"REDUCING GREEN GAP"- AN EMPIRICAL STUDY TO EXPLORE THE ADOPTION OF ELECTRIC CARS AMONG CONSUMERS IN KERALA

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INTRODUCTION

"India adds 678 new public EV charging stations between October-January, 2022" reports Economic Times. The sales of Electric vehicles especially two-wheelers & three-wheelers have rocketed in the year 2021- 22. The companies like Hero, Bajaj, TVS & Ola Electric have set aggressive plans in EV manufacturing of 10 million annually. Other two-wheeler companies like Simple One, Bounce, Okinawa Autotech are trailing behind trying to increase sales to two million. The prices of the two-wheelers & three-wheelers have also reduced making it more acceptable among public. However, the demand pick up of four-wheeler EV vehicles is much slower. Tata & Morris Garages is gaining popularity with its Nexon, Tigor & ZS EV models respectively. Premium car segments like Mercedes, Audi, and BMW are also selling electric cars in India but they are not targeting big volumes of sales in the near future. Maruti – Toyota alliance is expected to be a game changer in this industry setting up a platform for the global market. Maruti has the advantage of having India's first lithium-ion cell manufacturing plant since these batteries have huge cost. Hence sales of EVs are gaining momentum in India & it is expected to trigger an entirely new category of business to cater to this new segment mainly charging stations & batteries. International Players like ABB, Panasonic & TATA are aiming to put up charging stations in highways & cities. In this context where EV industry is gearing up for dramatic change it is highly relevant to examine the status of EV Industry in Kerala. EV has zero emission & they are a great solution to combat climate change. According to Economic Times, the state of Kerala has been at the forefront compared to other states in India in embracing green mobility solutions for public transportation & launched the first LNG Bus & solar ferry in India. Despite all the government initiatives & skyrocketing fuel prices, Electric cars are not so fast moving in Kerala. Despite all the government initiatives & skyrocketing fuel prices, EVs are not so fast moving in Kerala. In the year 2020, the Kerala government proposed many special incentives to 10,000 beneficiaries to promote the usage of e- rickshaws, but even after two years of constant promotions, there are only less than 1000 takers.

The e-rickshaw feeder service introduced in Kochi Metro and Smart City Thiruvananthapuram Ltd (SCTL) did not have much public acceptance showing that Keralites have not fully welcomed the new technology. However, Kerala shows a high HDI & literacy rate of 93.91% which is evidence of its overall achievement in socio-economic dimensions. A retrospection of Kerala history brings to light numerous socio-ecological interventions contrived by the people of Kerala which is a reflection of the political-ecological modernity of the society. The activities of Kerala Shastra Sahitya Parishad (KSSP, meaning Kerala Science Literature Movement) is a people's science movement, to fight people's livelihood problems, save Silent Valley campaign in Palghat district, save the Chaliyar river of Kozhikode district, the anti-Coco Cola people struggle in Plachimada (Palghat) are some of the examples that show that the state of Kerala was always in the forefront of Environmental activism & has always succeeded in challenging & halting many ecologically unsustainable corporate ventures. In spite of the socio-ecological consciousness of the people & modernity of the society, we find a poor response to EV adoption in the state. In this context, it is highly relevant to explore the reasons for disinclination toward owning EVs.

The purpose of the study can be enumerated as

1. To investigate the factors preventing consumers from translating their intention into green purchasing behavior.
2. To examine the various strategies that can be employed to ameliorate green purchasing.

LITERATURE AND CONCEPTUAL FRAMEWORK

Pro-environment Intention

De Leeuw et al., 2015 & Goh et. Al. 2017 defines Pro-environmental intentions as an indication of the strenuous & discretionary effort an individual would put into reducing the impact of his actions on nature Hence intentions encompass all motivational factors that influence human behavior. According to Jarreau (2014) the fundamental values, belief systems & attitudes of individuals are the contributing factors influencing our behaviors toward the environment. Kollmus and Agyeman defined pro-environmental intention as a kind of attitude that shows conscious & active responsiveness to current environmental issues. In 1986, Hines Hungerford and Tomera, inspired by Ajzen and Fishbein's theory of planned behavior published their Model of Responsible Environmental Behavior.

Knowledge of issues: The person has to be familiar with the environmental problem, its causes & its long-time implication on human health, the global environment & natural resources so that he can retrace his steps & take up sustainable actions.

