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EVALUATING THE FACTORS INFLUENCING PURCHASE DECISION OF ELECTRIC VEHICLES

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ABSTRACT

With the current depletion of fossil fuels and its price hike, there is a need for another energy resource to run the vehicle. The automobile sector is considering Electric Vehicle as a solution to the industry and environment in India. However, the current market penetration of EV is relatively low in spite of governments implementing EV policies. Through this paper potential scope of Electric vehicle in India will be studied and Consumer perception for same will be analysed.

Keywords: Electric vehicles, Consumer perception, Choice of vehicle, Environment, Conventional vehicle, Government policies

INTRODUCTION

India is a country with the third-largest road network in the world. Road travel seemed to be a preferred choice in India with over 60 % of the population used personal or shared vehicles to commute [1].

Conventional vehicles are a major cause of global warming and environmental air

pollution. All types of vehicles produce dust from brakes, tires, and road wear. The average diesel vehicle has worse effect on air quality than the average gasoline vehicle. But both gasoline and diesel vehicle pollutes more than the electric vehicle [2].

Governments started using fiscal policies,

such as road tax, to discourage the purchase and use of more polluting cars. Green tax is imposed while re-registering the vehicle after 15 years of use to make people discontinue the use of polluting vehicles and encourage them for fuel-efficient and less polluting vehicles. Fuel taxes may act as an incentive for the production of more efficient, less polluting, vehicle and the development of alternative fuels. High fuel taxes or cultural change may provide a powerful incentive for consumers to buy lighter, smaller, fuel-efficient cars, or to not drive. (transport policy)

The FAME India Scheme is an incentive scheme for promotion of electric and hybrid vehicles. It aims to promote electric mobility and gives financial incentives for enhancing EV production and the creation of electric transportation infrastructure. In 2015 the Ministry of Heavy Industries and Public Enterprises launched FAME to incentivize the production and promotion of eco-friendly vehicles including EV and hybrid vehicles. The scheme is proposed for establishing charging infrastructure [3].

The National Electric Mobility Mission Plan (NEMMP) 2020, a National Mission document providing the vision and therefore the roadmap for the faster adoption of EVs and its manufacturing. This plan has been

designed to boost national fuel security, to supply affordable and environmentally friendly transportation, and to enable the Indian automotive industry to attain global manufacturing leadership [4].

LITERATURE REVIEW

Electric Vehicles: A Synthesis of the Current Literature with a Focus on Economic and Environmental Viability: Marcello Contestabile, Dr Gregory Offer, Dr Robin North, A

research concludes that the longer term uptake of EVs will depend heavily on progress in battery technology, to bring down costs and increase energy density, and on the provision of a suitable recharging infrastructure [5].

Potential Need for Electric Vehicles, Charging Station Infrastructure and its Challenges for the Indian Market: by Praveen Kumar and Kalyan Dash, India should invest in small scale reinforcements to manage the load issues locally rather than going for an enormous change. Home charging should be encouraged. Proper planning of place, population, traffic density and safety should be considered before implementing the massive scale charging infrastructure. The integration of activities within the energy and transport fields is important. Development goals through

different innovative policies and programs, for instance, drivers of electrical cars are offered a financial consumer incentive, like tax credits, purchase subsidies, discounted tolls, free parking, and access to restricted highway lanes will help the market to grow [6].

Conventional, Hybrid, or Electric Vehicles: Which Technology for an Urban Distribution Centre?: by **Philippe Lebeau, Cedric De Cauwer, Joeri Van Mierlo, Cathy Macharis**, Freight transport has a major impact on urban movement. Researcher explored the possible integration of electric vehicles in urban logistics operations. A fleet with different technologies has the opportunity of reducing the costs of the last mile. Researcher presented a fleet size and mix vehicle routing problem with time windows for EVs. The main contribution of the authors was considering the variability of the range of EVs. In the segments of small vans, EVs are often the most competitive technology. In the segment of large vans, diesel has seen the most interesting solution from a financial point of view as electric vehicles would need to cover a longer distance to be cost-competitive. Hybrid vehicles are chosen in the segment of trucks as its running costs and fixed costs are lower than the diesel truck [7].

