval was given by the Project Implementation and Approval Committee (PISC) in 2019 the auspiciousand ambitious project in which the government has the intention to sell only electric cars in India.Government of India has shortlisted 11 major cities of the country for the presentation of electric vehicles (VE) in its open vehicle frame as part of the FAME (Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicles in India) program which the government quoted a requirement of 10000 crore rupees for the financial year 20–22.

Electric vehicles (EV) are the future philosophy of the automotive industry in the world. A future whose establishment is posed and unions find a way to make this activity a success. In 2018, global transactions in electric vehicles including BEVs, PHEVs and FCEVs exceeded 2 million units. This figure reflects the growing recognition of these vehicles and the majority have merged this new innovation into their ecosystem. In any case, more than 70% of these transactions took place in the United States, China and Japan. On the world front, India, in spite of everything, still has a long way to go, but the introduction of electric vehicles into the Indian market has been an extraordinary beginning for the excursion.

The largest type of EV with a count of approximately 25 million is Electric 2-wheelers and its demand has been affected due to high demand in Asian countries. India, China and Japan are the major players in the Asian continent which have impacted and increased the demand of electric 2-wheelers. According to SIAM 2020-21 reports almost 15119387 2 wheelers were sold in India and 143837 units out of these were of electric 2- wheelers. There is low adoption of Electric 2-wheelers in India mainly because of factors like high upfront costs, inadequate charging stations and high battery replacement costs. Bicycles, mopeds, scooters and motorcycles are basically what the electric 2 –wheeler category comprises of. Out of these the most commonly used electric 2 wheelers in India are electric scooters and motorcycles. These electric 2-wheelers have a portable battery which can be charged with the help of a standard outlet and thus they are more suitable for a country like India.

Another reason of why a developing country like India should adopt to electric motorcycles and 2 –wheelers is because of their high efficiency and cause less pollution and noise. With new manufacturing hubs, 100% FDI possible and an improvement in Infrastructure facilities the Electric 2-wheeler industry in India has been rapidly growing. With such a vast population India is offering the Electric 2-wheeler manufactures a vast untapped market with increasing support from the federal government.

There have been many research papers and studies related to adoption of electric cars but consumers however there are very limited studies on Consumer Attitude and Perception towards Electric 2 wheelers. This research focuses on adoption of electric wheelers and identifies the factors which impact the consumer’s intention to buy an electric 2 wheeler.

IV.LEADING ELECTRIC VEHICLE PLAYERS IN INDIA

100% Electrification is what India aims to achieve by 2030. In order to achieve this goal the government of India is constantly putting efforts and there has been seen a switch towards a cleaner transportation. Major players like Mahindra Electric and Hero Motocorp are constantly putting their R&D into this segment and increasing their presence. Ather Energy, Ola Electric, Okinawa Autotechetc are the startups whose sales have also increased over a period of time now. Between FY22 to FY25 the Electric 2-wheeler Industry is expected to grow at 75-80% compounded annual growth.

Hero Electric

Hero Electric is a subsidiary of Hero Motocorp and has become the largest player in the Electric 2-wheeler segment with a market share of approximately 36% . In 2017, Hero Electric entered this market by launching its first lithium ion battery based scooter. Since then there has been no turning back for Hero Electric and currently it is present in more than 325 cities, with 600+ dealership networks spread across the country.

Okinawa Autotech

Okinawa Autotech is a Haryana based private limited company which manufactures only Electric 2-wheelers in India. To escalate it's operations Okinawa Autotech has planned to spread its business from currently 24 dealerships to 450 dealerships across the country. Currently manufacturing electric scooters, Okinawa Autotech plans to enter into the market of manufacturing E-motocycles as well. In 2021, the company managed to sell almost 29,995 units in the Indian market and has achieved a milestone with sales crossing 100,000 mark.

Ampere Vehicles

With a market share of 14%, Ampere Vehicles is a Bengaluru based company and is a part of Greaves Cotton Company. Ampere Vehicles is one of the oldest company in this industry and outsold Ather Energy by selling almost 12, 470 units. This company supports on empowering women and thus has employed 30% women workforce. Reo, Magnus EX, Magnus Pro, Zeal and Reo Elite are some of the electric 2-wheeler that the company offers to the customers.

Ather Energy

Founded in 2013, this Bangalore based company accounts for 11% of the market share. Ather 450X and 450 Plus are the 2 models that the company manufactures and with just 2 models it has managed to make a sale of approximately 10,921 units in 2021. However, as the competition in this industry is increasing Ather Energy need to gather fresh funds and scale it's business in order to sustain in the market.

