

Consumer Preferences for Mid-Segment Electric Cars-An Indian Perspective

Bhaskar M G
Assistant Professor,
Industrial Engineering and
Management
RV College of Engineering
Bengaluru, India

Dr. Narahari N S
Professor
Industrial Engineering and
Management
R V College of Engineering
Bengaluru, India

Dr. C K Nagendra Guptha
Associate Professor
Industrial Engineering and
Management
R V College of Engineering
Bengaluru, India

Abstract — The Mobility sector is undergoing a transformation and is expected to see a paradigm shift over the coming decades. The challenges in realizing the goal of achieving all electric vehicles (EVs) are manifold. This paper is an attempt to understand the challenges in the mid-segment electric car (E-car) and also consumers buying preferences and concerns. The paper also presents key statistics related to India with respect to pollution, contributors and initiatives through the Government of India (GoI) to tackle the broad goals, set to improve air quality. Further, initiatives from GoI related to electric mobility (E-mobility) have been studied and compared with consumer's expectation from EVs. The study also includes feature by feature comparison of two existing EVs. Suggestions towards suitable value proposition for Indian consumers have been provided. Usage trends of primary users and their expectations over the past three different decades have been captured. The results from the preliminary research indicate that mid segment EVs preference considerably increase when it comes to consumers buying a car for secondary purpose owing to the shortcomings of existing EVs in the mid segment. Recommendations for mass adoption of EVs are proposed

Keywords— Value proposition canvas, Electric cars, Consumer preference

I. INTRODUCTION

It has been broadly accepted globally that E-Mobility is the future of the mobility sector and more specifically when it comes to road transport. Most countries across the globe have taken up the commitment to reduce the pollutions levels and contribution to the carbon foot print due to the usage of internal combustion engine (ICE) vehicles. These initiatives are part of the climate change pledge and the target is to have 30% EVs by 2030. In India, the Faster Adoption and Manufacturing of (Hybrid&) Electric vehicles (FAME II) scheme has been launched on 1st April 2019 with a view to boost the auto manufacturers to build a sustainable ecosystem and transform mobility solutions in India with an emphasis to speed up the rate of building charging infrastructure. China remains the world's largest E-car market, followed by Europe and the United States. Norway is the global leader in terms of E-car market share (46%). While vehicle growth in India is rapid; ownership per 1000 population has increased from 53 in 2001 to 167 in 2015.

II. LITERATURE REVIEW

Considerable attention has been paid to the field of research related to E-Mobility and more specifically on the market trends related to the mobility and comparison of

enabling regulatory frameworks for faster adaption of EVs transition from the ICE vehicles. This paper cites a few of these works. Fanchao Liao et al in their research throw light on methodology, modeling techniques and experiment designed to conduct studies on EV preference [1]. Pritam K. Gujarathi et al present a case study on Consumer's perspective to understand ground realities and also discuss tariff for EV charging, challenges for Indian market growth, policies and promotions required [2]. John Paul Helveston et al presents a comparative study of EV preference among Chinese and American consumers and how low and mid-range plug-in hybrid electric vehicles (PHEV) compete against their gasoline counterparts in the similar price range without national subsidy in these two countries [3]. Theo Lieven et al provide information on impact of range barrier, price range among several vehicle categories on the preference of EV [4]. Patrick Plötz et al opine that EV adoption is limited to private EV buyers, middle aged men with technical professions and living in sub-urban multi-person household [5]. Ghazale Haddadian et al call attention to policy makers to incorporate both push and pull strategies within incentives scheme for mass EV adoption [6]. Anco Hoen et al give insights on the concerns of private car owners based on negative preferences for the electric and fuel cell car, due to limited driving range and high charging times [7]. Paul D et al discuss about van Westendorp price sensitivity method and showcase the acceptable price range for EVs. Also provide insight on unwillingness of consumers to pay huge premium in spite of providing information on future fuel savings [8]. Kenneth Lebeau et al present an interesting insight that consumers with more knowledge want a car with a higher maximum speed and desire faster charging durations [9]. Zulkarnain et al proposes a conceptual model of EV ecosystem with emphasis on consumer acceptance, Technical and environmental challenges [10]. Majority of the papers reviewed provide insights on EVs as a segment and literature related to studies on preference of Electric cars is limited. Concern regarding charging infrastructure overshadow all other concerns. Research evidence on comparing government policies, Consumer preference and the loopholes arising out of it is limited. Focused research relating to mid segment market income group is essential as they form the major segment of the Indian automotive sector business.

