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A Study on Consumer's Attitude Towards Electric Vehicles in Shivamogga District

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Abstract: ***The electric vehicles in the automobile industry are developing rapidly in the country. The public needs to be made aware of the developments to be more successful. The purpose of the study is to understand consumers' attitudes towards electric vehicles in the Shivamogga district. Regression analysis was used to find out the impact of consumer perception on the perception towards buying E-vehicles. The study is guided by a descriptive research methodology. Descriptive research is usually defined as a type of quantitative research; though qualitative research can also be used for descriptive purposes. A questionnaire was used to collect the data, and about 185 electric vehicle users were targeted. Consumer-expected factors such as a clean environment, gender, lower maintenance costs, incentive prices, innovative behavior, social media, E-vehicles as a symbol of status, affordability, and product style are the variables that have a positive relationship with consumers' buying behavior towards E-vehicles. E-vehicle product attributes such as innovations and inventions, companies' ability to adopt new technology, lower price and affordability, companies' service capability, no sound pollution, low maintenance cost, and self-dependency in fuel consumption are the variables that have a positive relationship with consumers' buying behavior towards E-vehicles.***

Keywords: Electric Vehicles, *Consumer's attitude,* Product attributes, Shivamogga

1. Introduction

The growth of air pollution in Indian urban areas was a cause for concern for manufacturers. There are more than 25 major Indian cities among the 100 most polluted urban areas in the country (World-Nation, Ranjan, I., Jha, S.K., and Mondal, S. 2022). The cause for the production of air pollution in urban areas is associated with an array of sources, but the division of transport makes a crucial commitment. Transport discharges are critical divisions that are minimal (Adhikary, S., et al., 2022). The antagonistic influence of air quality on human health and the economy is well known, and, in this sense, producers are dreaming about reducing the impact on earth with a couple of options. In the last couple of decades, there has been an increase in the volumes of electric vehicles being sold (Rout, D., et al., 2020). A large number of studies have been carried out on this subject with respect to the consumers' perceptions and their motivational factors towards purchasing an electric vehicle and the impact that this adoption will have on the energy sector, primarily the oil and gas market (Acharya, S. 2019). Another important impact will be seen on the power market, as the demand for electricity will also surge with a conducive increase due to development and population expansion (PwC Report, 2018). With the growing demand for electric vehicles, a number of studies have been conducted in this regard to assess the impact of this growth on the energy sector, primarily the oil and gas sector (Sankar, U. and Rajasekaran, R. 2021). Globally, electric vehicles are growing at a rapid pace with a compounded annualized growth rate (CAGR) of 21.7 percent; by 2030, it is supposed to grow from 8.1 million units to 39.21 million units. The enormous growth has been influenced by several factors like efficiency, pollution, and environmental concerns (Campino, J., et al., 2023). All over the planet governments have started to encourage EV industries by providing subsidies as the consumer continuously demands eco-friendly vehicles rather than petroleum or diesel vehicles (Parmar, Ajaysinh. 2021). Coming to the scenario, in India, the future of electric vehicles is still standing at a critical point. Whenever there is a hike in oil prices or a change in climate, electric vehicles are the first solution to be discussed and approached. Indian companies entering the EV industry take a lot of risks and make efforts to normalize the EV segment, but it has not happened yet (Charles, V. 2021). More than 15 years have passed, but the EV industry has not hit the potential that was predicted. Today when we look at the roads, a small proportion of electric vehicles are spotted compared to traditional vehicles. Now in 2022, the EV industry has all the tools to hit its highest potential and finally take off. As the Government of India has been providing various schemes and benefits for EV manufacturers, collaborations between companies and the government have been beneficial in increasing EV production and the market in India (Choksi, S. and Ayre, V. 2022). Top CEOs of India's automobile industries praised the government's new "vehicle scrappage policy" introduced in the Union Budget, 2021-22. As per budget 2023, the Fast Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) has been projected at Rs. 2,908 crores, which is three and a half times more than the budget year of 2022 (FAME), amounting to Rs. 827 crores.

