



Full length article

Analysis of Current Infrastructure & Future Perspective For E-Mobility in India

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ABSTRACT

The study will highlight several infrastructural problems and some crucial variables that may push India's transportation industry to buy an electric automobile. The study's primary section will shed light on the environmental, economic, and other benefits of e-mobility transportation. Afterwards, the second part reflects the basic understanding of e-mobility and the everyday challenges and barriers to e-mobility. The next part of the study covers research aspects such as the research strategy and different methods and tools for data collection to complete the research work. The next chapter demonstrates the analysis of the data gathered from the different sources. Following this, the article indicates the approach strategy of the Indian government toward e-mobility and infrastructural comparison between India and some developed countries to figure out the main factors. In the end, the last chapter of this article recommends some strategies and solutions to counter challenges that can affect the Indian automobile sector and the determination of some significant elements to ensure an effortless change from conventional mobility to an electric method of transportation.

1. Introduction

The automotive expansion rate has risen due to the population explosion and industrial growth. The rapid population growth and rise of the nuclear family hello are the primary reason for the excessive expansion of the automobile industry. In addition, numerous companies sell their device at affordable prices (Mukherjee, 2019). As a result, most urban cities suffer from overcrowding of motor vehicles and traffic. It is observed that the amount of carbon dioxide and volatile organic substances such as halocarbons and hydrocarbons is 250 % more in urban areas. In short, the conventional transportation mode system is answerable for more than 45 % of air pollution. Such vehicle pollution causes global warming and the greenhouse effect, which is responsible for damage to the ozone layer. Many developed regions deal with poor air quality, smoke, and visibility issues (Rinkesh, 2021).

To reduce the adverse effects of global warming and pollution, almost every country is trying to alter its policies, rules, and regulations and provide different facilities to develop sustainable products. According to a study on E-mobility, it is considered the future of transportation because it can quickly reduce environmental and pollution issues. Some European countries such as Norway, Netherlands, England, and France have successfully implemented EV vehicles in their public and private transportation systems. The higher authorities of these countries provide various benefits to EV drivers. To illustrate, EV drivers can get different kind of subsidies and tax relaxation (E-flux, 2021). However, there are some challenges to adopting an EV vehicle, such as insufficient infrastructure for charging facilities, battery monitoring, An optimal EV loading strategy for intelligent power management, rare earth elements, critical substances for battery production, lack of skilled workers, etc. (Garg, 2022). India's EV vehicle adoption rate is significantly low compared to other countries because of the unavailability of appropriate facilities in sufficient amounts. The adoption rate of bicycles is relatively high compared to four wheels because of the affordable price range. At the same time, four wheels are roughly twice as expensive as conventional vehicles, restricting individuals from shifting to E-mobility. The primary aim of this research is to find out the exact situation and facility of e-mobility structure in India and What strategies should be employed to transition from conventional to e-mobility?

The e-mobility structure covers the total strength of charging facilities, service stations, accessibility of original equipment manufacturers, EV stores, numbers of models, etc. Appropriate information about search facilities can help to implement a practical approach that can quickly and efficiently alter the Indian automobile division towards the EV-driven sector. The main objective of this article is to figure out crucial factors that can act as barriers during the adoption of e-mobility structures, different EV vehicle-related infrastructures, and the approach of higher authority to fulfil transition. To successfully carried out this transformation, it is essential to understand modern innovation and techniques that may help the government and entrepreneurs. Afterwards, finding out the significant difficulties India faces during this transition and some solutions that can fix such challenges is essential.

1.1 Research Framework

The combination of a dependent variable and three independent elements throughout this analysis forms the foundation for these interactions. Therefore, it addresses Sector (X1), Driving Forces (X2), and the federal government and new innovators' roles in E-mobility (X3) regarding a smooth changeover from traditional to E-mobility (Y). As the figure suggests, one independent variable and three dependent variables exist. The conversion of the Indian automotive sector from ICE to EV is the independent variable. Dependent variables will primarily drive the change in the automobile sector. Hence, the available independent variable is going to use to evaluate the excellence of each dependent variable.

