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Electric Vehicle Acceptance Challenges and Long-Term Sustainability

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ABSTRACT

The purpose of this study is to recognize initial challenges that Electronic Vehicles could face in the India market. Infrastructure challenges, higher initial investments in buying the EV's, Higher Battery costing, long term maintenance cost for electronics part and different charging standards and different technologies used of charging, availability of grid connections and meeting the increasing demands of power consumptions are few factors that affect the adaptation of EVs. In this study, the challenges are identified are allied to the commercialization of EVs in India

The data's will be collected, analyzed, and will be compiled from secondary sources. The secondary data will provide a concise insight and comprehensive information regarding what is happening around the globe as well as in the Indian context. Further, the challenges will be investigated through a focus group study, which will be conducted by including few consumers and automobile retailers and service providers and Engineers.

This study will help in better understanding of the challenges which were identified earlier and how those problems can be addressed with an effective solution and how these solutions can boost the adaptation of the EV's in Indian market. And how the EV's will help the Indian economy to grow and improve our environmental issues in long term. And long-term sustainability of Electric vehicles. And, how EV market will affect the current IC engine market and will affect the non-conventional fuel prices.

INTRODUCTION

The increasing focus on pollution produced by IC engine vehicles has boosted the development of EV's interest in their potential market penetration. Most prior analysis has used stated preference data to elicit preferences towards EVs and their characteristics, with a few also accounting for latent attitudes that affect individual choices. Stated preference data are needed when a product is not fully available on the market, which is usually the case when studying new vehicle technologies. However, carefully customized, well designed and conducted, stated preference experiments on EVs were done in hypothetical settings where individuals express their preferences without having any true experience of the "product" they face raising skepticism over usefulness. In this paper, we investigate the extent to which individual preferences and attitudes change after individuals experience an EV in their daily life.

LITERATURE REVIEW

Addressing the challenges to electric vehicle adoption via sharing economy: an Indian perspective in this paper author has discussed about the basic challenges of adaptability of the electric vehicles in Indian market and their long-term sustainability. Here the research was conducted in two phases, in the first phase the study is about the global perspective and in the second phase we worked on the Indian perspective. Regrading to global perceptive the EV's were familiarized in early 90's, but the invention was not a success.

The technology was again reintroduced with more reliable and reusable energy and in account of reducing the carbon emission and towards a pollution free environment.

Due to increase in dangerous atmospheric level of dangerous gas and greenhouse effect and in order to move towards sustainability. Every western country adopted this technology aggressively in order to reduce the transportation cost and reduce the carbon footprints.

The awareness programmed of the were held by the government's administrative strategy and incentives and consumer awareness drive and motivation. This activity helped this nation to incorporate Electric vehicles with a great success. And majors also can help us in the process of adaption. Some of the factors which are currently affecting the adaptation process are price of EV, range Charging infrastructure and serviceability, total cost of ownership, and maintains of the EV's.

This have not covered the long-term suitability of the EV's and key environmental effects, those are going to affect our environment and power related issues and energy surges. And Indian infrastructure issues to adapt the Electric vehicles. (Jha, 2020)

Technical challenges for electric power industries due to grid-integrated electric vehicles in low voltage distributions: A review Here in this researcher paper the author has discussed about the challenges related to technology and power distribution for charging of electric vehicle through grid connections. This paper has information related to GIV's and challenges related to GIVs which are mentioned below:

Electric vehicle technology and current trends:

- Electrical vehicles major drawback in currently is increase in the power surges due to sudden increase in EV's and increase usage of block chain technology.
- The costing also plays an important role while adaptation of EV.
- The lack of grid supply in every place us one of the major challenges because, many place in India and other underdeveloped nation don't have grid access.

And no constant supply of the power. Other than this current battery technology is also a major drawback and low SOC (state of charge) which leads to fast discharging of the battery during the operations and heat generation during its operation and lack of BMS and thermal management system, which leads to frequent charging of the battery it reduces it battery life cycle. EV charging technology is also not a standard and difference from vehicle to vehicles. Which leads to increase in different specific chargers and procurement of their raw materials. And that leads to uncertainty of charger's availability for the owners. Other than the pricing of EV's due to high costing of motor and batteries available in the market. (Haidar, 2014)

Electric Vehicles in India: Market Analysis with Consumer Perspective, Policies and Issues Early in the twenty-first century, new firms emerged to capitalize on the absence of established automobile manufacturers in the EV industry, including Tesla Motors in the United States, Think in Norway, BYD in China, and REVA in India. Globally, all these new manufacturers had introduced one or more EV vehicles, altering the auto industry equation. Looking at the Indian scenario, which still has a long way to go, the article covers the current Indian EV industry, market participants in two and four-wheelers with recent advances, and the current state of Indian road transportation. Government policies and activities are discussed. To grasp the ground reality, a case study with a consumer's perspective is offered. The EV charging tariff is mentioned.