Consumer preferences for electric vehicles: by **Fanchao Liao, Eric Molin & Bert van Wee**, Widespread adoption of EVs may contribute to lessening of problems like environmental pollution, global warming and oil dependency. However, this penetration of EV is comparatively low in spite of governments implementing strong promotion policies. They presented a comprehensive review of studies on consumer preferences for EV aiming to convey policy-makers and give direction to further research. They compared the economic and psychological approach towards consumer preference for Electric vehicle. The impact of financial and technical attributes of EV on its utility is generally found to be significant, including its purchase and operating cost, driving range, charging duration, vehicle performance and brand diversity on the market. The density of charging stations also positively affects the utility and promotion of EV. The impact of incentive policies, tax reduction is quite effective [8].

International Council on Clean Transportation: **Lingzhi Jin, Peter Slowik**, The early market growth for electric vehicles continues, but a number of barriers prevent their widespread uptake. These barriers include the additional cost of the new technology, relative inconvenience of

technology considering range and charge times, and consumer understanding about the availability and viability of the technology. This last point, typically referred to as “consumer awareness,” is crucial [8].

Study on Electric Vehicles in India Opportunities and Challenges: by

Mohamed M, G Tamil Arasan, and G

Sivakumar, The replacement of ICE with electric engines will reduce pollution to a great extent and be profitable to consumers. Many countries have implemented this technology and are contributing to the improvement of the environment. The researcher saw the opportunities and challenges faced in India over implementing EVs. Opportunities like Government Initiatives, Batteries, Industries, and Environment have been considered. With these challenges like cost of EVs, efficiency of EVs in India and demand for EVs were taken into consideration. The implementation of EVs in India aims primarily to scale back greenhouse emissions and cut oil expenses. The govt. should make the foremost out of the opportunities available and find suitable ways to tackle the challenges [9].

Electric Vehicles in India: Market Analysis with Consumer Perspective, Policies and Issues: Pritam

K. Gujarathi, Varsha A. Shah, Makarand

M. Lokhande, Indian Scenario is different because the current market share of EV/PHEV is around 0.1%. Presently almost all vehicles consider fossil fuel-based transportation. These pollute the atmosphere by the emission of greenhouse gases & causes global warming. The gap between domestic petroleum production and consumption is widening. India imports around 70% of oil required per annum. Hence there's an urgent need to investigate factors and challenges for sustainable and cleaner alternatives [10].

Perception and Awareness Level of Potential Customers towards Electric

Cars: Masurali.A, Surya P,

India contributes around 18% in transport sector alone in terms of carbon emission. The Electric Vehicle (EV) is one of the foremost feasible alternative solutions to beat the crises. Several automotive companies are introducing EVs and are expanding their portfolio. Promoting EVs can help reduce fuel dependence and pollution and beneficial for both consumers and the nation. The education of people has significantly higher influence over their awareness level on EVs. Apart from manufacturers, Government should strive hard to spread awareness and influence positive perception among potential customers [11].

A Study of Consumer Perception and Purchase Intention of Electric Vehicles:

Pretty Bhalla, Inass Salamah Ali, Afroze Nazneen, Choice of cars depends upon environmental concern, cost, comfort, trust, technology, social acceptance, infrastructure availability. These arguments have been tested for both conventional cars and EVs. They assume that these factors have direct influence on individual choice of vehicle. They found that EV manufacturers and Government have to invest more in social acceptance of the vehicle by creating more infrastructural facilities, putting more thrust on technology to create trust. The analysis depicts that the population is well aware of the environmental benefits. The responsibility lies on the shoulders of the Government and manufacturers to investing in the manufacturing of vehicles [12].