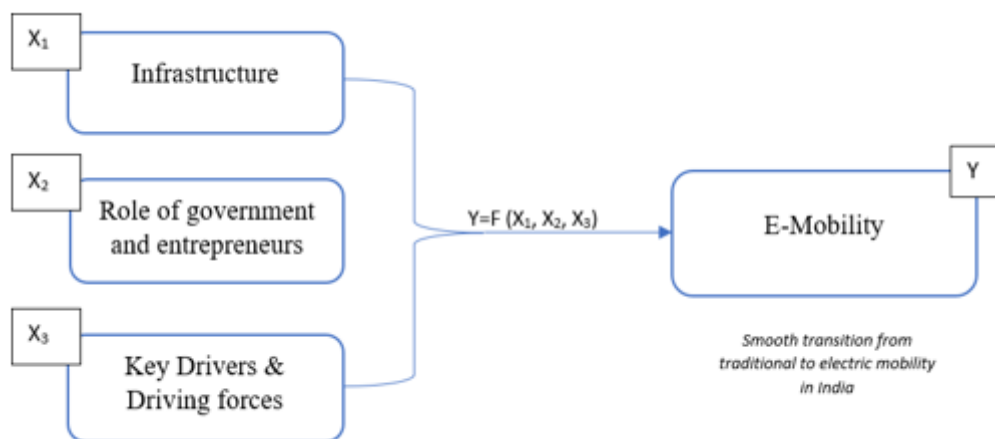


Figure 1. Research framework

The other part of the article compares the Indian e-mobility sector with some European countries such as Norway, France, and Iceland. Apart from this, research indicates some Indian government policies to achieve electric mobility transition. Furthermore, the research paper covers several challenges that act as barriers to e-mobility transformation and suggests strategies and solutions that may help achieve the desired transition. The research paper makes understandable points about the Indian electric mobility department and some root causes that slow down the EV mobility adoption process. All the approaches and policies from the government and critical factors are taken into consideration to accept the beneficial progress flourishingly.

2. Literature review

2.1 History and evolution

The term “automobile” is derived from the integration of the Latin word “mobilise”, which means movement, and the Greek word “auto”, which indicates “self” (Khodorkovsky, 2010). Sumerians assigned the emergence of wheels in approximately 3500 BC; the invention of the wagon alongside steering and wheel shock absorbers crafted in 1300 are a few breakthroughs in improvement that were crucial to the evolution of automobiles. Joseph, in 1779, made the steam chariot. Nicolaus Otto introduced this concept for the first dynamic power generator in 1864. George Brayton created the industrial internal combustion machine in 1872. (DD Bhubal, 2022) Cauls Benz became the first person to create a car in 1885. He is the pioneer of the internal combustion engine-powered automobile. Karl Benz secured a patent for a durable two-stroke gasoline power source in 1879. Carl Benz's advancement of the three-wheeled auto. The designation of that kind of automobile is called Motorwagen (Wang, 2020).

2.2 Types of EV

An electric automobile device, for example, an electric car, uses the available electric engines that a lithium battery has driven. Regardless of the specific type of EV, the electronic engine might help an ICE model or might provide the entirety of the vehicle's energy. There are mainly three kinds of electric vehicles available: 1) hybrid electric vehicles (HEV), 2) plug-in hybrid electric vehicles (PHEV), and 3) battery electric vehicles (BEV) (National roads and motorists, 2020).

2.2.1 Hybrid electric vehicle (HEV)

Hybrid electric vehicles consume power from ICE and the electric motors in which the energy is stored in irons. This vehicle must not be plugged into a charging station to charge batteries. Consequently, vehicles' internal combustion motors and braking systems charge the battery. Having this application, a small capacity engine is sufficient due to the electric motors help to enhance the power. This battery can also help to minimise power usage. Having these essential elements can noticeably improve the efficiency of the vehicle. Many automobile manufacturers in India, such as Toyota, Honda, and mg hector, make hybrid electric vehicles (Nayak, 2022). The dependency of this type is relatively less on fuel, and customers can quickly get a more resale amount of vehicle.

2.2.2 Plug-in hybrid electric vehicle (PHEV)

Plug-in hybrid electric vehicles generally use electricity until a vehicle's battery is completely drained. Afterwards, this engine initiates utilising the available fuel to produce more energy. Some engines ideally use the balance of electric power and fuel energy while the battery is fully charged. This kind of engine is known as a blended-mode PHEV. Over 50 EV models use this engine (EPA, 2022). It has many benefits, such as not plugging to charge the batteries and providing comparatively higher mileage than other EV types (Auto express, 2020).

2.2.3 Battery electric vehicle (BEV)

Battery Electric Vehicles, sometimes abbreviated as BEVs or more generally referred to as EVs, are defined as completely electric vehicles without a gasoline engine. There is a complete absence of equipment like ICE, fuel-carrying containers, etc. Customers might encounter uncertainty because they must confirm their BEV has enough battery to go unless they pick a different vehicle with an alternative internal combustion engine, such as the BMW i3 generation model (Yong, 2019). It provides some benefits like the absence of engine noise, safe and eases of utilisation and environment friendly as well. On the other hand, it has a few cons: the customer cannot predict the exact range of battery, lengthy charging periods, etc. (YOcharge, 2022).

2.3 Difference between ICE & EV

Internal Combustion Engines	Electric Vehicles
The engines of IC vehicles require more fossil fuel.	In Electric vehicles, there is a lithium-ion battery which consumes less.
This engine has a high-power density.	It has a comparatively low power density.
They are responsible for the emission of greenhouse gases.	These engines are not emitting greenhouse gas.
The time required to refuel the fuel is significantly less.	The time required to recharge an electric vehicle's battery is very lengthy.

Fuel tank consumes less space in automobile device.	The battery of electric vehicles requires ample space.
A sophisticated gear facility is required.	There is no need for a gear system.
These engines create noise.	These engines are generally noise-proof.
This kind of automobile generally has a single engine.	EV vehicles contain motor engines as well as batteries.

