SUSTAINABILITY AS A BUSINESS PURPOSE: A CASE OF ELECTRIC VEHICLES

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Abstract

Sustainability is an important aspect of business purposes in organizations. It has been emphasized by a number of corporations and firms as a key component of their long-term success (Grove & Clouse, 2018). Using electric vehicles (EVs) as a context for sustainable products, our empirical study attempts to understand the factors that influence the purchase of EVs in India. The snowball sampling technique has been used to collect data from 156 respondents who own a car or were considering buying one. The research uses a rational choice theory as a framework for analysis. The key findings of the study include a new conceptual model, the responsible innovation sustainable eco-friendly (RISE) adoption model, and a set of new additional factors such as financial incentives, environmental concerns, and cost constraints, in addition to the existing behavioral factors, charging infrastructure, and external influences that are present in the literature. Given the current focus on sustainability and EVs across the world, this study is highly relevant for automobile companies to formulate their EVs strategies and also give pointers for policymaking in this area. There are several theoretical and managerial implications for various stakeholders outlined.

Keywords: Sustainability, Electric Vehicles, Business Purpose, New Product Adoption, Automobile Industry, Rational Choice Theory

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1. INTRODUCTION

In the last two decades, one word quite often holds and connects countries, companies, and consumers. This word is "sustainability". Rising pollution, carbon footprint, and deterioration of air quality have been causing anxiety across the world. India was ranked 46 in the list of the world's 100 top most polluted countries. Switzerland-based climate group firm and technology partner of the United Nations Environmental Program (UNEP), IQAir, identified the top 3 cities in India — Delhi, Mumbai, and Kolkata — as having the worst air quality index (IQAir, n.d.). The State and Central Governments have been proposing guidelines to reduce vehicle emissions. But how do EVs contribute to sustainability? Though the manufacturing process is the same for both conventional and electric cars, the latter generates more emissions during production. After a certain point of break-even, their carbon footprint is reduced compared to that of conventional vehicles. The Government of India

encourages reusable batteries and environmentally friendly technologies in this regard. In 2016, the Government decided to skip BS5 emission restrictions and leap straight to BS6 emission norms from BS4, in response to increasing air pollution. In April 2020, they began implementing the sixth rule on vehicular emissions. The most significant difference between the BS4 and BS6 emission regulations is the amount of particulate matter, sulfur and nitrogen oxides. The amount of sulfur traces in BS4 fuel is five times that of BS6 fuel (Vats, Singhal, Tripathy, & Jena, 2022). The Government of India has planned US$3.5 billion as incentives to boost the production and export of clean technology vehicles. In National Electric Mobility Mission 2020, the Government has propelled Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) in India to encourage the manufacturing of electric and hybrid vehicle technology. They also announced incentives and subsidies and started promoting sustainable product development and related infrastructure. As the green environment goes mainstream, auto manufacturers spend greatly on electrically powered vehicles which are environment friendly. India is one of the world's fastest-growing (5th major) vehicle markets, the electric vehicle penetration in the two-wheeler segment is estimated to be at 9%, could increase to Rs.12000 crores, and is further estimated to reach Rs.50000 crores by 2025. It is one of the major sectors of the country employing millions of people directly or indirectly (India Brand Equity Foundation [IBEF], n.d.).

The automobile industry is affected by the four megatrends connectivity, autonomy, shared mobility, and electrification (CASE) technologies (Deloitte, n.d.). This digital evolution of new technologies has a significant impact on the growth of the automobile industry. It has brought an incredible change in the way we manufacture and assemble products, carry out processes, and the way we drive. Amongst this transformation, the COVID-19 outburst is putting additional stress on the industry (Eversmann, Choudhury, Irwin, & Seiberth, 2020). The pandemic tested companies and intensified evaluations of their corporate business models and risk readiness. Firms all over the world had to shut their operations down in several phases (Ford, ElAlfy, Wilson, & Weber, 2021). During 2019–2021, the industry experienced huge semi-conductor shortages and other supply chain interruptions caused by extended COVID-19 lockdowns (Burkacky, Lingemann, & Pototzky, 2021).