The challenges for Indian market growth, policies, and promotions necessary, as well as possible choices, are reviewed, together with the worldwide context. (Guajarati, 2018) (Kumar, 2018) E-vehicles are set to produce a big upheaval in both the automotive and energy industries throughout the world. This disruption is being driven by a strong desire to make the world a greener, safer, and more sustainable place. Over 194 nations are taking part in the historic Paris climate accord, which went into effect in 2016, aimed to restrict average global warming to 1.5 degrees Celsius. In this century, the global temperature will rise by less than 2 degrees Celsius.

The United States, China, and India account for a staggering 50 percent of the world's population. Emissions of Greenhouse Gases (GHGs). These large economies' transportation sectors represent the majority of GHG emissions The United States and China have previously advocated the replacement of fossil- fuel powered automobiles by e-vehicles, and as of 2016, is the biggest stock of EV's in the world as compared to other developed countries of the world India is still lagging the population density of India is much higher as out of 20 most populated cities of world India has 15 of them.

India has vowed to considerably reduce its contribution of GHG emissions in order to prevent the average increase in world temperature. As a result, the Indian government has taken action. Established a goal of achieving 100 percent e-mobility by 2030 India began its e-vehicle adventure in 2012. In November 2017, 100 e-vehicle units were sent, and four were installed. In a city, there are charging stations.

The purpose of this article is to investigate the commercial viability of the pilot project and identify the first bottlenecks and their solutions in order to Increase on a pan- India basis. The pilot project was investigated in order to accomplish this. In April and May of 2018, all stakeholders were interviewed and surveyed in detail. If this mass transition occurs in the case of passenger cars, the fuel cost would be reduced. decreased to Rs 1.04/km for private e vehicles and Rs 1.16/km for public (taxis) e- vehicles This represents a significant savings over the current fuel costs of Rs 4/km (petrol) and Rs 3.2 g/km (diesel). The notion of total cost of ownership is introduced here (TCO). Because of the small size When compared to ICE cars, TCO is lower because to reduced component prices and lower fuel expenses. To elaborate, reducing TCO, batteries near the end of their useful life for EV use often have 70% capacity remained in it [16]. These batteries can be reused in different ways.

Research Methodology

EV's are not common on the Indian roads and their infrastructure are not widely accessible in the market. Potential EV adopters/users may never have seen, driven, or charged such cars. The characteristics of these vehicles are unfamiliar to most people.

A systematic questionnaire was used to collect data. The instrument that was created provided information about constructions and their elements. The questionnaire was divided into two sections. The first section concentrated on data pertaining to the respondent's demographic characteristics, which included gender, age, education, household income, and the number of automobiles in their homes. The model variables are measured in the second section of the questionnaire. There was one dependent variable, four independent variables, and one mediating variable.

This pilot research included 26 questions for 6 different test variables. Based on the pilot test and appropriateness, the amended list included 22 items. There are six constructions, four of which are independent, one of which is a mediator, and one of which is a dependent variable. The final instrument had 19 items that measured the input variables. The items were used to determine which BI to implement.

Sample Size:

Structure Equation Modelling (SEM) does not have a formula for determining the optimum sample size. Regardless, several writers proposed sample sizes of 100 or 200, and 5 or 10 observations per estimated parameter, and 10 instances per variable as guidelines.

Measurement:

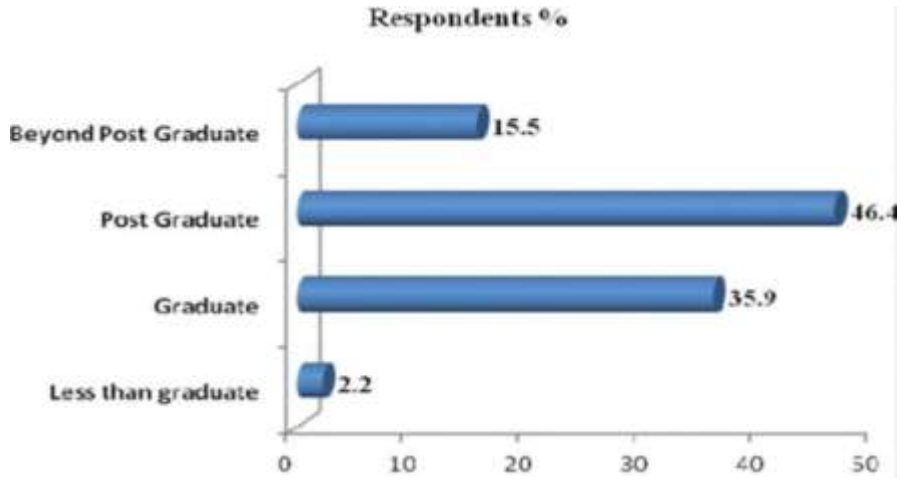
The first section collects categorical data on demographic variables. The second section employs a 5-point Likert scale to assess the model variables (1 as strongly disagree and 5 as strongly agree).