Source: (Saini, 2022)

2.4 Advantages of EV:

Environment friendly: The first and foremost benefit of electric vehicles is that they do not require fossil fuels and not emits harmful gases such as carbon dioxide and nitrogen oxide. Hence, it benefits the environment in terms of air and noise pollution.

Low maintenance: Every automobile device requires service after some time, but the EV significantly requires few services as compared to the ICE because, in an EV, there are very few moving parts available. Hence, it costs drastically low than ICE vehicles (George Milev, 2021).

Efficiency: Every vehicle's quality is essential for better performance. Initially, the reputation of EVs was not good enough, so expectations were minimal from this segment. However, with some innovative development, many automobile companies are investing in this technology. Recently, a variant from Tesla has become most popular because it has an immense acceleration speed than other electric vehicle models.

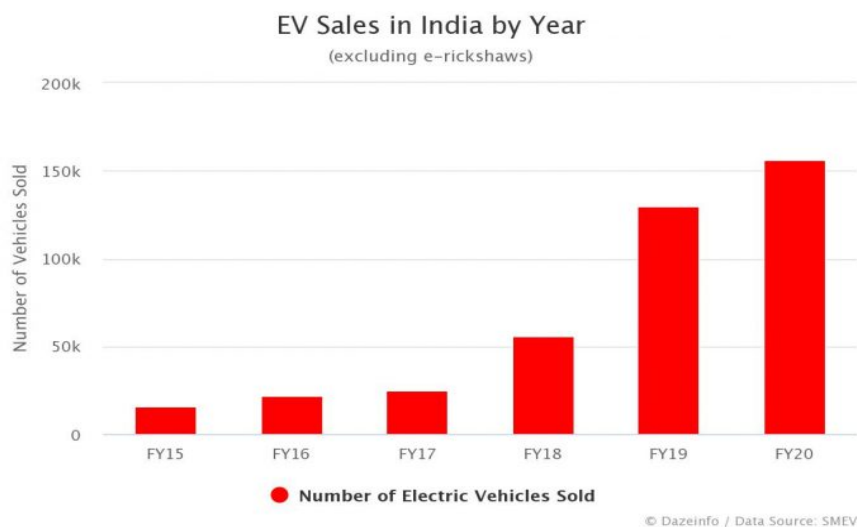
Running cost: the main expenditure in the ICE vehicles is the cost of fossil fuels. For example, in the UK, the average expenses of fossil fuels for medium-range ICE vehicles are almost 100 euros, while for the same range, the cost of EVs is around 15 euros (ecocost savings, 2022).

2.5 Challenges in Electric Vehicles

The major challenge of electric vehicles is to fulfil the energy requirement and the distribution facility of energy resources. Apart from this, the power department must supply more electricity because of the sudden growth in electricity consumption. It is hard to generate more energy with the current electricity production infrastructure. Following this, making efficient batteries at a minimum price is another challenge for many manufacturing companies because lithium-ion batteries are made up of rare and expensive components. The dispersion of electric vehicles battery is another concern because it has components such as lithium, titanium, and nickel, which can easily harm the environment. Furthermore, fast charging infrastructure is also required, and the automobile should be able to consume high voltage or current for fast charging (Sonali goyal, 2021).

2.6 The automobile sector in India

In India, there are more than three lakhs of electric vehicle registration till 2021, and the government expects a rise in sales. According to a study, Indian consumers are purchasing two-Wheeler electric vehicles significantly, but there is no search kind of positive response to four-Wheeler. India is expected to transition by 2040 when the electric car market is more than ICE vehicles and 2 Wheelers r more excellent Lee available in the TV segment. However, the sales of electric vehicles have recently increased yearly (SINGH, 2021).



Source: (Dazeinfo, 2020)

2.7 Past studies on e-mobility in India and the research gap

India has more than 220 million automobile vehicles, which is expected to rise by 600 million. So, India 3rd in importing fossil fuels for the transportation sector and the fifth most significant vehicle-producing sector. The country cannot adopt the transition of electric vehicles shows that the government has decided to take the initiative to acquire the transition. According to some research, poor EV infrastructure and economic limitations are significant barriers. (DB Digvijay, 2021) Furthermore, a lack of appropriate knowledge is creating confusion in consumers' minds about the resale value of cars, the availability of service centres, and the replacement cost of EV batteries. The previous study was based entirely on infrastructure availability and sophistication in technology. The study has not had convincing information about government policies and approaches regarding electric vehicles. However, this research article tries to cover all the aspects of the e-mobility unit in India and crucial factors for a better translation (Anil khurana, 2019).

3. Research Methodology

3.1 Data collection method

To achieve the research goal, there is the requirement to gather in-depth information about some essential factors, barriers, and availability of different things. To gain knowledge about E-mobility number of articles and research papers are analysed. Questionnaires and surveys gather the crucial factors of electric vehicles from

experts in this field. Two types of data collection methods are used to acquire all the valuable information about this topic: 1) primary data collection method and 2) secondary data collection method. All the information and data collected first time from interviews or surveys are considered primary data or first-hand data. At the same time, secondary data is commonly derived from different study materials such as analysis of research papers, thesis, and websites.

