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"Electric Vehicles and Attitude of Metropolitan Consumers"

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Abstract

Everybody is talking about electric vehicles (EVs). From media to government to automakers to stock market experts and yes, the consumers too. While driving on roads of metropolitan cities, one can spot few electric vehicles, both 2-wheelers and 4-wheelers. As professor of marketing, it is obvious question that how much or how fast we as a nation, going to accept the e-vehicles concept. Perceptions and attitudes are basic building of consumer buying behaviour. Since the EVs are yet to penetrate in Indian society, the preferred mode of understanding the mood of consumer is understanding the attitude. This study takes the help of some earlier work in attitude measurement and the statement used are re-crafted to suit the product category. The automobile market of metropolitan cities is showing some enthusiasm about the EVs and hence the geography has chosen to understand and estimate mood of the consumer. The statements are validated through Cronbach's alfa and exploratory factor analysis (EFA). The final items forming a unidimensional construct and hence attitude towards EVs across various income groups or gender can be compared.

Introduction:

The United States, China, and India collectively account for half of all global greenhouse gas (GHG) emissions. The transport sector of these major economies is one of the major reasons for the bulk of the emission of GHGs. With dramatic growth in vehicle ownership over the past decade, the situation in major cities like Mumbai and Delhi has deteriorated severely, where the average roadway speeds for motor vehicles have been reduced by more than 50% during the past decade. There is a major reliance by most of the Mumbai's inhabitants on public transport to make the daily commute to their workplace. Probably this could be one reason amongst other reason for EVs potential.

The number of electric two-wheelers across India is projected to cross the allotted

26 million units mark in 2030. The environmental could not be the sole reason. Despite tons of literature in the area of green consumer behaviour, other factors such as economy, price, design, snob-value place important role in consumer decision making process.

Technology of the new category (EVs) has always a point of contemplation. Studies show that two-wheeler electric vehicles have been substantially less purchased compared to IC engine counterparts. The major counterpart of the electric two wheelers has been the present-day scooters having continuous variable transmission technologies.

The maximum speed and accelerating capability of the low-speed electric 2-wheeler does not match with that of IC engine vehicles. Technical limitations, production challenges, and consumer uncertainty have all had a role to play in the hampering of electric bike segment's developments. But with technical capabilities improving, production costs trending down, and a societal-wide demand for sustainable solutions.

The electric bikes division is gearing up to witness an increase in the market share specific to Mumbai and other regions, respectively. Environmental, socio-political, and economic forces are three major factors driving significant support for electric vehicle adoption at the governmental level, with central and local governments in numerous countries instituting policies to incentivize EV adoption.

Investment is flowing in EV startups. Hero MotoCorp, which is the market leader within the two-wheeler segment is engaged in developing innovative and advanced technologies for future mobility, including electric vehicles (EVs), and has also invested Rs.130 crore in Ather Energy, an electric two-wheeler startup to boost electrification standards. Ola getting huge investment from Softbank is an old story. The list is endless.

While the technology getting new patrons, the product adoption is also increasing. Through a self-survey analysis, it was noted that the age group between 18-30 years will most likely adapt to the system of electrification of bikes. The youth play an important role in comprehending the preservation of nature for which they must be educated about the severity of the environmental crisis. Better the communication, better acceptance we can presume for EVs.

If we take Mumbai as representative of all the metropolitan cities. The Automobile Market in Mumbai is advancing towards the trajectory of a viable electro mobile ecosystem to extensively reduce the GHG (greenhouse gas) emission practices within the transportation space. Greenhouse gases have been notably considered as anthropogenic pollutants which essentially has given rise to implementation of BEV (Battery Electric Vehicles) for sustainable urban mobility.

Government has also stimulated production of electric vehicles for all 2 wheelers upto 150cc after March 31, 2025 with respect to environmental benefits and economic factors such as easy utility, cost efficiency and less maintenance. The roadblocks involved in EV Penetration are mainly because of unsettled policies to incentivize local manufacturing and sales, lack of public charging infrastructure and a high cost of batteries.

Literature Review:

Sreeram k, Preetha P K, Prabhakaran Poornachandran, (2019) writes that electric vehicles (EV) have attained admiration due to its eco-friendly nature. Electric bikes are a lot of cleaner than customary gas 2 wheelers. EVs make less noise, involves simple operation in addition, reducing the fuel costs. Integration with smart grid via Vehicle to Grid (V2G) provides financial benefit for the customer through bidirectional charging. Major challenges towards EV adoption are high capital cost due to batteries and fuel cells, limited range due to battery capacity and speed, long charging period depending on battery type and charger and insufficient charging stations.