2. Literature Review

Environmental challenges force the transportation sector to move to eco-friendlier technologies. Electric Vehicles (EVs) are regarded as a green transportation solution (Selva, J. and Arunmazhi, R., 2020). The main focus of the paper is on batteries, as they are the key component in making electric vehicles more environment-friendly and cost-effective and driving the EVs into use in day-to-day life (Harikrishnan, V. and Praveenkumar, S. 2023). Consumer's perception towards the electric vehicle industry—a study on the role of electrical vehicles in environmental sustainability: The researchers observed a focus on omitting greenhouse gases and upgrading the old and regular vehicles with new electric vehicles to maintain low levels of pollution. (Shivabeerappa, M. and Divya, L. 2022) The study concluded that European car drivers see the opportunities that electric vehicles could offer but that a number of prerequisites need to be fulfilled in order to ensure that the car drivers can consider electric vehicles as

a credible vehicle choice (Lashari et al., 2021). India could invest in small-scale reinforcements to control load concerns locally rather than attempting a massive overhaul. The practice of charging should be encouraged (Tiwari, A., et al., 2022). Place, population, traffic density, and safety should all be carefully planned. Before putting in place a large-scale charging infrastructure, thinking about it will be very important, and so will the importance of blending of activities (Kumar, A. (2023). It is crucial in the domains of energy and transportation. Various inventive methods are used to achieve development goals (Muthukrishnan, R., et al., 2023). Drivers of electric automobiles, for example, are offered a financial consumer incentive through regulations and initiatives. Tax credits, purchasing subsidies, low tolls, free parking, and access to limited interstate lanes are just some of the options available (Varghese, A.T., et al., 2021). They will contribute to the market's expansion and will really help India in taking a big step towards becoming an electric vehicle-centric country. (Indira, M. S., 2021) In their study, scholars have established that the effect of monetary and technical/mechanical qualities of EV on its usefulness is critical, together with its purchase and overhead cost, driving range, duration of the charge, the performance of the vehicle, and diversity of the brand on the market (Lissy, N. S. 2022). Numerous studies have investigated the variables that affect EV acceptance and consumers' purchase intentions. For example, Jose, S.P., et al. (2022) explored factors affecting the public acceptance of autonomous EVs by using data collected from an online survey in China. Considering the potential environmental benefits of EVs, they evaluated the environmental concerns that affect people's intentions of buying autonomous EVs (Vidyabharati, 2019). The results of their study showed that perceived usefulness, perceived ease of use, and environmental concern have a positive relationship with consumers' intentions to purchase autonomous EVs. In addition, Malagi, A.K. and Ramya, S. (2022) analyzed the effects of consumer knowledge about EVs, perceived risks, usefulness, and current financial incentives. The results of their study showed that consumer awareness about EVs has a positive effect on perceived usefulness, attitude, and intention to purchase EVs; however, it is negatively related to perceived risks. Further, to identify the interacting factors in the relationship between perceived value and adoption of EVs, José, C., et al. (2023) examined the moderating effects of environmental traits and government support on adoption intentions. They identified operational economic benefits and charging risk as the main motivators or hurdles for EV diffusion (Kumar, P., et al., 2022). Moreover, they found that environmental concerns and financial incentives significantly enhanced the perceived values of adoption intention. Another study by Kumar, Aditya (2023), investigated multidimensional benefits based on users' expectations (Masurali, A and Surya, P (2018). They found that the decision to adopt EVs in the United Kingdom is significantly influenced by contributory features such as efficiency, practicality, and driving range; hedonic attributes such as driving pleasure; and symbolic characteristics such as driving pride (Zameel, I., and Aly, A.S. 2020). The economic benefits of EV adoption have also been examined empirically as primary determinants of acceptance intent for EVs.

