

European Journal of Technology (EJT)



Consumer Preferences for Adoption of Two Wheeler Electric Vehicles

Syed Waqas Javed and Dr. Hafiz Muhammad Khurram



Consumer Preferences for Adoption of Two Wheeler Electric Vehicles

Syed Waqas Javed^{1*} and Dr. Hafiz Muhammad Khurram¹

¹Department of Industrial Engineering Management, University of Engineering and Technology, Taxila, Rawalpindi, Pakistan

*Corresponding Author's Email: waqas.eng99@gmail.com

Abstract

Purpose: This study provides important perceptions to the policy makers in Pakistan to introduce a new mode of transportation for the consumer. In this particular case, the consumers in Pakistan are still showing their interest in buying Internal combustion engine (ICE's) over Electrical vehicles (EV's) due to non-awareness of merits and demerits of EV's.

Methodology: Therefore to evaluate consumer's preferences towards two wheeler electric vehicles a survey was conducted by distributing questionnaire among the people of country in different regions. About 317 respondents living in Pakistan participated. Eleven different factors related to consumer's preference has been observed for the purchase of E-bikes. After analyzing these 11 factors, top three factors like awareness about E-bike, design and aesthetic and health and safety issues have found their preference. Similarly, three other bottom factors i.e. availability of charging facilities, mileage per charging and price factors has found main causes of low purchase of EV's by consumers.

Findings: After conducting survey it has revealed that awareness about electric vehicles should be developed among the students and other users, maximum dealership should be given to the experts, distribution network should be strong and also prices of E-bikes should be decreased in order to increase the sale.

Recommendation: The study also had revealed that Govt. of Pakistan with the consultation/coordination of manufacturers within the country could prepare a policy for the installation of plants/factories of E-bikes wherein with the support of Govt. for the provision of necessary infrastructure and subsidy to the consumer.

Keywords: *Global warming, transportation sector, green agenda, harmful pollutants, electric vehicles, influencing factors, govt. policy*

1.0 INTRODUCTION

Pakistan is confronting numerous multi-faceted problems in various sectors. So to solve these problems solutions are required that effect these sectors in a positive manner. In this section, we present arguments that EVs in Pakistan can solve problems of various areas including environment, transportation, power and economy. The term EV covers all of transportation including bikes, cars, trucks and buses. The transportation section has been increased two times in Pakistan. High consumption of non-renewable energy sources, including oil may just disintegrate the further circumstance. As indicated by the National Economic and Environment Development Study (NEEDS) report, Pakistan is required twofold its emission by 2020 and further multiplying it by 2030 (Andrew, 2018). Carbon outflows will increase as well as other different risky mixture of gases, for example Sulfur Dioxide (SO₂), Nitrogen Dioxide (NO₂) will also take part in atmospheric environment due to increase of consumption of non-renewable energy sources day by day. Due to the effectiveness of battery based power storage, EVs can give a similar mileage with 33% of the expense contrasted with their FFV rivals. Moreover, EVs as compared to FFVs require minimum maintenance, repair and does not require the change of oil and other oily lubricants. It is estimated that in future Pakistan will be able to produce the 37% renewable energy source of electric power. Comparatively efficacy of EVs brings about 70 to 80 percent less environmental emissions when contrasted with FFVs (Ullah, 2019).

EVs include Hybrid Vehicles (HVs), Plug-in Hybrid Electric Vehicles (PHEVs) and Battery Electric Vehicles are called EVs. The objective of all EVs isn't a usual objective. Accordingly, it may not be accomplished until several decades for even the most advanced nations on the globe. In this way, efforts are being made by some developed countries to convert the fuel vehicles into electric vehicles. Similarly, Norway planned to sale all EVs up to 2025. Netherlands is also making efforts to introduce the same up to 2030 whereas western countries has also focused the same up to 2040 (Shove, 2018). Contrary to these objectives, many automakers have additionally set to eliminate fuel based vehicles (FFV) from their vehicles line up. Shortly, an uprising is occurring in the transportation division and a move towards electric charge of the vehicle is unavoidable. In any case, the quantity of EVs and charging foundation is a 'chicken and egg' issue but with careful planning and arrangements this issue could be solved. With successful policies and procedures, EVs is considered more suitable for both types of usage; public and private. Greater recognition of EVs would decrease hazards for savings in E-transport and inspire car manufacturers to raise construction. Different categories of EVs could give various environmental friendly benefits.

1.1 Objectives of study

Present study had performed to investigate the decision making process of Electric Bike owners and to determine the purpose of electric bike purchasing. To examine the profile of the Electric Bike owners on the basis of demographic factors like age, gender, income level, education level and profession and to identify and analyze the factors influencing the purchase of Electric Bikes. The focus of this survey is to find out the influencing factors that impacts on buying Electric Bikes by consumers. The significance of this study is that the findings of this research work can be useful for the marketer's to formulate marketing strategy. It can benefit both the consumers for making buying decision easily and the marketer for manufacturing their products as per need of consumers.