Knowledge of Issues in this study refers to an individual's understanding of the world around him & it is centered on the exploration of ways to reduce the impact his actions & way of life have on the physical environment.

Knowledge of action strategies: This is a process that enables individuals to select & implement a plan of action from the available alternatives which can facilitate change behavior at the individual & system level. Knowledge of Action Strategies implies planning to organize & execute a process of doing something with an aim to reduce its impact on the environment so as to preserve nature. In this research knowledge of action strategies is a prerequisite to reducing the impact of human activity on nature.

Locus of control: This represents an individual belief about the ability to control what happens to them. In other words, people with a strong internal locus of control attribute outcomes as a direct result of their actions & take responsibility for the consequences while people with a strong external locus of control feel that their actions are insignificant & outcomes are contingent on external uncontrollable & unforeseen factors such as luck, fate. People with a strong internal locus of control believe that their actions however small are change agents that can induce a positive impact on the ecosystem around them thereby conserving nature. On the other hand, People with an external locus of control underestimate their individual actions & feel that they are insignificant to bring about a dramatic change in the world and that changes can only be brought about by powerful others. Hence people without an internal locus of control are insensitive to ecological issues & do not take proactive actions to conserve nature

Attitudes: Attitude is a psychological construct referring to a set of emotions & beliefs of an individual towards external objects, events, or individuals which characterizes their personality. People with strong pro-environmental attitudes are found to be more inclined to pro-environmental behavior.

Verbal commitment: This can be defined as the communicated willingness of a person to engage or refrain from doing something. Verbal commitments strengthen pro-environmental behavior & the individual sense of responsibility: People with a greater sense of personal responsibility engage in environment-friendly behavior & work towards sustainable goals.

Hence Pro Environment intention stems from Environment Concerns. Environmental concern can be defined as an emotional awareness of the adverse effect that anthropogenic activities have on nature & empathies towards issues concerning environmental problems (Minton and Rose, 1997; Hansla et al., 2008). According to Chen and Chai,2010 & Bang et al., 2000 environment concern of the consumer is a major deciding factor that influences the consumer buying behaviour of EV.

In the consumer EV adoption research, environmental beliefs and consumer awareness of environmental issues and human effects have been theorized to positively affect the intentions to purchase EVs (Lane and Potter, 2007; Carley et al., 2013; Egbue and Long, 2012; Skippon and Garwood, 2011). However, research also shows that consumer adoption of technological innovations is greatly influenced by consumer characteristics, demographic factors, social influence, product features, the ease of use of technology & perceived economic benefits. (Arts et al., 2011; Schuitema et al. 2013). Sometimes when new products or technologies are introduced into the market, consumers are often hesitant to adopt them due to the risk associated with them. Consumer attitudes towards EV vehicles have also been examined in this perspective (Egbue and Long, 2012; Moons and De Pelsmacker, 2012) . Several researchers such as Lane and Potter (2007) have explored the familiar attitude-behavior gap in this regard and emphasizes that expressing a positive attitude towards eco-friendly products does not directly lead to consumer purchase of that product or service. Further, Knowledge about the product & service have a profound effect on the buying decision. The studies conducted the world over show that people are usually hesitant to buy electric vehicles because they are concerned about the range and how far EVs can travel (Egbue and Long, 2012). For a new technology to be adopted, the consumer should be aware of its functioning and should perceive it to have more value than the existing technology.

Subjective norm deals with the influence of the social environment. The subjective norm is the person's perception that most people who are important in the society or group of people will approve & support a particular behaviour Carley et al. (2013) Subjective norms for an individual are determined by the perceived social pressure from others to behave in a certain manner and their motivation to comply with those people's view. In
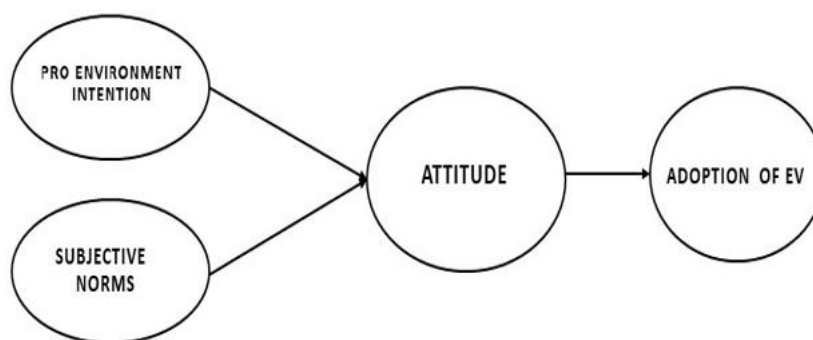
other words, believes or opinions of peers, approval of reference groups exert influence on the adopter to perform a certain behaviour. (Jansson et al., 2010).