Despite this, a host of other issues such as the new Bharat Stage VI transition, goods and services tax (GST) regime, rise in fuel prices, insurance premium, high-interest rate, and non-banking finance corporation (NBFC) liquidity crisis have affected the automobile industry in India (Khan, 2021). NBFCs have been a strong pillar of the automobile industry and its liquidity crunch severely affected the automobile industry, as they are the key moneylenders for supporting automobile purchases in rural and semi-urban areas, where credit accessibility from the banks is generally challenging.

Another important factor that drives the future of the automobile industry is sustainable technologies. Governments across the world are now prioritizing their focus on clean and sustainable mobility. For instance, the Government of India recently revised the FAME II scheme to make EVs more affordable. Under this scheme, as of November 2021, 1,65,000 electric vehicles have been supported (US$75.16 million as a demand incentive) to promote sustainable mobility (Bhardwaj, 2022).

As EVs go mainstream, let us understand where it all started.

The history of electric cars traces back to the 19th century. Anyos Jedlik, a Hungarian who invented the small car with an electric motor in 1828. Robert Anderson, a Scottish inventor, developed an electric carriage (1832–1839, exact year uncertain). In 1835, Professor Stratingh from Groningen, Holland designed a small electric car and built it with his assistant Christopher Becker. Thomas Davenport and Scotsman Robert Davidson built electric vehicles using non-rechargeable electric cells in 1842 (Bellis, 2019).

In India, the first electric vehicle *Vikram Safa* (three-wheeler) was made and sold by Scooters, India Pvt Ltd. (Evautocars, 2017). After 2010, the Government announced subsidies to support electric vehicles. Fast forward to 2022, when the Government and auto companies are working together to reduce carbon emissions.

The market is broadly segmented into four segments, namely: two-wheelers, three-wheelers, passenger cars, and commercial vehicles. According to the power source, the market is further segmented into hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), and fuel cell electric vehicles (FCEVs).

Though electric vehicles are not new in India, the country continues to face challenges such as user acceptance. Semiconductor shortages and other supply chain disruptions, poor supply networks, pose challenges to the automobile industry.

Many studies have found that environmental performance is the key motivator for the adoption of EVs. For example, environmental benefits, environmental consciousness, environmental awareness, pro-environmental behavior, reduced environmental risk, and sustainable environmental aspects are widely discussed in relation to the adoption of EVs. The purchase intention of EVs has an indirect relationship with eco-friendly aspects (Mishra & Malhotra, 2019; Wang, Li, & Zhao, 2017; Biresselioglu, Kaplan, & Yilmaz, 2018; Khurana, Ravi Kumar, & Sidhpuria, 2019; Singh, Singh, & Vaibhav, 2020).

Consumers choose to buy an EV due to several reasons. The logical answers to EV adoption are well researched and documented using a rational choice theory (RCT), as it provides answers to the consumer decision-making process. The rational choice methodology has driven "the construction of a transdisciplinary paradigm [that has] transformed the conceptualization and methods of many disciplines" (Balme, as cited in Chaserant, Girard, & Pietri, 2016, p 102). Several scholars in management used RCT because it takes a logical and convincing approach. In other words, it provides straightforward answers to the consumer's decision-making process (Smith, 1991; Posner, 1998; Carley, Krause, Lane, & Graham, 2013). This theory is used in various fields. For instance, in the economics discipline, the RCT became unchallenged and it is commonly denoted as an "economic approach" (Cinar, 2021). The RCT is an appropriate theory to explore and cognize consumer behaviors on electric vehicle adoption (Cinar, 2021). This study attempts to outline the various adoption factors of EVs using rational choice theory. In addition to RCT, our new

model uses environmental concerns, cost constraints, and financial incentives — all together to study the purchase intention of the consumers.

The remainder of the paper is structured as follows. Section 2 presents the relevant literature review. Section 3 presents the methodology and proposed model. Section 4 outlines an analysis followed by discussions in Section 5. Section 6 discusses conclusions, limitations, and scope for future research.

2. LITERATURE REVIEW

The recent COVID-19 pandemic not only shook the countries and companies but prompted many consumers across the world to rethink their product choices. Due to the heightened awareness of the environment and health, consumers started seeking sustainable products and practices.