2.0 RESEARCH METHODOLOGIES AND DATA COLLECTION

This methodology applied to carry out the proposed research work is divided into five different phases, which are explained one by one. In first step literature review is made to explore the research gap. In second phase extensive literature review is carried out for variable identification to select construct as well as measurement components. Research questions related to consumer preference for adoption of Electric Vehicles in Pakistan are developed in third phase. Beside the questionnaire is design for data collection in third phase. The data collection from different cities of educated people of Pakistan through questionnaire and screening of data is made in this step. In fourth phase different simple statistics techniques are implemented for data analysis and results are analyzed. In fifth phase, results are discussed and conclusions are made for future work. A complete diagram of research methodology is also given for better understanding. In this chapter steps and phases are discussed and factor identification of consumer preference for adoption of Electric vehicles is studied in detail. The research methodology flow diagram is shown in following figure 1.

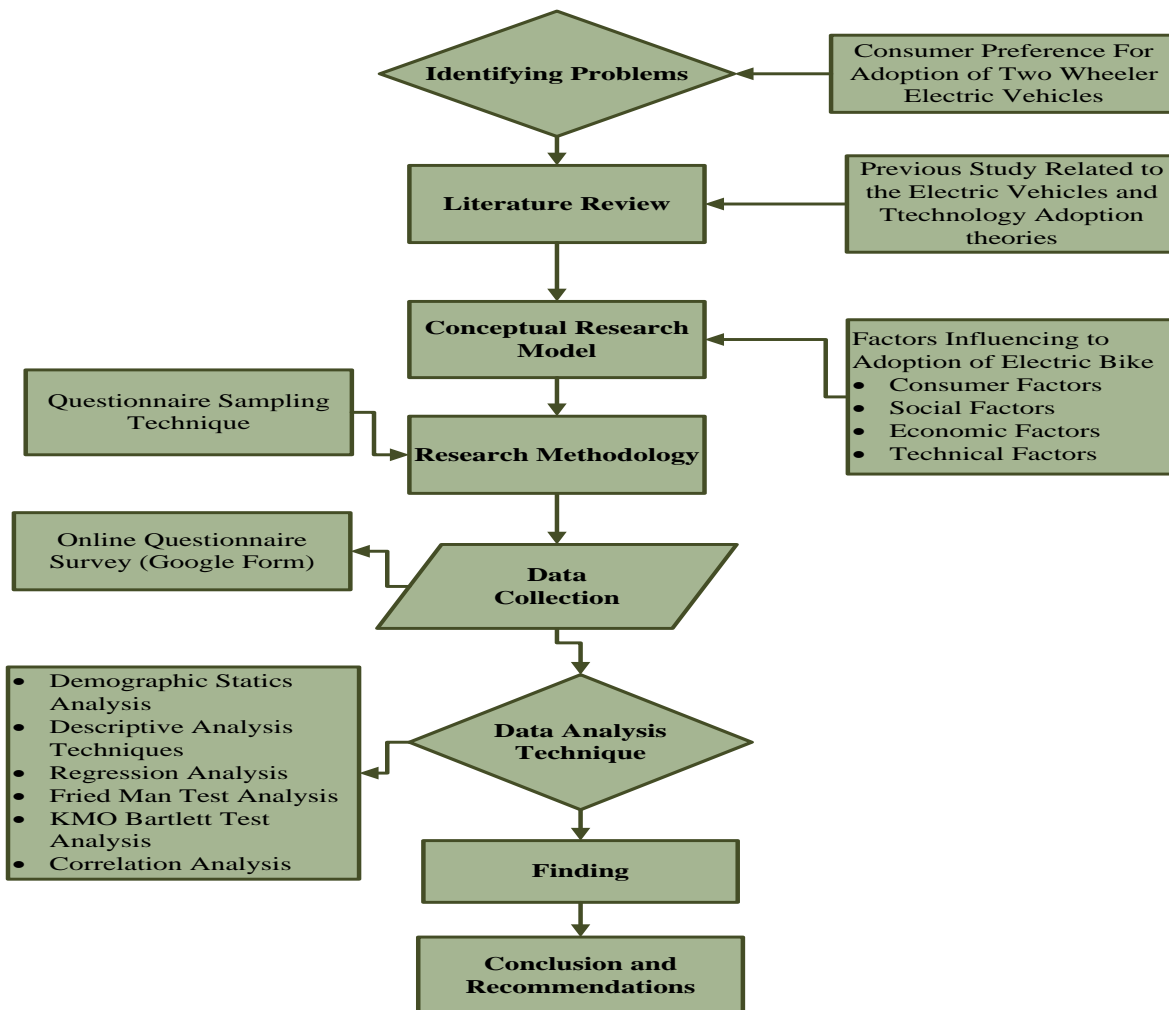


Figure 1: Research methodology flow chart

2.1 Research Design

Way of planning and conducting research work to find answers of required questions of research is named as research design. Different types of research designs are used to conduct research work including descriptive design which is key design to find the answers of problems particularly in marketing. It explains a particular occurrence involving attributes of consumers like age, income and life style etc (Kerlinger, 1986).