Consumer attitudes have been frequently used in many studies to foresee the ecologically conscious behavior of consumers and the usage of eco-friendly products. Cognitive, Affective & Behavioural components holistically comprises the Consumer attitudes. Consumers might opt to buy a product on an impulse or in some situations due to the affinity to the brand name or sometimes due to a feeling of moral responsibility towards a cause. Some attitudes are more likely to be based on feelings, some are more likely to be based on behaviours, and some are more likely to be based on beliefs. This attitude of consumers has a relevant impact on EV adoptions. (Mostafa, 2007) . Still other attitudes are acquired by individuals through exposure through mass media or social media interaction with networking groups (Hargreaves & Tiggemann, 2003; Levina, Waldo, & Fitzgerald, 2000) or through our interactions with friends (Poteat, 2007)

Green Gap
In the post-pandemic era, the people & the society are found to be highly green conscious & share great ideals about sustainability. However recent studies show that even though there is a great increase in green consciousness & pro-environment intentions among citizens, it does not get translated to pro-environment behavior. This is referred to as the green gap or the gap that stems from a disparity in intention and behavior. Hence this research intends to explore the attitude of consumers in Kerala towards sustainability goals

and measure the effects of such understanding and attitude toward the green purchasing of EVs. The previous studies show that elements such as Product Knowledge, Environment Concerns, and Subjective Norms has been detrimental to EV adoption in other countries. (Egbue and Long, 2012; Carley et al. 2013) Hence this study tries to throw light on the impact of these above constructs on EV adoption in Kerala.

Methodology
The structured questionnaire was distributed through the online platform LinkedIn. When designing the questionnaire meticulous care was given to properly arrange each item of variable so as to prevent respondents from subjective speculations. Polling was conducted to reach out to networks residing in Kerala. A purposive sampling method was used to collect data from the respondents & a total of 350 responses were collected. Incomplete questionnaires were excluded & finally 325 valid questionnaires were selected for analysis. A total of 24 items were used in the study.

Hypotheses
H1: Pro-environment Intentions have a significant effect on Adoption of EV
H2: Subjective norms have a significant effect on Adoption of EV
H3: Attitude has a significant effect on Adoption of EV
H4: Attitude of Consumers mediates the relationship between Pro-environment Intentions & Adoption of EV
H5: Attitude of Consumers mediates the relationship between subjective norm & Adoption of EV.

Proposed Model

Overview of the Sample
Of the 325 respondents, 68% of the participants were Male, 32% were female. 7 % of the respondents fall in the group 18- 25years, 13% of the respondents where in the age group of 25-

32years, 20% belonged to 32- 39years, 28% in 39 - 46 years, 32% above 46 years. 46.5% had Bachelor degree, 32.6% had Masters degree 3% had Doctoral degree while 17.9% had only diploma or equivalent. 37 % of the participants belonged to the

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upper class , 233 % to upper middleclass , 17 % to middle class , 13% to lower middle class.

To determine the awareness level of consumers about electric cars, their basic understanding of Electric cars brands was explored. 45% of participants had very good knowledge of Electric cars brands, 33 % had good knowledge, 12% had fair knowledge, 10% had very poor knowledge of the brands that offered electric cars. 47% of the participants knew about electric cars through social media & internet, 13% knew about electric cars through mass media, 20% through print media & 20% learnt about electric cars from word of mouth.

Statistical Analysis & its Implications

The data collected from 325 respondents were analyzed using descriptive statistics, confirmatory factor analysis & structural equational modeling. IBM SPSS Statistics Version 22 & IBM SPSS AMOS Version 23 were employed for the data analysis.

Table 1 provides the mean, standard deviation, and other descriptive statistics of variables among the sample respondents. Preliminary checks for normality were done, and all variables were in the acceptable range of skewness and Kurtosis (Hair et al., 2010).