3.2 Research Philosophy

Research philosophy is the method of using research workers to enhance their understanding of the research subject. There are mainly four types of research philosophy.

3.3 ethical consideration

All the ethical considerations are followed throughout the research work, all the information and data gathered for study purposes and did not share with turn official individual or organisation, and the information described in the article is acquired from genuine sources.

3.4 Limitations

Even though there are some research limitations, such as the majority of analysis is done by secondary data collection method. This is due to the unavailability of appropriate data and time.

3.5 Questionnaire survey design

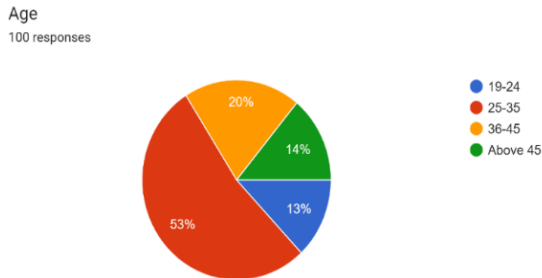
The questionnaire was developed to discover information about the condition of the EV sector in India and determine the prominent causes for the poor adoption rate of an EV. The first part of the questionnaire contains a person's basic data search as age, sex, educational qualification, etc. The second part focuses on impactful factors that can reduce the electric vehicle adoption rate.

The analyst utilises the questionnaire to assess the information taken and understand it while paying attention to secondary information to draw the definitive result. Furthermore, reliable statistical equipment and devices will examine the derived result. Studies also adopt regression analysis to measure links between both dependent and independent variables. As a result, the connection between variables can be evaluated and simulated in this analysis to establish whether an organisation is efficient. The "Data Analysis" part offers a comprehensive review of the insights made and displayed effectively to examine their relevance.

4 Results

4.1 Analysis of data

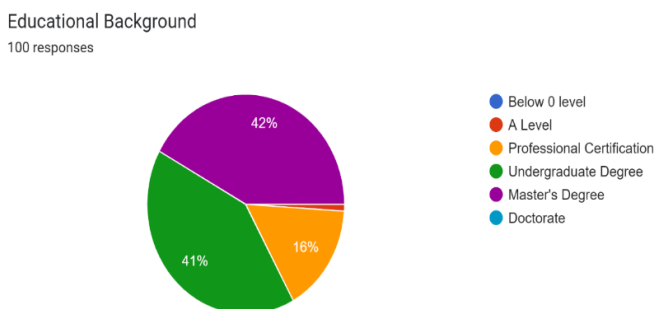
4.1.1 Demographic Analysis



1) Age group

Questionnaire results: Age group

For demographic analysis, the primary data was collected from 100 participants, and more than half participants were between 25-35 your age category. At the same time, more than 80% of participants are between the age of 19-45. This demography value of the dependent variable the correctness of their statistics and confirms the accuracy of the assessment.

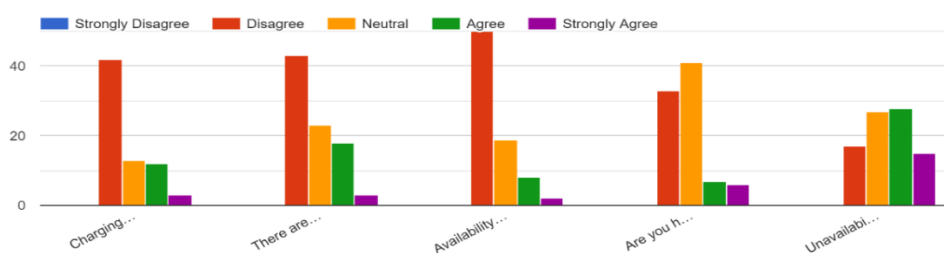


2) Educational background

Questionnaire result: educational background

3) survey response/insight

Infrastructure (X1)

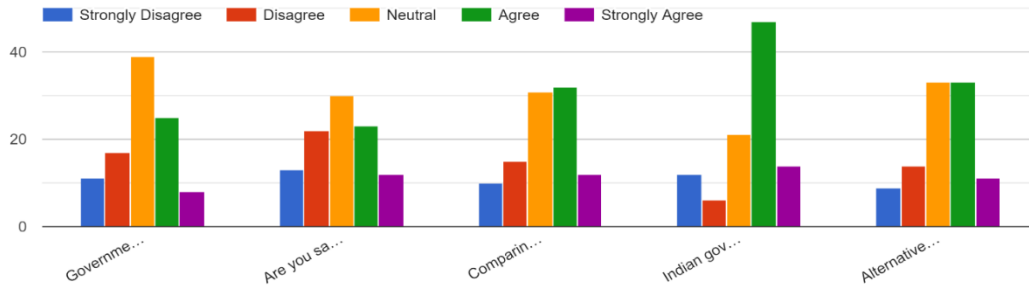


This data is gathered to assess the exact strength and efficiency of infrastructure. The majority of participants vehemently denied the question of a sufficient charging facility. According to their response, they must heavily

rely on a home charger facility and deal with range anxiety. Some users of electric vehicles are satisfied with the quality of service.

