Electric Mobility in India: A perception study amongst manufacturing and IT hubs in Maharashtra

Vishnu Ps
Symbiosis Centre for Management and Human Resource Development, SCMHRD, Symbiosis International (Deemed University), SIU, Hinjewadi, Pune, Maharashtra, India
vishnu_ps@Scmhrd.edu

ABSTRACT

The post covid-19 era presses for changes in mobility and impresses upon a transition towards sustainable/green mobility options so as to reduce dependence on imported crude oil. Target towards improving the electric vehicle adoption in India have already been implemented through a set of policies like the National Electric Mobility Mission Plan (NEMP) - 2020, and the Faster Adoption and Manufacturing of Electric Vehicles (FAME-I and FAME-II). However, the adoption of electric vehicles has been stunted so far. This paper studies the widely held perceptions and opinions about electric vehicles amongst the manufacturing and IT hubs in Maharashtra. A method of approach was adopted for the study whereby in-depth quantitative data collection from over 120 respondents from the chosen area of Manufacturing and IT sector. This investigation explores the key deterrents to higher EV adoption amongst manufacturing and IT hubs in the country - the 2 sectors with highest vehicular intensity in the country, and recommend policy interventions accordingly

Keywords
Electric vehicle, green mobility, perception study

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Introduction

With increase in climate change issues and global warming, many countries are coming up with innovations and strategies, and policies that support a greener environment. One of the key priorities is to transition to green mobility - with the dual objective of reducing vehicular pollution and reduce the consumption of oil which reduces imported inflation. Mobility through electric means offers a critical solution to reduce the pollution and emissions at the same time offering an undisturbed level of mobility to the consumers. Vehicles have been successful in terms of their promising innovation and that some of the governments have effectively taken steps and strategies to advance and implement the innovation. As per Bloomberg's report (BNEF, 2017), the improvements in the past 10 years have established that EVs are the most promising and efficient means of transport all over the world. EVs are approximately 5 times more efficient in terms of energy when compared to combustible vehicles. Electric vehicles are a means of greater reliability as it uses much lesser moving parts than the traditional combustible vehicles.

Automobile manufacturing firms like Nissan, Tata Motors, Mahindra and Mahindra are trying to make the most of the initial high growth period of Electric vehicles by investing in R&D and are trying to have a strong competitive entry into the market [3]. As per the present scenario, it is challenging to understand a faster transition in the void of a clear-cut policy, restricted knowledge about difficulties in the technology, deficiencies in infrastructure, and absence of acceptance and awareness by the consumer in the current local market. For a quicker adoption, it is important to develop a mechanism to tackle these challenges. It is highly important to understand the factors which influence a customer to purchase or to build an intention to purchase an Electric Vehicle and thereby focusing on the commercial success. Some of the factors which influence the customers based on the research conducted are price of the vehicle, charging infrastructure owing to availability of charging points, maintenance costs, safety reasons, and so on. There are a few parameters which based on the study would hinder the acceptance of EV's like experience, safety, reliability over the traditional methods of transportation and there is a risk and uncertainty over the introduction of the new technology. While literature has captured barriers to a higher EV adoption, this study focus on the manufacturing and IT hubs in Pune. Pune has a current available road network of 7% whereas there is a strong requirement of 15% and this gap identifies the immense traffic in various parts of Pune [9].

Further, Manufacturing and IT concentrations account for higher vehicular intensities. The aim of this study was to understand EV adoption enablers and disablers within the sample and recommend solutions to enhance the rate of adoption.

The study was conducted in the following way,

- Research Methodology: Internet based survey designed with 21 in-depth questions to the people of the designated sector
- A total of 151 samples were collected from the respondents, from 5th June to 25th June 2020, adding their thoughts and barriers towards adoption of EV's. The main parameters on the consumer perception is towards environment, pricing of the vehicles, social acceptance and so on.
- The structure of the paper consists of the Results and analysis from the respondent feedback and thoughts, limitations drawn from the responses, literature review to support the concept of EV adoption

India is looking forward to have three strategies to look on electric vehicles:

1) Rates of Carbon Emission: It is of high importance to focus on the need to diminish the carbon emission and is undoubtedly a major development goal.
2) Decreased Power Demand: Power Demand has not witnessed a boom with respect to the improving generation capacities which leads to non-viability of the current sector. Grid stability would be made helpful with the rise on electric vehicles.
3) Fuel Security Risks: India currently depends on large scale imports of crude to meet most of its mobility fuel needs