2.2 Methods of Data Collection

The data was collected from the self-administered well-structured questionnaires from different places of Pakistan cities such as Islamabad, Rawalpindi, Taxila, Wah Cantt, Haripur, Sargodha, Lahore, Khushab, Sialkot, Jhurabad, Mianwali, Sheikhpura, Jhang, Hyderabad and Karachi, as source of primary data. The questionnaire is designed to make it simple, clear, understandable and short but efficient. The questionnaires were distributed in such a manner that the study can cover the respondents from various races, traditions, cultures, religions, geography, economic groups, age groups, professions, gender, and education levels in order to reflect realistic result of Electric Bike buying behavior of consumers.

A sample data is the selection of certain number of random respondents from population. The size of the sample is 317 respondents selected randomly from Pakistan district. For the sampling 350 set of questionnaires were prepared, and distributed to different places of Pakistan district. Out of 350 questionnaires, 317 questionnaires are returned with correctly filling and remaining 33 set are not returned.

4.0 RESULTS AND DISCUSSION

A questionnaire method of analysis is selected to examine the data. Data about descriptive and inferential statistics of whole study is presented in this chapter. Frequencies, means square, percentages and graphs and table are included in this chapter. Multiple correspondence analyses are used to deal with categorical data.

4.1 Demographic Features Affecting for Adoption of Electric Bike

It is imperative to study Demographics features of consumer Preference for adoption of an Electric Bike. The studied demographic features are; Gender, Age Group, Profession, Income level and Education level. In order to attain results the demographic profile of the consumers are presented and analyzed with tabular form and graphical representation.

Table 1: Profile of questionnaire respondents

Sample	Category	Number	Percentage %
Gender	• Male	• 265	• 83.6
	• Female	• 52	• 16.6
Age (Years)	• 16-20	• 16	• 5
	• 21-30	• 155	• 48.9
	• 31-40	• 94	• 29.7
	• Above 40	• 52	• 16.4
Monthly Income	• Below 15000	• 29	• 9.1
	• 15000-30,000	• 52	• 16.4
	• 31000-50,000	• 90	• 28.4
	• 51000-100,000	• 96	• 30.3
	• Above 100,000	• 50	• 15.8
Education	• Intermediate	• 43	• 13.6
	• Graduation	• 145	• 45.7
	• Master Degree	• 108	• 34.1
	• Ph. D	• 21	• 6.6
Occupation (Profession)	• Student	• 57	• 18
	• Govt. Job	• 78	• 24.6
	• Private Job	• 142	• 44.8
	• Business	• 40	• 12.6

As mentioned above, 317 samples are randomly collected from different 317 respondents of different places in Pakistan Cities. According to the Table 4.1, which is given below, 83.6% were male and 16.6% were female out of 317 respondents. The majority of respondents aged between 21-30 contributing 48.9% of the total respondents followed by 31-40 age group 29.7%, Above 40 age group 16.4% and 16-20 age group 5%. In the terms of monthly income level, the respondents belong to below Rs. 15000 level contributing 9.1%. Similarly, Rs. 15000-30,000 income level has 16.4%, Rs. 31000-50000 income level has 28.4%, Rs. 51000-100,000 income level has 30.3%, and above Rs. 100,000 income level has 15.8%. Regarding education level of the respondents, 13.6% were completed intermediate, 45.7% were completed Graduate, 34.1% were has Master Degree, 6.6% has Ph. D degree. Referring to profession, 18% respondents are students, 24.6% are Govt. job holder, 44.8% are doing private job, and 12.6% are related to business.