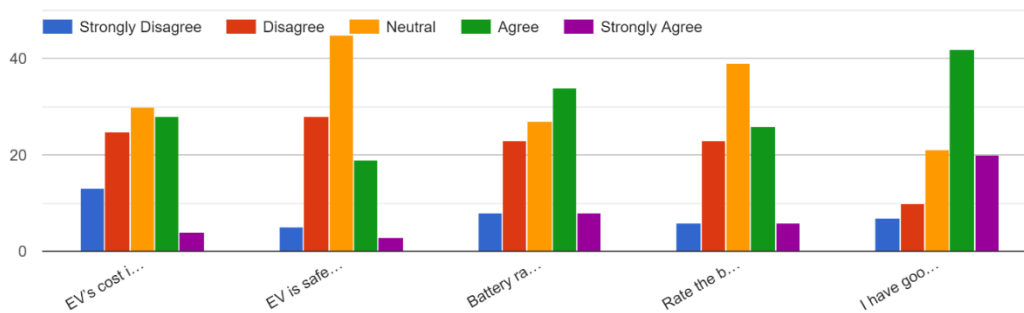
4) role of government policies and entrepreneurs

Role of Government policies and entrepreneurs (X2)



Some questions are asked about different government policies regarding electric vehicles. The primary aspects are determining whether customers are satisfied with government tax relaxation and exemption policies. Most consumers seem completely satisfied or dissatisfied with the policies of state and federal authorities.

Key Drivers (X3)



5) key drivers

It can be derived as the vast number of electric vehicle users are entirely knowledgeable about different economic and environmental benefits according to the satisfactory answers to key drivers related questions.

1) Regression Statistics

SUMMARY OUTPUT	
<i>Regression Statistics</i>	
Multiple R	0.679944537
R Square	0.462324573
Adjusted R Square	0.445522216
Standard Error	0.60681953
Observations	100

The coefficient of correlation is generally termed “multiple R”, which helps to determine the interrelation between 2 different variables. The “multiple R” result can be derived between -1 and 1. Where 1 indicates or direct correlation between variables and a -1-repression week correlation. In this study, the final value of multiple R is 0.67.

2) ANOVA analysis

ANOVA					
	<i>df</i>	SS	MS	F	Significance F
Regression	3	30.39604801	10.132016	27.51545935	0.000000000000629439
Residual	96	35.35007444	0.368229942		
Total	99	65.74612245			

In an analysis of the variance process, the “significance of F” access is relatively dependent on the conclusions. Three dependent parameters and one independent variable are introduced in these arithmetic operations. The consistency of data is denoted by the value of "significance F" under 0.05, and the estimation of data collected provided the "significance F" value less than 0.05.

4.2 case study analysis

Nations have primarily been selected depending on their equivalent automobile systems, which become abounding with both public transport services and private transport, in a bid to determine the fundamental factors of e-mobility (Bhujbal & Shafighi, 2022; Brahme & Shafighi, 2022). The case study evaluations of each of those nations may serve as a quick summary of the difficulties and potential chances that India may face in pursuing E-mobility. The nations that have currently adopted e-mobility are taken into consideration.

4.2.1 Norway

Norway is a pioneer in the global adoption of renewable energy mobility. Recently, it became the 3rd most attractive region for implementing electric vehicles. After 2020, almost all car purchases in Norway were entirely electric, featuring several of the most prominent models of existing electric. To achieve zero emissions before the year 2050, Norway is endeavouring to modernize all kinds of transportation; before 2030, they aim to run all of their small-distance flights on electricity (ErikFigenbaum, 2017).

Government incentives

Toll tax at half-price:

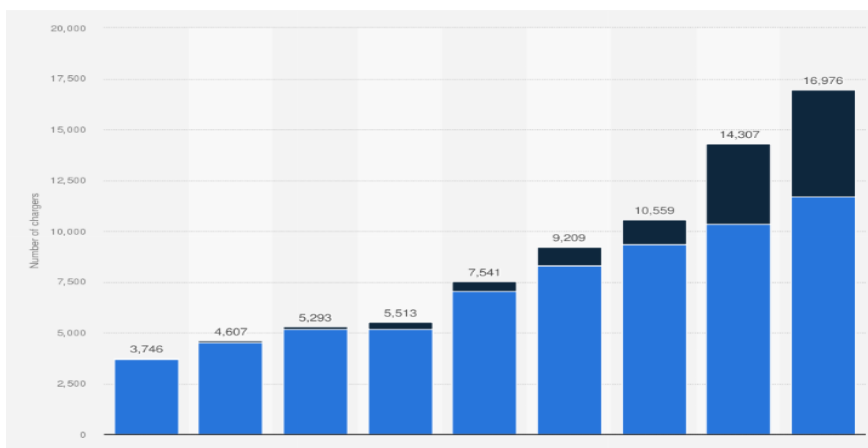
According to Norway legislation and rules, proprietors of electric vehicles must pay only half the toll taxes.

