# An empirical analysis of consumer attitude and perception towards Electric Vehicles in India.

Ankit Sharma, Ayush Kumar Singh

## Abstract

Electric Vehicles are the future of automobile industry, considering the current situation of today's world regarding pollution and global warming which is occurring at a very high speed and is causing a lot of damage to our world right now. Many companies are there like TATA and TESLA which are focusing on the production of electric vehicles and developing the viable technology to grow the process by enhancing the technologies for the full production of electric vehicles.

As the awareness is increasing amongst the people regarding the growth of the pollutants and as companies are also contributing and focusing on electric vehicles, people are also getting aware nowadays and are also getting serious regarding the adoption of EVs.

As the fossil fuels are exploiting due to the heavy consumption through traditional automobiles the time has come now that we should think about finding out the alternative of the fuel use through fossil fuel and concerning the current technological advancement of electric Vehicle technology ot is the only solution as of now to adopt the use of electric vehicles and to enhance the technologies which would develop the proper technologies leading to the adaption and growth of Electric vehicles down the road .

This whole research talks and describes about how the electric vehicles are going to be adopted in future and how the movement which has already began for the adoption and enhancement of electric vehicles. Many countries are already working on it and are focus towards the growth of electric vehicles and are considering it the technology for automobiles in the future.

## Introduction

Electric vehicles (EV) are promoted as a viable near-term vehicle technology to cut back dependence on fossil fuels and ensuing gas (GHG) emissions related to standard vehicles (CVs) (Rezvani *et al,* 2015). In spite of the advantages of electrical vehicles, many obstacles ought to be overcome before EVs are going to be wide adopted. Electrical vehicles are going to be the sole alternate which can fulfill our wants and conjointly save the setting (Sethna, 2015). The business of the automobile industry was initially joined to the electricity. Later on, the combustion engines came into existence. In today's era, attributable to many circumstances, the automobile business is being researched on the EVs for many years, though these things business has to be compelled to go through the necessary breakthroughs to commercialize these types of car expeditiously (Vidhi & Shrivastava, 2018). As the "low carbon, inexperienced growth" agenda, that stressed property development through equilibrium between economic process and environmental preservation, is propagated apace in peninsula (Gallagher & Muehl, 2008). They are creating new product created through advanced technologies, like "Hydrogen electric cell Vehicles". Customers tend to resist new technologies that are thought of alien or on trial, therefore there ought to be some policy selections that think about their crucial issues which might have the next rate of success. The environmental issues and therefore the perception of environmental policy are antecedent factors of the perception of full electrical vehicles that influences the activity intention to get full electrical vehicles. Perception of economic profit is additionally one in all the key factors influencing the adoption of full electrical vehicles (Junquera *et al,* 2016). Vehicle operators ask for economic advantages from future semi-permanent fuel savings, high energy potency, and low-cost electricity, therefore government endeavor to push low- carbon transportation must rescale its efforts to reinforce citizen's environmental issues and to determine correct environmental policy similarly on give long- term money and strategic support for electrical vehicles (Burns & Grove, 2005).

Historically quality and fossil fuels are inextricably joined with EVs being flourishing solely in of the niche markets. Over a final year a bundle of circumstances has conspired to make a gap for EVs to enter the mass market. Those forces include: Climate change, Advances in renewable energy, and fast urbanization (Dillman *et al,* 2014). In Asian nation several circumstances that contributive to an environment quality have created the chance for accelerated the adoption of electrical vehicles. Over Indian context electric vehicles which are relative in abundance of exploitable renewable energy resources which are also handiness

of high experienced forces and technology in producing IT software systems (Patton, 1990). These circumstances have positioned Asian nation to pursue an electrical vehicle policy which are able to consistently make sure that India's electrical vehicle program keeps running with the worlds scale.