It is estimated that there will be 43 megacities by 2030 where most of them are present in the developed regions. With the advent of quicker urbanization, there has been a massive increase in city spaces which eventually lead to increase in the trip lengths and the amount of vehicles on the road. Mumbai and Pune has become a preferred location of residential development including close proximity to major IT/ITeS hubs and key infrastructure road projects like the Mumbai-Pune and Pune-Bangalore Expressways. Proposed infrastructure initiatives, including the development of an international airport, the Pune metro, and building of flyovers and underpasses will have a positive impact on the real estate market. Because of the above mentioned reasons, Mumbai and Pune are much opted cities by many people for settling down and to lead a life. As most of us are aware a large number of people in these cities use their own vehicles instead of public transport due to many reasons, because of which the amount of carbon emission is increasing day by day. In such scenarios, with the increased use of electric vehicles will help the environment and other important factors like lower expenditure in fuel and maintenance costs, etc.

India, the leader amongst the G20 nations, aims to surpass the Nationally Determined Contribution (NDC) with the implementation of National Electricity Plan (NEP) - 2018. An important measure as per NEP is to shift from the traditional combustible transport means to a cleaner solution of mobility like the electric vehicles. As mentioned, environmental concerns are raising every day and the reward for the mitigation of these concerns are given to the minds of technological advancement of EV's. People are aware of the ill effects caused due to this concern and are willing to protect the same. The Government is worried and are restricting the release and production of vehicles which could harm the environment in a great way and pollution control check has become equally important to the driver's license in India. There is a matureand trending means of implementing technologies in Electric vehicles which provides comfort and efficiency.

A change or transition from the traditional vehicles to electric mobility is expected and this change should initiate from the concept of acceptance and trust which builds on this segment. One of the factors for a strong resistance towards the adoption is the experience, safety and reliability of EV's and other factors include the concept of uncertainty and risk avoidance towards the adoption of a new technology. This study tries to build a relationship between the personal mind sets and situational factors that affects the purchase intentions. The result and analysis builds a major influence from the policies and schemes implemented to promote EV's to support and benefit the environment.

Literature Review

William Sierzchula, SjoerdBakker, KeesMaat, BertvanWee from their study has found that financial incentives, the availability of infrastructure for charging and the in-house EV manufacturing facility added value and significance in predicting electric vehicle adoption rates for the nations. Also from these above mentioned parameters, availability of charging infrastructure claims to be the best predictor of the nation's electric vehicle market share.

However, descriptive analyses indicated how country-specific factors such as government procurement plans or the target recipient of subsidies could dramatically affect a nation's adoption rate. On the whole the study provides endorsement of financial incentives and charging points as a way to adopt and increase the EV adoption. The literature has conflicting results with respect to the effect of consumer subsidies on HEV adoption. While some studies have shownfinancial incentives to be positively compared to HEV sales found that higher fuel prices, not consumer subsidies, were related to increased adoption [11]. However, the present study focuses on the people from the geographic location of Maharashtra and those who are explicitly employed in the IT and Manufacturing sector.

The potential socio-technical barriers to consumer adoption of EV's and determining if sustainability issues influence consumer decisions to purchase an EV are studied by Ona Egbue, SuzannaLong. The results of this study can guide policy makers in crafting energy and transportation policy. However, this paper deals with the consumer's (from the West region) perception on the adoption of Electric Vehicles with a view to understand the factors or parameters causing a hindrance it its adoption. The results show that knowledge, attitudes and perceptions with respect to EV's differ across gender, age, and education groups. Furthermore, the findings suggest that although sustainability and environmental benefits of EVs have a major influence on EV adoption they are ranked behind cost and performance. Overall, the results conclude that a moderate to high interest in EVs exists in-spite of several reservations targeted towards EVs [4]. The leading global practices on electric vehicle consumer awareness and outreach activities are studies. It reviews literature on the advantages of consumer awareness and understands the actions in leading electric vehicle markets. Some of the findings are that the steps to increase consumer awareness is a major part of the growth in the initial EV market. An electric vehicle consumer awareness program is important in assessing the effectiveness and feasibility [6].

As per the research conducted by Mifzala Ansar & Monika, 76% of the respondent's vehicles were run by petrol and only 8% electric vehicles were used as mode of transportation. A majority of 46% of the respondents spent approximately 3000-5000 per month on fuel expenses. 62% of the respondents agreed that they are aware about the fact that EV's reduce the emissions that contribute to climate change and smog, improving public health and reducing ecological damage [2]. Studies indicate that the buying intention of EV's is explained over 55% variance by

personality and perception. Two sorts of personality, like self-innovativeness and environmental concern affect EV purchase intention directly. They're also significantly mediated by two varieties of perceptions which helps in recommendation for policymakers and industries on promoting EVs [5]. However, this paper tries to understand the mind set of people on buying an EV and the level of awareness and knowledge on the current trends in the technology adopted to enhance the acceptance of electric vehicle.

