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PREFERENCE OF E-BIKE BY WOMEN IN INDIA–A NICHE MARKET FOR AUTO MANUFACTURERS

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Abstract. The increasing urbanization with climate change, global warming issues and the related need to decarbonize the economy, is forcing urgency for identifying the alternate source for the global adoption and sustainable scalable solutions. The country's demographic and road patterns and its natural resources availability provide enormous scope for the electric bike industry. As per the "Navigant Research Report", it is predicted that by 2018, the sales of electric vehicles in India will shoot up by 17 percent. 1.1 million electric vehicles will be targeted within next five years. A recent study on the environment impact of e-bikes with other forms of transportation found that e-bikes are about 18 times more energy consumption than SUV, 13 times than a sedan, 6 times more than rail transit, and it is having considered as an innovated conventional bicycle. It is a frugal innovation strategy which provide safe carbon free environment, and moreover a part of health rehabilitation programmes. It is required that societal, economic and political and infrastructure systems integrate together to balance the energy environment. With this potential, the era of electric bike started its new avenues on the roads of India specifically focusing on Indian women. To develop this viewpoint, the present study focuses on the preference of e-bike among the women in Madurai city.

Keywords: e-bike, electric vehicles, customer preference, women preference, Madurai city.

JEL Classification: M 31.

Introduction

The passenger vehicle sector is addressing the need for next generation transportation which is technically innovated, safer, friendly to the environment and flexible to the users. An electric vehicle (EV), also known as a battery operated vehicle (BOV) or electric bike comes in different configurations: 2-wheeler electric bicycles, electric mopeds, electric scooters, electric motorcycles, electric three wheelers and electric cars. Electric Vehicle (EV) technology and usage is still in its infant stage. Technical advancements and commercializing the potential product in the market is in the way of present trend. Despite its slowness and setbacks the hybrid and pure electric vehicle business is set to continue an upward trend through 2013, posting profits and growth in most sectors. As per the recent research report (Navigant Research Report 2014), it is predicted that by 2018, the sales of electric vehicles in India will shoot up by 17 percent. The market is micro segmented as mobility vehicles for the disabled and the handicapped, elderly and obese too. Taiwan presently accounts for about 70% of the global output of mobility vehicles for the disabled. However this market is slowly moving for women as a lucrative segment. The country's crowded urban centres and congested travel routes make it a new optimism for the electric vehicles. Additionally, the reinstatement of the government scheme for electric vehicle purchases will encourage Indian automakers to develop new models. The electric vehicles in India have been minimal due to many factors like lack

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of awareness, small domestic production, and higher cost, a lack of government initiative, an often irregular power grid, and almost no proper charging stations.

Making the electric bike vehicles more conducive to users, the industry will take up years to grow with the present market share in the short term. According to the Motorcycle Industry Council, share of the female ownership is up to 10% of the total motorcycle owner population. E-bike manufactures are becoming aware of the increasing market and the buying power of women group and are now targeting the woman rider on Indian roads. Hence, the present study focuses on the awareness and preferences of e-bike among the women in Madurai City.

1. Review of literature

The literature reveals that worldwide CO_2 emissions from the combustion of various fossil fuels such as coal, oil, and natural gas were expected to exceed 40 billion metric tons by 2030 (Energy Information Administration (EIA) of the US Government). However, pure electric vehicles that were powered solely by the battery could contribute to a great extent to the reduction of the same. Hatwar *et al*. (2013) projected a new approach in the design of e-bike which consists of hybrid system of battery and super capacitor for increasing speed, and avoid the complaints of long charging time and short lifespan of battery.