## Literature review

Auto industry of India in respect to the world is the sixth largest economy. In the last decade, India has grown rapidly in terms of its contribution to the automotive industry (Nunnally, 1978). The transportation sector of India is alone responsible for 18 percent $CO_2$ emissions. The Indian government is trying to switch to alternative fuel technology. An electric vehicle (EV) is a more viable alternative to overcome crises of pollution and global warming. Several automotive companies are gradually entering into EV space and are expanding their shares in the market. Promoting electric vehicles through innovation means that it can help in reducing the dependence on fossil fuels (Tenenhaus et al, 2004). Electric vehicles may have significant impact on reducing greenhouse gas emissions and pollution associated with the transportation sector. (Hensler et al 2009) The adoption of electric vehicles widely can eliminate the environmental and global warming problems. However, despite many governments implementing strict promotion policies, EV's penetration into the current market is relatively low (Mathooko and Ogutu, 2015). Today's world scenario about rapidly changing environment and the concern of the people towards the same is thrusting the manufacturing and sales of the Electric vehicles. (Richardson, 2013) The reason for such an attraction is that India is a platform of large customer base, the labor and production cost in India is low. Hence, we can provide them with a pure technological and a semiskilled technological base. So, India has attracted the manufacturing giants like Bosch, Tesla, Tata, and Cummins to set up their production units here (Chau et al, 2008). Governments around the world are enforcing various policies to increase the use of electric vehicles and to reduce the dependency on fossil fuels, which could help in decreasing the greenhouse gas and also may help in improving the air quality. If we see the trends globally, Electric vehicle sales are definitely on an increase, from just hundreds in 2010 to over 500,000 in 2015and over 750,000 in 2016 Early growth of this market is increasing, but many obstacles further prevented wide absorption. These barriers include the additional cost of a new technology, relative with convenient technologies with respect to scope of sustainability Development of electric vehicle markets are fundamentally related to the general awareness of potential

consumers and understanding the potential advantages of electric vehicles (Vilathgamuwa et al, 2008)

## Research Gap

Despite of the positive results of electrifying the light vehicles, the number of such vehicles in usage is still insignificant. One of the various barriers underlying the same is the perception of consumers towards the electric vehicles. As with any consumer-centric product, understanding consumer sentiments is an effective means to understand ground-realities and how to shape the automobile industry that is making a shift towards EVs .Hence, the present study is focusing on customers 'perception regarding the acceptance of such vehicles. There are numerous factors influencing the customers' perception i.e., environmental issues, investment, technology, efficiency, infrastructure etc. The results show that concern towards environment and the trust of the customers are the antecedent factors. However, cost and social influence are main reason for non-adoption of these vehicles. Therefore, this study investigates the consumer's perception and reasons for non-acceptance. Understanding the potential buyer's awareness about the eco-friendly electric cars and their perception level towards various features offered by electric cars will help in formulating the campaigns by manufacturers and Government as well. (Rahimi et al, 2013)

## Objectives

- To investigate the differences in perceptions and attitudes among people regarding the purchase of electric vehicles.
- To check the effect of attitude of people on behavioral intention towards electric vehicles.
- To examine barriers in adoption of electric vehicles.

## Research Methodology

This survey has been conducted to know wide perception of awareness of electric vehicles of different age groups, income groups and gender groups. Convenient sampling method was used to select respondents having proper industrial (domain) information in wake of limited available resources. Finally, a total of 400 respondents have been considering for data

collection. Questionnaires' distribution was donevia emails to reduce the biasness caused by the adoption of single data collection method. After one week, an email reminder was sent to the non-respondents. Likewise, after one additional week, a questionnaire was sent again to individuals who had not responded. Table 1 reports the characteristics of the respondents including respondents' demographics and position held. Total 17 statements belonging to four latent constructs based were asked from the respondents on five-point Likert scale (strongly disagree-1 to strongly agree- 5), demographic variable scale (Hundal and Kumar, 2015a). We have espoused the scales used in extant literature and modified one construct (behavioral intention) only. Remaining constructs have been adopted from the study of Egbue (2012). A questionnaire was framed which consisted of several parts, firstly asking the respondents about their basic personal information, next seeking the awareness level of the people about EVs. Further moving towards perception and information they have about EVs and lastly enquiring about their knowledge level about various steps and initiatives have taken to enhance the sales of such vehicles.

## Demographic profile

The sample of the survey is extra inclined towards the male population as compared to the female population inside that (70%) are males and (29.3%) are females. The majority of the sample is belonging to young respondents between the ages of 20 and 50. The respondents are students, faculties, graduates, undergraduates, and PHDs. Total male population tried and true be used of alternate four vehicles in male category are 250 and in female class is 104 and total respondents are 354 inside that mean of male respondent is a pair of 0.076 and of female respondent is 2.68 total is 2.73 and ($p=0.599>0.5$) that shows that there's no important distinction between them. Respondents were jointly asked for his or her biggest concern regarding electrical vehicles inside that 250 males responded and 104 females and total norm is a pair of 0.93 and value of ($p=0.996$) that on the far side the alpha level 0.5 and it shows that there's no important distinction between the values. When asked from the respondents regarding what amount kilometers do, they drive on a median, total responded of us were 354, total mean is 2.24 and value of (p) is $0.000< 0.5$ and it shows that there's very distinction between the values. Same results are shown once of us were asked that whether or not electrical vehicles could supply the benefits of typical vehicles where (p) value is shown 0.17 that jointly shows that there's very important distinction. Once of us were jointly asked regarding their intention to buy for electrical vehicles if it ranges between positive value