3. Need for The Study

The need for the study is to understand the consumer perception and the purchase intention of e-vehicles in India. The significance of the study is that EVs can cause remarkable impacts on the environment, the country's economy, the power system, and other related sectors. There are possibilities of enormous environmental benefits as well, as EVs can extensively reduce the greenhouse gas emission from the transportation sector. However, there are some major obstacles for EVs to overcome before replacing conventional internal combustion engine vehicles. This study is focused on reviewing all the useful data available on factors that influence the consumers, technology, charging techniques, impacts, trends, and possible directions of future developments. Its objective is to provide an overall picture of the current consumer trend and expectation on EV technology and ways of future development to assist in future researches in this sector.

4. Research Problem

The research in the field of the automobile sector is conducted aggressively; still, there is scarcely any research that concentrates on the client perception of electric vehicles. This advanced research establishes links between client perception of electric vehicles and their impact on sales. Perceived behavior control refers to a person's sense of how difficult it is to do a specific behavior. It simply refers to people's perceptions of their capacity to accomplish a specific behavior. The resources and opportunities an individual has affect this; the more resources and opportunities an individual has, the greater the perceived behavior will be. When customers believe they have the necessary funds, the resources to charge electric vehicles, and the authority to decide whether or not to buy an electric vehicle, they may believe it will be more difficult to buy an electric vehicle in the future, and they will have greater control over the perceived behavior of buying electric vehicles. It's becoming more difficult to target electric automobiles as the globe spends more time and money on more electric vehicles in the global market. Consumer preference is a hard-to-control marketing tactic. Consumers are bombarded by marketing messages transmitted through electric vehicles, and its global business should evaluate not only whether electric vehicles are more suitable for the ride but also the cost of electricity. Infrastructure is tough to maintain, and purchasing an electric vehicle is difficult. Positive atmosphere, government incentives, beneficial financial options Lack of consumer choice, expense, and long recharge time are all factors that influence electric car purchases, as is a lack of trust in new technologies. As a result, marketers must find a means to transform the negative perception of electric vehicles and their business in the worldwide market into a good one, as well as raise customer awareness. Products and services are evolving and framed to undertake adapting this to work in the electric vehicle sphere as technology changes.

5. Objectives of the Study

1) To explore the impact of E-Vehicles buyer perception on consumer's buying behavior towards E-vehicles.
2) To examine the influence of E-Vehicle Product attributes

on consumer's buying behavior towards E-vehicles.

6. Hypothesis

H01: There is no significant impact of E-Vehicles buyer perception on consumer's buying behavior towards E-vehicles.
H1: There is a significant impact of E-Vehicles buyer perception on consumer's buying behavior towards E-vehicles.
H02: There is no significant impact of E-Vehicle Product attributes on consumer's buying behavior.
H2: There is a significant impact of E-Vehicle Product attributes on consumer's buying behavior.

7. Research Methodology

Regression analysis was used to find out the impact of consumer perception on the perception towards buying E-vehicles. The study is guided by a descriptive research methodology. Descriptive research is usually defined as a type of quantitative research; though qualitative research can also be used for descriptive purposes. The research design is developed to ensure that the results are valid and reliable.

Primary data
The first-time data has been through a self-administered structured questionnaire, which was developed and asked to be filled out. Personal interviews were also done with respondents. A structured questionnaire was prepared containing the statements ratings with five-point scale ranging from strongly disagree to strongly agree. "Strongly agree" was assigned a score of 5, "agree" a score of 4, "can't say" a score of 3, "disagree" a score of 2, and "strongly disagree" a score of 1 for conducting regression analysis.

Secondary Data
Peer-reviewed journals were considered based on their knowledge validity and their highest impact on the research field. Online E-Sources, Published reports, journals, theses, magazines, research articles, newspapers, etc. The following are the sources from which the secondary data was collected, such as information that has been gathered from selected peer-reviewed articles from bibliographic databases (Emerald, Sage journals online, Science Direct, Scopus, Taylor & Francis online, Web of Science, and Wiley (online library).

8. Sample Size

The respondents are the users of E-vehicles in Shivamogga district. Convenience sampling techniques was used in the present study which helped in saving time and resources. It indicates the numbers of people to be surveyed. Though samples give more reliable results than small samples but due to constraint of time and money, the sample size was restricted to 185 respondents who are using electric vehicles.