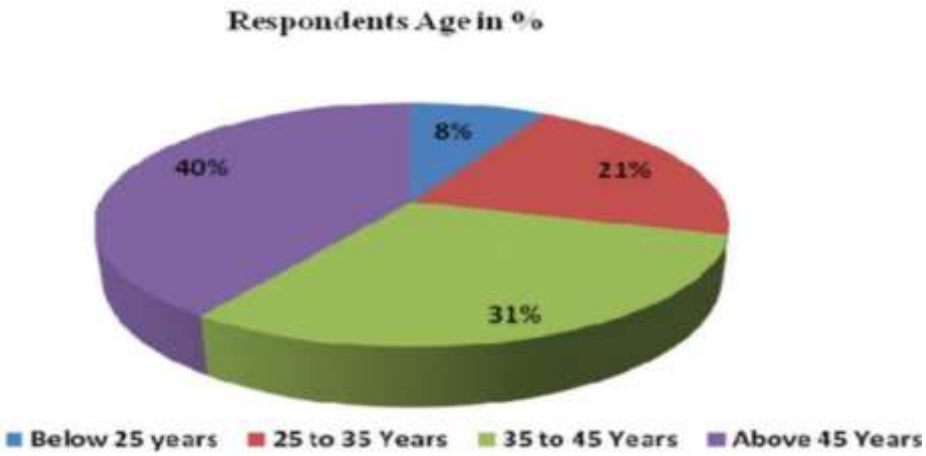
For data analysis, SPSS version 21.0 (Software Package for Social Sciences) and AMOS version 21.0 (Analysis Moment of Structures) were employed. The measurement model and the structural model are the two parts of structural equation modelling. The measurement model is validated in the first stage of the two-stage structural equation model. The second stage assesses the relationship's scope and direction.

Data Analysis and Result:

The Pilot Questionnaire tested 33 Respondents for reliability

Out of 214 respondents, 24.3 per cent were women, and the rest, 75.7 per cent, were men. All respondents were existing car owners and Indian nationals





A structural equation model is a sophisticated approach for studying the relationship between many components at the same time. It is an equation framework that can handle several relationships in a single analysis.

SEM was used in this work to evaluate the predictive association between the four exogenous variables. PEB (Perceived Economic Benefit), EC, SoC. In, and IM are the acronyms for these terms. BI was the endogenous variable, with ATT acting as a moderator. Mediation provides a trustworthy interpretation of the causal impact. It describes the influence of the antecedent on the dependent variables as well as the reasoning for the connection. This study investigates the role of ATT in mediating the relationship between exogenous and endogenous factors.

Construction development and measurement:

Four exogenous viable and one endogenous variable are included in the proposed model. PEB, EC, IM, and SoC are all acronyms. Each variable is assessed using four items. Three questions are used to assess the endogenous variable BI. Three items are used to assess the mediation impact of ATT. To assess items, this research used a 5-point Likert scale, with 5 representing Strongly Agree and 1 representing Strongly Disagree.

SEM is a two-part validation procedure. The first phase evaluates the measurement model using confirmatory factor analysis (CFA), and the second step validates the structural model with SEM. The measurement model has access to the instrument used to measure the underlining construct's reliability and validity.

Construct Reliability and Validity:

Reliability and validity are quality evaluation techniques for the instrument used to measure the construct of a hypothetical model. The scale's reliability is its capacity to give consistent findings. Cronbach's alpha is used in this study to analyze internal consistency among construct pieces. The capacity of the scale to give accurate findings is referred to as validity. Average Variance Extracted (AVE) validates the scales used to measure the constructs of the hypothetical model. In general, an AVE value of 0.5 or greater indicates appropriate convergence and validity.

Other than these consumer challenges for adoption there are many other physical challenges related to the adaptation surrounding, temperature issues, income, and power surges related issues in Indian subcontinents.

Data Analysis:

As per the data collected from the survey it indicated that a greater number of males are ready to adapt then females a large number of working class people are interested to convert themselves to electric or hybrid two wheelers in order to pursue their daily travelling under the kilometre of 40 to 80 km.

Most of the people daily travel within the city via highways and major section of female students has shown interest to adopt electric vehicle technology in order to save cost of travelling.

Most of the sedan owners expect their TVs under 6lakhs to 10lakhs but due to high price of semiconductors and battery price the pricing of the EV's is higher. And due to lack of grid connection and proper power supply.

And the EV's batteries are changed in every 6-7 years based on the SoC. And the maintenance of the EV is also very less and running cost of the EV's are 60% lower than IC engine vehicles.

Conclusion:

We have examined the effects that hand on experience with an EV has on the preferences and attitudes towards EVs and ICVs. We use data collected in two waves, before and after the respondents had a three-month real experience with an EV. Our results show that individual preferences do change after the use of an EV in real life. In particular our results confirm that driving range is a major concern related to EVs but also reveal that the concerns that individuals have about low driving ranges

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