section, a very important distinction was seen where (p) value came 0.000 that's method extra however the alpha value (p>.05). In the survey between the age of 20-30 years are mentioned as Students, schools between the individuals of 30-40, non-teaching employees between the age 40-50 years. Once the respondents were asked regarding their interest towards electrical vehicles total vary of student respondents were 325, faculty respondents were 21, non- teaching employees were 2. Total mean was 3.45 and (p value is 0.006) that's a smaller quantity than the alpha value 0.5 and it shows that there's very important distinction. A similar case is seen once the respondents were asked regarding the thought of feeling battery swap stations total responded of us were 354 and total mean is 1.16 and so the (p) value came to 0.001 which jointly shows that there's very important distinction.

**Table I :Anova Table**

| | **Age** | | **Education** | | **Income** | |
|---|---|---|---|---|---|---|
| | **F** | **Sig** | **F** | **Sig** | **F** | **Sig** |
| BI1 | 0.215 | 0.643 | 0.586 | 0.741 | 0.441 | 0.820 |
| BI2 | 0.266 | 0.606 | 1.913 | 0.078 | 1.387 | 0.229 |
| BI3 | 0.000 | 0.996 | 0.470 | 0.830 | 1.101 | 0.360 |
| BI4 | 0.544 | 0.461 | 1.259 | 0.276 | 1.072 | 0.376 |
| EC1 | 0.824 | 0.365 | 0.912 | 0.486 | 0.986 | 0.426 |
| EC2 | 0.134 | 0.714 | 2.617 | 0.017 | 0.943 | 0.453 |
| EC3 | 0.213 | 0.644 | 0.604 | 0.727 | 1.949 | 0.086 |
| PEV1 | 0.794 | 0.373 | 0.795 | 0.575 | 1.677 | 0.139 |
| PEV2 | 0.132 | 0.717 | 0.934 | 0.471 | 1.503 | 0.144 |
| PEV3 | 1.988 | 0.159 | 0.777 | 0.589 | 0.520 | 0.761 |
| PEV4 | 1.632 | 0.202 | 0.719 | 0.634 | 0.878 | 0.097 |
| PEV5 | 0.199 | 0.663 | 0.504 | 0.805 | 0.839 | 0.523 |
| PEV6 | 0.456 | 0.500 | 0.645 | 0.694 | 0.638 | 0.671 |
| PGP1 | 0.632 | 0.202 | 0.757 | 0.605 | 1.949 | 0.086 |
| PGP2 | 0.132 | 0.171 | 0.689 | 0.659 | 0.915 | 0.471 |
| PGP3 | 0.343 | 0.559 | 0.795 | 0.575 | 1.677 | 0.139 |

Some smaller variations are seen once the respondents are asked regarding their biggest concern concerning electrical vehicles, total respondents where 354 total mean was 2.93 and

(p value is 0.786) that's larger than the alpha value 0.5 and it shows that there's smaller distinction of us that responded on the perception of upper riding comfort between electrical vehicles and ancient vehicles, total mean came to be 3.70 and (p value) came 0.629 that shows slightly smaller distinction. Many cases are seen once the respondents responded whose values showed smaller variations and higher important variations in relation to their buying behavior, purchase intentions and interest towards electrical vehicles are shown. The level of education mentioned inside the survey were elementary, high school, college, college boy degree, postgraduate degree, PHD, post doctor's degree, inside that it's seen that graduate of us are extra inclined towards the adoption of electrically vehicles they're a lot of probably to attract from the benefits of electric vehicles , they show a positive sign towards environmental problems and damages caused through typical vehicles and are extra towards adopting electrical vehicles in near to future than others.