Many researchers (Ji *et al*. 2013; Xu *et al*. 2013) have expressed their opinion towards environment compact design of e-bike that compared to other transit modes (car, public transport, taxi and two-wheeler), e-bikes are releasing less greenhouse gas per person. In some countries; the government started subsidizing the purchase of electric vehicles. Countries like Isreal, which are greatly concerned with energy security issues, realized the potential of the electric vehicles and initiated measures to increase the percentage of such vehicles on road. Although electric bikes proved to be fuel-efficient and environmental-friendly, they had some limitations from the consumer perspective. The Adoption of Lithium-ion batteries addressed this concern to some extent; it also improved the driving range per charge and the lifetime of the batteries. According to analysts, the technology was best suited for small countries or big metropolitan areas, with a high population density. These places offered scope for scalability of the charging network. But in very large countries, establishing the network would be a cumbersome task and the return on investment might not be commensurate with the risks involved. In Europe, the electric vehicles market was estimated to exceed 250000 units by 2015, according to a study by Frost & Sullivan in October 2008. Among emerging nations, observers expected China to take the lead in electrification of road transportation. According to a recent research report, India becoming the third-largest market for electric vehicles in the world within 5 years (Navigant Research Report 2014). The ecological concerns of using two wheelers in urban areas have supported the quick development of electric vehicles in the world in recent years (Chiu, Tzeng 1999). A comparative (Cherry, Cervero 2007) analysis were made within two cities in China for examine the motive behind the usage of electric vehicles. The study output was little diverse in opinion that people preferred e-bike as a higher quality mobility option only to a public transport. A survey was conducted by Weinert *et al*. (2007) in a medium populated city having high usage of two-wheelers in China to find out their preferences towards e-bike.

The study concluded that people shifting towards e-bike from public transport and specifically women felt it is reliable while crossing roads compared with other bikes. But they recommended increasing the e-bike speed capacity. Along with the market aspect of e-bike, the safety practices also required to publicize the same. A study by Abdullah *et al*. (2013) has confirmed that the customer preference and their order of importance, price, quality of service, branding are considered to be the important customer dimensions in automobile industry. Knowing these dimensions relative influence may result in better allocation of resources for effective services in electric vehicle industry. A recent survey (Du *et al*. 2013; Yao, Wu 2012) has remarked the on-road traffic safety practices and riding behaviours among e-bikers in a developed city in China. This study revealed that the vital need for developing road regulations and attitudinal interventions to enhance the safety practices among e-bikers in China because it is associated with both gender and driving experience of public (Yao, Wu 2012).

With huge market potential, the industry is customizing its e-bike models specifically for women users. A survey was conducted by Calfee (1985) to identify consumer preferences for electric vehicles attributes like price, operating cost, and comfort. The result indicated a great diversity of opinion in comfort and speed of the vehicle. Cervero (2002) study also recognized new dimensions such as cost and socioeconomic attributes of travellers other than core dimensions – density, diversity and design of electronic vehicles. Relatively very few studies have been conducted in favoring e-bike from the market side. The study highlighted the individuals' gender, age, occupation and income have its own impact on the choice of e-bike. Another study was conducted (Larouche *et al*. 2013) to popularise the active transportation (walking, cycling/e-bike) habit among school going children in Canada. The study contended that social marketing campaigns of creating environmental awareness in one's lifestyle are a prerequisite for e-bike manufacturer. The promising features of zero-emission, less noise level and power efficiency of e-bike has contributed towards preferring female motorist as one of the potential target market in India has made the researchers to conduct the present study in India.

2. Methodology

The present study is based on descriptive analysis. Primary data is used to study the objectives and for testing the hypotheses. A well reviewed structured questionnaire was used to collect the primary data. The primary data used for the study were collected for a period of two months from 1st April 2013 to 31st May 2013.

Statement of the problem

The notion of customer preferences is always an electrifying topic for researchers. The expression of customer willingness and their preferences helps the industry to differentiate it with others while capturing the market share. Being customer centric is the core strategy for the manufacturers to be successful in the market. Madurai is an important agrarian, industrial and educational hub in South Tamil Nadu. The city is home to various automobile, rubber, chemical and granite manufacturing industries and famed for its jasmine flower plantations. The livelihood of many small and agrarian based businesses has been carried out mostly by women in and around Madurai city and they mainly rely on bicycle or public transportation for commuting. A study done by Ye *et al*. (2014), pointed out the relationship between the choice of activities and their preference towards vehicles. Thus the aim of this research paper is to understand whether the choice of e-bike for women serves the various purposes such as for commuting and developing their business and to identify the factors influencing the purchase of the e-bike.