The population and earning prospects of a large segment of society have boosted the need for vehicles. As a result, there has been a rise in pollution. Vehicle emissions are one of the leading drivers of air pollution in New Delhi (capital city of India), and the number of vehicles on the road as well as vehicle pollution, is expected to continue to rise (Vidhi & Shrivastava, 2018). This drives home the demand for sustainable growth and EVs are a strong alternative in this regard. Researchers have studied the degree to which the public embraces EVs, the tools used to measure the advantages and risks of EVs, and the variables influencing their attitudes towards EVs. Safety, expense, legislation, productivity, efficiency, and environmental effect have been described as six factors related to EV acceptance (Casley, Jardim, & Quartulli, 2013).

Consumer adoption intentions are influenced by a number of important aspects such as performance characteristics, economic rewards, environmental awareness, social pressures, and psychological factors. For example, the adoption of electric vehicles is more likely among consumers that have a positive attitude toward environmental concerns. The consumers' perception of EVs with respect to their attributes such as features, price, and technology also directly affect their adoption behavior (Pradeep, Amshala, & Kadali, 2021; Schuitema, Anable, Skippon, & Kinnear, 2013).

Consumers are compelled to project a positive image, which they can do by purchasing such products (He & Veronesi, 2017). Consumer impression of the symbolic qualities of EVs is positively associated with their EV adoption choice, according to previous studies (Noppers, Keizer, Milovanovic, & Steg, 2016; Egbue & Long, 2012; Schuitema et al., 2013). Social impact (adoption rate of EVs in an individual's social circle) alters people's preferences for these vehicles; however, the effect is minimal (Kim, Rasouli, & Timmermans, 2014).

Another factor that controls adoption behavior is the high price associated with the acquisition of EVs, even though it is a one-time investment cost and a finite driving range. The low range of EVs is a well-known technological adoption hurdle (Skippon, 2014).

Literature assessment also shows that environmentally aware and conscious consumers are nowadays more frequently aligning with a long-term strategy and trade-offs that evaluate the current and upcoming financial positions, meaning that even if the return on investment in the short-term is higher, they prefer to stick to long-term benefits associated with the environmental benefits (Li, Davis, Lukszo, & Weijnen, 2016). In addition, consumers who place a premium on societal pressures and are influenced by primary adopters are very important in the study of adoption intention since these secondary adopters weigh their purchase decision on whether others would approve or disapprove of their ownership of an EV (Adnan, Nordin, Rahman, & Amini, 2017).

Various scholars studied the total cost of ownership in relation to the adoption of EVs in different countries. The financial cost differs from country to country as it depends on tax, insurance, subsidies, and energy costs. The analysis includes several dimensions of financial cost like acquiring cost, repairs and maintenance cost, depreciation, energy, etc. (Gnann, Plötz, Funke, & Wietschel, 2015; Breetz & Salon, 2018).

Several factors influence consumers' decision to purchase an EV. Individuals find it difficult to determine which options or products to consider above others as there are numerous things to reflect upon. The versatility of the RCT lends itself to application in many areas, including EVs. Numerous researchers in EV adoption studies have considered EV adoption behavior as rational and have studied their tendency to adopt EVs and their attitudes to EV purchase behaviors in different magnitudes (Cinar, 2021; Jian & Wei, 2019; Rezvani, Jansson, & Bodin, 2015; Carley et al., 2013; Jensen, Cherchi, & Mabit, 2013).

After reviewing the past work of literature, the researchers identified the following key variables, namely: constraints, utility, and belief. The authors have selected the same variables adopted by Jian and Wei (2019) and Cinar (2021) to study the relevance of the model in the Indian EV context. To make this model more robust, the authors also included one more variable, namely experts' influence, to overcome the limitations of the RCT model.

Constraints play a significant part in consumer behavior in rational choice theory. Consumers often face constraints when they want to adopt a product or service, for instance, financial difficulties. This is especially crucial in the case of EV adoption because EVs are more expensive (Cinar, 2021).

The underlying premise in the RCT states that consumer behavior is based upon welfare and utility maximization. Because most individuals purchase EVs for day-to-day use, utility is vital (Rezvani et al., 2015). Consumers need to maximize their usefulness by making the best choice in terms of vehicle adoption (Cinar, 2021).

The next important unit in the RCT is beliefs. It is affected by the individual value system. For instance, individual who cares about the environment is more likely to choose EVs.

One limitation of the RCT is its individual focus and this has been addressed in our new model. The RCT assumes that individual action is instrumental, meaning it can be explained by the actors' will to reach certain goals, but Boudon (1998) points out that action is not supposed to be always instrumental and which makes the RCT non-applicable to all types of action (Green, 2002; Cinar, 2021). An external influence (experts) variable has been considered in our study along with the existing interpersonal influence.