The respondents were asked regarding their interest towards electrical vehicles total respondents were 354 inside that graduates were 184, elementary were 3, high school were twenty 3, faculty were 45, post graduates were 94, and PHDs were 1, inside that total mean was 3.45. 187 of us graduate people responded showing their interest in electrical vehicles. (p value is 0.000) that's a smaller quantity than the alpha value 0.5 and it shows that there's very important distinction of us have responded for the method many kilometers do they drive on a median inside that total norm is 2.42 and (p value is 0.00) this is often often yet again however the value 0.5 that after a lot of shows that there's very important distinction. A smaller distinction is shown once of us were asked regarding the adoption electrical vehicles whether or not or not it's wise or not, of us responded fully inside that total norm came to be

3.77 and

## PLSSE analysis and results

After formulating the above stated hypotheses, PLS regression as a statistical technique has been chosen to analyze the data set using Smart PLS 2. Using this variance based on statistical techniques (Henseler *et al.*, 2009; Hundal & Kumar, 2015b; Hundal & Kumar, 2017). However, all latent variables are formative in this study. Moreover, repetitive subsamples are generated internally by PLS SEM which overcome the problem of small

sample and sample size does not affect the validity of results of PLS SEM (Henseler*et al.*, 2009; F.Hair Jr *et al.*, 2014; Kumar & Hundal, 2015; Kumar & Hundal, 2019).

## Assessment of the measurement model

As per variables were used in the empirical model. Indicator per constructs ranges from three to six. Measurement model basically stands for the psychometric validity by evaluating items' reliability, factor loadings, composite reliability and convergent validity (Tsou *et al.*,2015; Kumar Hundal & Kaur, 2019a; Kumar Hundal & Kaur, 2019b). Table I derives the results of measurement properties and it delineates that all factor loadings are found be considerably above than the cut off level of .5 (Hair. 2010) and the composite reliability of all constructs is well above the recommended ceiling of .7 (Kumar, Syan, Kaur & Hundal, 2020; Kumar, Hundal & Syan, 2020; Nunnally,1978). Composite reliabilities are generally used as a measure of internal consistency and reliability qualitative study .In addition to these validity algorithm, a bootstrapping method to check statistical significance has been also deployed.

**Table I.** Factor analysis (outer loadings)

| Construct | Indicators | Factor Loading | Composite Reliability | Cronbach's Alpha | AVE |
|---|---|---|---|---|---|
| Behavioral Intention | BI1 | 0.8629 | 0.9161 | 0.8777 | 0.7321 |
| | BI2 | 0.8994 | | | |
| | BI3 | 0.8481 | | | |
| | BI4 | 0.8097 | | | |
| Environmental Concern | EC1 | 0.7889 | 0.8232 | 0.6824 | 0.6148 |
| | EC2 | 0.9238 | | | |
| | EC3 | 0.6072 | | | |
| Perception of Electric Vehicles | PEV1 | 0.624 | 0.8983 | 0.8634 | 0.5977 |
| | PEV2 | 0.7824 | | | |
| | PEV3 | 0.7545 | | | |
| | PEV4 | 0.7599 | | | |
| | PEV5 | 0.8358 | | | |

| | | | | | |
|---|---|---|---|---|---|
| | PEV6 | 0.86 | | | |
| Perception of Government Policy | PGP1<br>PGP2<br>PGP3 | 0.7761<br>0.8274<br>0.8292 | 0.8523 | 0.7417 | 0.6582 |

**TableII.** Discriminant validity (inter-construct correlations)

| | Behavioral Intention | Environmental Concern | Perception of Electric Vehicles | Perception of Government Policy |
|---|---|---|---|---|
| Behavioral Intention | 1.0000 | 0.0000 | 0.0000 | 0.0000 |
| Environmental Concern | 0.4093 | 1.0000 | 0.0000 | 0.0000 |
| Perception of Electric Vehicles | 0.7343 | 0.4510 | 1.0000 | 0.0000 |
| Perception of Government Policy | 0.4770 | 0.4684 | 0.6329 | 1.0000 |

**Source:** Compilation the basis of primary survey with the help of PLS-SEM.

Two types of inferential statistics are used for overall goodness of fit; test of model fit and approximation of model fit. Goodness of fit indices (test of model fit) in partial least square technique is checked with the help of geometric mean of the average communality and the average $R^2$ of the all-endogenous variables (Kumar, Syan, & Kaur, 2020; Syan, Kumar, Sandhu, & Hundal, 2019; Henseler *et al.*, 2009). The values of average communalities of all constructs are extracted by applying the blindfolding technique and taking an omission distance of seven (D=7). The corresponding values of R square is 0.5469asshown in figure1.

## Assessmennt of structural Model

Path coefficients provide the basis to test the stated hypothesis and evidences for model fit and AVE helps in checking the robustness of data.

