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Factors Influencing the Satisfaction of Customers Towards the Usage of Electric Bikes in Kerala

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Abstract - **India is witnessing the rise in the adoption of electric vehicles due to several factors such as reduced costs, bettering infrastructures, technological developments, environmental concerns, government incentives, urban difficulties, and shifting consumer attitudes. These factors contribute to the growing acceptance and adoption of EVs among Indian consumers. These components encourage the growing adoption and acceptance of electric vehicles among Indian consumers. This study was intended to determine the factors influencing on how satisfied customers experienced with their use of electric bikes. This study target the audience in Kerala who were the prospective electric bike owners and the researcher gathered information from 110 sample respondents in order to analyse the study's objectives. Tools for statistics used are regression analysis, factor analysis, and percentage analysis. According to the study, there are four elements that have the biggest beneficial impact on consumer satisfaction: price, performance, quality, and service.**

Keywords: **Electric Bikes, Electric Vehicles, Kerala, Satisfaction, Usage**

I. INTRODUCTION

Global greenhouse gas emissions are rising as a result of people using more personal vehicles. Air pollution is one of the primary causes of greenhouse gas emissions. Transportation is responsible for 8% of greenhouse gas emissions overall, according to research (Xu et al., 2019). To lessen this type of air pollution, the Indian government offered incentives to consumers who bought electric cars. Kerala faces problems with urbanization, traffic jams, and air pollution just like any other Indian state (Almusawi et al., 2024). By seeing the need for change, kerala government has launched a green initiative to end the state's reliance on fossil fuels (Jasim & Mustafa, 2022). In addition, the government promotes the use of electric vehicles by providing subsidies, tax breaks, and loans with favourable terms, enough charging stations, and other benefits (Zhang et al., 2018).

Kerala has therefore seen a remarkable increase in the use of electric vehicles (Raman et al., 2024). The two-wheeler industry is one of the largest in the automotive sector. Bicycles are a practical and reasonably priced mode of transportation, which is why many people opt to ride them across the nation (Sujith & Sumathy, 2023). In comparison to traditional bicycles, electric bikes are more affordable because they run on fuel. The best approach to cut costs and energy use is with the introduction of electric two-wheelers (Alshebaney, 2024; Han et al., 2017). Consumer satisfaction with Kerala's use of electric vehicles is a significant issue that requires in-depth research. This research aimed to pinpoint the elements that impact consumers' satisfaction while riding electric bicycles (Hoseinian & Asadollahi, 2017).

II. STATEMENT OF THE PROBLEM

The satisfaction of customers towards the usage of electric bikes in Kerala is influenced by various factors that require comprehensive examination. While electric bikes offer an eco-friendly and convenient mode of transportation, several aspects may impact customer satisfaction. This study's objective is to identify and analyze the primary factors affecting customer satisfaction with electric bikes in Kerala. Investigating the extent to which customers are motivated by environmental concerns in choosing electric bikes over conventional vehicles, and how this aspect affects satisfaction. It provides insights into improving customer satisfaction towards the usage of electric bikes in Kerala, thereby facilitating the sustainable adoption of electric transportation in the region.

III. SCOPE OF THE STUDY

The scope of the study on factors influencing customer satisfaction with electric bike usage in Kerala encompasses various dimensions to offer a comprehensive understanding of the subject (Das et al., 2020). The study will cover different regions of Kerala to capture diverse socio-economic and geographical factors that may influence customer satisfaction with electric bikes. The research will consider various customer segments based on demographics, socio-economic status, and usage patterns to understand how different groups perceive and experience electric bike usage (Lebeau et al., 2015). It analyse the performance metrics of

electric bikes, including battery life, speed, range, and reliability, to determine their impact on customer satisfaction. The research will investigate the level of awareness and perception among customers regarding electric bikes, including their understanding of the technology, benefits, and limitations (TS & Sumathy, 2022). This study aims to enhance the existing literature on electric vehicle adoption and offer practical insights for stakeholders to create a supportive environment for electric bike usage in Kerala (Kesari et al., 2019).