Half-price parking:

Recently, most of the country's higher authorities r confused about deciding the cost of EV parking. In Norway, regulation has been implemented that the EV consumer has to pay only 50% of the amount for regular parking (Policies, 2022)

Efficient charging infrastructure

For any country, the availability of efficient electric vehicle charging stations is essential. Charging infrastructure is crucial for the adoption of electric mobility in any area. Around 9400 sets of accessible public supercharger stations will be installed in Norway by the end of 2019. More than 17,000 charging stations are currently available in Norway (Mer, 2022). The advancement of charging stations in Norway is described in the column chart below.



Source: (Carlier, 2022)

4.2.2 France

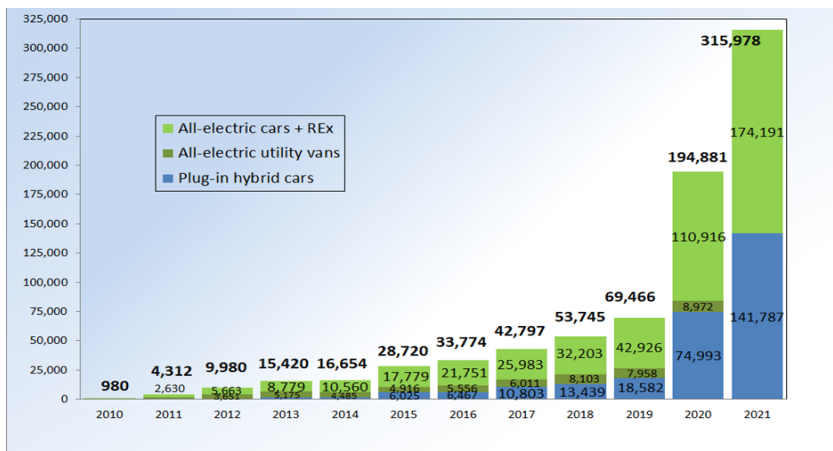
After 2010, the primary objective of France is to develop the electric vehicle sector; during 2015-16, France is the largest market for EVs in the European country. To achieve their goal, they had to follow strategies such as car-sharing services, efficient facilities for charging, etc. The adoption of electric vehicles in France is easily observed from the chart.

Electric Vehicle Swap Scheme

In 2011, the French province of Nice introduced an electric car-sharing initiative, which marked the start of the nation's push to adopt electric mobility. In the upcoming years, the consumers of electric vehicles will be nearly 4000 and almost 80 charging infrastructures.

Initiatives of government

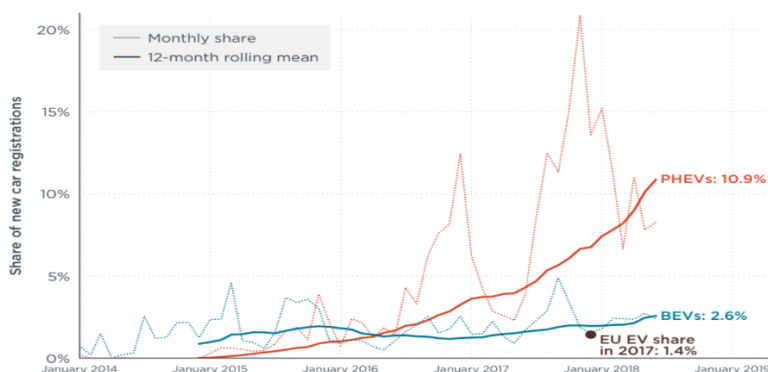
The city council of Paris established the objective of abandoning fossil fuel-powered vehicles by the end of 2030, which was even more enthusiastic than the French government. By 2025, the country is expecting to generate more than 9,00,000 batteries for electric vehicles (Wappelhorst, 2020).



(Compare the market, 2021)

4.2.3 Iceland

Iceland has surged past other nations to become the worldwide powerhouse in electrical mobility. The following graph illustrates Iceland's monthly market position in the EV sector.



Source: (Wappelhorst, 2018)

Iceland is a country that adapts to new inventions more quickly than other countries; it is a society that follows a culture of accepting innovation. The same thing they have done in their electric vehicle recharging stations, Iceland they what technology of fast charging that can efficiently recharge the lithium-ion battery in a few minutes (Wappelhorst, 2018).

5. Indian government policies

To adopt an electric vehicle transportation mode, many barriers, such as charging infrastructure, technological advancement, and approaches from entrepreneurs, play a significant role. However, among all the factors, government policies significantly impact transition. The higher authority of India has launched many policies to

adopt electric vehicles, relaxing for the manufacturer company and customers. This part of the research will display government policies to adopt electric vehicle transportation modes. Among the 100 participants, almost all of them have at least an undergraduate qualification.