9. Respondents

This survey was implemented by identifying the customers at the shopping malls and especially in parking places. Users of E-vehicles were requested to rate their perception on the towards buying E-vehicles. A structured questionnaire has been issued to the respondents to collect the data. The interaction was made with respondents who are users of E-vehicles in Bengaluru districts.

10. Scope of the Study

The study focuses on the consumer perception and purchase intention of electric vehicles in Shivamogga. Many studies and researches happened to analyze the technology, benefits, environmental impact, and social acceptance related to vehicle. Here, the study conducted by considering those works of literature and the inferences from a sample survey from the individuals' owning vehicles, to address the issue of lack of knowledge with the public regarding EVs, further this study throws light upon the expectation about these vehicles in the minds of the buyers. To suppress the problem of Air pollution and environmental Hazards to the maximum extent while using EV.

11. Data Analysis—Results and Discussions

11.1. Consumer Expected Factors and Consumer's Perception

The linear regression analysis was run by using SPSS software to test the data collected for the analysis purpose.
The data were measured by using a five-point Likert scale.
H01: There is no significant impact of consumer expected factors on consumer's buying behavior towards E-vehicles.
H1: There is significant impact of consumer expected factors on consumer's buying behavior towards E-vehicles.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.987[a]	.915	.912	.27310

ANOVA[b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	178.955	15	11.323	165.952	.000[a]
	Residual	8.893	188	.068		
	Total	177.802	184			

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.499	.128		-3.879	.000
	Clean environment	.178	.071	0.155	2.703	***.008***
	Customer's demographic profile	-.158	.049	-0.142	-3.228	***.002***
	Customer's Education	-.013	.034	-0.015	-0.406	.567
	Buying for city roaming	-.033	.043	-0.035	-0.778	.543
	Less maintenance cost	.069	.033	0.064	1.934	***.045***
	Incentive prices	.073	.025	0.078	2.929	***.004***
	Protect the environment	.002	.035	0	0.068	.623
	Personal factors	.004	.045	0.002	0.091	.871
	Attachment for new products	.065	.027	0.072	2.322	***.031***
	Social Media	.359	.045	0.305	8.188	***.000***
	E-Vehicles as a symbol of status	.219	.045	0.248	4.922	***.000***
	Save cost	-.089	.048	-0.113	-1.809	.072
	Affordability	.112	.036	0.116	2.819	***.004***
	Product Style	.251	.048	0.364	5.396	***.000***
	Brand Image	.029	.052	0.025	0.565	.643
a. Dependent Variable: Perception Towards E-vehicles						

A multiple regression analysis was used to investigate the effect of 15 variables of consumer expected factors on consumer's buying behavior towards E-vehicles. From the above table it is understood that, that consumer expected factors (R = 0.987 indicating high degree of correlation among the variables, t =-3.877, p <.01) had a positively significant effect on consumer's buying behavior towards E-vehicles. Hence, it can be concluded that if the average level of consumer expected factors were high, the average level of consumer's buying behavior towards E-vehicles would also be high. The analysis also reveals that consumer expected factors were able to explain the total variation in customer satisfaction by the regression model about R^2 = 95% being high indicating model fits the data well. Thus, answering the hypothesis **H1:** There is a significant impact of consumer expected factors on consumer's buying behavior towards E-vehicles, posited for this research is accepted. The coefficient table shows the contribution of each consumer expected factors of consumers. From the above table the beta values demonstrate the unique contribution for the variables such as Clean environment (β=.178, p <.008), Customer's demographic profile (β=-.158, p < .002), Less maintenance cost (β=.069, p <.045), Incentive prices (β=.073, p <.004), Attachment for new products(β=.065, p <0.031), Social Media (β=.359, p <.000), E-Vehicles as a symbol of status (β=.219, p <.000), Affordability (β=-.112, p <.004), Product Style (β=.251, p <.000), in predicting consumer's buying behavior towards E-vehicles.