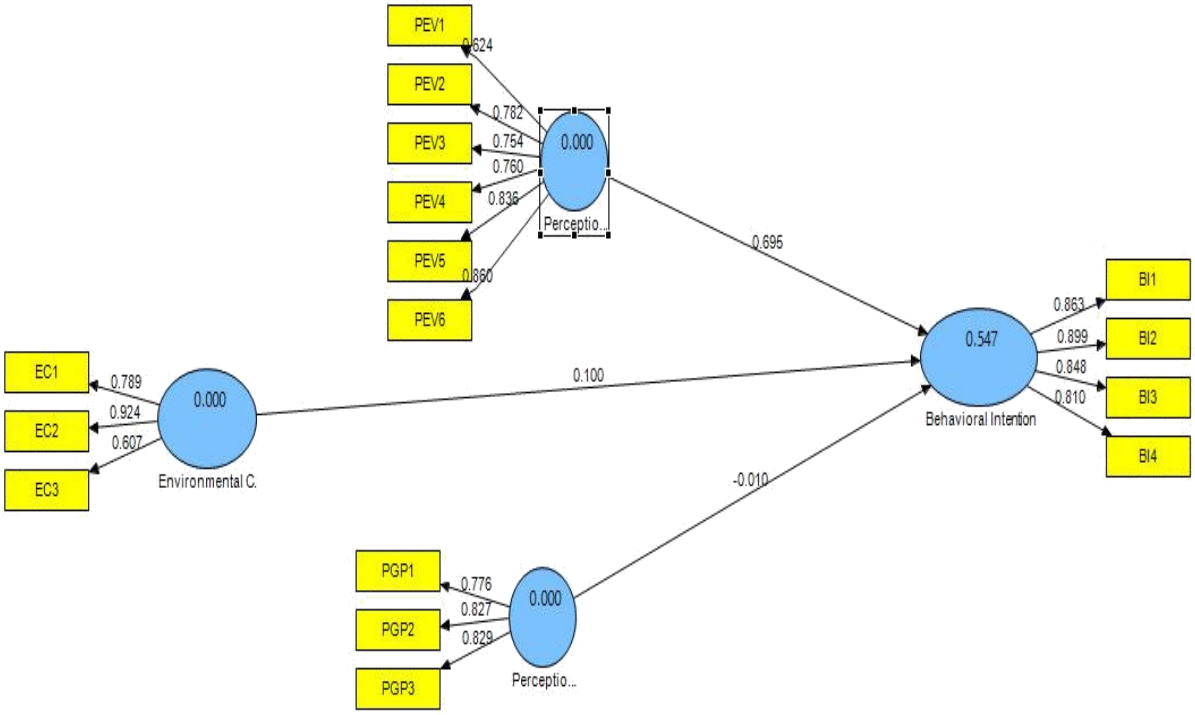

**Figure2: The estimated structural model(regression results )**

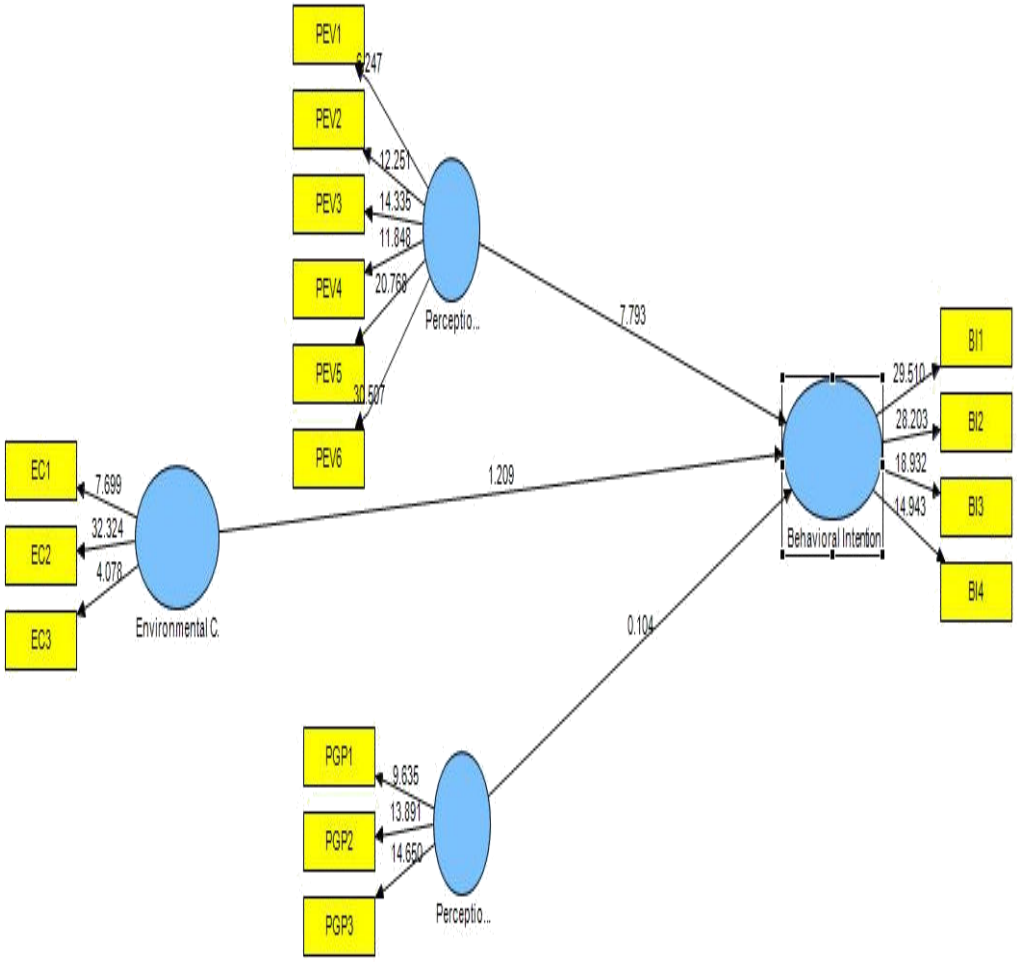

**Figure2:The estimated structural model(boot strapping results)**

| | Hypotheses Paths | Path coefficient | t-values | Results |
|---|---|---|---|---|
| H1 | Environmental Conn ->Behavioral Intention | 0.1004 | 1.2093 | Not Supported Supported |
| H2 | Perception ofElectricvehicles-> Behavioral Intention | 0.6953 | 7.7934 | Not Supported |
| | | -0.01 | 0.1037 | |
| H3 | Perception of Government Policy ->Behavioral Intention | | | |

Note: Significancevaluesp<0.1(ift-valueisgreaterthan1.645);p<0.05(ift-valueis greater than 1.965); p<

0.01(ift-value is greater than 2.586).

It is quite discernible from the bootstrapping results that Perception of Electric vehicles is an important independent variable that affects behavioral intention positively. Boot strapping result confirm enough statistical support for H2as its t-values are much higher than the standard cut offs (1.645 at 5% level of significance) as shown in figure 2, while H1and H3werenot confirmed and remained unsupported in this study.

## 3. COMPLETEWORKPLANWITHTIMELINE:

Firstly, we choose our topic which is on the consumer perception and adoption of electric vehicles by analyzing the current scenario of electric vehicles in Indian market then we made

questionnairebasedontheperceptionandbuyingbehaviorofelectricvehiclesandconventional vehicles, liking and disliking of electric vehicles etc. After that survey was done which took around 3 weeks in which 354 respondents were collected. Then after doing the survey we analyzed the survey result and started working on our research paper by writing down the introduction, review of literature, finding out certain government policies which are there in regards to the electric vehicles, all this was done by reading different research papers which we present on the internet regarding the electric vehicles it's adoption and barriers which took around 2 weeks. Then at last we analyzed our survey data into software's which were PLS 2 and SPSS and made models and wrote the extracted data and findings into the results and conclusion part.

## 4. FINDINGSOFTHESTUDY:

The study resulted into the findings of the current scenario of the adoption of electric vehicles, perception, awareness and the government initiatives into the adoption of EVs. The study also concluded the barriers which are there which are restricting the EVs to enter into the market. The study also briefs about various government policies and subsidies which are there in several countries which are implemented so as to widely adopt the electric vehicles and reduce the pollutions or emissions caused by the conventional vehicles so as to save our environment. Our studies confirm the relationship between perception about electric vehicles.

## Findings

The study resulted into the findings of the current scenario of the adoption of electric vehicles, perception, awareness and the government initiatives into the adoption of EVs. The study also concluded the barriers which are there which are restricting the EVs to enter into the market. The study also briefs about various government policies and subsidies which are there in several countries which are implemented so as to widely adopt the electric vehicles and reduce the pollutions or emissions caused by the conventional vehicles so as to save our environment. Our studies confirm the relationship between perception about electric vehicles and its effect on their buying intention towards electric vehicles. Effect of environmental concern and perception of government policy did not find to have any effect on the buying intention of the respondents. After examining the data in anova research found that most of our data is above the 5% level of significance.

