



# An empirical analysis of factors influencing consumer adoption of sustainable vehicles in Haridwar

Dr. Krishna Kumar Verma<sup>1\*</sup> and Dr. Jyoti Singh<sup>2</sup>

<sup>1</sup> Professor, Department of Commerce, Hemvati Nandan Bahuguna Garhwal University (A Central University), Srinagar, Uttarakhand, India

<sup>2</sup> Assistant Professor, Department of Commerce & Management, Ramanand Institute of Pharmacy & Management, Haridwar, Uttarakhand, India

\*Corresponding Author: Dr. Krishna Kumar Verma

Received 9 March 2026; Accepted 13 Apr 2026; Published 6 May 2026

DOI: <https://doi.org/10.64171/JSRD.5.S1.22-26>

## Abstract

The Automobile industry is a very important driver of economic growth and infrastructure development in India. The present paper highlights the infrastructure, economic, product, and environmental sustainability enabled by innovation in the Automobile Industry. The study aims to predict consumer buying behavior towards eco-friendly vehicles in Haridwar. The paper analyses the factors influencing the sustainable vehicles in the study area. In this paper, data are collected through primary and secondary sources. Primary data were collected through a questionnaire distributed to 250 respondents in Haridwar, using a random sampling method. The collected data were analyzed using SPSS and MS Excel secondary data collected from government reports, RTO office, websites, etc. Frequency distributions, percentages, means, standard deviations, and various statistical methods, such as reliability tests, correlation, and regression analysis, were carried out. The findings reveal that consumers are aware of environmental concerns, adopt Sustainable Vehicles, and have a positive attitude towards purchasing them in the study area. The environmental practices employed in the automotive sector include minimizing greenhouse gas emissions, conducting life-cycle assessments, adopting cleaner production practices, and promoting eco-innovation. The analysis indicates that sustainable vehicles are well structured in terms of sustainability and process innovation in the present study area. Further, electric vehicles are good for our clean environment. More than 60 percent of respondents responded positively to innovation, specifically electric vehicles in the automotive industry, which led to environmental, economic, and social well-being and sustainability. The study concludes that consumers are becoming more conscious of environmental protection and aim to preserve the environment for future generations without compromising their current needs. Consumer buying behavior is gradually shifting toward sustainable vehicles, especially electric vehicles.

**Keywords:** Consumer behaviour, Environmental concern, Infrastructure facility, Sustainable vehicles, Electric vehicle

## Introduction

India is one of the ten largest automotive markets in the world, and given its burgeoning middle-class population with buying potential and steady economic growth, accelerated automotive sales are expected to continue.

Consumer behavior is the interdisciplinary study as to select, purchase, use, and dispose of products, services, ideas, or experiences of e-vehicles by individuals, groups etc.

Electric vehicles (EVs) are motorized vehicles that are powered fully or partially by electricity. They are a key technology in the global push towards sustainable transportation. Electric vehicles (EVs) play a vital role in minimizing the impact of vehicle on environment. Their adoption helps lower greenhouse gas emissions, aligning with global efforts to combat climate change. Further, integrating renewable energy sources into the charging infrastructure enhances environmental benefits, making EVs a more sustainable transportation option.

## Environmental benefits

Produce zero tailpipe emissions (BEVs, FCEVs) and have a

lower life-cycle carbon footprint, especially as electricity grids use more renewable sources.

Performance and Maintenance-offer instant torque for quick acceleration, quieter operation, and fewer moving parts, leading to lower maintenance costs (no oil changes and less brake wear).

## Cost saving

Electric vehicles have lower fuel costs, as electricity is often cheaper than gasoline. Additionally, eligibility for various government incentives and tax credits can offset the initial purchase price over time.

Initial Cost -Electric vehicles generally have a higher purchase price than comparable conventional vehicles, which can be a significant barrier for many buyers.

## Charging infrastructure

The network of public charging stations is less extensive than that of gasoline stations, which may cause inconvenience for users. Charging stations are still limited in many regions, creating "range anxiety" for long trips.

**Charging time**

Recharging an electric vehicle takes significantly longer than refueling a gasoline car, though fast-charging technologies are continually improving.

In 2025, consumer behavior in the automotive environment is increasingly defined by a shift from hardware-centric ownership to software-driven experiences. High-tech features, once viewed as luxuries, have become standard expectations for many consumers, particularly in segments focusing on connectivity, automation, and electrification.