Recent rapid improvement in technology have enabled the emergence of affordable electric bicycles. Supported by favourable law, this has caused a dramatic increase in both purchase and use all over the world. China is the leader in this segment with 93% of global market share in 2012. Still, the global market is far from saturated. The developing job of bike's Western urban vehicle frameworks, and the emergent worldwide middleclass, are changing western urban communities into ever-rising markets for e-bicycles. This was proposed in an exploration clarifying about EV situation over the globe. (Strömberg H, Smith G, Pontus Wallgren, 2017)

In a research paper titled Electric Vehicles Scenario and a Roadmap for India, P. R. Shukla, Subash Dhar, Minal Pathak, Kalyan Bhaskar (2019) expressed that EV shares have increased globally and this has spurred numerous innovations in EV related technologies. For instance, battery innovations are relied upon to experience significant changes which will cut down expenses and increment energy density. Large scale penetration of EVs will require both demand side tax incentives or electric charge incentive and improved infrastructures in India.

Sreeram k (2019), argues that although the market for 2-wheeler electric motorcycles is growing in the world but in India there are still some measures needed to see the rapid growth which was expected. Future developments should be aimed at designing better batteries and charging technologies that reduce charging time and increase flexibility and improving charging infrastructure.

Dill J and Rose G (2018) talks about adoption of electric 2 wheelers which was conducted from early adopters it was inferred that Owners of e-bikes noted their ability to travel longer distances and over hills with relative ease and to arrive at a destination, such as work, less sweaty and less tired than a regular bicycle would allow. After Interviewing early adopters, it was found out that owners of e-bikes used their bikes as a substitute to a man driven bicycle or traditional motor vehicles.

NITI Aayog, (2008) in its report writes that the Indian 2-Wheeler segment is the largest in the Automobile industry and is most likely to penetrate the EV market and lead the charge given the significant interest of stabilizing the ecosystem. The need for the adoption of E-Mobility stems from achievement of greener transportation through a shift from conventional based fuels to renewable sources of energy.

The FAME India (faster adoption and manufacturer of hybrid and electric vehicles) which is an incentive scheme for the promotion for electric and hybrid vehicles in the county has somehow not been as successful as anticipated. The scheme was commenced with an outlay of Rs.10,000 crores and was applicable to vehicles with only advanced batteries which excludes lead acid battery-powered-two-wheelers. Electric two-wheeler sales fell sharply due to this exclusion and resulted as an

unsuccessful measure**.** (S Seethalakshmi, K Shyamala, 2019)

Nita Aayog, in its report on EVs also mentions that automakers, battery makers, providers, vendors and force utilities are right now in converses with make a manageable environment for charging stations in the nation. An EV utilizes power as fuel which is put away in a battery in the vehicle. The charging can be done using home chargers or public chargers. Batteries account for 50% of the vehicle cost and swapping batteries are considerably more appropriate given the condition that it will work only when users find close by station to swap batteries – existing petrol stations can be integrated as a part of accomplishing this step.

The government proposed an aggressive arrangement to have an all-electric vehicle armada, including autos, by 2030 to cut India's air contamination. However, it scaled back to a more realistic target of 30% after facing opposition from car and motorcycle makers. Now the government and bike manufacturers are at odds over the proposed electrification of motorcycles. The proposition of the government requires 18 million bikes out of 21 million to be sold annually. (Kiran Sharma, 2019)

The two-wheeler manufacturers are in the process of mapping out potential utility methods of electric bikes and a few have already manufactured electric bikes and undertaken testing. Ather Energy founded by IIT-Madras alumni Tarun Mehta and Swapnil Jain, Tork motorcycles founded by Kapil Shelke, Emflux founded by Varun Mittal, Ultraviolette Automotive founded by Niraj Rajmohan and Narayan Subramaniam and backed by TVS Motor, Orxa Energies and Yulu are some of the startups spearheading the electric bike movement in India all with the focus of to beat traffic congestion, reduce air pollution and save energy too. The concerns remain about specifications like battery range, speed, charging time, and comfort. (Sustrishna Ghosh, 2017)

Tax initiatives to promote fully electric vehicles have been facilitated. GST reduction on Fuel cell vehicles ranges from 28% to 18%, GST reduction on Li-ion battery - 28% to 12% and Hybrid vehicles have been kept in the same category as luxury cars and will be taxed at the peak rate of 28% plus a tax of 15%. The GST rate for EV may be brought down which if not feasible then the state government may consider exempting SGST. The road tax should be fully exempted in EV for first few years in anticipation to boost sales. Setting up manufacturing units, charging stations and EV purchase(s) can be considered under priority sector lending. These are some of the fiscal measures being proposed as a measure to ramp up EV tech. (NITI Aayog)

As per an MOU deal between MMRDA (Mumbai Metropolitan Region Development Authority) and Yulu bikes, E-bikes will be made available to commuters across 25 different localities without a mandate imposition of license. Through an app-based function, individuals can access facilities 24/7 with a fare charge of Rs.10 for basis every 10 minutes. This may be viewed as a small but very essential step that will be conducive for future electrification systems. (Manthak Mehta, 2016)

Electric Vehicles Sales growth is yearly witnessing an increase with sales of 20,000 units sold in FY15-16 to 23,000 units sold in FY16-17 and 54,800 units sold in FY17-18. A spike of 138% has been recorded in fiscal year 2017-18 which clearly indicates that manufacturing of E-2 Wheelers must be ramped up and measures

should be undertaken to eradicate barriers such as lack of infrastructure, charging stations and government policies and encourage EV deployment practices.