Business opportunities in green mobility, improved government cognizance, a significant reduction in the costs due to speed of research and increase in the economies of scale, and altering consumer perceptions are leading the path for mass-scale production and envisioned demand of EV's [1]. There are various initiatives taken to market electric mobility that might not yield the required results mainly because of the cost of EVs, challenges in battery technology, limited range of EVs, and also the lack of infrastructure. However, with the appearance of new missions like 100% EV nation by 2030 and schemes like FAME to provide subsidies on electric and hybrid cars will encourage the manufacturers to introduce more EVs in Indian market [8]. This paper enhances the focus group of consumersfrom Maharashtra, on the range of difficulties in accepting EV's, priorities and suggestions (under the findings section), the knowledge and awareness of government policies, etc.

The shares of EV have increased widely and this has led to various innovations in the field of technologies supporting EV's. For instance, there is going to be a major transition in the technology, particularly with respect to the battery technologies, which could replicate in terms of reduced costs and increased energy density. It is understood that EV two wheelers with limited driving range and low costs are suitable for intra-city traveling owing to the short trip lengths. There will be an increase in the demand for electricity when EV's are penetrated into the market at a higher rate and moreover the demand will not be very significant and does not require major capacity additions within the sector [10]. However, this paper studies the thoughts and understanding of consumers concentrated in a few sectors of work, and their perception about Electric Vehicle.

Research Methodology

The geographic area chosen is Maharashtra State, particularly Mumbai and Pune cities. An internet based survey was designed with 21 in-depth questions and was conducted to collect the sample for the study on acceptability and perception of people. A purposive sampling technique was used, it consisted of conventional car owners or otherwise and their thoughts about what they believe on the upbringing of electric vehicles to support and understand the perception of consumers. Data was collected from respondents in the service industry or who had their own businesses, who are regular users of fuel cars and contribute to vehicular intensity. Hence thetarget population consists mainly of the people from the Manufacturing and IT hubs, with the idea of gaining public opinions, perceptions and attitudes and who are likely to be the near owners of EV's. The study conducted here is purely exploratory in nature and hence only exploratory conceptual perceptions and awareness are considered for the analysis.

This study models the factors on which EV adoption rests. Both the benefits and barriers can be related to environmental, cost, comfort, technology, social acceptance, infrastructure availability discussions for both normal and electric cars. It is assumed that these factors have direct influence on individual choice of EV's. The sample had significantly higher participation of males (73.5%) and therefore the female number was only 26.5%. The research on perception on adoption of EV's in India is conducted by doing a comparison on the combustible vehicles advantages, reliability, features and acceptance over that of electrical vehicles and this would readily help in the technological growth and also enables to realise the primary driving factors that ideally lead the change in the EV technology.

Results And Analysis

A total of 151 usable responses were analyzed. Most of the exploratory insights reveal characteristics of the consumers that are likely to throw a light over the decision to purchase EV. The following sub-section helps understand respondent profile in more detail:

A. Demographic profile of the respondents

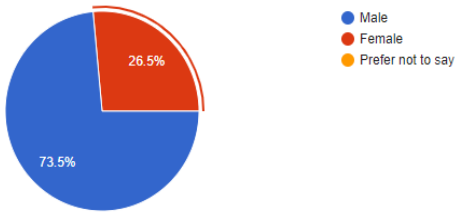

Chart 1 - Gender

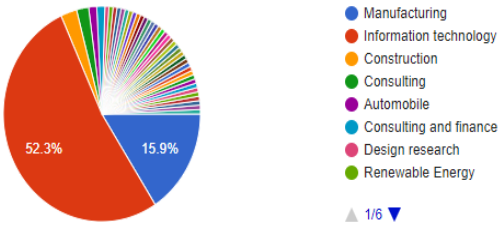

Chart 2 – Field of Employment

The respondents under the study were 73.5% male and 26.5% female (Chart 1). There were 52.3% of the respondents who are working in IT and almost 16% working in the manufacturing sector. Our study was focused on these two industrial sectors as they contribute more to the vehicular intensity in our country. Responses from these sector of work were closely monitored to study the perception and traits in accepting the electric vehicle technology. A lot of people from various backgrounds have responded to the survey which helps us in understanding the mind set on acceptability.