IV. Review of Literature

(Jena, 2020) determined the attitude of Indian consumers regarding electric cars. Roughly ten percent of India's air pollution is caused by traffic. The report suggested that the Indian government encouraged the use of electric vehicles (Kumar & Dash, 2013; Franke et al., 2017) investigated battery electric vehicle (BEV) range satisfaction. The study found a relationship between range satisfaction and the main markers of widespread adoption of BEVs. Kwon et al., (2020) determined 160 samples were used to gauge South Korea's electric battery vehicle users' happiness. The poll indicates that cost-cutting measures are the primary motivator behind South Korea's adoption of electric battery automobiles (Mohamed et al., 2018). The study determined that other factors influencing the uptake and satisfaction of electric battery vehicles include perceived social impact, range satisfaction, charging satisfaction, expectation of BEV in the future, and buying inconvenience. Asadi et al., (2021) investigated the variables affecting Malaysia's adoption of electric vehicles. In Malaysia, the researcher gathered information from 177 possible EV buyers. Several factors influence the adoption of electric vehicles (Trivedi et al., 2023). According to the study, including perceived value, attitude, subjective norms, and personal norms, ascription of responsibility, perceived consumer effectiveness, and awareness. Vakil et al., (2021) investigated the opinions of consumers on electric cars. The investigator gathered information from the city of Coimbatore and utilized SPSS for analysis. The majority of respondents to the study expressed satisfaction with electric automobiles. Gunawan et al., (2022) investigated the elements affecting the consumers' decision to utilize electric vehicles in Indonesia (Han et al., 2017). To determine the variables impacting the willingness to use EV, the researcher employed the TPB and UTAUT models. The researcher used the TPB and UTAUT model variables. According to the findings, factors that encourage the adoption and use of electric cars include attitudes towards use, subjective norms, perceived behavioural control, price, hedonic reward, and anticipated effort. Most of the research has focused on the adoption of electric vehicles, as the literature review will demonstrate (Falchetta & Noussan, 2021). There has been minimal investigation into this topic specifically in Kerala and India (Sujith & Jisha, 2017). As a result, the study tried to identify the factors influencing Kerala consumers' happiness with electric bike use (Bhalla et al., 2018).

V. Objectives of the Study

To determine the elements influencing Kerala customer's satisfaction with electric bikes, with a focus on the Ernakulum district.

VI. Methodology of the Study

The study employed descriptive research to identify the variables affecting electric motorcycle customer satisfaction in Kerala. The investigation utilized both primary and secondary data, with primary data being gathered directly from electric bike riders. A structured questionnaire was used to collect data on various issues. Convenience sampling was chosen as the sampling technique, and the sample size consisted of 110 respondents from the rural areas of the Ernakulam district. The collected data underwent several statistical analyses, including regression analysis, factor analysis, and percentage analysis. Factor analysis was employed to identify the key factors influencing consumer satisfaction, while regression analysis was used to determine the relationship between these factors and customer satisfaction.

VII. Result And Discussion

TABLE I SOCIO-DEMOGRAPHIC PROFILE OF THE RESPONDENTS

Variable	Description	Frequency	Percentage
Gender	Male	47	42.7
	Female	63	57.3
	Total	110	100.0
Education	Below +2	16	14.5
	Graduation	48	43.6
	PG	34	30.9
	Others	12	10.9
	Total	110	100.0
Income	Below Rs 25,000	20	18.2
	Rs 25,001- 50,000	45	40.9
	Rs 50,001 - 75,000	14	12.7
	Rs 75,001 - 1,00,000	16	14.5
	Above 1 Lakhs	15	13.6
	Total	110	100.0
Occupation	Govt. Employee	25	22.7
	Private Employee	51	46.4
	Business	17	15.5
	Others	17	15.5
	Total	110	100.0
Age	25 years and below	37	33.6
	26-50 years	54	49.1
	Above 50 years	19	17.3
	Total	110	100.0

(Source: Primary Data)

The demographic profile of 110 respondents is shown in the above table I, taking into account age, gender, occupation, income, and education. The table shows that 57.3 percentage respondents are females 42.7 percentages of all responders are men. Considering the respondent's educational background, 43.6 % respondents are graduates, 30.9 % respondents are post graduated, and only 10.9% of respondents are professional and others respectively. The above table revels that, 18.2% of respondents have income below 25000, 40.9% 0f respondents have income in between

25,001- 50,000 and only 13.6% of respondents have income above 1,00,000. Private sector employees make up 46.4% of the respondents, while government employees make up 22.7%. According to the respondents' ages, 49.1% of them come fall into the 26–50 age group, and just 17.3% fall into the age of above 50.

TABLE II KMO AND BARTLETT'S TEST

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.792
Bartlett's Test of Sphericity	Approx. Chi-Square	599.951
	df	66
	Sig.	.000

(Source: Computed from Primary Data)

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy, with a value of 0.792, indicates a good fit for the data. Additionally, Bartlett's Test of Sphericity yielded a significant result ($P < 0.05$ at the 5% significance level), demonstrating that the variables chosen to analyze factors influencing consumer satisfaction with e-bikes in Kerala are interrelated shows in table II.