## Conclusion

The sample which has been used in the study may not represent the entire population because of the differences in environmental awareness, education and income of the majority of the respondents.

The study has provided helpful insights about preferences and attitudes of people regarding electric vehicles. The study has shown the attitudes; knowledge and perception of people related to electric vehicles which differ across gender, age and education groups, our findings have suggested that although sustainability and environmental benefits of electric vehicles have a major influence on the electric vehicles adoption which are ranked behind in terms of cost and performance. Overall a moderate to high interest in electric vehicles exist among people's perception. The attitudes towards electric vehicles were neither fully positive nor fully negative, however the completely negative attitudes to electric vehicles should be ignored and not taken into consideration. The evidence which has been provided in the study emphasizes the need to address socio-technical barriers which are barriers for electric vehicles adoption. As mentioned previously some of the major challenges which are faced by the electric vehicles include the battery technology, battery costs and charging infrastructures. However, acceptance of consumer is important as it is the key factor to the commercial success of the electric vehicles even if the other criteria are not met properly. One of the major potential barriers to widespread electric vehicle's adoption which has been detected among the respondents is the uncertainty which is associated with the electric vehicle's battery technology and sustainability of fuel sources. Some of these uncertainties may be attributed to the unfamiliarity in respect to the electric vehicle's technology but may be also because of the fact that several respondent individuals are not convinced that the electric vehicles are a better option than some of the currently available conventional vehicles. It is also seen in the study that some of the respondent's question about sustainability and environmental performance of the electric vehicles compared to the conventional vehicles which shows that some of the individuals with high environmental awareness or the values may not consider the purchase of an electric vehicle as beneficial to the environment and Current government policies which are being implemented for the adoption of electric vehicles such as cost of electric vehicles and fuel taxes may impact a little on the electric vehicle's penetration in market only if consumers show less interest in electric vehicle's technology. There should be some measures to be taken so as to increase the share of market of

electric vehicles. The measures some of them are already being explored which include education, increased investments in the technology of electric vehicles, developing the infrastructure, implementing the battery swap stations, giving strong warranties on the electric vehicle's batteries and perhaps increment in the tax credits to subsidize the cost of electric vehicles. Since opinion of public could be influenced through the media and social networks therefore policy makers can use these mediums to influence the appreciation of public for the non-financial benefits of electric vehicle's adoption such as the energy security and reduction of the ecological footprints.

## References

Hundal, B. S., & Kumar, V. (2015a). Assessing the Service Quality of Northern Railway by using SERVQUAL Model. *Pacific Business Review International*, *8*(2), 82–88.

Hundal, B. S., & Kumar, V. (2015b). Consumer Perception towards Green Products: A Factor Analytic Approach. *Pacific Business Review International*, *7*(10), 1–7.

Hundal, B. S., & Kumar, V. (2017). Customer Relationship Management-A Study of Public & Private Hospitals in Punjab. *Pacific Business Review International*, *9*(8), 19–30.

Kumar, V., & Hundal, B. S. (2015). Customer Perception towards Celebrity Endorsement. *Pacific Business Review International*, *8*(5), 46–53.

Kumar, V., & Hundal, B. S. (2019). Evaluating the service quality of solar product companies using SERVQUAL model. *International Journal of Energy Sector Management*, *13*(3), 670–693. https://doi.org/10.1108/IJESM-07-2017-0007

Kumar, V., Hundal, B. S., & Kaur, K. (2019a). Exploring the Service Quality determinants of Solar Product Dealers. *Asia-Pacific Journal of Management Research and Innovation*, *15*(1-2), 27–38. https://doi.org/10.1177/2319510X19829339

Kumar, V., Hundal, B. S., & Kaur, K. (2019b). Factors affecting consumer buying behaviour of solar water pumping system. *Smart and Sustainable Built Environment*, *8*(4), 351–364. https://doi.org/10.1108/SASBE-10-2018-0052

Kumar, V., Hundal, B. S., & Syan, A. S. (2020). Factors Affecting Customers' Attitude towards Solar Energy Products. *International Journal of Business Innovation and Research*, *21*(2), 271– 293. https://doi.org/10.1504/IJBIR.2020.104819

Kumar, V., Syan, A. S., Kaur, A., & Hundal, B. S. (2020). Determinants of farmers' decision to adopt solar-powered pumps. *International Journal of Energy Sector Management*, *14*(4), 707– 727. https://doi.org/https://doi.org/10.1108/IJESM-04-2019-0022.