III. MOTIVATION FOR CURRENT RESEARCH

In 2018, the global E-car fleet exceeded 5.1 million, up 2 million from the previous year and almost doubling the number of new E-car sales [11]. The emphasis from the government to boost the auto manufacturers seems to be limited to building charging infrastructure [12]. India uses a large variety of motorized transport on roads and its auto-segments are quite different from rest of the world [13]. The questionable assumption made by the policy makers and others in this case is that if the ecosystem is built, then the consumers will prefer to switch to EVs. While ecosystem is an important aspect for end users to switch to hybrid and EVs, there are several other factors which also play an important role in changing consumers buying preference. The policy announced by the GoI as part of FAME II scheme emphasizes very little on building a sound service infrastructure and is not based on a clear understanding the needs of the end user.

IV. KEY STATISTICS AND STATUS REPORT ON POLLUTION IN MAJOR INDIAN CITIES

According to an article by economic times, 7 of the top 10 most polluted cities in the world are in India [16]. The index measures the presence of fine particulate matter known as PM2.5; Source contributions demonstrated a clear urban enhancement in PM 2.5 from gasoline engines (by a factor of 1.14) and diesel engines (by a factor of 2.3), which is significant due to the well-documented negative health impacts of vehicular emissions [17]. The major cities of India namely the four metros along with Bengaluru, Hyderabad and Pune constitutes to about 32.01 million vehicles as on 2016 [18][19]. The number of registered vehicles has gone up 700 times from 0.3 million in 1951 to 210 million in 2015 as per study conducted by Centre for Science and Environment (CSE) titled 'At the Crossroads' [20]. India to surpass China to become 2nd largest oil demand centre in 2019. India spent an estimated Rs8.81 lakh crore (US\$120 billion) to import 228.6 million tons of crude oil in 2018-19. The Indian automobile market is the 4th largest in the world and on course to be 3rd in the next three years. Transport sector being the major contributor to pollution with 10% total greenhouse gas emissions (GHG).

Several studies have suggested that EVs can reduce the pollution level by reducing local concentrations of pollutants in the major cities [14]. The Government has set an ambitious target of converting 15 per cent of the total vehicles in the country to electric by 2024 (30% by 2030). Uttar Pradesh leads the electric race with nearly 139,000 battery-operated vehicles, followed by 76,000 EVs in Delhi, according to Union Minister for Road Transport and Highways. The third and fourth spot is grabbed by Karnataka and Maharashtra, respectively. Surprisingly, Assam, with 15,192 EVs, is ahead of all northeastern states and several other states in the rest of India [15]. Statistically speaking there are less than 30 cars for every 100 Indians which indicates India as a huge potential market for car segment itself.

V. MAJOR INITIATIVES BY GOVERNMENT OF INDIA TOWARDS E-MOBILITY AND CLEAN AIR

The prospect of rapid global temperature increase has created the need for a reduction in the use of fossil fuels and

associated emissions. India has committed to cutting its GHG emissions intensity by 33% to 35% percent below 2005 levels by 2030 [14]. GoI has been in the forefront in strategizing and releasing required funding with regard to achieve the green initiative. FAME II scheme has been launched upon completion of FAME I scheme and Table 1 shows the comparison of FAME I and FAME II schemes [22].

TABLE 1: Comparison of FAME I and FAME II Scheme
 (Source: Report by Department of Heavy Industries)

Scheme	Started on	Expected End date	Extended Up to	Initial Budget Cr of Rs	Extended budget Cr of Rs	Objectives
FAME I	1/4/2015	31/3/2017	31/3/2019	795	895	Stakeholders for Implementation. Allocation of funds.
FAME II	1/4/2019	31/3/2022	--	10000	--	Technology development, Market creation, demand aggregation, Pilot Projects and Charging Infrastructure.

Ministry of Heavy Industries & Public Enterprises, GOI, in its press release claimed to have provided financial support to about 2,61,507 electric/ hybrid vehicles. 119 models of vehicles of 27 OEMs got registered. Department of Heavy Industries (DHI) has so far sanctioned 455 electric buses for 9 cities in a pilot scheme launched on 31st October 2017, which got interest from 44 cities seeking 3144 e-buses. FAME II emphasizes on reduction of purchase price of hybrid and EVs focused on public or shared transportation (buses, rickshaws and taxis) and private two-wheelers [11]. The outlook of FAME II scheme has glimpses of product-out and push strategy.