Objectives of the study

- To identify the awareness level of respondents towards e-bike in Madurai City.
- To determine the factors that influences the respondents' preference towards e-bike.
- To analyze the respondents' level of satisfaction towards the use of e-bike on the roads of Madurai City.

Sampling area

Madurai city is the third largest city and second largest corporation in Tamil Nadu, India and it has been a major settlement for two millennia and is one of the oldest continuously inhabited cities in the world. According to 2011 census, Madurai had a gender-ratio of 999 females for every 1,000 males; much above the national average of 929. The geographical area of Madurai city was used as the sample area. The Questionnaire was distributed in person randomly to the respondents in Madurai city. Based on this, 1100 women respondents of Madurai city were opined their views for the study.

Statistical tools applied for analysis

The techniques used for analysis are Frequency analysis, Chi-Square test and Friedman Two-way ANOVA.

3. Analysis and interpretation

Demographic characteristics

62% of the respondents were from rural areas of Madurai and the rest were from urban areas. The mean monthly family income of the respondents was Rs. 33450.52. 17.2% of the total respondents were educated upto10th, 22.0% of the total respondents were educated up to 12th, 43.8% of the total respondents were under graduates, 18.8% of the total respondents were post graduates, 15.4% of the total respondents held Professional qualifications. 31.1% of the total respondents were aged between 20 to30 years, 43.3% of the total respondents were aged between 30 to 40 years, 11.9% of the total respondents were aged between 40 to 50, 13.6% of the total respondents were aged above 50years. 37.8% of the total respondents were Home makers, 40.1% of the total respondents were occupied in office and Industries, 22.1% of the total respondents were entrepreneurs.

In order to identify the preference of e-bike among the respondents, awareness and their willingness to purchase the bike is important. For this purpose, the objective wise analysis and the results are presented below.

Objective 1: Awareness level of respondents

79.3 percent of the respondents are aware of e-bike. 62 percent of the respondents prefer e-bike for their domestic use. A Chi-square analysis was carried out to find out the association between the demographic characteristics of the respondents and their opinion towards purchase of e-bike.

Research proposition – H_0 – There is no association between demographic characteristics of the respondent and opinion towards purchase of e-bike at 5%.

Table 1 clearly reflects that the null hypothesis is rejected and there is an association between all the demographic characteristics of the respondent and opinion towards purchase of e-bike at 5% level.

Table 1. Respondent's demographic profile and their opinion towards purchase of e-bike

Sl No.	Opinion	Frequency	Percent	Cumulative percent
1	Yes	821	74.63	74.63
2	No	279	25.37	100.0
	Total	1100	100.0	

Objective 2: To determine the factors that influences the respondents to purchase e-bike

After the Ch-square analysis, the respondent's ranks on the factors that induced them to buy the e-bike were analyzed using Friedman Two-Way ANOVA and the results are presented in Table 2.

Table 2. Factors inducing to opt for the e-bike

Sl No.	Factors	Mean rank	Chi-square (significance at 5% level)
a.	Style and Design	5.89	902.670 $df = 8$ $p = 0.000$
b.	Comfort while driving	4.96	
c.	No Fuel	5.30	
d.	No license for vehicles under 50 cc.	3.60	
e.	Cost efficieny	7.24	
f.	Better after sales service	6.12	
g.	Long-term guarantee and warranty for spare parts	6.51	
h.	Economically viable and easy to maintain	6.00	