Electric vehicles in India are costlier than traditional vehicles (Team Ackodrive, 2022). Thus, consumers will be making a rational evaluation of

various factors before coming to a decision related to buying an EV. We will validate the significance of factors such as financial incentives, financial cost, and charging infrastructure as sub-categories under constraint; vehicle performance as a utility factor, environmental concerns, and external and internal influences, to predict the purchase intention of the consumers.

3. RESEARCH METHODOLOGY

Quantitative research was done to test the above-mentioned hypotheses that would impact the EV purchase. Validation of the hypotheses was carried out using a survey form with a questionnaire instrument that measured financial incentives, vehicle performance, financial cost, infrastructure, environmental concerns, external influence, and interpersonal influence to 156 respondents.

The target group for our study was people who either owned a car or were willing to buy a car and had basic knowledge about EVs. Although there are several non-probability sampling strategies, snowball sampling (which comes under haphazard sampling and volunteer sampling) was chosen for this study (Saunders, Lewis, & Thornhill, 2016). Respondents were encouraged to share the questionnaire with their friends, coworkers, and family members and urge them to participate (Saunders et al., 2016). This strategy may be effective "if a researcher lacks a sample frame or has limited ability to contact study participants" (Scherbaum & Shockley, 2015, p. 39). Given the COVID-19 pandemic, gaining access to the respondents was difficult and thus we opted for a non-probability sampling method such as snowball sampling as it was easier to reach out to people through referrals. However, to maintain the heterogeneity in the responses collected, a slight variation of the snowball sampling method was adopted, known as "respondent-driven sampling" to only collect responses based on the aforementioned criteria related to target group selection. Furthermore, to authenticate the responses, reverse scoring questions were also added to eliminate random answers. We observed that 79% of the respondents were males and 21% were females based on the responses. In terms of income, 36.31% are in the < 5,00,000 group, 29.94% are in the > 10,00,000 group, and 33.76% are in the 5,00,000–10,00,000 group. Respondents from various demographics were administered the instrument on a Likert scale (1–5). The questionnaire was designed for all the variables by adopting a scaling technique (Selltiz et al., 1976) on a 5-point Likert scale where 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, and 5 = Strongly agree.

In a non-COVID scenario, respondents can fill out the questionnaire on paper and send it in an envelope, or they can fill it out online using a specified link. A stratified sampling approach might potentially be used to discover adequate numbers for each of the designated categories.

3.1. Proposed model

Different researchers have used different theoretical frameworks to study the purchase intention of consumers toward the adoption of EVs. For instance, attributes such as behavior intention, attitude, socio-demographic characteristics, perceived risk, and environmental ease directly affect the acquisition of EVs. When compared to gasoline cars, EVs' restricted battery technology may pose a higher traffic risk (for example, a battery fire). A larger perceived risk lever could result in a decreased buying intention. Research on the topic of EVs using new product adoption and consumer behavior theories has witnessed a dramatic increase over the past decade. This is supported by marked increases in practitioner and academic articles, and conferences in the area. Several scholars studied new product adoption, and consumer behavior using various theories. In the EV context, researchers studied a theory of planned behavior, TPB (Adnan, Nordin, Amini, & Langove, 2018; Türnau, 2015), a diffusion of innovation theory, DOI, a technology acceptance model, TAM (Wolff & Madlener, 2018), a theory of reasoned action, TRA (Peters & Dütschke, 2014), a rational choice theory, RCT (Türnau, 2015; Anable, Skippon, Schuitema, & Kinnear, 2011), and a market diffusion theory, MDT (Kim, Oh, Park, & Joo, 2018).

It is important for any researcher to comprehend the basic theories relating to the research subject. This section explains the key theories discussed by the various scholars in the context of sustainable product adoption (Table 1).