Further, National electric mobility mission plan (NEMMP) has brought in initiatives to promote EVs. The rates of GST on EVs are 12% (with no Cess) as against the 28% GST and Cess up to 22% for ICE vehicles. Ministry of Power has allowed sale of electricity as 'service' for charging of EVs. This provides a huge incentive to attract investments from entrepreneurial ventures to upgrade the charging infrastructure. Further, Ministry of Road Transport Highways issued notification regarding exemption of permit in the case of battery operated vehicles.

VI. FACTORS INFLUENCING CONSUMER PREFERENCES ON ELECTRIC VEHICLES

The share of global consumers that would consider purchasing an EV is on the rise. In the United States, between 10 and 30 percent of consumers indicated their preference to consider an EV as their next purchase as per one of the national surveys. In Europe, the reported share of consumers considering EV purchase was pegged at 40 to 60 percent, and in China, it was over 70 percent, given the presence of strong government incentives to adopt these vehicles. This trend is even more pronounced among Consumers aged younger than 50 year's old living in urban areas. Sales in 2018 only provide

a partial view, given that EVs accounted for less than 5 percent of sales in most markets.

Buying a car in India for long has been a family choice and depended heavily on word of mouth. The current demographic trend is that the Indian car buyers are getting younger and more aspirational. With the excessive online information and comparisons, blogs, vlogs available, the definition of family and friends is slowly changing. The major influencing factors determining buying preference in Electric car segment includes Variety, Range, Vehicle cost and resale value, time to recharge, Infrastructure, reliability, battery life and Mindset orientation towards contributing to the environment. These also act as entry barriers to switch from the conventional ICE vehicle to EVs. More than half of the passenger vehicles sold in India last year cost 5.6lakhs or less, according to BNEF. According to a report it is said that E-cars won't achieve price parity with ICE cars until the early 2030s [21]. The consumer preference in buying a car is compared as a trend considering a span of three decades and depicted in Table 2.

TABLE 2: Comparison of Consumer Choice of Buying in 3 Decades

Decade	2000-2010	2010-2020	2020-2030
Parameters			
First car buying age	33-35	23-30	20-25
Price of mid segment passenger vehicle	3-5 Lakhs	5-7 lakhs	6.5 lakhs and above
Car features expectation from Consumers	No frills	Power steering, power windows, AC, Navigation, entertainment unit	Fully Loaded with sensors
Preferred segment for vast mid-segment Indian consumers	Basic models and mid segments	Top end model of Mid segment and off-road vehicles	Top end compact sedans and compact SUV's- One car for all purpose
Years before exchange	7-8	5-6	3.5-5
Km driven per year	5000-10000	10000-15000	13000-18000
Decision influenced through	Word of Mouth	Word of mouth and predominantly online information through blogs, websites, vlogs, portals like carwale.com etc	Predominantly online resources and personal choice through test drives at preferred locations.
Payment mode	More from savings and small loans from banks (Low disposable income)	Less from savings and more from bank loans (moderate disposable income)	Predominantly from bank loans (High disposable income)
Esteem needs of car buyers to be fulfilled	Stability (Seeking reassurance and appreciation)	Prudence (Seeking control) Belonging (Seeking positivity and sense of being provider)	Daring dynamism (seeking an adrenaline rush) Prestige (Seeking Admiration and exclusivity) Liberation (Seeking excitement)
Choice of vehicle	Petrol due	Diesel due to hike	Petrol and diesel

purchased	to ease of maintenance	in petrol prices	along with E-cars due to environmental awareness and policies of government
-----------	------------------------	------------------	---

Detailed Year on Year (YoY) figures of leading car manufacturer in India sales reported as on January 2020 is also furnished below in Table 3. The buyers of the current decade are more value seekers which is evident from the sales figures in the last four quarters.

TABLE 3: Year on Year figures of sales reported as on January 2020 [23]

Car Category	YoY sales %	Trend
Small Car Category	11.4	Upward
Utility Vehicles (UVs)	27	Downward
Vans	19	Downward
Light Commercial Vehicle (LCV)	11	Downward

VII. ANALYSIS OF VALUE PROPOSITION FOR THE MID SEGMENT ELECTRIC CARS IN INDIA

The Value Proposition Canvas is a tool which helps ensure that a product or service is positioned around what the customer values and needs. A reference of TESLA and TOYOTA E-cars has been studied for plotting value proposition canvas considering the consumer segment as middle income group with high aspirations (Refer annexure 1).