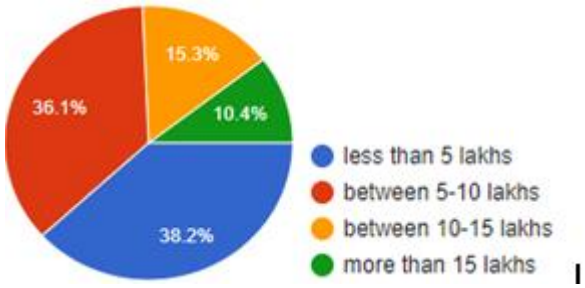

Chart 3 – Income Level

The income levels of the respondents were captured and chart 3 illustrates the split of income level groups which would help us in understanding the perception on Electric Vehicles. As per the study conducted, high cost of the vehicle also dampens the adoption rate of EV's across the category of people [8].

B. Awareness of Electric Vehicles

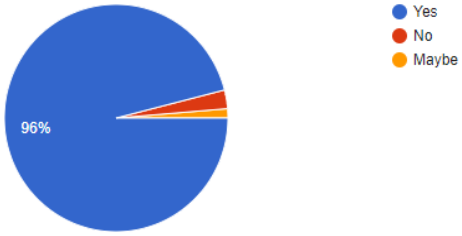

Chart 4 – Awareness of EV

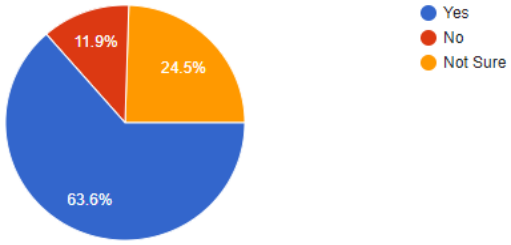

Chart 5 – Advantages of EV over traditional vehicles

Looking at the responses above in chart 4, the majority of the respondents are aware of the Electric vehicle technology. 96% of the total 151 respondents were aware of EV and out of that percentage of the people, 63.6% (chart 5) feels that owning an Electric vehicle has an advantage over owning a petrol/ diesel/ gas powered vehicle and a minority of people comprising 11.9% has responded otherwise. These 11.9% of minority are those who may not be aware of the technological advances and benefits which EV brings to the table. The second minority of 24.5% people who voted "Not sure" can also fall in the above category as they are not informed about the environmental advantages of EV. These 36.4% of people who think otherwise that the current means of traditional transportation is ideal may believe or rather be worried on the pricing and maintenance of the electric vehicle.

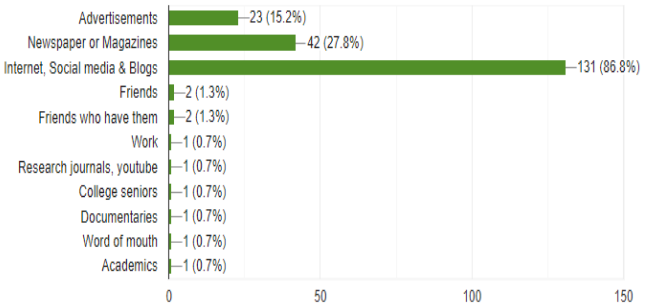

Chart 6 – Source of knowledge on EV

The chart above depicts the sources from which the respondents got most of the knowledge about Electric Vehicles. Interpreting the data in Chart 5, we find that Internet, Social media and Blogs contributed the most with 86.8%. Newspaper/magazines and Advertisements also contributed with 27.8% and 15.2% respectively. There is a lot of information on EV's in the form of articles, published papers, media reports on the schemes and policies that the Government has come up with to hold up the implementation, adoption and promotion of EV's in India.

C. Electric Vehicle – Advantages Role and Understanding

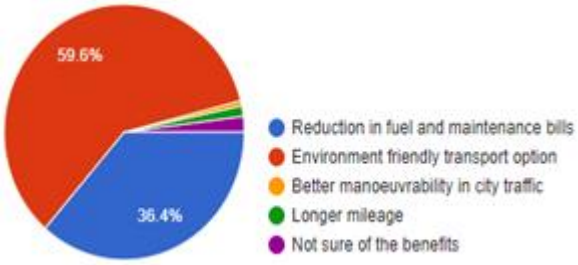

Chart 7

Respondents were asked on the most important advantage of EV to which it can be inferred from the chart 7 that a majority (59.6%) of the respondents feel that "Environment friendly transport option" as the most important advantage. The second majority of the respondents feel that with the implementation of EV, there will be a reduction in the fuel and maintenance cost. EV's have lesser moving parts than the combustible vehicles and takes a lesser costs than CV's and EV's run on electrical energy and saves up on fuel. As discussed previously, there is a minority of people who are not sure of the benefits of EV.