National electric mission mobility plan (NEMMP)	The primary aim of the national electric mission mobility plan is to maintain a sufficient amount of national fuel by developing hybrid and electric automobile devices in India. From the publication of this scheme, India's higher authority estimates sales of 60-70 lakhs of electric vehicles each year (Vikaspedia, 2020).
Faster adoption and manufacturing of electric vehicles (FAME)	The main objective of the faster adoption and manufacturing of electric vehicles policy is to enhance the overall sales of electric vehicles. To fulfil their motto, the higher authority is providing different kinds of discounts along with this scheme to boot the acquisition of new EVs that may help the transition of electric vehicles transportation mode. The government has also extended the project for an upcoming couple of years.
E-AMRIT	The primary aim of the accelerated e-mobility revolution for India's transportation policy is to support the government's efforts to broaden awareness about electric vehicles' best transportation mode. It also helped to provide the vision and aware the consumers of current strategies and policies of the government, subsidies, and tax relaxation on e-mobility .
Production-linked incentives (PLI)	According to the production-linked incentive scheme, the government is set to invest almost \$3.5 billion in the automobile sector, which also explains the economic incentives of up to 18% of the overall to promote local production of technologically advanced automobile components and attract different resources to fulfil the sector's production chain (Invest India, 2020).
Scrappage policy	According to the Indian government's scrappage policy, they took the initiative to eliminate old and unsecured automobiles and try to substitute them with new electric vehicles. The policy aims to establish a framework for unfit and polluting automobiles to minimise the country's total co2 emissions. This scrappages policy of the government consented in 2021. Assessment comprises a full inspection to assess if a vehicle is fit to drive. The examination additionally analyses whether the automobile is damaging the environment. Automobiles that pass the fitness test can get subsidies of 10 to 15% of vehicle tax (IBEF, 2021)

6. Comparison: Indian and other E-automobile sectors

This part of the article will compare different driving forces of electric vehicles, such as charging stations strength, availability of EV companies, condition of the original equipment manufacturer, fuel price range, and the price

range of the electric vehicle. This comparison is made between India and some European countries which have successfully implemented E-mobility. At the end of this chapter, there is a table that compares all the driving forces that can impact the adoption rate of electric vehicles; the comparison is made between Norway, France, Iceland, and India.

Charging stations

The charging stations are the crucial factor for the adoption of E-mobility. So, having an efficient charging infrastructure can solve a massive charging problem. (SS Brahme, 2022) In Norway, there are 17,000 charging stations available. While France has almost 50,000 charging facilities, and Iceland and India have 400 and 1,742 charging amenities, respectively (acea driving mobility for Europe, 2022).

EV companies and OEM availability

The availability of different companies can act as the trump card for the transition of the electrical device because customers can select their automobile device from numerous options according to their budget and the characteristics that customers want in their electric vehicles. The presence of original equipment manufacturers is directly proportional to the presence of EV companies. The OEM presence can satisfy customer requirements and increase the sales of the automobile company.

Price of fossil fuels and EV cars

The prices of fossil fuels differ in different countries because state and federal duties and taxes differ in each country. Similarly, the price range of EV cars also fluctuates from country to country because some countries can make their lithium-ion batteries. In contrast, others have to import them from other companies, which can increase the prices of electric vehicles (Hurst, 2022).

Facilities of EV sharing

The amenities of EV sharing can solve the problem of battery range anxiety. Search kinds of initiatives are already started in some countries, and the customers of electric vehicles are satisfied with this facility. In India, there is an absence of the concept of a lithium-ion battery-sharing strategy (Sureka, 2022).

7. Challenges with electric vehicles in India

Inadequate charging facility

The absence of a sufficient amount of charging stations is one of the significant obstacles to the deficient transition of EV vehicles. Following that, sometimes, charging duration is based on the efficiency of the charging station and the capacity of EVs battery. So, manufacturers of charging stations have to establish the facility in areas where users of EV vehicles can keep their vehicles parked for an extended period because recharge might require more time (Garg, 2022).

Range uncertainty

The second most claimed challenge to adopting electric vehicles is the reported range limitations. Many people feel "range uncertainty" because they anticipate that an Electric vehicle does not have enough efficient batteries to take them to the desired place. Factors like battery switching and enhancements to the connectivity for charging stations should be more (Feil, 2022).

Composition of batteries

The production process and distribution chain are other barriers to adopting e-mobility vehicles in India. Because the primary electric battery component is lithium, India has to rely on other countries to get sufficient

amounts of lithium. India relies on other countries for efficient batteries, and the overall price of electric vehicles has increased. For other raw materials, mining and logistics infrastructure are required (HECTOR, 2021).

Vehicles beta version

The commodities the automobile companies are recently making may be coming into the market with consumers for the maiden time and with the new technology. So it is expected that creating an efficient and errorless product in the automobile sector is complex and not beneficial for the consumer. EV buyers have to face several issues that should have been assumed (Kumar, 2022).

Battery cost and life span

The Li-ion battery in powered mobility is intended to last for a minimum of 6-7 years, or hardly eight years. Beyond this time, the users of an electric motor are left with no other option but to purchase a replacement battery, which charges approximately 70% of the expense of the entire car. Considering autonomous motors still represent a relatively young technology within the marketplace. Among consumers, the life span of batteries will be a critical challenge for Vehicle owners and manufacturers for the upcoming few years.