From table 2 and table 3, it is evident that new age car buyers are value seekers. Desired features expected by value seekers from mid-segment group are Keyless start/stop/entry, Sunroof/ moon roof, Automatic cruise control, Rain sensing wipers, Cell phone mirroring etc. These will also be the features which will be offered in the mid-segment ICE cars in the near future owing to the tough competition. The likelihood of consumers choosing EV is greatly influenced by how similar the new EV proposition is in comparison to the existing models of ICE cars. These also are the assumption that needs to be tested as drivers for consumers to switch from ICE cars to E-cars.

VIII. GOVERNMENT OF INDIA'S (GOI) E-MOBILITY SCHEMES AND THE REALITIES RELATED TO CONSUMER'S NEEDS

There are numerous factors that favour increased sales of E-cars in the near future. Modern Battery Electric Vehicles (BEV) currently offer a wide range of benefits such as superior performance, cutting-edge technology and connectivity, a quieter ride, lower running cost, full city access, Unique exterior styling and increased interior space. Consumer expectations reveal that the FAME II scheme has to be supplemented by the respective state governments by incentivizing certain benefits towards them. Such benefits include either waiving off or offering concessions on road tax, permit, toll tax, parking fee, registration charges and cost of acquisition. Deloitte estimates that the market will reach a tipping point in 2022- when the cost of owning an EV will be almost equal to that of ICE counterpart which makes EVs a viable option [24]. Approximately 20 major cities worldwide

have announced plans to ban production of ICE cars by 2030. Copenhagen plans to ban gasoline vehicles from 2019 and UK has commissioned “Zero Emission Zones” (ZEV). These are predominantly based on the assumption that battery technology will develop at a faster pace to bring down the existing entry barriers.

There are more such factors which might hinder consumer confidence and in turn reduce sales. Demand incentives above mentioned are subject to several conditions. Manufacturers of EVs have to meet these conditions to be in position to offer three year comprehensive warranty and adequate facilities for after sales service as assurance to customers. The benefits are bound to be extended by the state government with respect to waiving off or concessions is yet to take effect on the ground and not clearly visible to the customers at present. The subsidies have not resulted in reducing the on-road price of E-cars and at present do not seem viable to majority of the Indian consumers. Currently there are only few options in EVs in the Indian market as opposed to consumers being spoiled for choices when it comes to the ICE segment. Studies also indicate that the government incentives impact on the adoption of EVs is still relatively low. Mushrooming of new entrants in to EV manufacturing with very little or no expertise from other fields can create dilemma in the minds of consumers to shift from the ICE vehicles to EVs.

IX. PRODUCT BENCHMARKING AND MOMENT OF TRUTH

As a value adds to the current research a “product benchmarking” study of existing and to be launched E-cars have been presented in a tabular format based on product features for comparison purposes (Refer Annexure 2). The EVs are arranged in increasing order of range offered in Kilometre (KM) which is then compared against their top speed and price. Moment of Truth (MoT), is the moment when a consumer interacts with a brand, product or service to form or change an impression about that particular brand, product or service. First Moment of Truth (FMoT) is when a consumer tries to understand the segment or the product offering through primary research. The factors in an E-car which can create satisfaction, dissatisfaction and delight are categorized in to four quadrants as Hygiene, critical, enhancers and neutral factors as shown in Fig 1. Range, top speed and price of the vehicle are obtained as key performance indicators (KPI) from product benchmarking and moments of truth. The results are plotted as shown in Fig 2.

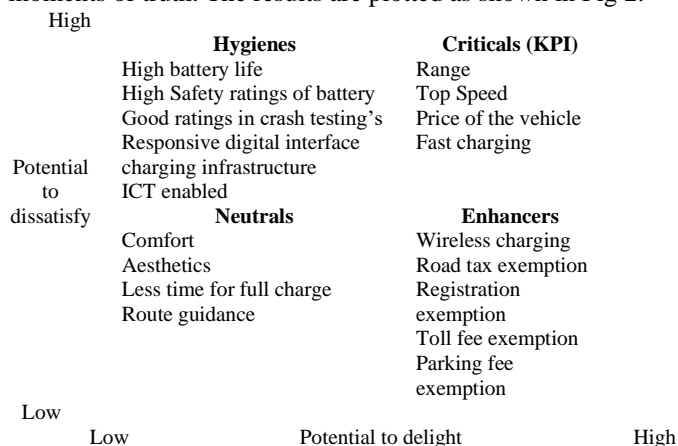


Fig 1: Delighting and Dissatisfying factors [25]