Ranks	Price	Benefits to Environment	Low Noise Level	Design of the car	Comfort of the car	Safety	Mileage and Performance
1	72	34	19	22	38	63	53
2	31	34	22	29	33	19	41
3	14	30	26	28	19	26	9
4	10	16	19	23	25	18	24
5	6	10	13	24	15	10	7
6	7	17	20	16	12	5	9
7	11	10	32	9	9	10	8
Total	151	151	151	151	151	151	151

Table 1

We have identified some of the factors (like Price, Benefits to the Environment, Low Noise level, Design and comfort of the car, Safety and Mileage and performance) which a

consumer would consider while buying an Electric Vehicle. From table 1, we can understand the importance of these parameters upon buying an Electric vehicle. From the table, we can infer that almost 50% of the respondents consider price to be the most important factor. The second and third majority has voted on Safety and performance of the vehicle. These parameters are ranked based on the consumer's perception towards acceptance and purchase of an electrical vehicle. These are personal characteristics which embarks the purchasing on EV.

D. Policy and technology support

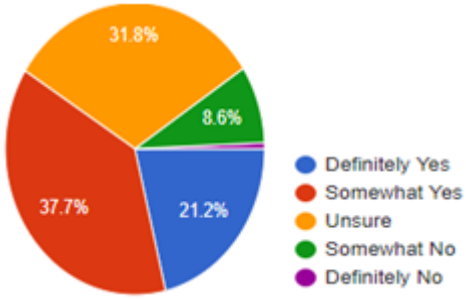

Chart 8

The respondents were asked if the government policies are in favor of Electric vehicles and incentivizing them would promote the sales of EV's, to which a section of the people (around 60%) has agreed but almost 32% of the respondents are unsure if it makes an impact. This set of crowd are not aware of the policies and schemes led out for EV's promotion. This lack of information could have a deepening effect in the adoption and acceptance of EV.

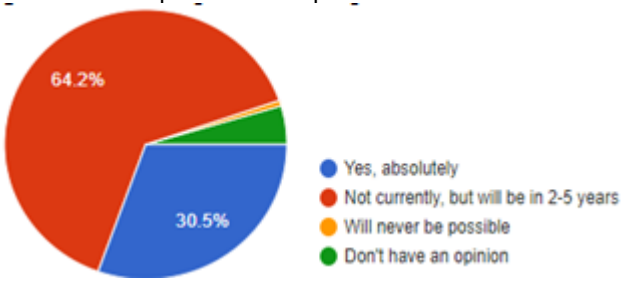

Chart 9

The respondents were asked if India is technology-rich currently to make electric cars which can meet our demands, to which a majority of the people have voted that they don't think about the immediate transition from the traditional vehicles to EV's rather it would take approximately 2-5 years for the effective implementation and production of Electric Vehicles in India.

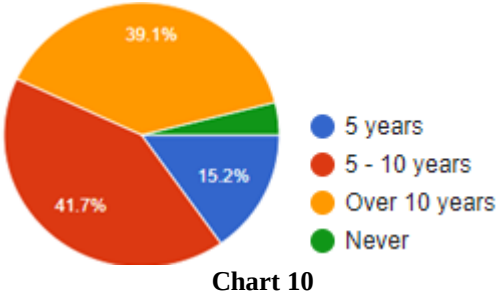

Chart 10

Majority of the respondents believes that EV transition from the traditional means would take 5-10 years, while some others believe it would take over 10 years for EV's to completely take over the petrol/ diesel/ gas vehicles.

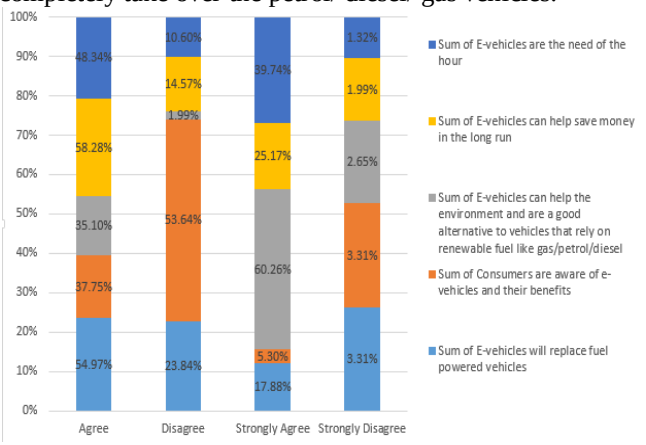

Chart 11

A variety of scenarios were put up for the respondents to agree/disagree on and these scenarios would let us understand the perception and adoption of Electric Vehicles based on its implementation. The chart 10 makes us understand that people strongly believes that Electric Vehicles can reduce the pollution drastically and support the environment and also agrees upon the fact that EV's are the need of the hour currently and this need could be for various reasons. The majority of the respondents also believe that the consumers are not readily aware of the electric vehicles and the benefits which we have also understood from chart 8. There is a 57% of people who disagree that the consumers are aware of the EV technology and the benefits towards the environment and climate, which adds to its implementation. Most of the respondents are agreeing to the fact that EV's can be replaced and provided added advantages, which show a positive attitude or perception towards the acceptance of EV.