Electric Vehicles for India: Overview and Challenges: by Mr. A. Rakesh Kumar, Dr. Sanjeevikumar Padmanaban,

Global pollution is on the rise and each effort made, is to cut back the CO₂ emissions and save the earth. One such effort is the introduction of EVs. The transport sector is one in all the largest emitter of CO₂ and hence it's important to reduce it. The government has come up with ambitious plans of introducing EVs to the Indian market and confine pace

with the event of EVs globally. The National Electric Mobility Mission Plan 2020 has included an in-depth report on the EVs. India encompasses a huge challenge in shifting the transportation sector from ICE engines to EVs. This needs lots of planning along with R&D. Charging infrastructure must be adequately build to deal with range anxiety. It's vital to form demand generation by making all government buses electric and offering tax exemptions for personal EV owners [13].

Opportunities and Scope for Electric Vehicles in India: by Janardan Prasad Kesari, Yash Sharma, Chahat Goel,

Developing an aggressive strategy for the adoption of EVs in India and ensuring a well-executed implementation is a challenge but vital for government. The geography and diversity of India will present problems that require thoughtful solutions. Public procurement is expected to be an important driver of growth of EVs, with the purchase of four-wheeled vehicles for government offices, three- wheeled vehicles and buses for public transport. Investments by fleet operators such as Ola and Uber, and operators of food distribution services, are also expected to boost the initial growth of two- and four- wheeled electric vehicles. However, the private EVs may take 5-6 years

to gain popularity and acceptance [14].

Indian Electric Vehicles Storm in a teacup: Yogesh Aggarwal, Vivek Gedda and Kushan Parikh, Users of scooters, who need only to travel short distances, may consider an EV, but those, who need to travel longer distances and already own bikes like a Hero Splendor, may find it difficult to move to an e- 2W. For cars, it is relatively simple to improve the range with increased battery size. For electric 2Ws though, every increase in kWh may provide an extra 30km in range, but the increase in weight is around 10kg, approximately a 10% increase in the total weight of the bike. This weight issue is even more pronounced in smaller bikes (less than 150cc) [15].

OBJECTIVE

The objective of this paper is to understand consumer perception and the factors important for the purchase of EVs in India.

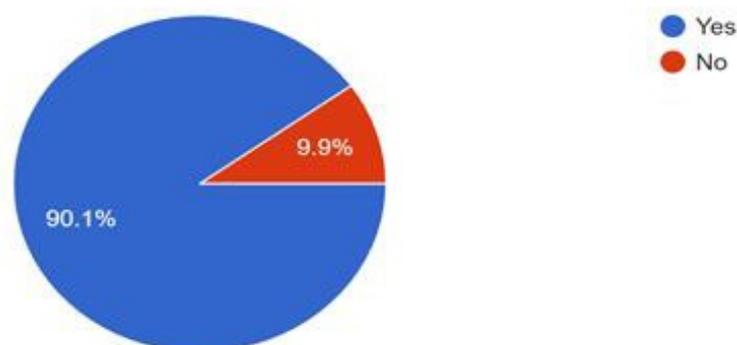
RESEARCH METHODOLOGY

Descriptive research methodology is used. Primary data of a sample population of 212 is collected using online questionnaire. Chi square test is used to test the hypothesis.

DATA ANALYSIS AND INTERPRETATION

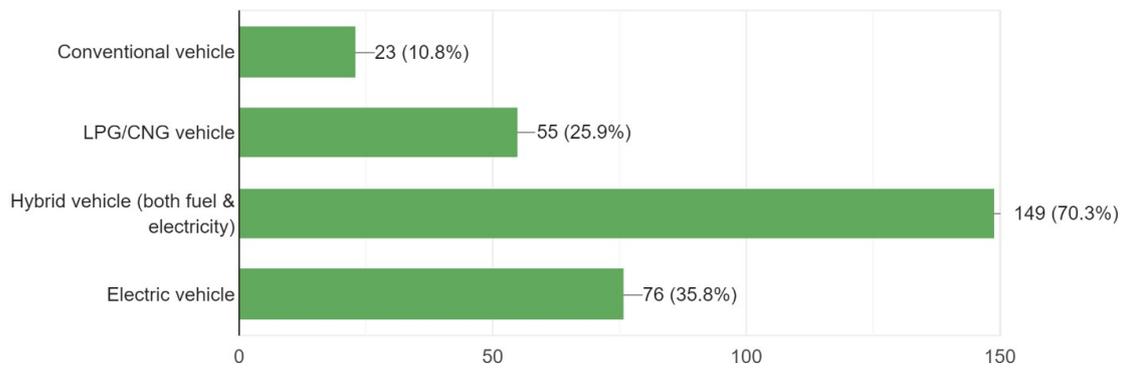
The sample size is **212** out of which **60.4%** are male and **39.6%** are female. **7.5%** of respondents fall under age group of 18-23 yrs, **55.7%** in 24-40 yrs, **27.8%** in 41-55 yrs and **9%** are 56 yrs & above. **90.1%** were in favour of eco-friendly vehicles and **9.9%** favoured conventional vehicle. Respondents are aware of climate conditions and ready to change their preference to eco-friendly cars.