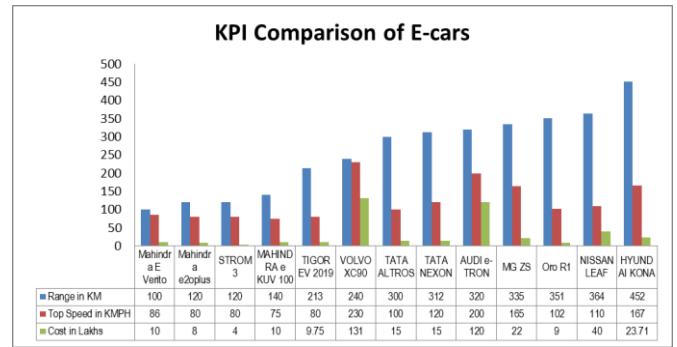


Fig 2: Representation of E-cars along with range, top speed and price.

Correlation is a statistical technique that shows whether and how strongly pairs of variables are related. The correlation coefficient's values range between -1.0 and 1.0. Correlation among KPI is tabulated in Table 4. The data suggests significant correlation between price and top speed, poor correlation between price and range, poor correlation between top speed and range.

TABLE 4: Correlation of Range, Top speed and Cost

	Range	Top speed	Price
Range	1		
Top speed	0.514353	1	
Price	0.220228	0.859988	1

X. CONCLUSIONS

This paper is based on an exploratory research aimed at a developing a holistic understanding of the planned infrastructure development for promoting E-mobility in the future and emphasis in this study is on bringing to the fore consumer's point of view. It is expected that the perspectives from this research will help in transitioning the switch from the ICE vehicles to EVs. The policy imperatives in the Government initiatives and the raising consumer expectations seem to be in conflict, this may put auto manufacturers wanting to expand the E-Mobility offerings in a dilemma. Based on the broad understanding of the problems and challenges related to the E-Mobility sectors, it can be said that affordability of E-cars is an issue and may only appeal to small segment of middle income group in urban India. It is best suited for those who are planning for a Second purchase to facilitate commute within the city. The authors based on the current research believe that it will take long time for E-cars to become the primary preference for all purpose among the Indian households. The strategy going forward is to achieve price parity with ICE vehicles, through cost reduction programs at manufacturers end and promote E-cars is to introduce disincentives by increasing taxes on ICE vehicles. Additionally levying of carbon taxes for causing pollution can also be looked in to. With all these measures, it might still turnout that luxury of buying ICE vehicles might override the preference of the buyers till appropriate infrastructure for the cheaper manufacture of EVs and rapid progress in the area of battery technologies towards cost reduction of batteries as a component of the EVs and to fill the existing pricing gaps between ICE vehicles and EVs.

Based on the exploratory research by the authors the following recommendations to all the stakeholders in the E-Mobility are proposed to realize the faster adoption of EVs at a mass scale are categorized as below:-

INFRASTRUCTURE

- a. Creation of Visible charging infrastructure in the urban setup.
- b. Standardization in charging socket. (Preferably 3pin universal socket, one each for slow and fast charging respectively).
- c. Build sound service infrastructure.
- d. Use the existing petrol bunk infrastructure effectively for battery availability.
- e. Erect charging stations at malls, educational institutions through PPP/Franchise model.
- f. Parking spaces to be effectively utilized as charging stations with a fee.

STRATEGIES

- g. Subsidies in buying for commercial purpose to bring down payback period.
- h. Target taxi conglomerate (Ola/Uber) to use EVs only from a stipulated period.
- i. All vehicles in the proposed new smart cities to be electric.
- j. All firms, schools and colleges providing transport services to employees to phase-in EVs.
- k. Increase the confidence among citizens by using electric buses throughout the city.
- l. Emphasize on RMA requirements (Reliability, Maintainability and Availability)
- m. Cash back on return of empty battery sockets.
- n. Utilize existing bounce model for battery replenishment.
- o. Vehicle to grid (V2G) to be realized to bring about balance during peak demand.
- p. Solar energy harvesting by domestic houses to reduce the load on the grid to provide.