Discussions

A) Affordable Pricing

This study has explored how consumer perception and personality plays an important role in their intention to purchase EVs with a series of right targeted questions. India stands as the fourth largest automobile market and has enormous potential for electric vehicles yet the parameters of affordability and infrastructure has been critical and has challenged the sales of the EV's in India. Hyundai Motor Corporation had recently rolled out its first Electric SUV Kona, urging the youths of the country through fancy commercials but ended up with hardly any business. India after having a committed support from the Government for Electric Vehicle Infrastructure through policies, these instances readily shows that the EV manufacturers are facing difficulties in setting up its foot in the EV business in one of the fourth largest automobile markets.

The price of the electric SUV, Kona is estimated to be over 23 lakh INR which approximates it to $32,000 where the average earning of an Indian is close to $2,000. This gives us a picture of why EV's are not picking up its pace which was expected by analysts during the design of the vehicle. Owing to the lack of charging infrastructure, banks are

resisting to finance and a lot of factors like pricing affects the business on a larger scale. It is highly important to understand and study the idea on adoption traits of consumers in buying EV's in India. As per the data from Bloomberg, India has sold just over 8000 units of EV's in the past six years whereas China sells the same quantity in less than two days.

Results from this study proves that consumers are more concerned about the affordability and infrastructure to enhance purchasing of electric vehicles. The chairman of Maruti Suzuki India Ltd, Mr. RC Bhargava also proclaims that the affordability of electric vehicles is not there yet in India and he believes that neither the Government or the car companies could expect a boost in the buying of EV's in a couple of years from now on. This sector has not seen much improvement years after which the Government has started promoting environmental vehicles in our country. Many companies, like MG Motor, Nissan Motor Co., foresee an opportunity to expand their business in Asia's third largest economy. Maruti Suzuki which dominates the Indian market have been challenged by many global automobile manufacturers, who believe there is an immense opportunity for expansion of their businesses. According to BNEF, more than 50% of the passenger vehicles sold in the year 2018 cost less than or equal to $8000 and also estimates that electric vehicles will not achieve price parity with the traditional vehicles (gas powered cars) until the early 2030 or longer.

B) Electric Vehicle Infrastructure

One of the predominant consumer perceptions in purchasing EV is the availability of the adequate charging infrastructure in place. Apart from the availability of charging stations, the concern also extends to the quality of electricity provided from the grid, from one location to another, to the charging stations keeps fluctuating. As per the reports of Market Watch, there are 250 public charging stations currently in India and this number is expected to grow on a larger scale in the coming years. The report also estimates an over 40% growth on the compound annual growth rate during the period from 2019-2025.

FAME II, a scheme with an outlay of 10,000 crores over the period of 3 years from April 2019 focuses extensively on improving the electrical vehicle infrastructure. The Government is aiming to set up 2636 charging stations by 2030 in 62 cities across 24 union territories and states in India. The proposed goal of 30% EVs on road by 2030 creates a benefit of doubt and opens for discussion if there are not enough charging stations to support this growth of electric vehicles. As discussed, the quality of electricity from the grid also plays an important role in the mind-sets of consumers as well as the EV charging manufacturers in the adoption of EVs in India. European nations and the US have a steady supply and quality of electricity that the concept of stabilizer is almost scarce unlike in India, where quality and supply keeps fluctuating on a regular basis.

Lesser contingent on infrastructure for public charging can also pave the way for greater acceptance of EVs. By improving the means and ways of charging and mechanism of removable battery may lead to better and quicker development of electric mobility in India.

The charging infrastructure in India cannot be copy pasted from any other country as parameters like humidity, heat, harmonics and humans are unique for our ecosystem and these parameters pose a challenge to the over-all electric vehicle charging infrastructure. Studies on public charging stations let us understand that these stations are expensive in the eyes of high operational costs with respect to land rentals. These stations become economically possible only by charging high prices on consumers.

Many experts from the industry believe that as the technology grows we will be able to witness the utilisation of renewable energy for electric vehicle charging, which would charge the vehiclein a days' time at a cheaper rate, and simultaneously make revenue. Policies from the Government have been clear to slide with the acceptance and adoption of EVs which is also complimented by steps to improve the renewables growth in India. It is likely that we can expect the combination of electric mobility and renewable energy sources as future endeavors in the industry for battery storage and charging.