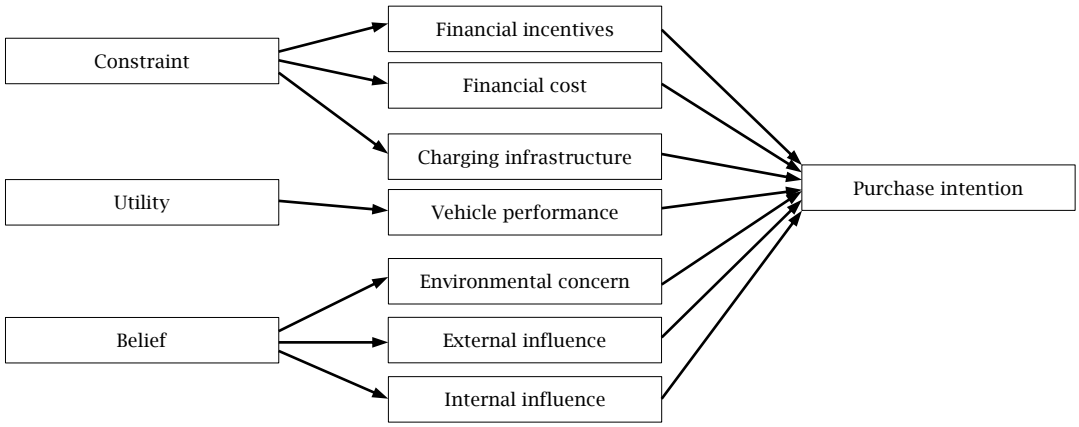
Table 1. Consumer behavior theories

Theory	*Developed by*	*Definition*
Theory of reasoned action (TRA)	Fishbein and Ajzen (1975)	The theory of reasoned actions outlines the relationship between behavior and attitude. It predicts how individuals will act based on their preconceived notions, attitudes, and intentions.
Theory of planned behavior (TPB)	Ajzen (1991)	The theory of reasoned actions extended as the theory of planned behavior (TPB) in 1980. The key factor to this model is behavioral intentions. These behavioral intentions are influenced by the expected outcome, risks, and benefits associated with that outcome.
Diffusion of innovation theory (DOI)	Rogers (1962)	The diffusion of innovations theory outlines how, why innovative technological and further progressions spread; and at what rate they spread ranging from innovators to laggards.
Technology acceptance model (TAM)	Davis (1989)	The technology acceptance model is an information systems framework or model to study technology adoption. Like the TRA and TPB, this model also uses behavioral intention as a factor. These theory models how operators or users accept/adopt and use technology.
Rational choice theory (RCT)	Smith (1776)	The rational choice theory (RCT) originated in the 18th century. The theory has been developed upon and extended to include other standpoints. The RCT constitutes a set of premises that help understand behavioral intentions (social and economic behavior). In other words, the RCT is used to model decision-making, to know the behavior of a people in terms of individual actions as explained through rationality. It is more and more practically applied to other areas for instance microeconomics, behavioral science, politics, etc.

Source: Authors' elaboration.

Figure 1 is an illustration of the conceptual model developed for our research. Though many research studies have been attempted on consumer adoption of EVs in various countries, it is very limited in India. Our study is partly based on the RCT and is empirically tested. The extant literature focuses mainly on behavioral factors, charging infrastructure, and external influences. In addition to this, our new model used environmental concerns, cost constraints, and financial incentives altogether, to study the purchase intention of the consumers. Organizations will now be able to focus more sharply on their marketing strategy and resource allocation to be able to enhance the adoption of EVs.

Figure 1. Responsible innovations sustainable eco-friendly (RISE) product adoption model: Extension of the RCT



3.2. Hypotheses

Hypothesis generation aids in understanding the business problem as we dive deep into concluding the various factors affecting our target variable. It is highly useful to get a much better idea of what are the key factors that are accountable to solve the problem.

3.2.1. Financial incentives

The initial upfront cost is a crucial aspect that buyers evaluate when purchasing an EV. Moreover, financial incentives given at the time of buying EVs such as direct subsidies, fiscal incentives, etc., seem to attract customers to choose EVs (Zhang, Xie, Rao, & Liang, 2014). The government incentive plans might be regarded as the essential aspects of the financial incentives. Other than these factors, the company that is manufacturing EVs can also provide incentives such as lease facilities, corporate discounts, etc. Thus, financial incentives can be considered an important factor for our research.

H1: Financial incentives impact EV purchase intention positively.

3.2.2. Financial costs

Since EVs have very few moving components, they have a lower maintenance cost, which plays a vital role in defining customer perception of EVs. The entire operating cost of an EV is also reduced because power is less expensive than other options. Two other major costs in EVs are purchase price and battery cost (Wu, Liao, Wang, & Chen, 2019). These are the major costs that customers have to bear while owing an EV.