11.2 E-Vehicle Product attributes and consumer's perception

H02: There is no significant impact of E-Vehicle Product attributes on consumer's buying behavior.
H2: There is significant impact of E-Vehicle Product attributes on consumer's buying behavior.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.973[a]	0.946	0.941	0.26923

ANOVA[b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	168.162	11	15.287	210.909	.000[a]
	Residual	9.64	178	0.072		
	Total	177.802	184			

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-0.633	0.114		-5.451	0
	Companies product development capability	0.002	0.028	0.001	0.05	0.876
	Companies Technological capability	0.322	0.041	0.268	7.482	0
	Companies ability to adopt new Technology	0.188	0.039	0.224	4.717	0
	Less price and affordability	-0.138	0.048	-0.176	-2.794	0.006
	Companies service capability	0.088	0.038	0.109	2.402	0.018
	No sound pollution	0.212	0.043	0.284	4.509	0
	Car comfortability	0.013	0.052	0.008	0.202	0.798
	Emission free	0.078	0.045	0.059	1.345	0.157
	Low maintenance cost	0.155	0.029	0.136	4.683	0
	First Buyers	0.026	0.054	0.028	0.485	0.721
	Self-Dependency in fuel consumption	0.188	0.052	0.2711	3.578	0.001
a. Dependent Variable: Perception Towards E-vehicles						

A multiple regression analysis was used to investigate the effect of 11 variables of consumer E-Vehicle Product attributes on consumer's buying behavior towards E-vehicles. From the above table it is understood that, that technological factors (R = 0.973 indicating high degree of correlation among the variables, t =-5.449, p <.01) had a positively significant effect on consumer's buying behavior towards E-vehicles. Hence, it can be concluded that if the average level of E-Vehicle Product attributes were high, the average level of consumer's buying behavior towards E-vehicles would also be high. The analysis also reveals that E-Vehicle Product attributes were able to explain the total variation in customer satisfaction by the regression model about $R^2 = 94.6\%$ being high indicating model fits the data well. Thus, answering the hypothesis **H2:** There is a significant impact of E-Vehicle Product attributes on consumer's buying behavior, posited for this research is accepted. The coefficient table shows the contribution of each E-Vehicle Product attributes. From the above table the beta values demonstrate the unique contribution for the variables such as Companies Technological capability (β=.322, p <.000), followed by Companies ability to adopt new Technology (β=-.188, p < .000), Less price and affordability (β=-.138, p <.004 Companies service capability (β=.088, p <.018), No sound pollution (β=.212, p <0.000), Low maintenance cost (β=.155, p <.000), Self-Dependency in fuel consumption (β=.188, p <.001), in predicting consumer's buying behavior towards E-vehicles.

12. Research Findings

Consumer expected factors such as clean environment, gender, less maintenance cost's, Incentive prices, innovative behavior, Social Media, E-Vehicles as a symbol of status, Affordability, Product Style, are the variables have the positive relationship with consumer's buying behavior towards E-vehicles.

E-Vehicle Product attributes such as innovations and invention, Companies ability to adopt new Technology, less price and affordability, Companies service capability, no sound pollution, low maintenance cost, self-dependency in fuel consumption are the variables have the positive relationship with consumer's buying behavior towards E-vehicles.