C) industrial consumers perspective

The industries associated are supportive of implementing electrical vehicle adoption and are regularly putting their money in Research and Development, and in the manufacturing arena. The Electric Vehicle technology is continuously evolving and expensive, and thus the concept of forced EV adoption cannot be sustainable. However, most of the EV value chain are residing outside India and following a forced adoption might lead to importing of low quality parts, thereby losing the competitive advantage in the market. The battery cost in EV accounts to 40- 50% of the vehicle cost and thus by localising the cell manufacturing unit, would bring down the price of the vehicle drastically which leads to an increased sustainable growth rate of EV's. The need of the hour which supports the in-house cell manufacturing unit is to have a national level strategy to procure raw materials, to incentivize the business through FDI policies, investment models like Public Private Partnership (PPP).

From the Industry's perspective towards adoption of electric vehicles, there is a drastic shift from the conventional powertrain of engine and transmission in Internal Combustion Engines (ICE) vehicles to battery, motor and charger. A majority of the workforce, who are working in the engine manufacturing and who are part of the unorganised sector working in the services of ICE,jobs of these people are at risk as the sophisticated electric vehicles will be maintained and managed by the authorised service centers. Moreover electric vehicles having lesser number of moving parts when compared to ICE vehicles, there is a reduced need for servicing and maintenance and thus, the adoption of EVs bring lesser business to the unorganized workshops.

There is an in-bound industrial belief that even though the adoption and acceptance of EV shoots, the demand for ICEs are not likely to reduce. Since most of the revenue of the automobile parts industry is coming from the manufacturing of engines, a huge sway from IC engines to battery, charger

and motor would make the entire industry in a difficult situation. There is a requirement for massive training and reskilling of the unorganized sector workforce to adapt to serving EV's along with ICEs. Some of the factors which would propagate the demand of electric vehicles are job opportunities in EV related industries, increased government support, reduction in the cost owing to the speed of the research and improving EOS, and positive consumer perceptions.

D) Government Intervention and policies

Some of the policies brought up by the Government of India towards the support and adoption of electric vehicles are,

National electric mobility mission plan (nemmp) - 2020

This mission was introduced by the Ministry of Heavy Industries and Public Enterprises to improve the call of electric vehicle technology in India. Key principles which guides the roadmap of electric vehicles adoption in NEMMP are,

a) Acceptability of consumers for electric vehicles
b) Providing infrastructure to support the adoption of EVs
c) Development of Electric Vehicle technology
d) Setting up of in-house manufacturing competence

Faster Adoption of Manufacturing of Electric Vehicles (FAME I) - 2015

The Ministry of Heavy Industries and Public Enterprises launched the FAME-India Scheme on April, 2015. The important points are:

1) The plan was launched for the first 2 years for a period from 2015 to 2017, which was later prolonged till March of 2019.
2) The plan had an amount of Rs. 795 Cr which was amplified to Rs. 895 Cr owing to the leeway of Phase I
3) The policy included the entire vehicle segments of electric vehicles

Faster Adoption of Manufacturing of Electric Vehicles (FAME II) - 2019

The government proposed the phase-II of the FAME policy in March 2019. The overall budget of 10,000 crores was allotted focusing primarily on the infrastructure and demand incentives. The funding allotted in FAME-II was over the battery size, and not specific to any vehicle model like in FAME-I, as 40-50% of the vehicle price is the battery price. This scheme is particularly applied to vehicles which serve as public transport and most of the budget allocated under the scheme is for the demand incentives.

CONCLUSION

Electric mobility industry has its own opportunities and limitations, but it narrows down to how we, as consumers, comprehend and perceive the adoption of electric vehicles in India. Based on the study conducted, it is affirmed that people are aware of the environmental benefits upon the implementation of electric vehicles on a large scale but EV makers and the Government should invest more in the areas of infrastructure and amenities supporting electric mobility which would make the consumers trust in this technology. In the Indian Market, people have trust and faith in EV technology but does not convert to EV adoption. Trust is a primary factor in both industry's and consumer perception and has to make it stronger over the time, and organizations would not be able to stand back if this trust is shattered which would lead to the tumble in the market share. A part of the positive consumer perception comes from the support and initiatives from the manufacturers and the Government towards building trust in consumers. India's EV market is steadily growing with the support from the Government through schemes like FAME-II which allows entry of multiple EV makers into the market. This shows a positive response and indicates a stronger growth in the Electric mobility sector. The National Electric Mobility Mission Plan
(NEMMP) 2020 was introduced by the Ministry of Heavy Industries and Public Enterprises with an agenda to improve the national energy security and to boost in-house manufacturing facilities for EV's.