It can be concluded from the above Table 2 that no license for vehicles under 50 cc is the factor which induces the respondents to prefer e-bike since its mean rank is 3.60. Electric Vehicles, which have power less than 250 W and speed less than 25 kmph are not categorized under motor vehicles and which is one of the inducing factor for the respondent. The next important factor is the comfort while driving (mean rank = 4.96) to opt for it followed by no fuel requirement instead it requires only a charging facility with a mean of 5.30. The factor, style and design is the next important with a mean rank of 5.89 followed by economically viable and easy to maintain (mean rank = 6.00) and better after sales service (Mean rank = 6.12) long term guarantee and warranty for spare parts is the next important factor with the mean rank of 6.51 followed by cost efficiency (mean rank = 7.24). It is also interesting to note that the chi-square (902.670) is significant for 8 degrees of freedom at 5% level of significance, which reveals that there is a significant difference among the respondents in ranking the factors determining to opt for a e-bike.

Objective 3: To analyze the respondents' level of satisfaction towards e-bike

The respondents' level of satisfaction towards e-bike was analyzed using appropriate statistical tools and the results are tabulated below.

It is obvious from Table 3 that majority of the respondents (821) are willing to purchase e-bike. However, 25.37% of the respondents are not willing to purchase the same.

It is seen from Table 4 that majority of the respondents (153) are of the opinion that the e-bike is environmental friendly followed by 148 of them reasoning easy maintenance, 125 respondents have replied that brand image as the reason for the satisfaction of the e-bike. On the other hand 124 and 121 respondents have opined that it is based on innovative technology and good appearance respectively 61 respondents opined health tool as a reason for the satisfaction of the e-bike.

Table 3. Respondents' willingness towards purchase of e-bike

Demographics	Chi-square value	Sig.	Decision
Place	28.567	0.006	Reject H0
Category	30.167	0.000	Reject H0
Income	35.615	0.024	Reject H0
Education	71.342	0.000	Reject H0
Age	43.231	0.000	Reject H0

Table 4. Reasons for the satisfaction of e-bike

Sl No.	Reasons	Frequency	Per-cent	Cumulative percent
1.	Not satisfied	279	25.37	25.37
2	Innovative technology	124	11.27	36.64
3	Environment friendly	153	13.90	50.54
4	Easy Maintenance	148	13.45	63.99
5	Brand reputation	125	11.36	75.35
6	Brand image	89	8.09	83.44
7	Good appearance	121	11.0	94.44
8	Health tool	61	5.56	100.0
	Total	1100	100.0	

Table 5. Reasons for dissatisfaction of the e-bike

Sl No	Reasons	Fre-quency	Percent	Cumulative percentage
1	Satisfied	821	74.63	74.63
2	Less Carrying capacity	21	1.9	76.53
3	Low Speed	52	4.72	81.25
4	Non availability of recharging stations	88	8.0	89.25
5	Not suitable for long distance travel	48	4.36	93.61
6	Less resale value	70	6.39	100.0
	Total	1100	100.0	

Table 5 emphasized that majority of the respondents have expressed their willingness to purchase e-bike. And only 279 respondents are not willing to purchase the e-bike. Among them, 88 respondents have opined that non availability of recharging stations, 70 respondents have replied that less resale value, 52 respondents as low speed, 48 respondents as not suitable for long distance travel and 21 respondents as less carrying capacity as the reasons for their dissatisfaction on the e-bike.