Ranking is the data transformation in which numerical or ordinal values are replaced by their rank when the data are sorted. Ranking provide an incentive for better data collection within institution, they can expose pockets of institutional weakness and confirm areas of strength, and they are useful for benchmarking against like institutions. Rankings encourage institutions to re-examine mission statement.

Table 1: List of E-Vehicle Manufacturers

Companies of E-vehicle
Ather 450
Revolt RV 400
Bajaj Chetak
Hero Photon
Ola S1 Air

Tata Nexon EV
Hyundai Kona Electric
MG ZS EV
Tata Tiago
Others
Total

V. REVIEW OF LITERTURE

According to Philippe Lebeau [2015][1], goods transportation significantly affects how people move across cities. Researchers looked into how electric cars might fit into urban logistical systems. There is a chance for a fleet with varying technology to lower last mile costs. A fleet size and mix vehicle routing problem with time windows for electric vehicles was provided by the researcher. The primary contribution of the writers was taking into account how the range of electric vehicles can vary. Electric vehicles are frequently the most competitive technology in the compact van categories. From a financial perspective, diesel has shown to be the most intriguing option for huge vans, as electric cars would need to go a greater distance to be as competitive in price. In the truck category, hybrid vehicles are preferred because they have lower fixed and operating expenses than diesel trucks.

Widespread use of electric vehicles, according to Fanchao Liao [2017][2], may help reduce issues including environmental pollution, global warming, and reliance on oil. Despite the implementation of robust promotion programmes by governments, the penetration of electric vehicles is rather low. The goal of their thorough analysis of customer preferences for electric vehicles was to inform policymakers and provide guidance for future study. They made a comparison between the psychological and economic approaches to consumer demand for electric vehicles. The financial and technical characteristics of electric vehicles, including as their cost of purchase and operation, driving range, charging time, vehicle performance, and variety of brands available, are generally considered to have a substantial impact on their utility. The usefulness and promotion of electric vehicles are also positively impacted by the density of charging stations. Tax reduction and incentive programmes have a very positive influence.

According to Mohammed M [2018][3], switching to electric engines from internal combustion engines will significantly cut pollution and benefit customers. This technique is being used in many nations, which is helping to improve the environment. The study observed the prospects and difficulties India had when introducing electric vehicles. Initiatives from the government, batteries, industries, and the environment have all been taken into consideration. These difficulties, including the price of electric vehicles, their effectiveness in India, and consumer demand, were taken into account. Reducing greenhouse gas emissions and oil costs are the main goals of India's EV adoption. The administration ought to take full advantage of the chances at hand and devise sensible solutions for the problems.

According to Masurali A [2018][4], India's share of carbon emissions in the transport industry alone is over 18%. The Electric Vehicle (EV) is a highly viable substitute approach to combat current crises. A number of automakers are diversifying their product lines and launching electric vehicles. Encouraging the use of electric vehicles can benefit the country and its citizens by lowering reliance on fossil fuels and pollution. People's awareness of electric vehicles is greatly influenced by their degree of education. In addition to producers, the government ought to make a concerted effort to raise awareness and shape prospective customers' favourable opinions.

Glamorous Bhalla [2018][5] The selection of cars is influenced by various factors such as cost, comfort, technology, social acceptance, availability of infrastructure, and environmental concerns. These claims

have been put to the test using both traditional and electric vehicles. They believe that these elements directly affect each person's choice of car. They discovered that in order to increase societal acceptability of electric vehicles, governments and producers of such vehicles must make more investments in infrastructure development and technological credibility-building. The investigation shows that the general public is aware of the advantages for the environment. The onus of making investments in the manufacturing of automobiles is with the government and manufacturers.

Shukla Vishal According to [2021][6], the Law of Demand, a fundamental economic principle, is driving more demand for oil-based energy as globalisation rises. This, in turn, is causing a sharp volatility in crude oil market prices. The demand and price instability of crude oil puts pressure on governments and policymakers to find alternatives, one of which is the adoption of green technologies. Similar to industrialised nations, India, a developing country, is prepared to enter the cutting-edge market for electric vehicles (EVs) and hopes to establish itself as a significant manufacturer of EVs for both the domestic and international markets.

VI. CONCLUSION

The Electric Vehicles are necessary in the current stage of life because the population of the country is increasing rapidly. This will create need for more vehicles and the need of more vehicles will increase the demand for fuel. The continuous use of Fuel will make the shortage in supply of it. All these aspects provide a way for the introduction of Electric Vehicles. The introduction of Electric vehicles also an Eco-friendly invention this will reduce the pollution in the environment. The Rapid increase in the Electric vehicles leads to heavy competition in the market. By considering the above elements the study is made to identify the consumer preference and satisfaction towards electric vehicles in Coimbatore city. Hence, this work is based on consumer perception and satisfaction towards E-vehicle in Haryana.

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