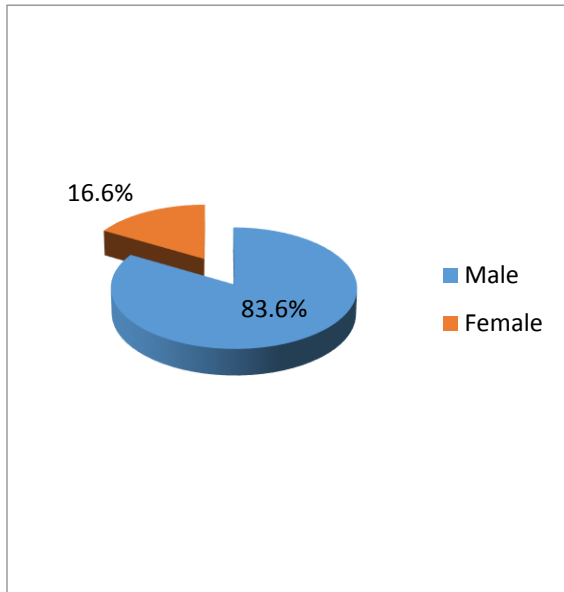


Figure 2: Gender-wise distribution of respondents

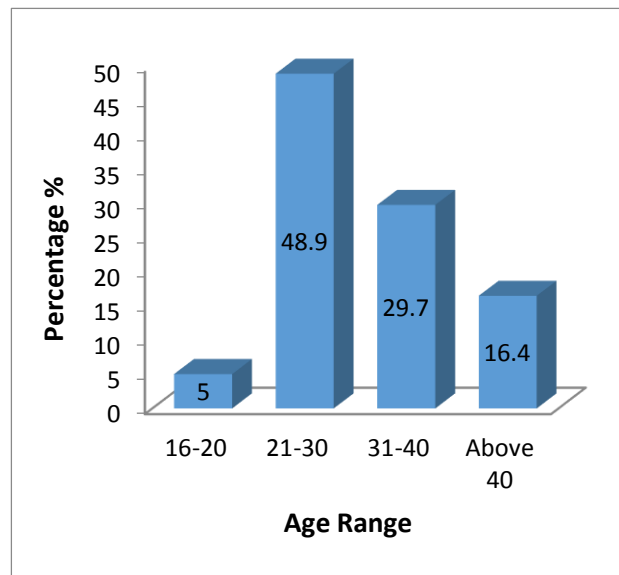


Figure 3: Age groups of the respondents

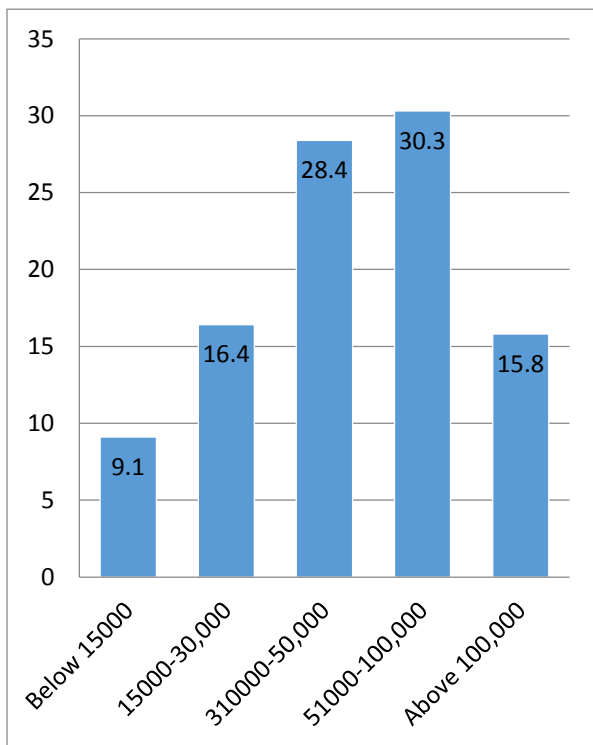