H2: Financial (ownership) costs impact EV purchase intention positively.

3.2.3. Infrastructure

The availability of charging stations is a crucial aspect of the future adoption of EVs (Biresselioglu et al., 2018; Neves, Marques, & Fuinhas, 2018). Parking spaces are becoming scarce and should be reconfigured to optimize EV access to chargers (Bonges & Lusk, 2016) and other infrastructure changes are required to be made to make people adopt EVs like implementing proper EV etiquette and practices. The precision of location maps is another critical factor influencing customer perception that we must consider. The establishment of EV standards and regulations is also a significant component in facilitating the wider use of EVs.

H3: Infrastructure impacts EV purchase intention positively.

3.2.4. Vehicle performance

Vehicle performance is seen as a key aspect affecting consumer preferences (Wu et al., 2019). Customers are particularly worried about vehicle performance in difficult situations, for instance, climate conditions, at night-time, or in low visibility. The charging speed of the battery is considered one of the most important factors and with it, the aspects of fast charging as well as slow charging adoption should also be taken into consideration (Zhang, Niu, Li, Wang, & He, 2021). Battery performance can also help in the reduction of range anxiety. Various technology advancement in EVs also plays an important role in measuring vehicle performance such as connected features, geo-fencing, drive modes, etc. Driving mileage, power, and torque are important factors when measuring the performance of EVs.

H4: Vehicle performance impacts EV purchase intention positively.

3.2.5. Environmental concerns

The persistent and accelerating overuse and degradation of natural resources is a serious threat to human beings and their climate. An increase in environmental concern and information about the consequences of the continuing degradation of the environment for future generations seems to be an absolute necessity. Environmental concern refers to a person's knowledge of environmental issues and willingness to address such issues. Studies found that those who are worried about the environmental issue are more likely to buy an EV (Pierre, Jemelin, & Louvet, 2011). To support these findings, it has been found from a consumer survey that environmental benefits are key factors in the adoption of EVs (Peters & Dütschke, 2014). The adoption of EVs should not only be done with the sole purpose of energy conservation but should also emphasize the protection of the environment.

H5: Environmental concerns impact EV purchase intention positively.

3.2.6. Experts' influence

Experts' influence refers to the impact that expert opinions on a particular topic, mass media, advertisements, and articles have on consumers' intention on buying a product (Bhattacherjee, 2000). This study hypothesizes the impact of external influence on consumers' purchase intention of EVs.

H6: Experts' influence impact EV purchase intention positively.

3.2.7. Interpersonal influence

Consumers' readiness to accept new technology has been found to be influenced by interpersonal influence, or the impact of others represented by family, friends, coworkers, or social groups with whom they have regular encounters (Taylor & Todd, 1995). The paper hypothesizes the influence of interpersonal influence on consumers' purchase intention of EVs.

H7: Interpersonal influence impacts EV purchase intention positively.

4. RESULTS

4.1. Reliability test

Financial incentives, vehicle performance, financial cost, infrastructure, environmental concerns, and interpersonal influence all have Cronbach's alpha coefficients better than 0.6, indicating that the items had reasonably good internal consistency. In the majority of study scenarios, a dependability coefficient of 0.60 or above is regarded as "acceptable". The dependability coefficient for the variable external influence was less than 0.60. As a result, the external influence was not examined further.

To identify the existence of the relationship between the independent variables and the purchase intention of the customers, Kendall's tau-b correlation test is performed from the response rating. The correlation matrix aids in the comprehension of the variables' relationship. The existence of a positive association between some of the common traits is discovered in this research by looking at the r values of all the variables above.

The Kendall rank coefficient is often used as a test statistic in a statistical hypothesis test to establish whether two variables may be regarded as statistically dependent. The Kendall τ coefficient is defined as:

$$\tau = (Number\ of\ Concordant\ Pairs) - (Number\ of\ Disconcordant\ Pairs)/[n(n-1)/2] \quad (1)$$

A factor rotation test is done on these variables under factor analysis to further establish the association between these variables and to determine the critical factors.

4.2. Factor analysis

The samples must be examined for their relationship with the variables indicated before any factor analysis test can be done. To investigate this, the KMO test of measuring sample adequacy is used to calculate sampling adequacy.