TABLE III COMMUNALITIES

Items	Initial	Extraction
Quality 1	1	0.585
Quality 2	1	0.759
Quality 3	1	0.772
Price 1	1	0.807
Price 2	1	0.8
Price 3	1	0.625
Performance 1	1	0.681
Performance 2	1	0.731
Performance 3	1	0.669
Service 1 -	1	0.716
Service 2	1	0.789
Service 3	1	0.771
Extraction Method: Principal Component Analysis.		

(Source: Computed from Primary Data)

The table III shows the communalities of the various elements before and after the extraction stage of Principal Component Analysis. A community represents each observable variable's percentage of variance that may be explained by the shared components discovered during Principal Component Analysis.

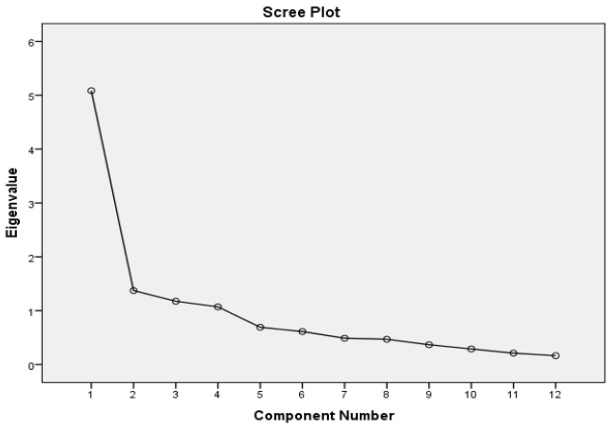

Fig. 1 Scree plot – Factors Influencing Satisfaction of Customers on the Usage of Electric Bikes in Kerala

In fig. 1 shows the scree plot clearly shows the influence of the four factors, whose Eigen values are greater than one.

TABLE IV TOTAL VARIANCE EXPLAINED

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.085	42.373	42.373	5.085	42.373	42.373	2.414	20.114	20.114
2	1.374	11.446	53.819	1.374	11.446	53.819	2.161	18.012	38.126
3	1.175	9.795	63.614	1.175	9.795	63.614	2.108	17.565	55.691
4	1.072	8.93	72.544	1.072	8.93	72.544	2.022	16.853	**72.544**
5	0.692	5.763	78.307						
6	0.613	5.105	83.412						
7	0.489	4.073	87.485						
8	0.47	3.914	91.398						
9	0.368	3.064	94.463						
10	0.289	2.408	96.87						
11	0.212	1.764	98.634						
12	0.164	1.366	100						
Extraction Method: Principal Component Analysis.									

(Source: Primary Data)

The preceding table indicates that out of 12 statements about the satisfaction of customers on the usage of electric bikes in Kerala (Singh et al., 2020). In the above table IV, there are four factors identified with the help of factor analysis and these four factors explain the total variance of satisfaction of customers to the extent of 72.54%.

TABLE V ROTATED COMPONENT MATRIX

	Component			
	1	2	3	4
Price 2	0.833			
Price 1	0.800			
Price 3	0.759			
Performance 2		0.848		
Performance 3		0.794		
Performance 1		0.744		
Quality 3			0.843	
Quality 2			0.838	
Quality 1			0.630	
Service 2				0.821
Service 3				0.759
Service 1				0.647
Extraction Method: Principal Component Analysis.				
Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 5 iterations.				

(Source: Computed from Primary Data)

The four factors that the rotated component matrix derived from the 12 statements are displayed in the above table V. The identified factors named after thorough measuring relationship with statement. The first factor identified as "Price", explained by 20.11%, second factor "performance", explained by 18.01%, third factor "quality", and explained by 17.56% and fourth factor "service" explained by 16.85%.