Figure 4: Monthly income levels of respondents in '000

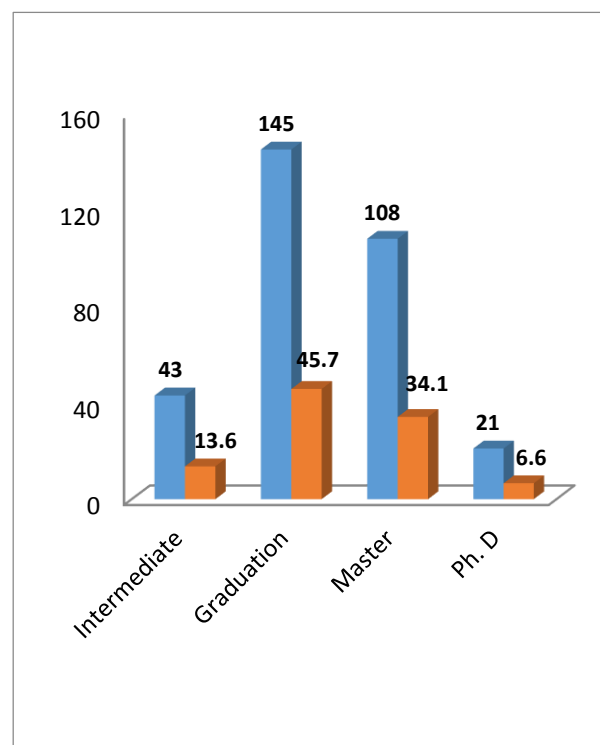


Figure 5: Education levels of respondents

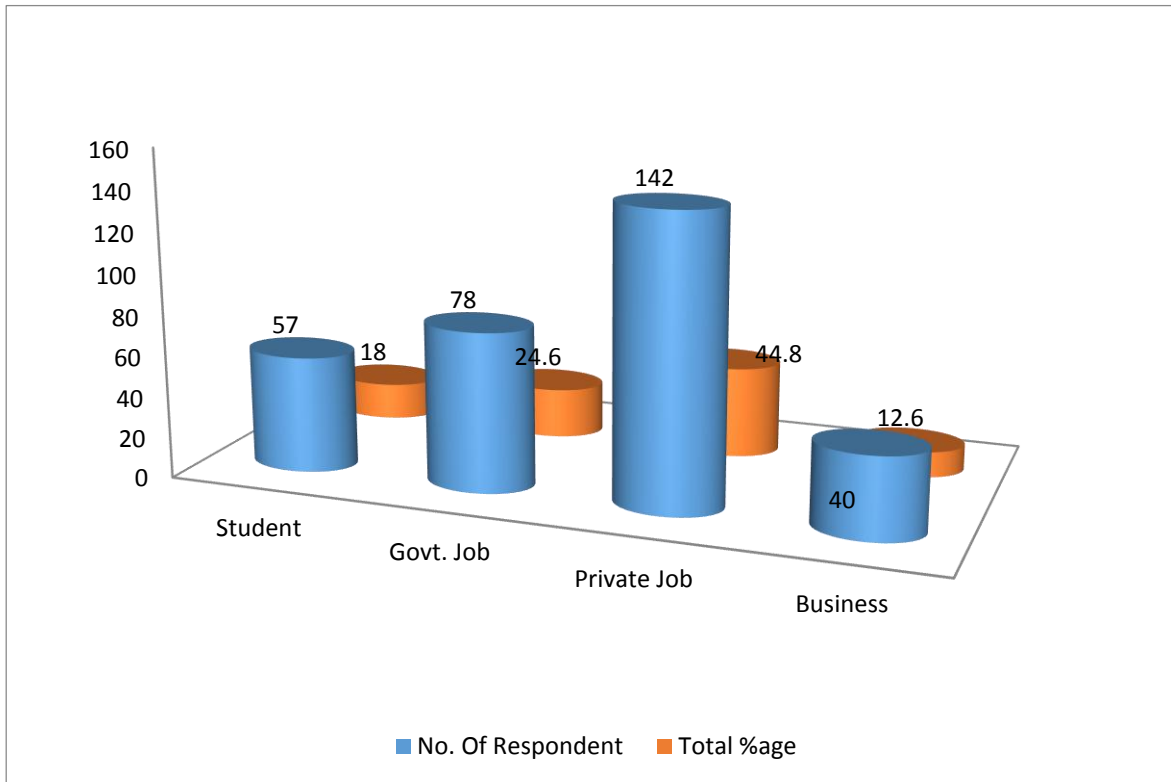