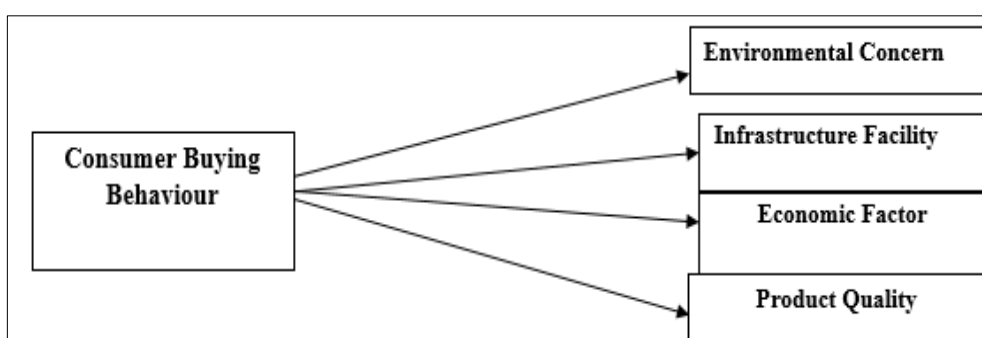
**Technological advancements and market trends (2025)**

- Improved Batteries-Ongoing innovation in battery chemistry, including research into solid-state batteries, is leading to longer ranges. Many new EV models now offer over 300 miles (500+ km) of range, along with faster charging times through 800V architectures.

- Expanding Infrastructure-The number of public charging points is rapidly increasing globally, with a strong focus on deploying ultra-fast chargers (>150 kW) along highways and in urban areas.
- Smart Technology-New features include advanced driver assistance systems (ADAS), improving safety, convenience, and driving experience.

**Structural model of consumer buying behavior**

- Environmental Concern
- Consumer Buying Behaviour
- Economic Factor
- Product Quality
- Infrastructure Facility



Source: Prepared by Author

**Review of literature**

Al-Azzam. A *et al.* (2021), evaluated the impact of digital marketing on buying decisions. The articles' results indicate that Jordan has better digital marketing capabilities, which, in turn, affects customer buying behavior. The study was based on primary data collected from 220 respondents in the Jordanian market through a questionnaire distributed using a simple sampling technique. Descriptive analysis, correlation tests, multiple regression analysis, and reliability tests were used in this study. The survey results indicate a direct impact of digital marketing, specifically mobile and social media marketing, on consumer buying behavior in the study area.

Dilotsotlhe (2022) [2], evaluated the factors influencing millennials' intention to adopt hybrid vehicles in Gauteng, South Africa. The article was based on primary data collected from 504 respondents, using convenience sampling and a well-structured questionnaire. The said hypothesis was tested using multiple regression analysis. The study's findings show a significant association between millennials' emotional, social, and conditional values and their intention to adopt hybrid vehicles. A negative relationship is observed between epistemic value, functional value, and behavioral intention toward hybrid cars. The study concluded that the effects of social, emotional, functional, conditional, and epidemic values are highlighted in relation to the respondents' behavioral intention to purchase environmentally friendly cars and two-wheelers in the study area.

Ranawat. P *et al.* (2023), examined the market viability and consumer attitudes towards electric cars in India. The research is based on primary and secondary data. Primary data were collected from 40 respondents. After analyzing the data, the study concludes that there is significant market viability for electric vehicles in India, with consumer awareness of electric cars increasing, driven by government support and technological advancements.

Suma. P *et al.* (2025) [4] examined consumers' awareness and choice to purchase electric vehicles, which involves preference-based content delivery through personalized digital marketing. The study was based on primary data collected using a structured questionnaire from 148 respondents, employing a quantitative research method. Using the Structural Equation Model (SEM) approach, the connection between personalized digital marketing, consumer awareness behavior, and purchase decision is analyzed in JASP. The study results demonstrate a positive correlation between the customs marketing approach and consumer choices, as evidenced by well-informed consumers who make informed purchasing decisions and adopt environmentally friendly hybrid vehicles.

**Objective of the study**

- To study the consumer buying behaviour towards sustainable vehicles.
- To study the factors which affects the purchase of e-Vehicles.

### Research methodology

Research methodology is the blueprint of the entire research process. It justifies the choice of specific methods and explains how the data were collected and analyzed. The study is based on data collected from primary and secondary sources. Secondary data were collected from various sources, including journals, newspapers, research papers, and articles. Primary data were gathered from respondents (e-vehicle owners). A questionnaire on 5-point Likert scale was used in the study to measure awareness, attitude, and consumer buying behavior towards sustainable vehicles.

### Satisfaction Index of Post-sale service users

Maximum= Mean + SD

Minimum = Mean - SD

### The formula used for the satisfaction Index of post-sale service

Consumer satisfaction Index (CSI)= Total score of the consumer respondent/No. of major factor \*100

### Sampling method

Purposive and simple random sampling were used in the study.

### Sample size

The study sample comprises 250 respondents, and the data were collected through a well-structured questionnaire distributed in the study area, Haridwar, Uttarakhand.