NOVEL IDEAS

- q. A regular battery along with space for four supplements which can cater to 10% of regular battery. (40% extra)
- r. Substitute batteries to be sold for domestic purpose by anyone without taxation.
- s. Utilize AI to bridge the gap between supply and demand.
- t. Understand thoroughly the latent needs of customer through market research.

It is hoped that this study furthers the interest in researching on the consumer related issues to accelerate the switch from the conventional ICE vehicles to EVs in the Indian context.

REFERENCES

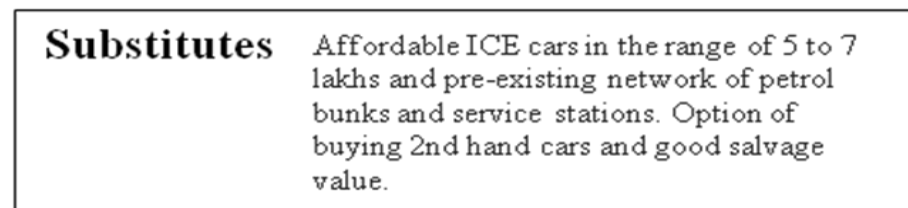
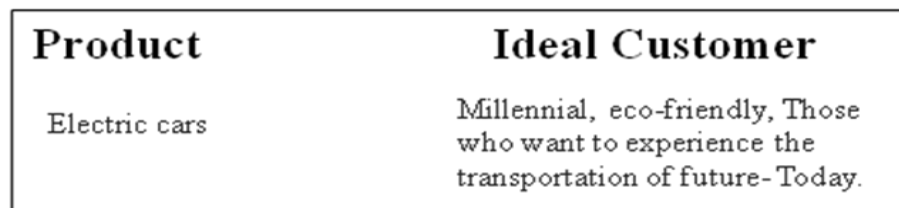
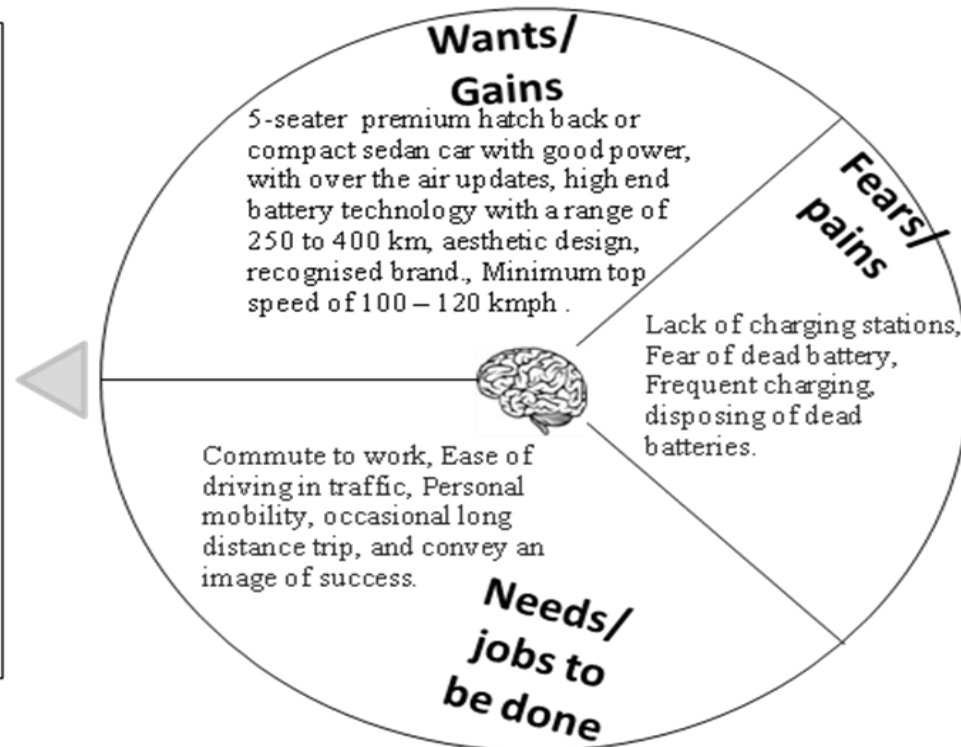
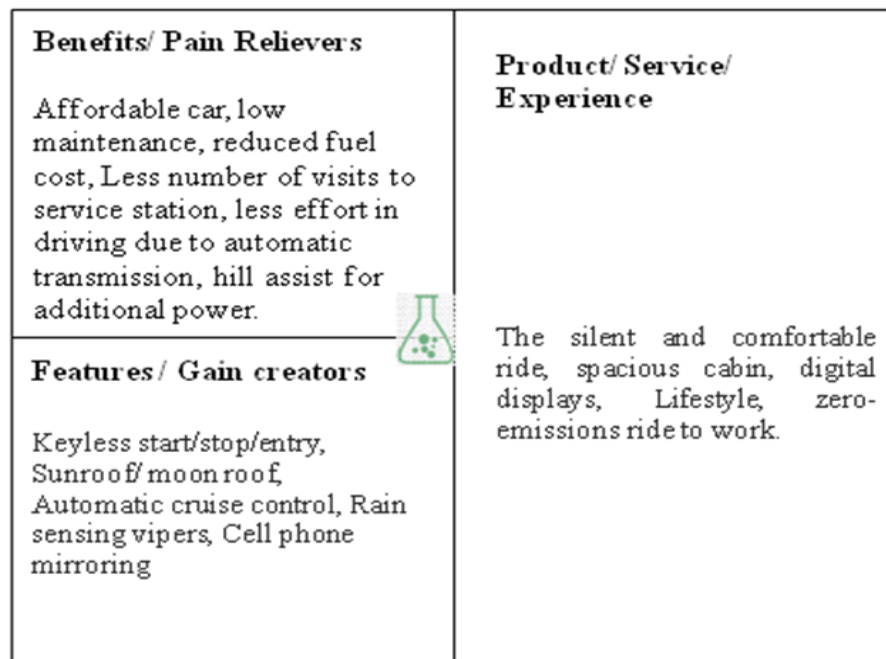
- [1] Fanchao Liao, Eric Molin & Bert van Wee, "Consumer preferences for electric vehicles: a literature review", Taylor and Francis, VOL. 37, NO. 3, 252–275, 2017
- [2] Pritam K. Gujarathi, Varsha A. Shah, Makarand M. Lokhande, "Electric Vehicles in India: Market Analysis with Consumer Perspective, Policies and Issues", Journal of Green Engineering, Vol.81,17–36, 2018
- [3] John Paul Helveston, Yimin Liu, Elea McDonnell Feit, Erica Fuchs, Erica Klampfl, Jeremy J. Michalek, "Will subsidies drive electric vehicle adoption? Measuring consumer preferences in the U.S. and China", Transportation Research Part A 73 (2015) 96–112, 2015
- [4] Theo Lieven, Silke Mühlmeier, Sven Henkel, Johann F. Waller, "Who will buy electric cars? An empirical study in Germany", Transportation Research Part D 16 (2011) 236–243, 2010
- [5] Patrick Plötz, Uta Schneider, Joachim Globisch, Elisabeth Dütschke, "Who will buy electric vehicles? Identifying early adopters in Germany", Transportation Research Part A 67 (2014) 96–109, 2014
- [6] Ghazale Haddadian, Mohammad Khodayar and Mohammad Shahidepour, "Accelerating the Global Adoption of Electric Vehicles: Barriers and Drivers", Elsevier Inc., Vol. 28, Issue 10, 2015
- [7] Anco Hoen, Mark J. Koetse, "A choice experiment on alternative fuel vehicle preferences of private car owners in the Netherlands", Transportation Research Part A 61 (2014) 199–215, 2014
- [8] Paul D. Larson, Jairo Viáfara, Robert V. Parsons, Arne Elias, "Consumer attitudes about electric cars: Pricing analysis and policy implications", Transportation Research Part A 69 (2014) 299–314, 2014