Complications with temperature

In India, the average temperature is relatively higher than the European country, and the temperature has a noticeable impact on the performance of electric vehicle batteries. Furthermore, the efficiency of the electric vehicle batteries is decreased in extremely high-temperature locations, and there is also a possibility that vehicles can catch fire. Following this, such batteries are also not practical in freezing weather.

Shortage of skilled workers and service stations

Finding a service station for an electric vehicle is a challenging operation, specifically in India. There is a greater probability of a fault condition or any other kind of complaint or complexity also because the mechanics of an EV are extensive and have few moving components. Additionally, there are very few EV charging outlets in India country places. As a result, clients should call EV care professionals and wait for them to resolve the specific issue. There are few EV professionals listed available in India, and they are expensive even though they cannot solve critical glitches in the electric vehicle because of a lack of experience and sufficient knowledge.

Safety Concerns in EV vehicles

The electric vehicle's battery contains many lithium and iron cells. In the case of an ultimately charged battery, such kinds of lithium and iron cells are acquired high energy. If the battery is damaged, it can easily catch fire. If somehow the fire continues burning, there is a significant probability of an explosion. Therefore, the only way to accurately detect an EV engine problem is to deploy an order to find specific or so much water that the fire has no chance of sparking. This is becoming a significant issue for rescue crews because it demands many resources to put out using a small fire. In India, regional fire stations are poorly prepared to handle the threat (Healey, 2022).

8. Implementation strategies for EVs in India

Accelerate Charging Infrastructure Development

As mentioned before, an insufficient charging infrastructure is a chief obstacle to using electric vehicles on a massive scale in India. To eliminate this problem, the administration can promote various investment plans for investors and construct the company's charging infrastructure. Expanding the growth of the facilities for charging EVs can encourage people to buy electric vehicles (Chatterjee, 2021). In addition, companies can also make

universal plugs and chargers for convenient use of charging stations. Furthermore, it can drastically reduce the probability of destruction or damage to the battery (FLEMING, 2013). Moreover, the electrical supply for the charging station is required in Power Distribution companies can solve the problem of transmitting electric supplies for charging stations. Time-to-time evaluation of charging stations can reduce the burden on the electricity system (Aayog, 2021).

Customer awareness

The state and federal authorities and the manufacturers of electric vehicles should promote e-mobility devices and promote their vehicles with the help of different mediums such as newspapers, TV, social networking websites, etc. The government can run an awareness campaign for EV devices with pros such as economical, environment friendly, and less maintenance cost. The Indian government can offer different subsidies to attract many customers because the price of electric vehicles is recently very high, and Indian consumers are price sensitive. The higher authority might also commence awareness sessions in which they can provide every piece of information and benefits of electric vehicles (Shelke, 2019).

Reduction in tax and import duties

The government can lessen the import duties on electric vehicles to encourage many customers to purchase EVs. Furthermore, the state government may reduce the tax on electric vehicles. To increase EV adoption, the higher authority should publish different policies. The management should also encourage automobile companies to construct EVs. To illustrate that, the government of Maharashtra has decided to give 10% compensation on every new EV registration till 2025. Similarly, the higher authority of Delhi is providing 20% of replay on the electric vehicle certification by 2024 (Aijaz, 2022).

Strengthen manufacturing system

By allowing internal producers tax incentives, India may enhance its environment for EV production and diminish its reliance on foreign oil and EV equipment. To formulate budget-friendly solutions and reduce vehicle expenditures, support research and development, including multilateral institutions.

In the end, the higher authority could encourage the research and development department by providing adequate facilities and funds for innovation. At that time, in India, few service centres are available for electric vehicles. So, manufacturers have to establish EV service centres that can quickly solve the issues and queries of the customers (Singal, 2021). Many incidents have recently shown that electric vehicles have caught fire for technical reasons. Automobile companies should fix the problem as soon as possible and provide optimum safety in electric cars.

9. Conclusion

To put it in a nutshell, it is crystal clear that some critical factors, such as the infrastructure of charging stations, government approach, policies, and appropriate knowledge about E-mobility, significantly impact the adoption of electric vehicles. Based on the study, it is apparent that countries like France and Norway have successfully implemented e-mobility by covering all crucial factors. This article also compares some fundamental driving forces with other countries' EV automobile units to identify the exact requirement of the electric mobility sector in India. The report also reviews the Indian government's different policies to know about the government's approach toward the electric vehicle transition. The higher authorities have brilliantly made policies, but the implementation of such policies is restricted because of some common problems such as poor infrastructure, insufficient knowledge about electric vehicles, and a few different challenges such as the country's economy,

conservative mindset to accept innovation, etc. However, the government's next aim is to cover all the impactful key drivers and eliminate several obstacles hand making India a substantial electric vehicle manufacturing unit. To conclude, based on statistics and the government approach, it is estimated that in the upcoming period, India will acquire positive changes and become the hub for manufacturing components of electric vehicles.

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