We framed a set of questions to understand the perception of consumers into purchasing Electric vehicles. The sample used in this research does not represent the complete people of the nation as people differ on basic parameters like awareness, profession, and so on but this study would provide a major insight into the perceptions and attitudes a consumer would consider upon purchasing EV. From the responses received, we can conclude that people are at the most concerned about the pricing of EV's and the availability of charging stations and amenities which support them into purchasing electric vehicles. The section on literature review compels that the adoption and perception of EV's primarily focuses and studies upon reducing CO2 emissions, cost, technology, social acceptance and infrastructure.

We understand that people are aware of the environmental facts in the adoption of electric vehicles but data from table 1 suggests that these environmental benefits are ranked behind the factors like pricing of the car, comfort of the car and safety. There are indeed other uses of implementing and adopting EVs such as less dependence on imported crude oils and reduction in the emission of greenhouse gas which thereby reduces air pollution. The growth in electrical mobility also provides a push to energy by renewable means owing to the excess energy demand upon the increase in the demand of EVs. Evidence provided in this study (based on chart 7) should embark the need to mitigate the barriers stopping or restricting the consumers from purchasing electrical vehicle like initiatives from the government and makers in resolving the conflict on EV infrastructure which is considered to be a major boon for consumers upon adoption of EVs. Another potential barrier in the adoption of EVs is the uncertainty associated with EVs with respect to the technology and not being aware of the benefits and schemes available in place. There is a good chunk of people (31.8% from chart 8) who are not sure if the policies and schemes put up by the Government are in favor of EVs.

In order to have a significant and a substantial growth, EV technology has to be supported with a proper infrastructure

for charging, renewable energy means, improved community transport system and localisation of electric vehicle making in India. Once the Covid is subsided, India is set to be one of the biggest markets and the crucial thing would be to contain and develop the EV ecosystem while the potential of incentives over EV is not wasted.

Limitations

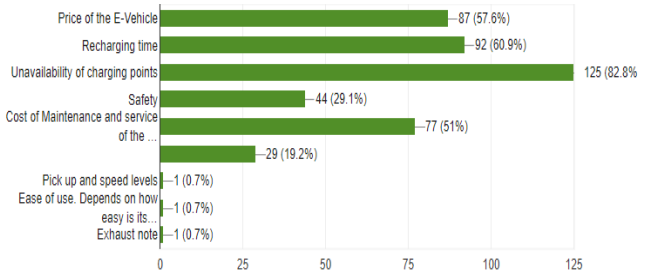

Chart 12

The respondents were given the opportunity to vote for the most important barrier or limitation which stops them from buying an EV which has all the features of a traditional petrol/ diesel vehicle. From the responses received, we could find that 'Unavailability of charging points' was voted by majority of the people as per the chart 11 (82.8%). Other factors like recharging time and Price of the EV also plays a significant role in limiting the consumers from buying an EV. In spite of several advantages of electrical vehicle know-how, the implementation of EV did not happen at a quicker degree. The reason was mainly due to the high fee of the battery owing to the increased cost of the electrical vehicle. This battery cost hampers the growth and restricts bulk production of EVs and presently India does not have a provision for battery cell manufacturing and is dependent on the imported batteries for assembling. There are over 50% of the respondents who voted for the high maintenance and service cost and believe that there will be a higher recurring cost in electric vehicles than the traditional vehicles per se. Addressing and understanding the consumers perceptions would make way for policy makers and industries to cater to the acceptance and growth of electric vehicles.

Amidst the Corona pandemic, there are uncertainties on the growth of this sector and a small ray of hope for EV manufacturers in boosting the growth of EV's market. Currently, most of the manufacturers depend on the imports from countries like China, South Korea and Japan for automobile components like drivetrains and batteries. Surprisingly, in the case of Internal Combustion Engine manufacturers, there is a boost in the business for the domestic manufacturers.

The automobile industry in India has been going through a rough time even before the pandemic started. Due to the restriction on imports and Covid lockdowns, the Indian electric vehicle sector has slowed down remarkably. The impact has been heavy on the mobility sector, which is a big consumer base for electric vehicle manufacturers. Many manufacturers believe that the Indian EV market is challenging and considers consumer acceptance as the most important parameter for the adoption of a technology or product. The regulations and government incentives, which are considered as powerful tools to influence consumer acceptance, are not enough apparently and the EV makers have started to believe that electric vehicles don't have any value over the green mobility factor as they are unable to yet justify the higher initial cost of electric vehicles. The speed at which the adoption of electric vehicles is occurring is not uniform across the various segments. The automobile manufacturers don't realise the complete incentives under the electric vehicle policies as the limitations of the qualified electric vehicle components suppliers in India makes the localisation difficult

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