### Statistical tools

After collecting the data, master sheets were prepared in MS Excel and SPSS. Data analysis of data was done by statistical tools as frequency distributions, percentages, average and standard deviations. Statistical techniques such as reliability tests and mathematical tools, including the consumer Buying Behavior index, correlation, and regression analysis, were employed in the study to measure consumers' buying behavior for electric vehicles in the research area.

### Limitation

- Language is one of the limitations faced by the investigator during data collection.
- Time is one of the constraints faced by investigators during data collection.
- Lack of local cooperation of local people during data collection is also a constraint.
- The cost of data collection is another limitation.
- The study is restricted to Haridwar only.
- The study is based on a limited sample size.

### Data analysis and interpretation

**Table 1:** Distribution of sample households according to gender

Gender	No. of respondent
Total Male	168 (67.2)
Total Female	82 (32.8)
Total Sample size	250 (100)

*Source:* Author's primary survey data, figures in parentheses indicate the percentage of the total

Table 1 shows the gender-wise distribution of respondents. Out of the total sample size of 250 respondents, 168 (67.2%) were male, and 82 (32.8%) were female. This indicates that male respondents constituted a higher proportion of the sample compared to female respondents.

**Table 2:** Age-wise and Gender Distribution of Respondents

Age group (Years)	Male	Female	Total
20-29	10(4.00)	4(1.60)	14(5.60)
30-39	49(19.60)	25(10.00)	74(29.60)
40-49	94(37.60)	45(18.00)	139(55.60)
>50	15(6.00)	8(3.20)	23(9.20)
Total	168(67.20)	82(32.80)	250(100)

*Source:* Author's Primary survey data, Figures in parentheses indicate the percentage to total

Table 2 presents the age-wise distribution of respondents according to gender. Among male respondents, the largest group (94 percent) was the 40–49 age group, followed by the 30–39 age group (49 percent). A smaller proportion of respondents were in the 20–29 and 50+ age groups. Overall, the data suggests that the majority of respondents were middle-aged adults. The table reveals the distribution of respondents into four age groups. The 40–49-year age group had the highest number of respondents, i.e., 139, accounting for 55.60 percent of the total respondents. This indicates that this age group has more vehicles and is willing to buy electric vehicles in the future, or some respondents already use them.

**Table 3:** Income-wise Classification of Respondents

Income range (per month)	No of respondent
Less than 25000	15(6.00)
Above 25000-50000	26(10.4)
Above 50000-75000	50(20.00)
Above 75000-100000	110(44.00)
Above 100000	59(23.6)
Total	250(100)

*Source:* Author's primary survey data, figures in parentheses indicate the percentage of the total

From the table examined, the distribution of respondents is based on household monthly income, divided into five categories. The fourth income category (₹75,000–₹1,00,000) has the highest number of electric two-wheelers and fuel-based four-wheelers among all categories, i.e., 44.00 percent, followed by the fifth category at 23.6 percent.

**Table 4:** Reliability test and cronbach's alpha

Reliability statistics		
Cronbach's alpha	Cronbach's alpha based on standard items	Number of items
.816	.804	15

*Source:* Author's primary survey data

The reliability test has been estimated and evaluated using SPSS software. According to Table 4 above, Cronbach's Alpha was applied to 250 respondents, yielding a reliability value of 0.816, indicating strong fit and support from the respondents.

**Consumer Behaviour Buying Index**

Maximum= Mean + SD

Minimum = Mean - SD

The formula used for the Consumer Buying Behaviour Index  
 Consumer Behavior Index (CBI)= Total score of the consumer respondent/No. of major factor \*100

**Table 5:** Consumer buying behaviour index of sustainable vehicles users (n=250)

Group	Buying index value	Respondents
High	>2758.48	67 (26.80)
Medium	2758.48-2241.52	144(57.60)
Low	<2241.52	39(15.60)

**Source:** Author’s primary survey data, figures in parentheses indicate the percentage of the total

The Consumer Buying Behavior of electric vehicles index has developed with the help of four parameters, i.e., environmental concern, infrastructure facility, economic factor, and product quality, providing a weightage scale to the individual respondents. From the table, it has been observed that the majority of respondents comes under the category of medium group buying behavior of index (57.60 percent) followed by the high category of buying behavior of index (26.80) This indicated that the majority of respondent are satisfied and planning to buy electric vehicles in future, which is environmentally friendly and saves the environment for future generations. This may affect the sale of electric vehicles and also accelerate their adoption.