Discussion and conclusions

The respondents are of the opinion that more rechargeable stations, more models with carrying capacity and subsidy from the government make them to go in for e-bikes in future. Hence, it is suggested that the manufacturers may design many number of possible models with rechargeable stations specifically for women. Most importantly, the customer preference is established by way of guarantee and warranty for the spare parts of two-wheelers which are sustainable for a longer duration. This will automatically increase the brand equity for that brand of two-wheeler thus enhancing its retention value. Hence, it is recommended that the manufactures should offer long-term guarantee and warranty for the two-wheeler spare parts and ensures its availability in the city. Non licensing requirement for fewer than 50 cc vehicles, environment friendly vehicle are ranked first among the other factors to purchase e-bike. E-bikes can be a useful part of cardiac rehabilitation programmes, and it is suggested by health professionals. So, this may be the niche market and frugal strategy for the auto manufacturing industry. The battery technology should focus on the commuter expectations of range, recharging and affordability. In India most of the EVs run on Lead Acid batteries, Li-on batteries are the need of the hour to improve the EV's efficiency. Battery leasing choices may also be considered by the manufacturer, for reducing ownership costs. A recent survey also concluded that (Salvi, Nambiar 2013) future technologies for EVs may be of Diagnostic Monitor System (DMS), Vehicle Information Data Download, Portable Electronic Tools, Climate Control Seats and Energy Management Systems be considered. The industry needs to attend the new calls and requirements of mid aged, mid income women as their target group. The Industry must create awareness along with promotional development activities partnering with various industry associations, social media etc. Designing a good after sales service network, promoting academic research among premier engineering institutions and initiating pilot programmes for further marketing focal point for e-bike.

E-bikes are gradually more common in China (Dill, Rose 2013) but reasonably low in India. As the growing economy of India has increased the purchasing power and preferences of women, these research findings provide in sight in to the possible market for and use of e-bikes in India. Still some of the critical factors also needs to be considered for electric bike segment in India. Compared to traditional vehicles, electric vehicles are still costly. Even customers keep their eyes on the rise of petrol or diesel prices, the majority of ordinary two wheelers are still providing a supposed mileage for them. But these e- vehicles owners have to manage with frequent battery breakdowns and replacements, which erode the pleasure and the economic gains. The back off of support of on road policies on electric two wheelers in mid 2012 has added cost burdens which in turn not offering the promised economic benefits to the owners. As found in the previous research done by Chiu, Tzeng (1999) and Cherry, Jones (2009), gender is an important decision determinant for e-scooters and motorbikes. This view is supported by the present research study and a worthwhile marketing strategy may be adopted to produce lines of e-bike geared to each gender. For example, in female-line of e-scooters, manufacturers could modify it by increasing its top speed, carrying capacity, and comfortable for long, extended travels. Women showed their preference for a scooter-style bike over a traditional style design most likely because the scooter-style is light weighted and design is more comfortable. The samples collected from Madurai city revealed several probable demographic markets for women and people with physical limitations. The e-bike can address concerns about health problems related to inactivity, pollution and other problems. Madurai being one of the largest cities in South India, has to its credit a considerable and relevant mix of various popular ethnic groups of the country such as Marwadis, Sourashtrians, Parsis etc., Most of them have migrated for business purposes and they form a sizeable population of the city. In addition to these, the city also has a good mix of population belonging to various regional, religious and communal groups that are seen across the country. Thus it can be concluded that the outcome of this study is relevant for the marketers of e-bikes to correlate to other states of South India and parts of North India too.Government has set up the Governing Council for Electric Vehicles which is operating under the Ministry of Heavy Industries and Public Enterprises. It will develop infrastructure for electric mobility – charging stations. Government will promote Joint Ventures, specifically in EV battery technology and plan for a council for further transfer of technology may have representatives from various Ministries – includes Road Transport and Highways, New and Renewable Energy and Power and other related industry representatives.Further research is needed to determine specific policies and safety practices to increase the adoption of e-bike.

From the study it is clear that exclusive show room, trendy models with different capacities and colors, and exclusive service stations for women in large numbers may create a new market potential for the automobile industry. The scarcity of fossil fuels, hike in price of crude oil, and increasing focus on environmental pollution and greenhouse effect on earth, and the global automobile industry is gradually

moving toward electricity as the source of power for automobiles in a hybrid form. Increased pressure to be more socially and environmentally responsible is inducing many manufacturers to install charging stations on their premises. Given such a favorable environment, electric vehicles and charging networks, which served the cause of environmental sustainability, appeared to have a bright future. This frugal innovative strategy would facilitate new business opportunities and making world becoming a low carbon economy.

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