- [9] Kenneth Lebeau, Joeri Van Mierlo, Philippe Lebeau, Olivier Mairesse, Cathy Macharis, "Consumer attitudes towards battery electric vehicles: a large-scale survey", International Journal of Electric and Hybrid Vehicles, Vol. 5, No. 1, pp.28–41. 2013
- [10] Zulkarnain, Pekka Leviakangas, Tuomo Kinnunen, Pekka Kess, "The Electric Vehicles Ecosystem Model: Construct, Analysis and Identification of Key Challenges", Managing Global Transitions, University of Primorska, Faculty of Management Koper, vol. 12(3 (Fall)), pages 253-277, 2014
- [11] Global EV outlook 2019 report
- [12] <https://dhi.nic.in/UserView/index?mid=1378>
- [13] <https://community.data.gov.in/registered-motor-vehicles-per-1000-population-from-2001-to-2015/>
- [14] https://niti.gov.in/writereaddata/files/document_publication/EVreport.pdf
- [15] https://www.business-standard.com/article/automobile/nearly-400-000-electric-vehicles-in-india-up-leads-race-delhi-at-2nd-spot-119071500233_1.html
- [16] <https://economictimes.indiatimes.com/news/politics-and-nation/7-of-the-top-10-most-polluted-cities-in-the-world-are-in-india/articleshow/68264913.cms>
- [17] Shuvashish Kundu, Elizabeth. A. Stone et al Composition and sources of fine particulate matter across urban and rural sites in the Midwestern United States
[<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4191923/>]
- [18] <https://www.statista.com/statistics/664874/registered-motor-vehicles-by-major-cities-india/>
- [19] <https://data.gov.in/resources/category-wise-detailed-total-registered-motor-vehicles-million-plus-cities-india-3132016>
- [20] <https://economictimes.indiatimes.com/news/politics-and-nation/pollution-worse-in-indian-cities-as-registered-vehicles-up-by-700-times-since-1951-study/articleshow/69761131.cms?from=mdr>
- [21] <https://www.thehindubusinessline.com/economy/indias-electric-vehicle-sales-face-challenges-of-affordability-charging/article29614676.ece>
- [22] <https://dhi.nic.in/writereaddata/UploadFile/publicationNotificationFAME%20II%208March2019.pdf>
- [23] <https://www.livemint.com/companies/news/maruti-suzuki-january-domestic-vehicle-sales-flat-year-on-year-11580537615824.html>
- [24] <https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/manufacturing/deloitte-uk-battery-electric-vehicles.pdf>
- [25] Service Operations Management: Improving Service Delivery by Robert Johnston, Graham Clark, Michael Shulver, Fourth Edition , Pearson Education, ISBN 978-0-273-74048-3