If wants to change/buy, would you prefer an eco-friendly vehicle?
212 responses



Which of the following would you prefer?

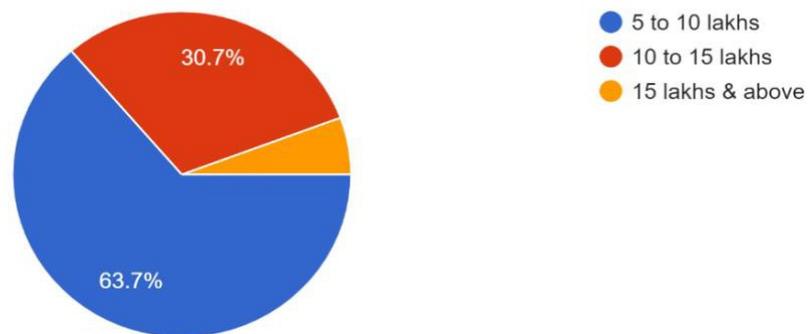
212 responses



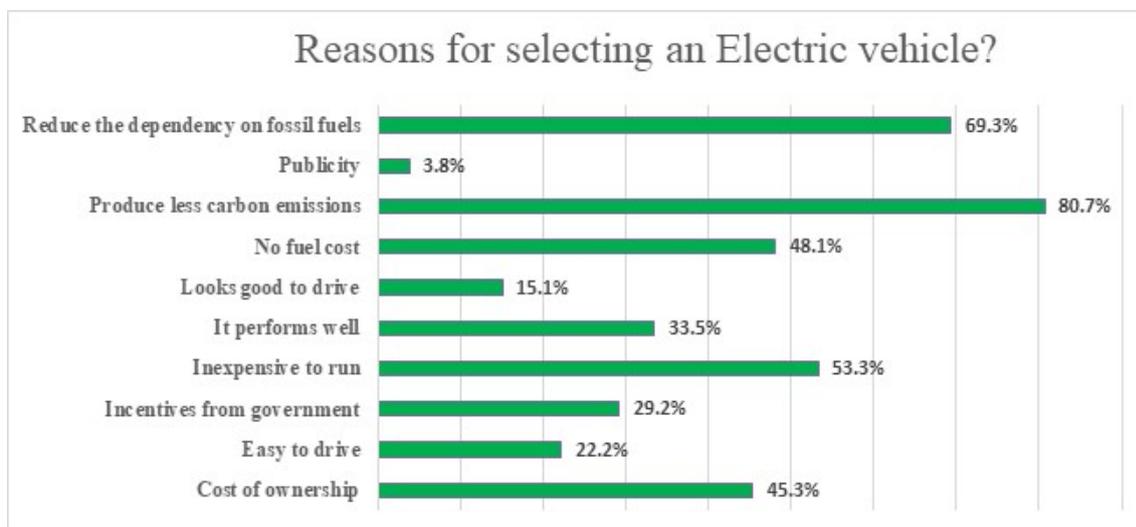
When asked regarding choice of vehicle, respondents majorly selected hybrid vehicles.

How much should be the cost of electric vehicles in the Indian market?