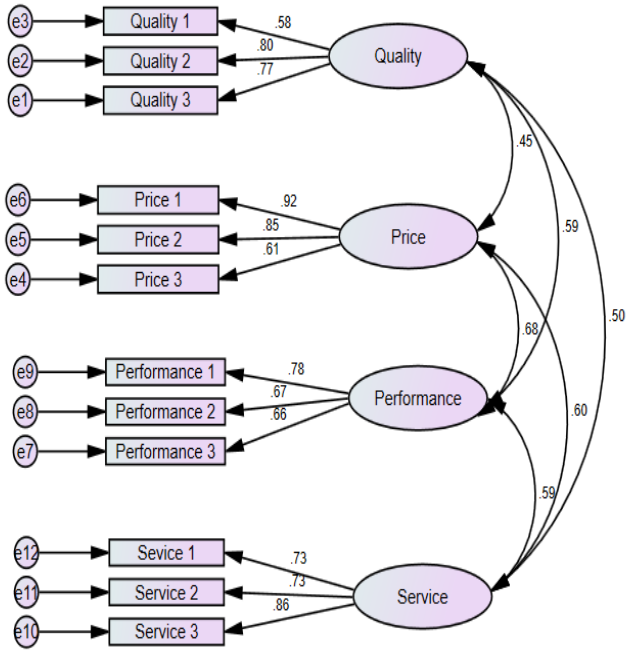

Fig. 2 Confirmatory Factor Analysis

The confirmatory factor analysis of the study's proposed research model is displayed in the fig. 2 above. There are three items in the quality confirmatory factor analysis. Each item in the collection has a quality level labelled on it, which goes from 1 to 3. The results showed that all three of the Quality items have been retained because the factor loadings are higher than 0.40. The other element, price, is composed of three things. The labels corresponding to Prices 1 through 3 are fastened to every item depicted. The outcome showed that because the factor loadings are greater than 0.40, all three of the Price items have been kept. The component Performance is composed of three observed variables, all of which have been retained since their factor loadings are higher than 0.40. The three service items have been retained since the factor loadings are higher than 0.40. This ensures the unidimensionality of the items since every measurement model item is positive and meaningful.

TABLE VI RESULTS OF GOODNESS OF FIT

Fit Indices	CMIN/DF	GFI	AGFI	NFI	CFI	RMR	RMSEA	TLI
Model Value	1.882	0.92	0.93	0.90	0.97	0.05	0.03	0.97
Acceptable Value	≤ 3	> 0.9	> 0.9	> 0.9	>0.95	≤0.10	< 0.06	>0.95

(Source: Primary Data)

The above table VI makes this obvious. It indicates that there is a good fit because the GFI value is 0.92 and the AGFI value is 0.93, both of which are greater than 0.09. It is a perfect fit, as evidenced by the NFI value of 0.90, the CFI of 0.97, the RMR of 0.05, and the RMSEA value of 0.03, which is less than 0.06.

H_0: There is no significant impact of factors such as Price, Performance, Quality, and Service on the satisfaction of the users' towards the usage of electric bikes.

TABLE VII REGRESSION ANALYSIS – MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.981[a]	.962	.961	1.692
a. Predictors: (Constant), Service, Quality, Performance, Price				
b. Dependent Variable: Satisfaction				

(Source: Primary Data)

The table VII above displays that the influence of Price, Performance, Quality, and Service on the satisfaction of the users' towards the usage of electric bikes. Customer satisfaction considered as the dependent variable and Price, Performance, Quality, and Service are considered as independent variables. According to the study, a 96% change in the dependent variable - customers' happiness with using electric bikes will result from any change in the selected independent variable. The researcher concluded that the variables such as Price, Performance, Quality, and Service have the highest significant positive effect on the customer satisfaction.

Suggestions

1. Invest in expanding the charging network and repair facilities across Kerala to enhance the convenience and accessibility of electric bike usage.
2. Encourage research and development efforts to improve the performance metrics of electric bikes, such as battery life, speed, and range, to meet the diverse needs of customers.
3. Introduce subsidies, tax incentives, and financing options to make electric bikes more affordable for a wider range of consumers, thereby increasing their attractiveness compared to traditional vehicles (Liao et al., 2017).
4. Launch educational campaigns to increase awareness among consumers about the benefits of electric bikes, addressing misconceptions and highlighting their advantages in terms of cost savings and environmental impact.
5. Collaborate with manufacturers to enhance the user experience of electric bikes by focusing on factors such as comfort, design, and ease of operation, thereby increasing customer satisfaction.

VIII. CONCLUSION

Since greenhouse gas emissions and environmental sustainability are becoming more and more of a concern, Electric vehicles (EVs) are starting to make sense as an alternative to conventional combustion engine vehicles. The future growth of a sustainable transportation sector is greatly encouraged by electric cars' very low to zero carbon emissions, silent operation, outstanding economy, and flexibility in grid integration and operation. The current study determined the variables impacting consumers' happiness with using electric bikes. With the aid of exploratory factor analysis, the study determined the four variables - price, quality, performance, and service. The performance is the most important factor determining customer happiness, according to the researcher's regression analysis.

IX. LIMITATIONS AND SCOPE FOR FURTHER RESEARCH

This research looks into the factors that affect consumer's satisfaction with using electric bikes. The researchers consider only four factors for measuring the satisfaction of customers; other factors may also influence the satisfaction of customers. So further studies may be conducted with the inclusion of more variables. The researcher gathered data exclusively from the Ernakulam district, which might limit the generalizability of the findings. To enhance the comprehensiveness and applicability of the research, the researcher can conduct comparative studies between electric bikes and other modes of transportation, such as conventional bikes and public transport. This would help identify the unique value propositions and factors influencing customer satisfaction across different transportation options.

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