Figure 6: Professions of respondents

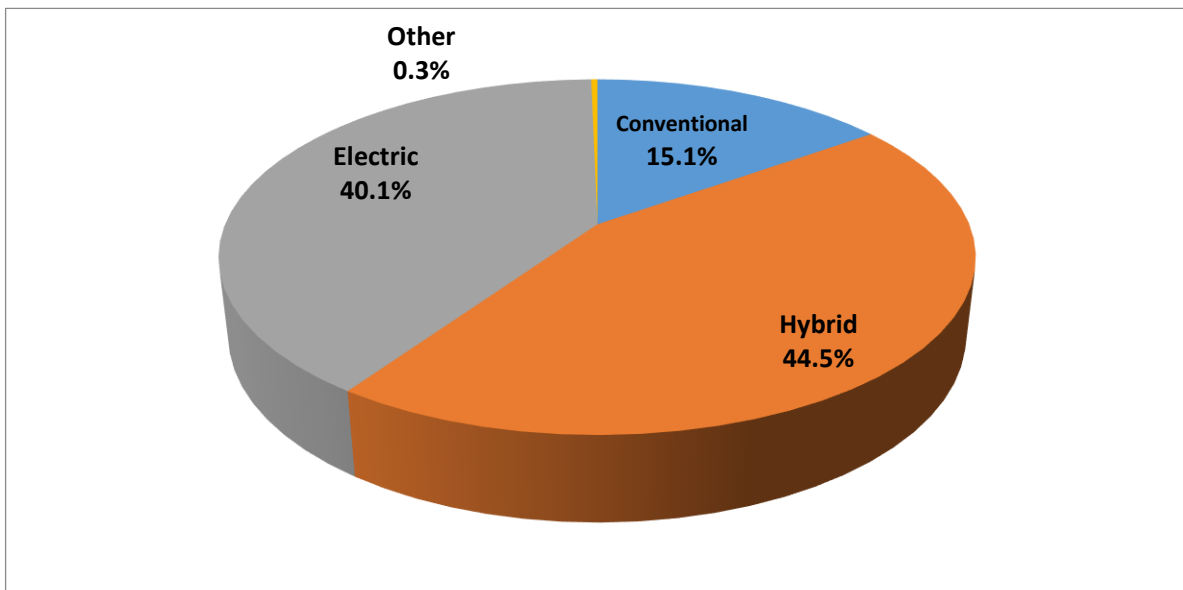


Figure 7: Bike preferences

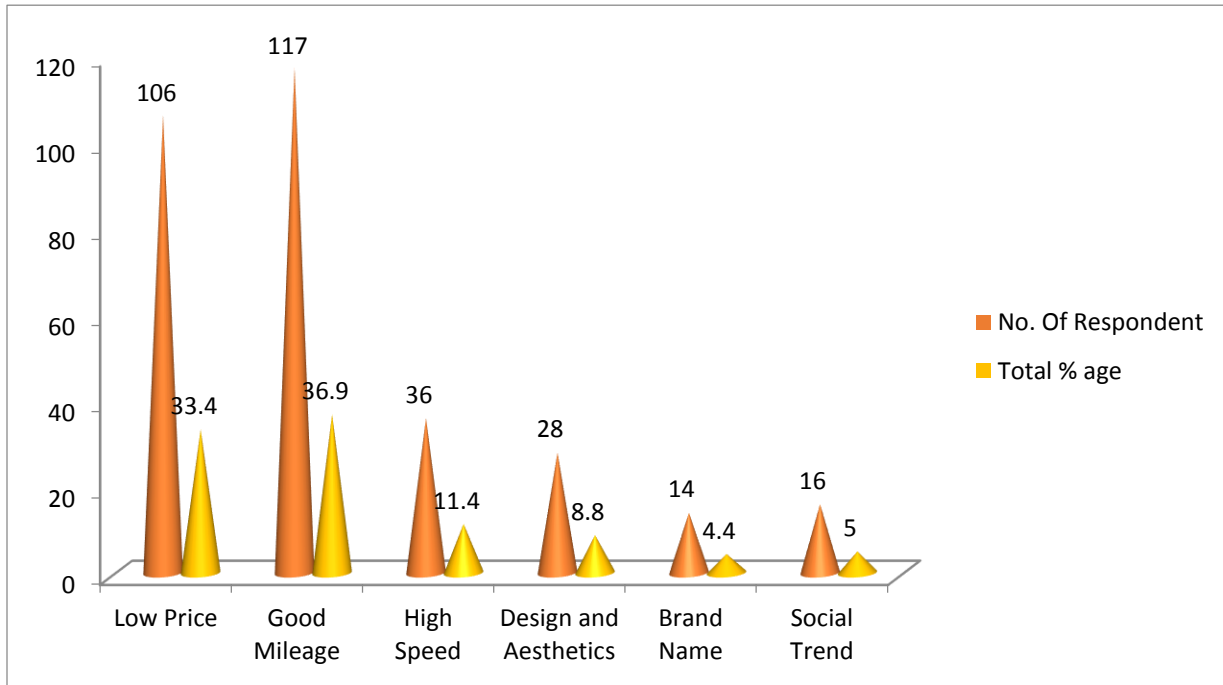


Figure 8: Strongest motivation to purchase an electric-bike.