212 responses

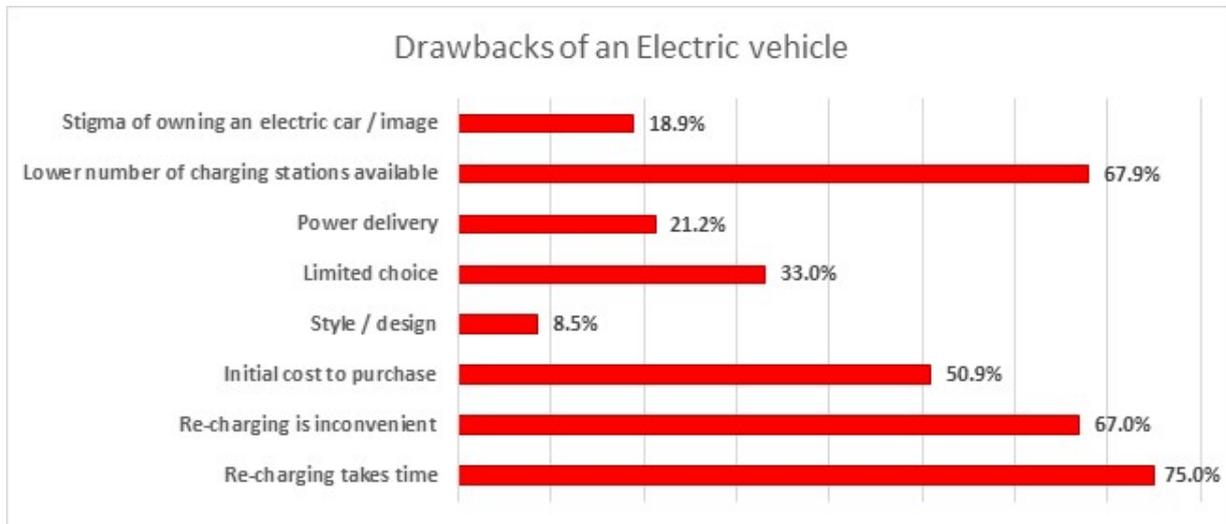


Cost being an important factor, customer expects EVs in 5-10 lakhs range.



To find the consumer perception it's important to find out the factors for selecting EV. Respondents considers less carbon

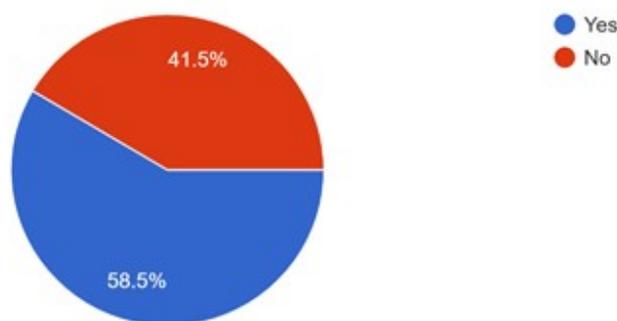
emissions, less dependency on fossil fuels, inexpensive to run as important factors.



Respondents considers recharging time, limited charging stations, difficulty in

charging as major drawback/limitation to consider EVs in current situation.

Do you think it is too early for electric cars, that they are not reliable enough?
212 responses

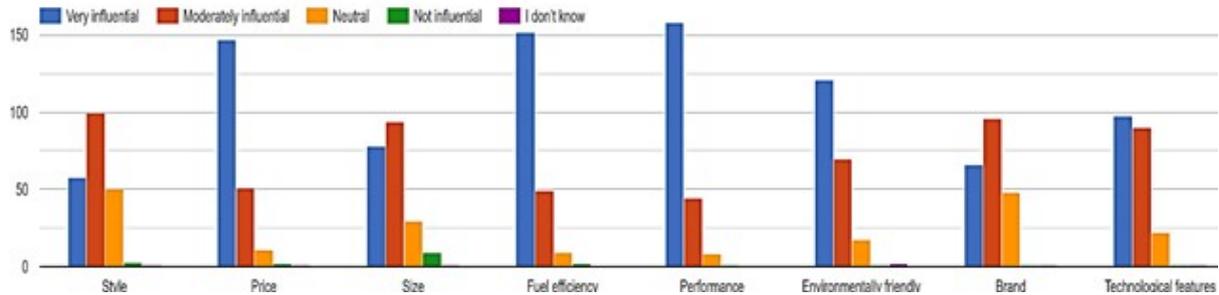


Considering the current infrastructure and development of electric vehicle in India, majority of respondents considers that it is early for EVs to launch.