To create a component matrix, the factor analysis test examines the samples and differentiates the variables into multiple components. Variables with a higher factor loading (more than 0.65) are generally categorized as factors that impact the goal of the study.

The variables are grouped under different factors (based on the rotated component matrix):

Factor 1: Environmental concerns

1) I care about reducing carbon emissions and alleviating the energy shortage problems.

2) I have high environmental values.

3) I am a trendsetter for environment-friendly technologies.

4) I use other environment-friendly products.

Factor 2: Interpersonal influence

1) I am recommended to buy an EV by my family.

2) I will buy an EV based on the recommendations of my friends.

3) Most people who are important to me would appreciate me if I bought an EV.

Factor 3: Vehicle performance

1) I feel that EVs generally have good functionality.

2) I feel that EVs generally have good horsepower.

3) I feel that EVs give a good range for my requirements.

Factor 4: Infrastructure

1) The availability of charging stations for EVs will be sufficient.

2) The time taken to charge an EV is fast enough.

Factor 5: Financial cost

1) The cost of repairs for EVs is less compared to combustion vehicles.

2) The cost of maintenance is affordable for EVs compared to combustion vehicles.

Factor 6: Financial incentives

1) The subsidies, including availing loans at better rates for purchasing EVs are helpful.

2) Subsidies and tax benefits are important for me to purchase EVs.

The results from the rotated component matrix and component transformation matrix indicate variables identified have been segregated into six factors or components wherein, the first component consists of *environmental concerns*, the second one *interpersonal influence*, the third one *vehicle performance*, the fourth one *infrastructure*, the fifth one *financial cost*, and the sixth one *financial incentive*.

As a result, these six factors — *environmental concerns*, *interpersonal influence*, *vehicle performance*, *infrastructure*, *financial cost*, and *financial incentives* — were treated as independent variables and their relevance in connection to EV purchase intent was assessed using the regression technique.

4.3. Regression statistics

The R-squared for this model is 9.6%, which means that when all other variables are held constant, this model explains 9.6% of the variation, i.e., *environmental concerns*, *interpersonal influence*, *vehicle performance*, *infrastructure*, *financial cost*, and *financial incentives*. Regarding the R-squared value, further analysis of variance reveals that the variables utilized in the model are significant.

The rotated component matrix of the factor analysis resulting variables were then used to create a "factor score" in SPSS for running a regression statistic to determine if these variables are significant or not. Factors 2, 3, 4, and 5 are found to be significant at a 90% confidence level for predicting the outcome variable (Sig. < 0.1) whereas Factor 1 is not significant with the dependent (predictor) variable — *purchase intention* at Sig. 0.182 (or 18.2%) and Factor 6 is not significant with the dependent (predictor) variable — *purchase intention* at Sig. 0.912 (or 91.2%).

When all other factors are held constant, the coefficients table shows that for every 1% rise in Factor 2, there is a 0.055 (5.5%) drop in purchase intention. Similarly, a 1% rise in Factor 3 results in a 0.054 (5.4%) drop in purchase intention while all other factors stay unchanged. Similarly, when Factor 4 increases by 1%, purchase intention increases by 0.049 (4.9%) while all other factors stay unchanged. Furthermore, when Factor 5 is increased by 1%, purchase intention increases by 0.057 (5.7%) while all other factors stay unchanged.

Thus, the factors evaluated for Factors 2, 3, 4, and 5 are described in Table 2.

Table 2. Variables identified

Factors	*Variables identified*
Factor 2: Interpersonal influence	1. I am recommended to buy an EV by my family.
	2. I will buy an EV based on the recommendations of my friends.
	3. Most people who are important to me would appreciate me if I bought an EV.
Factor 3: Vehicle performance	1. I feel that EVs generally have good functionality.
	2. I feel that EVs generally have good horsepower.
	3. I feel that EVs give a good range for my requirements.
Factor 4: Infrastructure	1. The availability of charging stations for EVs will be sufficient.
	2. The time taken to charge an EV is fast enough.
Factor 5: Financial cost	1. The cost of repairs for EVs is less compared to combustion vehicles.
	2. The cost of maintenance is affordable for EVs compared to combustion vehicles.

Table 3 summarizes the hypotheses supported by this study among the testing of seven hypotheses set out at the beginning of this research. Hypotheses supported summary table highlights the outcomes of several statistical techniques used to assess the hypotheses developed on the sustainable new product adoption of EVs.