**Table 6:** Correlation matrix of consumer buying behaviour

Variable	Y	X1	X2	X3	X4
Y	1				
X1	-0.15454	1			
X2	0.11249	-0.5714	1		
X3	0.467551	0.109167	0.135634	1	
X4	0.529653	0.324196	0.68774	0.003552	1

**Source:** Author’s primary survey data

Table 6 presents the correlation matrix for variables related to

**Table 7:** Multivariate regression model of consumer buying behavior of electric vehicle users

S. N.	Intercept constant	X1	X2	X3	X4	p value	R <sup>2</sup>
Variables	-5.65924 (0.788522)	0.52534*** (0.035542)	-0.48269*** (0.034002)	-0.27677*** (0.025548)	0.163176*** (0.02964)	-	0.811492*** (0.44725)
D.P						245** (2.73)	
Observation						250	

1. (Source: Author’s Primary survey data) 2. Figures in parentheses indicate standard error (3)\*\*\* star indicates =1 percent level of significance, \*\*star indicates = 5 percent level of significance, \*star indicates = 10 percent level of significance.

A multiple regression model was used in MS Excel 2013 to examine the effects of the independent variable and the dependent variable (consumer buying behavior). The regression shows that the regression coefficient R<sup>2</sup> has an 81 percent effect on the dependent variable at the 5 percent significance level. It shows a close relationship between the dependent and independent variables. X2 and X3 attributes negatively affect consumer buying behavior for electric

consumer buying behavior for sustainable vehicles. The independent variables i.e. environmental concern(x1), infrastructure facility (x2), economic factor (x3), and product quality (x4). From the table, the diagonal elements show that the correlation matrix is +1, indicating that each variable is perfectly correlated with itself. The off-diagonal elements show the correlation between variables. The value correlation coefficient of different combinations of the variables, i.e., x1, x2, x3, x4, and y variables. The value of the correlation coefficient (r) of x1 and x2 is -0.5714. This indicated that the relationship between the x2 variable (i.e., infrastructure facility) and the variable environmental concern (x1) is weakly negative. The positive relationship was seen with different associations of variables, a weak positive correlation(r). The positive strong relationship between the independent variable and the explained variable(y).

**Regression model of consumer buying behaviour of sustainable vehicles**

The algebraic form of a linear function

$$Y=f(X_1+X_2+X_3+X_4+.....X_n+\epsilon)$$

Whereas, Y=Dependent Variable, f=function, X<sub>1</sub>,X<sub>2</sub>,X<sub>3</sub>,.....

X<sub>n</sub> =Independent variables

β<sub>1</sub>, β<sub>2</sub>..... β<sub>n</sub>=Correlation Coefficient, ε=Error

Y = Customer Behavior weightage score (Post service of vehicles) (CBWS)

X<sub>1</sub> =Environmental Concern weightage score of Customer view (ECSC)

X<sub>2</sub> = Infrastructure Facility weightage score of Customer view (IFSC)

X<sub>3</sub>= Economic Factor weightage score of Customer view (EFSC)

X<sub>4</sub>=Product Quality weightage score of Customer view (PQSC)

ε = Error

**Multivariate regression model equation**

$$CBWS = \beta_1 ECSC + \beta_2 IFSC + \beta_3 EFSC + \beta_4 PQSC + \epsilon$$

vehicles in the study area, whereas X1 and X4 have a positive association with the buying behavior. It may be advisable to address this condition, which negatively impacts the improvement of vehicle publicity.

**Finding**

- It is found from the study that the study was conducted with a total sample size of 250 respondents, and males

formed a majority of the sample. Age-wise analysis shows that most respondents belonged to the economically active middle-aged group, which is relevant for understanding household-level perspectives.

- A high level of awareness regarding climate change and pollution remains the leading driver for consumers selecting e-vehicles.
- There is a limited number of public charging stations as a result the vehicles owners have an anxiety for long travel.
- Under age group 35, who are more data-driven and value sustainability-led design over traditional features.
- It was found from the study that the consumer buying behavior index of electric or sustainable vehicles, with 144 respondents coming under the category of medium index value, i.e., 2758.48 to 2241.52, followed by the high index category, i.e., 67 respondents. This shows that more than 50 percent of respondents are willing and able to buy electric or sustainable vehicles in the future.
- It was observed from the table of multivariate regression analysis that four independent variables, i.e., x1, x2, x3, and x4, were used. The results show that x1 and x4 are positively associated with the dependent variable.

### Conclusion

It is concluded that consumer buying behaviour towards sustainable vehicles, especially electric vehicles (EVs) and hybrid vehicles, reflects a peak in the market. The majority of consumers choose e-vehicle for their next purchase; their decision is due to awareness of environmental concern, economic viability, infrastructure readiness, lifestyle fit, and product quality. Many consumers are using hybrid to meet their specific range and price requirements. Environmental concerns remain the main motivator to buy e-vehicles in the study area. Despite high interest, with more than 60 percent of consumers likely to choose an EV as their next vehicle, a significant portion of the market remains in a “wait-and-watch” mode, particularly in developing economies where public charging networks are still scaling

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