Table 1

Constructs	Mean	Standard Deviation	Skewness	Kurtoz, k
Pro environmental intention	3.0640	1.03797	-.292	-1.578
Subjective norm	3.1163	1.00266	-.294	-1.601
Attitude	3.1590	.99062	-.275	-1.653
Adoption	3.1669	.99256	-.324	-1.620

Note: The CR values represents composite reliability and values in the diagonal (bold and italics) represent the sq. the root of average variance extracted (AVE) for each factor, while the variables below the diagonal represent the correlations between each pair of factors

Measurement model testing

Confirmatory Factor Analysis (CFA) was done to validate the factor structure of variables used for this study. CFA was performed on 24 items in which all the factor loading ranging from 0.57 to 0.84 were retained for further analysis. All the measurement items had loading greater than 0.50 has a satisfactory fit (2/df= 3.414; FtTAR= 0.036, CFI = 0.874, AGFI = 0762; R1V1SEA= 0.031). Prior to hypotheses testing, estimation of internal consistency was done to examine the reliability, followed by ensuring discriminant and convergent validity of the instrument items, and then, the confirmatory factor analysis was done for measurement model analysis. Composite reliability (ranging from 0.80. to 0.92), which is a more conservative measure of the consistency of measurement tools, was found to be satisfactory (Table 2)

Table 2 : Convergent and discriminant validity of measures

Constructs	Mean	SD	CR	AVE	Pro environmental intention	Subjective norm	Attitude	Adoption
Pro environmental intention	3.06	1.04	0.89	0.63	*0.79*			
Subjective norm	3.12	1.00	0.80	0.45	0.62	*0.67*		
Attitude	3.16	.99	0.89	0.57	0.61	0.63	*0.76*	
Adoption	3.17	.99	0.92	0.58	0.52	0.51	0.59	*0.76*

Convergent validity was checked using Average variance extracted (AVE) which can be defined as the amount of variance captured by a construct's measure. The AVE estimates of the value of .50 & above show that the convergent validity of the constructs measured is satisfactory. To examine the discriminant validity of the scales, AVE and the variance shared between the constructs were compared.
Table 2 provides the correlation coefficients in the off-diagonal elements of the matrix and the square roots of the AVE values for each construct along the diagonal, and it can be concluded that the constructs (ranging from 0.67 to 0.79) had adequate discriminant validity. Hence there is adequate evidence to prove the measurement model which permits us to move ahead with the estimation of the structural model and detailed hypothesis testing.

Descriptive statistics

Before exploring the factors underlying the adoption of electric cars, descriptive statistics were

carried out. 24 statements pertaining to predictive variables were used for the study. Descriptive statistics were carried out to obtain the characteristics of the data regarding consumers' perception of the factors underlying the adoption of electric cars.

Table 2.1 (annexure I) discloses 5 statements in connection with consumers' perception on the pro environmental behaviours. Highest mean value (3.20) was found on the statement 'In order to enjoy good Environment I will try my best to something beneficial to it. It means customers will try to their best to something beneficial to the environment is the most preferred pro-environmental behaviour variable considered by customers of electric vehicles. Table 2.2 (annexure I) discloses 5 statements in connection with consumers perception on the subjective norms. highest mean value (3.26) was found on the statement ' I feel moral obligation to use electric cars as part of my social networks'. It means customers feel more obligation to use electric cars as part of their social networks is the most preferred subjective norm variable considered by customers of electric vehicles. Table 2.3 (annexure I) discloses 6 statements in connection with consumers perception on the attitude. highest mean value (3.28) was found on the statement 'I am concerned about the range of electric cars & how far it cam travel'.It means customers are concerned about the

range of electric cars and how far it came to travel is the most preferred attitude variable considered by customers of electric vehicles. Table 2.4 (Annexure I) discloses 8 statements in connection with consumers perception on the adoption of electric cars. Highest mean value (3.26) was found on the statement 'I would buy electric car if there was more charging stations'. It means customers will buy electric car if there was more charging stations is the most preferred adoption variable considered by customers of electric vehicles.

Structural model hypothesis testing
Structural Equation Modelling (SEM) using IBM AMOS 23 was used to test the hypotheses. The bootstrapping method was used to check the hypothesized direct effect & indirect effect. Bootstrapping was performed with 2000 samples at 95% confidence intervals (Hair, Hult, Ringle & Sarstedt,2021). Before testing the mediation, the study tested the direct effects (Hypothesis 1 to 3) shown in the conceptual model. From the analysis, it was found that Pro-environmental intention (β = .321, P=.04) has a significant(positive) effect on the adoption of Electric vehicles. It was also found that subjective norm (β = .363, p=.001) has a significant (positive) effect on the adoption of Electric vehicles. Further, it was found that attitude (β = .380, p=.007) has a significant (positive) effect on the adoption of Electric vehicles. Thus, this study accepts hypotheses 1 to 3.