Annexure 1: Value proposition canvas for mid segment Indian car buyer

Value Proposition Canvas

Designed for : E-auto manufacturers

Designed by : BHASKAR M G



Annexure 2: Product Benchmarking

Features Car name	Range (KM)	Top speed (KMPH)	Price range (Lakhs)	Fast charging (Y/N)- H	Battery capacity (KWH)	Time for full charge (H)	Torque Info (NM)	Launch date (MM/YY)	Paise per km	ARAI approved (Y/N)	Additional feature	Acceleration (0 to 100km)-S	Battery warranty Info	Novel features
Mahindra E Verito	100	86	9.5-10	Y (1.5)	31	11.5	91	Existing		Y	Basic	11.2 (0-60)	3Y or 1.25L KM	510Lt boot space
Mahindra e2oplus	120	80	7-8	Y (1.5)	15	8	70	Existing	100	Y	Basic	14.1(0-60)	3Y or 60K km	135Lt boot space
STROM 3	120	80	3-4	Y (2)	16	8	48	06-07/2020	40	Y	Vehicle parking system	NA	1,00,000km	Large Sunroof
MAHINDRA e KUV 100	140	75	8-10	Y (1)	16	6	91	06- 2020	-	-	Remote diagnostics	11 (0-60)	-	Detect driving pattern
TIGOR EV 2019	213	80	9.17-9.75	Y (1.5)	21.5	11.5	105	01/2020	-	Y	Fog lamps	NA	3Y	DIS,ABS, Auto.
VOLVO XC90	240	230	80.9-131	Y (3)	11.6	7	640	Existing	183	Y	-	5.6	2Y	-
TATA ALTROS	300	100	10-15	Y (1)	30	1	113-200	09/2020	-	Y	-	6	8Y	-
TATA NEXON	312	120	15	Y (1)	30.2	8	245	01/2020	-	Y	Rain sensing wipers	8.2	8Y	Sun roof
AUDI e-TRON	320	200	120	Y(0.5)	95	9	230	2018	-	Y	Cold performance	6s	-	660ltrs boot space
MG ZS	335	165	20-22	Y (7)	45	16-18	350	02/2020	70	Y	KERS	8.2s	5Y	Internet SUV
Oro R1	351	102	6-9	Y (0.5)	35	10	125	-	-	-	-	-	-	-
NISSAN LEAF	364	110	40	Y (0.5)	40	8	320	07/2020	68	Y	Diff variants	8	8Y	ABS
HYUNDAI KONA	452	167	23.71	Y (1)	39.2	6.1	395	07/2019	45	Y	Paddle shifters, HUD	9.7	3Y	Virtual engine sound system