13. Suggestions

It is recommended that firms make adequate infrastructure available so they can meet the needs of EV vehicles nationwide. Assess how government initiatives like tax breaks, subsidies, and infrastructure spending could promote or inhibit the use of electric cars. Analyze the potential effects of these regulations on consumers' opinions of electric cars as a practical mode of transportation. Businesses should place a high premium on educating the public about new electric vehicle models. By increasing the number of charging stations, more people will be interested in purchasing E-vehicles. By reducing the need for crude oil and its exorbitant price, the government also gains from the development of E-vehicles. Electric cars are easier to use, and everyone should be aware of the rumors and user evaluations. Raise awareness of global issues. From the standpoint of the consumer, list the main advantages and disadvantages of electric cars, including reduced fuel expenses, environmental friendliness, a shorter driving range, and higher initial expenditures. It is advised that businesses have adequate infrastructure available so they can meet the needs of e-vehicles from throughout the nation. It is proposed that the government should implement suitable policies to promote the manufacture and use of e-vehicles. Since customers are still unaware about E-vehicles, it is necessary to update or modify the advertising plan to encourage the adoption of E-vehicles through internet media and advertising campaigns. Since the majority of customers don't drive electric cars, it would be beneficial to increase consumer test drives so they can learn more about and experience them. spreading the word and raising awareness before urging people to switch to electric automobiles from combustion-powered ones. The e-vehicle manufacturer asked to speak with the government about obtaining incentives and benefits for e-vehicles. It is also suggested to the government that it generate and supply adequate electricity power to encourage and manage e-vehicles. The market for E-vehicles will grow in the near future as a result of price reductions. The price of gasoline is steadily rising. The problem of rising gas costs may be resolved by using electric cars. The government's encouragement of E-vehicles will help the country's future growth. The study's participants recommended that the establishment of e-vehicle infrastructure, including charging stations, should be based on the principles of cost and accessibility. To engage and convince potential customers to embrace a new product or service, five adopter groups and unique marketing strategies are required. To help minimize environmental pollution, the government should offer incentives, tax breaks, and other measures to encourage the use of electric cars.

14. Limitations

Any new entry of a company into the EV market in India will not be possible before studying the Indian consumer, their requirements, and their purchasing power. Companies have not been able to develop proper infrastructure for e-vehicle owners with regard to charging points, repair stations, and availability of batteries. The credibility of the research could vary in the future; as primary data was taken into consideration while doing this research on electric vehicles. The study may have limitations in terms of the representativeness of the sample. For example, the study may have only included customers from a specific demographic, geographic region, or industry, which may limit the generalizability of the findings. 2. Due to limitation of time, only a few people were selected for the study. So the sample of consumers was not enough to generalize the findings of the study. 3. Getting a response from busy consultancies for our project and research work was a little difficult, as most of them denied sharing their internal data or information. 4. The study involves some organizations and people in the research, and sometimes you may get problems with access to these organizations. Due to this, you need to redesign and rewrite your study.

15. Directions for the Future Research

Future researchers can apply different methods of data analysis, such as machine learning and multi-criteria

decision-making approaches, to investigate EV purchase intentions and perform comparisons to introduce EVs. Future research could employ alternative stereotypes. The investigation took place in a single country and involved a single environmentally friendly product. In this sense, more research should be carried out to predict the real behavior of Portuguese consumers in relation to the purchase of ecological vehicles. A comparative analysis can also be carried out in other markets, for example, in Karnataka State. Further studies may improve our understanding of user attitudes and perceptions. For example, the longitudinal observation of behavioral changes of respondents will be useful to draw a more causal relationship between users' personal perceptions and EV purchase intentions. In addition, collecting cross-sectional data covering a wider range of consumers (e.g., from different countries/cities and those with different levels of EV experience) may help in observing the larger picture of divergent EV purchase intentions. Moreover, future researchers can apply different methods of data analysis, such as machine learning and multi-criteria decision-making approaches, to investigate EV purchase intentions and perform comparisons to introduce EVs.

16. Conclusions

This study aimed to explore the factors affecting consumers' intentions to purchase EVs, focusing specifically on users' perceptions and attitudes using survey data. Users' perception and attitudinal attributes considered in this study included users' innovativeness, technological concerns, expected environmental and economic benefits, purchase subsidy, and social influence/image. In addition to these attributes, respondents' perceptional expectations and product characteristics were examined. In this study, two approaches—regression analysis and. The random utility of a customer was extracted from a single-option situation, which is the intention to buy EVs. The statistical models successfully produced interpretable outcomes, revealing the influencing factors; thus, they can be used to help analysts reasonably predict a consumer's intention to purchase an EV. There are two major conclusions drawn in this study that are worthy of attention for boosting sales in the EV market and promoting their wide application in transportation systems.

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