Table 3: Hypothesis testing results

Path	Estimates	P values
Pro environmental intention ---> Adoption (H1)	.321	P< 0.05
Subjective norm ---> Adoption (H2)	.363	P< 0.05
Attitude---> Adoption (H3)	.380	P< 0.05
Pro environmental intention ---> Attitude ---> Adoption (H4)	.291	P< 0.05
Subjective norm ---> Attitude ---> Adoption (H5)	.099	P< 0.05

MEDIATION RESULTS
After the measurement model validation, the researcher validated the structural model. The structural model is shown in figure 1

Examination of various indices revealed that indices are within the threshold limits which provide sufficient evidence for model fit (Hair et al.,2010). After the direct effects were tested, the study proceeded with the mediation analysis and the proposed mediating variable attitude was entered into the model. Hypothesis 4 - (H4) stated attitude of Consumers mediates the relationship between Pro-environment Intentions & Adoption of electric vehicles. The study found support for this assumption and established that Pro-

environment Intentions is significantly related to adoption through attitude (indirect effect = 0.291, LLCI = 0.124, ULCI = 0.563, p < 0.05).
Further from the analysis, it was found that after introducing attitude the direct effect of pro-environment Intentions on adoption of electric vehicles(β = 0.32, p < 0.05) had decreased and had become significant (direct effect = 0.28, LLCI = 0.147, ULCI= 0.472, p = 0.006) which indicates partial mediation.
Hypothesis 5 - (H5) stated attitude of Consumers mediates the relationship between subjective norms & Adoption of electric vehicles. The study found support for this assumption and established that subjective norms is significantly related to adoption

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through attitude (indirect effect = 0.099, LLCI = 0.025, ULCI = 0.166, p < 0.05).

Further from the analysis, it was found that after introducing attitude the direct effect of subjective

norms on adoption of electric vehicles (β = 0.363, p < 0.05) had decreased and had become significant (direct effect = 0.32, LLCI = 0.227, ULCI= 0.421, p = 0.001) which indicates partial mediation.
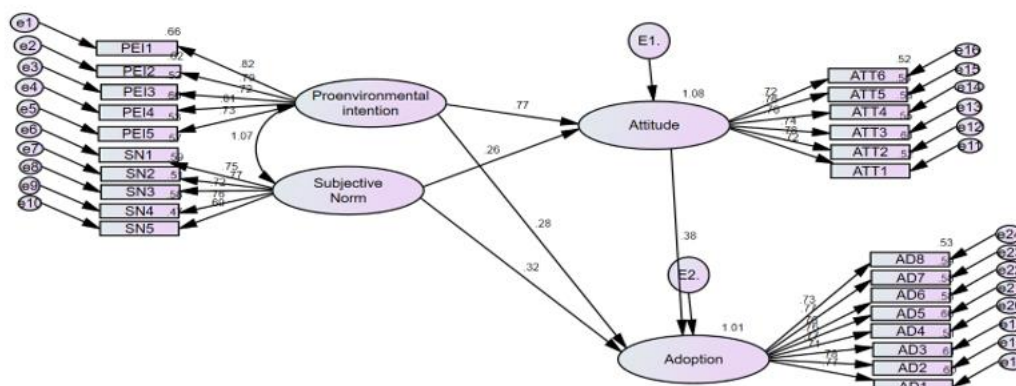

Figure 1 Structural Model

DISCUSSION

The findings of this study confirm that pro-environment intention have a positive impact on the adoption of electric cars. Past research studies have also established a positive & significant connection between environment concerns, attitudes of consumers & adoption of electric cars (Kim & Choi,2005, Vijay Gopal, 2018). However, the consumer's perception & attitude encompasses both affirmative as well as dissenting attitudes toward the purchase of electric cars. Consumer attitudes toward electric cars as an environmentally-friendly vehicle have been found to be a positive decisive factor influencing adoption of electric factor. However, this study shows that in Kerala the attitudinal factor of consumers towards technical features & operational cost of electric cars compared to conventional cars is found to be a hindrance in translating pro-environment intentions into to adoption of electric cars. People are hesitant to buy electric cars because they are concerned about the range & how far the electric cars are suitable for long-distance travel. Layman perceives electric cars as more complex than internal combustion engines in regular cars. The study shows that consumers of Kerala are skeptical about the settlement of electricity charges for instance how in a multi-tenant building a charging infrastructure can be created & the consumer be invoiced for the electricity consumed. Another prevalent factor is the consumers' attitude towards government policies of providing adequate charging infrastructure. A dearth of charging infrastructure is a major source of apprehension for consumers. Hence electric car companies & governments can improve the awareness as well as product knowledge of their target consumers using