Kumar, V., Syan, A. S., & Kaur, K. (2020). A structural equation modeling analysis of factors driving customer purchase intention towards solar water heater. *Smart and Sustainable Built Environment*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/SASBE-05-2020-0069

Syan, A. S., Kumar, V., Sandhu, V., & Hundal, B. S. (2019). Empirical Analysis of Farmers' Intention to Adopt Sustainable Agricultural Practices. *Asia-Pacific Journal of Management Research and Innovation*, *15*(1-2), 39–52. https://doi.org/10.1177/2319510X19848857

Consumer preferences for electric vehicles: a literature review. (2019). Transport Reviews.

Rezvani, Z., Jansson, J., &Bodin, J. (2015). Advances in consumer electric vehicle adoption research: A review and research agenda. Transportation Research Part D

Sethna, B. (2015). Consumer Perceptions of Electric Cars: The Effects of Exposure. Proceedings Of The 1984 Academy Of Marketing Science (AMS) Annual Conference, 269-274.

Vidhi, R., & Shrivastava, P. (2018). A Review of Electric Vehicle Lifecycle Emissions and Policy Recommendations to Increase EV Penetration in India. Energies, 11(3),

Gallagher, K., & Muehl egger, E. (2008). Giving Green to Get Green: Incentives and Consumer Adoption of Hybrid Vehicle Technology. SSRN Electronic Journal.

Junquera, B., Moreno, B., & Álvarez, R. (2016). Analysing consumer attitudes towards electric vehicle purchasing intentions in Spain: Technological limitations and vehicle confidence. Technological Forecasting And Social Change, 109, 6-14.

Policy, E. (2019). Energy Policy. Retrieved 14 November 2018, from 24Februry 2019

Burns, N. and Grove, S. (2005), The practice of nursing research: Conduct, Critique and Utilization, Elsevier/Saunders, St. Louis, Mo.

Dillman, D., Smyth, J. and Christian, L. (2014), Internet, mail, and mixed-mode surveys, John Wiley, Hoboken, NJ.

Patton, M. (1990), Qualitative evaluation and research methods. Second edition, Sage, Newbury Park, CA, 1sted.

Nunnally, J. (1978), Psychometric theory, McGraw-Hill Book, New York.

Tenenhaus, M., Amato, S., & Esposito Vinzi, V. (2004, June), "A global goodness-offit index for PLS structural equation modelling", In Proceedings of the XLII SIS scientific meeting Vol. 1, pp. 739-742.

Henseler, J., Ringle, C. M., &Sinkovics, R. R. (2009), "The use of partial least squares path modeling in international marketing", in Sinkovics, R.R., Ghauri, P.N., (ed.) New Challenges to International Marketing (Advances in International Marketing, Volume 20) Emerald Group Publishing Limited, pp.277 – 319.

Mathooko, F. and Ogutu, M. (2015), "Porter's five competitive forces framework and other factors that influence the choice of response strategies adopted by public universities in Kenya", International Journal of Educational Management, Vol. 29 No. 3, pp. 334-354.

Richardson, D. B. (2013). Electric vehicles and the electric grid: A review of modeling approaches, Impacts, and renewable energy integration. *Renewable and Sustainable Energy Reviews*, *19*, 247-254.

Chau, K. T., Chan, C. C., & Liu, C. (2008). Overview of permanent-magnet brushless drives for electric and hybrid electric vehicles. *IEEE Transactions on industrial electronics*, *55*(6), 2246- 2257.

Vilathgamuwa, D. M., & Sampath, J. P. K. (2015). Wireless power transfer (WPT) for electric vehicles (EVS)—Present and future trends. In *Plug in electric vehicles in smart grids* (pp. 33- 60). Springer, Singapore.

Chau, K. T., Wong, Y. S., & Chan, C. C. (1999). An overview of energy sources for electric vehicles. *Energy Conversion and Management*, *40*(10), 1021-1039.

Egbue, O., & Long, S. (2012). Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions. *Energy policy*, *48*, 717-729.

Rahimi-Eichi, H., Ojha, U., Baronti, F., & Chow, M. Y. (2013). Battery management system: An overview of its application in the smart grid and electric vehicles. *IEEE Industrial Electronics Magazine*, *7*(2), 4-16.