Respondents were being asked about the various factors which influences the purchase

decision of a vehicle. Majority of respondents consider performance, fuel efficiency, price, technical features and environment friendly as very influential, whereas they consider style, size and brand as moderately influential factors.

How influential are the following factors for you when purchasing an electric vehicle?



Hypothesis Testing

Test 1: Relationship between Choice of vehicle and Gender H0: There is no difference of gender on the choice of vehicle.

H1: There is significant difference of gender on the choice of vehicle.

Actual					
Count of vehicle	Column Labels				
Row Labels	Conventional	LPG/CNG	Hybrid	Electric	Grand Total
Male	19	18	73	18	128
Female	4	32	38	10	84
Grand Total	23	50	111	28	212

Expected					
Count of vehicle	Column Labels				
Row Labels	Conventional	LPG/CNG	Hybrid	Electric	Grand Total
Male	13.88679245	30.18867925	67.01886792	16.9056603	128
Female	9.113207547	19.81132075	43.98113208	11.0943396	84
Grand Total	23	50	111	28	212

P Value 0.000315703

P value is smaller than 0.05 thus we reject H0 & accept H1 i.e. there is significant difference of gender on the choice of vehicle.

Test 2: Relationship between choice of vehicle and Income

H0: There is no significant difference in income group of people and their choice of vehicle. H1:

There is significant difference in income group of people and their choice of vehicle.

Actual					
Count of vehicle	Column Labels				
Row Labels	Conventional	LPG/CNG	Hybrid	Electric	Grand Total
up to 5 Lakhs	7	16	33	12	68
5 to 10 Lakhs	6	21	36	6	69
10 to 20 Lakhs	7	7	22	7	43
20 Lakhs & above	3	6	20	3	32
Grand Total	23	50	111	28	212

Expected					
Row Labels	Conventional	LPG/CNG	Hybrid	Electric	Grand Total
up to 5 Lakhs	7.377358491	16.03773585	35.60377358	8.98113207	68
5 to 10 Lakhs	7.485849057	16.27358491	36.12735849	9.11320754	69
10 to 20 Lakhs	4.66509434	10.14150943	22.51415094	5.67924528	43
20 Lakhs & above	3.471698113	7.547169811	16.75471698	4.22641509	32
Grand Total	23	50	111	28	212

P value	0.556199434
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P value is greater than 0.05, we do not reject H₀, but this does not necessarily imply that we should accept H₀. We can conclude that H₀ is true or false but our experiment and statistical test were not “strong” enough to lead to a p-value lower than 0.05.

CONCLUSION

With the depletion of fossil fuels and constant hike in fuel prices, there is a need for energy transition in vehicles in India. Govt has taken initiative to fight pollution levels by promoting EVs and giving subsidies on purchase. To boost its production, Govt has eased the FDI norms. Various emerging brands are launching EVs in India. The Government and manufacturers should join their hands to build the infrastructure and create positive environment for EVs.

The respondents are aware of global climate conditions and are ready to change their preference from conventional to eco-friendly vehicles. Cost is an important factor while considering the purchase of EV.

Respondents are willing to consider EVs as their future purchase option, if proper infrastructure is available. Initial cost of purchase, less number of charging stations

and the time required to recharge the battery is creating limitation in boosting consumer confidence.

SCOPE

This study has focused on both primary and secondary data of electric vehicles in India. Though the research found a potential scope of Electric vehicles in India, still there is a scope for in-depth study with greater number of samples and more factors.

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