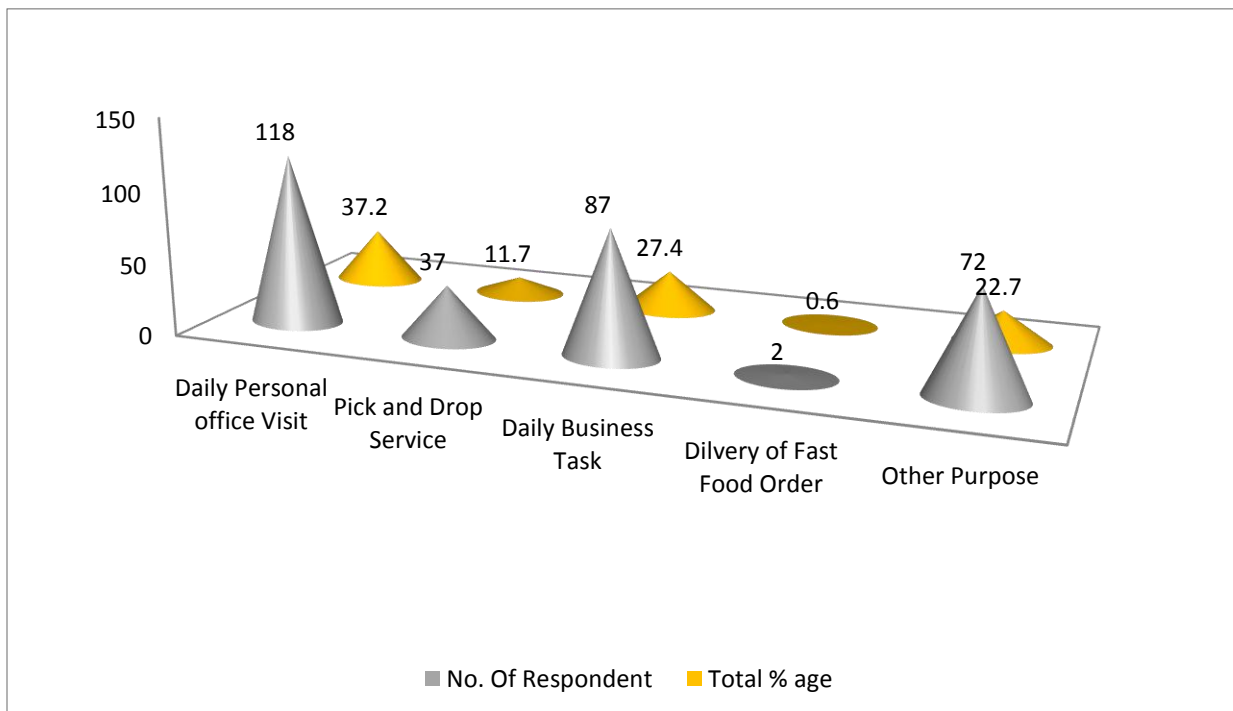


Figure 9: Use of bike

Mean and Standard Deviation of respondents for variable influencing purchase of Electric Bike.

Table 2: Descriptive statistics

	N	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Importance of Price Factor	317	4.61	.782	-2.433	.137
Importance of Maintenance Cost Factor	317	4.44	.763	-1.833	.137
Importance of Resale Value Factor	317	4.20	.895	-1.235	.137
Helpful to Create Job	317	4.43	.693	-1.554	.137
Health and Safety Issue Factor	317	4.27	.861	-1.325	.137
Design and Aesthetics Factor	317	4.25	.797	-1.226	.137
Availability of Charging Facility Factor	317	4.50	.664	-1.835	.137
Minimum Charging Time for full charging	317	4.51	.639	-1.820	.137
Battery Life Guarantee	317	4.52	.609	-1.574	.137
Mileage Per Charging Factor	317	4.54	.608	-1.740	.137
Awareness about E-Bike	317	3.14	1.321	-.451	.137
Valid N (Listwise)	317				

The data mentioned in above table indicates statistics in the form of description for variable purchase of Electric Bike. Responding individuals were accessible with 11 usually detected causes behind purchase of Electric Bike.

The scale used was a 5-point Likert Scale as mentioned below:-

Strongly agree =1

Agree=2

Neutral=3

Disagree=4

Strongly Disagree=5

Mean and standard deviation values for all variables are as follows, it can be concluded that Price Factor (mean=4.6, s.d=0.782), Maintenance cost factor (mean=4.44, s.d= 0.763), Resale value (mean=4.20, s.d=0.895), are the top three reasons to purchase Electric Bike, whereas helpful to create job (mean=4.43, s.d= 0.693), Health and safety issue (mean=4.27, s.d= 0.861), Design and Aesthetics Factor (mean=4.25, s.d= 0.797), Availability of Charging Facility Factor (mean=4.50,

s.d=0.664), Minimum Charging Time for full charging (mean=4.51, s.d=.639), Battery Life Guarantee (mean=4.52, s.d=0.609), Mileage Per Charging Factor (mean=4.54, s.d=0.608), Awareness about E-Bike (mean=3.14, s.d=1.321), are the bottom three reasons for purchasing Electric Bike.

5.0 CONCLUSION

Based on the mean and standard deviation values it can be concluded that importance of price, Maintenance cost and resale value are the three top reasons for purchasing Electric-Bike and Battery Life Guarantee, Mileage Per Charging Factor, Awareness about Electric-Bike are the bottom three reasons for purchasing Electric Bike.

REFERENCES

- [1] Ajanovic, A., & Haas, R. (2019). Economic and Environmental Prospects for Battery Electric- and Fuel Cell Vehicles: A Review. *Fuel Cells*, 19(5), 515–529. <https://doi.org/10.1002/fuce.201800171>
- [2] Bakker, S. (2019). Electric Two-Wheelers, Sustainable Mobility and the City. *Sustainable Cities - Authenticity, Ambition and Dream*, February. <https://doi.org/10.5772/intechopen.81460>
- [3] N. Sakthivel1* and S. Senthilkumar2 *Users' Attitude and Satisfaction towards E-Bikes: A Study in Erode District* DOI:10.15613/hijrh/2016/v3i2/136501ISSN (Print): 2349-4778.
- [4] Bhatnagar Y. Assessment of consumer buying behavior towards electric scooters in Punjab. *Journal of Driving Innovation with Enterprise Simulation*. 2006; 6(1):25–9.
- [5] Srivastava S. Customer perception on green brands of two wheelers and four wheelers in the state of Andhra Pradesh. *Bilingual Journal of Humanities and Social Sciences*. 2011 Jul; 2(1):25–30.
- [6] Hackbarth A. Consumer preferences for alternative fuel vehicles: A discrete choice analysis. *Multidisciplinary Journal of Research in Engineering and Technology*. 2012; 1(2):215–22.
- [7] Hausan. Influences of environmental consciousness and attitudes to transportation on electric vehicle purchase intentions. *Proceedings of the Eastern Asia Society for Transportation Studies*. 2013 Jul; 9(2):76–83.
- [8] Hatwar, N.; Bisen, A.; Dodke, H.; Junghare, A.; Khanapurkar, M. 2013. Design approach for electric bikes using battery and super capacitor for performance improvement, in *Proceedings of the IEEE Conference on Intelligent Transportation Systems ITSC*, 6–9 October 2013, Hague, Netherlands. Article number 6728516, 1959–1964.
- [9] Ji, S.; Cherry, C. R.; Han, L. D.; Jordan, D. A. 2013. Electric bike sharing: simulation of user demand and system availability, *Journal of Cleaner Production* 85(15): 250–257. <http://dx.doi.org/10.1016/j.jclepro.2013.09.024>