Research Methodology:

Research Objective:

- Understanding attitude of metropolitan consumer towards electric vehicles.
- Understanding the impact of factors such as gender or income group on the attitude of metropolitan consumers towards electric vehicles

Hypothesis:

H_{01}: Attitude of consumer towards electric vehicle is same across both the genders.

H_{A1}: Attitude of consumer towards electric vehicle is different across both the genders.

H_{02}: Attitude of consumer towards electric vehicle is same across various income groups.

H_{A1}: Attitude of consumer towards electric vehicle is different across various income groups.

Research Design:

To understand the attitude of metropolitan consumer towards electric vehicles, a non- probabilistic convenient sampling was chosen. Primary data is collected using structured questionnaire across various income groups.

Data Analysis & Finding:

Reliability Analysis

Reliability Statistics

Cronbach's Alpha	N of Items
.661	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Env_sus	7.0811	7.272	.323	.641
Low_fuel	6.9932	6.932	.320	.644
Less_Mt	6.8176	5.851	.464	.591
Ease_use	6.9189	6.034	.491	.579
Less_Nois	6.8514	6.127	.438	.601
Willing_buy	7.1284	7.854	.340	.644

Cronbach's Alfa is 0.661 which is well above the acceptable limit of 0.6. Hence the questionnaire is consistent internally. The process was started with 08 items and after reiterations, 6-item scale was finalized.

Correlation Matrix[a]

a. Determinant = .485

Determinant value is not zero. Hence factor analysis can be computed out of given data.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.751
Bartlett's Test of Sphericity	Approx. Chi-Square	104.224
	df	15
	Sig.	.000

Kaiser-Meyer-Olkin Measure of Sampling Adequacy – This measure varies between 0 and 1, and values closer to 1 are better. A value of .6 is a suggested minimum. Our value is 0.75 which is suitable for further computation.
Bartlett's Test of Sphericity – This test the null hypothesis that the correlation matrix is an identity matrix. The sig value is 0 which rejects the null hypothesis.
Taken together, these tests provide a minimum standard which should be passed before a factor analysis should be conducted.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.261	37.678	37.678	2.261	37.678	37.678
2	.924	15.399	53.077			
3	.846	14.099	67.176			
4	.786	13.098	80.275			
5	.618	10.300	90.575			
6	.565	9.425	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1

Ease_use	.715
Less_Mt	.680
Less_Nois	.666
Willing_buy	.554
Env_sus	.524
Low_fuel	.511

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

This is single component questionnaire and hence unidimensional.

Attitude towards the electric vehicles across gender

Hypothesis – 1

H_{01}: Attitude of consumer towards electric vehicle is same across both the genders.
H_{A1}: Attitude of consumer towards electric vehicle is different across both the genders.

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Att	Male	57	1.4123	.52996	.07020
	Female	91	1.3810	.48323	.05066

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Att	Equal variances assumed	.657	.419	.370	146	.712	.03133	.08474	-.13615	.19880
	Equal variances not assumed			.362	110.814	.718	.03133	.08656	-.14021	.20286

Since the significant value is more than 0.05 hence fail to reject the null hypothesis and hence attitude towards the electric vehicle of metro consumer is same across both the genders.

Attitude towards the electric vehicles across income groups

Hypothesis – 2

H_{02}: Attitude of consumer towards electric vehicle is same across various income groups.
H_{A1}: Attitude of consumer towards electric vehicle is different across various income groups.

ANOVA
Att

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.481	4	.370	1.500	.205
Within Groups	35.297	143	.247		
Total	36.778	147			

Since the significant value is more than 0.05 hence fail to reject the null hypothesis and hence attitude towards electric vehicle is same across all income groups.

Conclusion and Recommendation:

EVs have high prospects of shaping the future of transportation sector preventing global warming caused by traditional auto motives that are dependent on the depleting fossil fuels. Through the study it was found out that people are convinced to buy the e-vehicles due to the economy.

Other reasons such as price, range, lack of charging infrastructure etc. affect their buying decision. Government of India is mending policies, providing incentives to promote the growth of buying of electric vehicles. An environment promoting electric commute over fuel commute needs to be promoted to reduce the dependency on limited fossil fuels and to reduce the greenhouse gas.

The research found that there is no difference between a male and female when it comes to attitude towards the EVs. In the same attitude is same across various income groups. Research also found out that majority of people are ready to adopt this technology provided the above features the above features and proper infrastructure is provided. In fact, more than 50% of respondent believe that electric bikes existence would grow at a considerable amount 5 years down the line. With proper advancement in technology and proper legislative measures electric vehicles can soon replace the conventional fuel driven vehicles.

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