social media platforms. Another finding of this study is that the subjective norms of an individual have a strong positive influence on the purchasing behaviour of the consumers. Informal understanding within in social groups pave way for common acceptable behaviors. Consumer interface apps can help consumers to locate all charging stations in the cities including the real-time status of charging. Harnessing the power of social influence & social media platforms is one of the most effective ways to elicit pro-environmental behaviour in the consumption of electric cars.

Recommendation to reduce Green gap

The role of mediating variable attitude in translating the pro - environment intention of consumers to adopting electric cars is very evident in this study. The consumer attitude towards ecological wellbeing induces pro-environment intentions but the attitude of consumers towards technical features of electric cars & government policies deter them from buying it. Therefore to improve the green trust among consumers the automobile companies can release more trustworthy information on the technical aspects of the working of electric cars , its mileage , operational efficiency which will remove all misconception about electric cars in the minds of the people. Since subjective norms have vital role in Kerala society, Harnessing the power of social influence through social media platform can be used as a most effective way to motivate & enhance the buying of electric cars. To increase the impact of social influence, testimony of existing users of electric cars can be aired through all social & mass medias. Government can give extra mileage to tax exemption associated with buying of electric cars.

Public private partnerships in Kerala can add momentum to growth of charging infra structure.

Limitation of the study

This study proves highly relevant to contemporary society by exploring and testing the factors affecting the purchase of electric cars, however, only the perception of residents of Kerala a southern state in India has been captured. The perceived social pressure or subjective norms could be different in different economic strata but this study does not differentiate between the subjective norms of different economic & social strata. The attitude of people may change with the employment type however the attitude of consumers based on whether they possess government jobs, private or self-employment has not been considered for this study.

CONCLUSION

The electric car is an eco-friendly mobility solution that has the potential to significantly reduce carbon emissions & conserve nature. It can transform India into a greener & cleaner city. Reducing the green gap is vital not just for meeting corporate sustainability goals but for preserving the planet for future generations. Hence both policymakers, as well as car manufacturers, can use various social media platforms to create awareness about electric cars among common people & encourage sustainable consumption.

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Annexure I

Table 2.1 Descriptive Statistics of the Pro Environmental Behaviour

Table 2.2 Descriptive Statistics of the subjective norms

	SN1 Most of my friends in social media platform use electric cars	SN2 I feel moral obligation to use ELECTRIC CARS as part of my social networks	SN3 I take professional advice before I buy a car	SN4 Owning an electric car will show my belief & what I stand for	SN5 I would have better social status if I own a electric car
Mean	3.09	3.26	3.05	3.07	3.11
Std. Deviation	1.379	1.205	1.189	1.288	1.216

Table 2.3 - Descriptive Statistics of Attitude

	ATT1 Electric cars are more complex than conventional cars	ATT2 I am not sure if government will set up enough charging stations	ATT3 I believe electric cars are the right for the environmental even when it takes more more cost	ATT4 I feel electric cars will reduce pollution	ATT5 I am concerned about the range of electric cars & how far it cam travel.	ATT6 I don't feel confident about government policies regarding financial settlement of electricity used to charge electric cars
Mean	3.14	3.13	3.22	3.04	3.28	3.15
Std. Deviation	1.240	1.312	1.226	1.249	1.201	1.241

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Table 2.4 - Descriptive Statistics of Adoption of electric cars

	AD1 I am concerned about availability of spare parts when I consider buying electric cars	AD2 I have only limited brands to choose from while buying a electric cars	AD3 If there are more servicing facilities in kerala I would only buys electric cars	AD4 I want to buy an electric car in the next five years	AD5 I would. buy electric car if there was more charging stations	AD6 Buying electric cars will pay off in the long run	AD7 I know the cost of electric car is equal to cost of fuel needed for regular car	AD8 I prefer electric cars to conventional cars
Mean	3.14	3.11	3.12	3.20	3.26	3.19	3.18	3.15
Std. Deviation	1.291	1.264	1.208	1.197	1.273	1.303	1.253	1.238