- [10] Xu, Z.; Zou, Z.; Cao, B.-H. 2013. Beijing GongyeDaxueXuebao. Carbon emission assessments of passenger transport in urban city and approaches to low carbon development – Take Tianjin city as an example, *Journal of Beijing University of Technology* 39(7): 1007–1013, 1020.
- [11] Navigant Research 2014. *Navigant Research report on global forecasts for light duty hybrid, plug-in hybrid, and battery electric vehicles: 2013–2020* [online], [cited 30 November 2014]. Available from Internet: <http://www.navigantresearch.com/research/hybrid-and-electric-trucks>.
- [12] Chiu, Y.-C.; Tzeng, G.-H. 1999. The market acceptance of electric motorcycles in Taiwan experience through a stated preference analysis, *Transportation Research Part D: Transport and Environment* 4(2): 127–146.
- [13] Cherry, C.; Cervero, R. 2007. Use characteristics and mode choice behavior of electric bike users in China, *Transport Policy* 14(3): 247–257.
- [14] Weinert, J. X.; Chaktan, M.; Yang, X.; Cherry, C. R. 2007. Electric two-wheelers in China: effect on travel behavior, mode shift, and user safety perceptions in a medium-sized city, *Transportation Research Record* 2038: 68. <http://dx.doi.org/10.3141/2038-08>
- [15] Larouche, R.; Barnes, J.; Tremblay, M. S. 2013. Too far to walk or bike?, *Canadian Journal of Public Health* 104(7): e487–e489.
- [16] Du, W.; Yang, J.; Powis, B.; Zheng, X.; Ozanne-Smith, J.; Bilston, L.; Wu, M. 2013. Understanding on-road practices of electric bike riders: an observational study in a developed city Yao, L.; Wu, C. 2012. Traffic safety for electric bike riders in China, *Transportation Research Record* 2314: 49–56.
- [17] Cherry, C., &Cervero, R. (2006). Use characteristics and mode choice behavior of electric bikes in China.
- [18] Hidrue, M. K., Parsons, G. R., Kempton, W., & Gardner, M. P. (2011).Willingness to pay for electric vehicles and their attributes. *Resource and energy economics*, 33(3), 686-705.
- [19] Plötz, P., Schneider, U., Globisch, J., &Dütschke, E. (2014). Who will buy electric vehicles? Identifying early adopters in Germany. *Transportation Research Part A: Policy and Practice*, 67, 96-109.
- [20] Egbue, O., & Long, S. (2012). Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions. *Energy policy*, 48, 717-729.
- [21] Bjerkan, K. Y., Nørbech, T. E., &Nordtømme, M. E. (2016).Incentives for promoting battery electric vehicle (BEV) adoption in Norway. *Transportation Research Part D: Transport and Environment*, 43, 169-180.
- [22] Tamor, M. A., Moraal, P. E., Repogle, B., &Milačić, M. (2015).Rapid estimation of electric vehicle acceptance using a general description of driving patterns. *Transportation Research Part C: Emerging Technologies*, 51, 136-148.

- [23] Schneiderei, T., Franke, T., Günther, M., & Krems, J. F. (2015). Does range matter? Exploring perceptions of electric vehicles with and without a range extender among potential early adopters in Germany. *Energy Research & Social Science*, 8, 198-206.
- [24] Pierre, M., Jemelin, C., & Louvet, N. (2011). Driving an electric vehicle. A sociological analysis on pioneer users. *Energy Efficiency*, 4(4), 511-522.
- [25] Ko, W., & Hahn, T. K. (2013). Analysis of consumer preferences for electric vehicles. *IEEE Transactions on Smart Grid*, 4(1), 437-442.
- [26] Ullah, N. (2019). Electric Vehicles in Pakistan: Policy Recommendation Volume I, LUMS University, Pakistan
- [27] Kerlinger, F. N. (1986). Foundation of behavioral Research (3rd edition). *Fort Worth: Holt, Rinehart and Winston, Inc.*