Table 3. Hypotheses supported summary

Hypothesis	*Hypothesis statement*	*Factor*	*Significance value*	*R-squared*	*Result*
H5	Environmental concerns impact EV purchase intention positively.	1	0.182	0.096	Not supported
H7	Interpersonal influence impacts EV purchase intention positively.	2	0.056		Supported
H4	Vehicle performance impacts EV purchase intention positively.	3	0.062		Supported
H3	Infrastructure impacts EV purchase intention positively.	4	0.088		Supported
H2	Financial (ownership) cost impacts EV purchase intention positively.	5	0.048		Supported
H1	Financial incentives impact EV purchase intention positively.	6	0.912		Not supported

Only four of the six hypotheses seem to be supported: interpersonal influence, vehicle performance, infrastructure, and financial cost. The other hypotheses, including environmental concerns and financial incentives, are not statistically supported.

Based on the regression analysis, the unstandardized equation will be as follows:

$$Purchase\ intention = 1.159 - 0.055 * Factor\ 2 - 0.054 * Factor\ 3 + 0.049 * Factor\ 4 + 0.057 * Factor\ 5 \quad (2)$$

5. DISCUSSION

This study on sustainable new product adoption using EVs has a lot to offer in terms of implications. The new dimension of environmental concerns highlights the growing awareness of the eco-friendly preferences of Indian consumers. But at what cost, is the question raised by the other new dimension of financial incentives. Proper government policy on EVs and well-structured incentives to auto manufacturers and consumers will increase the adoption rate. Emerging countries like India is a price-sensitive market. There is a big difference between the middle and top segments. The key challenge in front of the automobile industry is to manufacture electric vehicles and provide a new experience at an affordable cost (Ali & Naushad, 2022).

Consumers seem to be more conscious about their environment than ever before and it has also been observed that the influence of family members and friends has an impact on consumers' decision of buying an EV, and these results are consistent with previous research findings in India (Shankar & Kumari, 2019). Apart from that, interpersonal influence also has a substantial influence on the adoption of EVs that proves that society does influence purchasing decisions (Bhalla, Ali, & Nazneen, 2018). Thus, targeted advertisements should be designed to increase awareness among people.

Aspects of interpersonal influence, vehicle performance, infrastructure, and financial cost emerge as significant independent variables, indicating that any new product introduction in the sustainability category needs to address these in their business offering. For instance, compared to conventional vehicles, consumers need to spend extra time charging an EV. Charging infrastructure needs to be improved. Identifying the consumers' pain points and addressing them early will increase the adoption rate. One of the major impediments to the adoption of electric vehicles in most countries is the lack of adequate infrastructure support (Bhat, Verma, & Verma, 2022).

People are still conservative about the adoption of electric vehicles in India and this study will help the government, marketers, and manufacturers. The key theoretical contribution from the study, namely the RISE conceptual model, pioneer's knowledge of aspects of consumer purchase intention of EVs in India. The factors taken here are comprehensive compared to the earlier research. From a managerial perspective, organizations in this sector will gain richly. They will now be able to fine-tune their marketing mix and technology focus more sharply, armed with the knowledge of what will drive purchase. Resource allocation can be done accordingly. Government policymakers can take note of the concerns of the public through this study. They can formulate regulations based on what will make EVs more attractive in the Indian market.

6. CONCLUSION

Electric vehicles are an important study area and this research furthers contribution in the same. Considering the heightened awareness of sustainability, there is a consumer explosion in the desire to purchase EVs. A new conceptual model that outlines factors that drive EV adoption is a significant outcome of this study. The sample includes people who already own a car or were considering buying one in the future, and who are urban professionals in India. To that extent, the sample may not exactly be representative of the Indian population.

The industry of EVs is witnessing huge investments and participation throughout the world. At a compound annual growth rate (CAGR) of 21.7%, the worldwide electric vehicle market is expected to reach 39,208 thousand units by 2030, up from an anticipated 8,151 thousand units in 2022 (Research Markets, 2022). Manufacturers are dealing with multiple challenges by way of consumer behavioral changes required, charging infrastructure, deep financial commitments, and the uncertainty of how all these will pan out. This study attempts to aid organizations on all these fronts. Inputs by way of what factors will facilitate consumer adoption and what may be required to accelerate EVs in India are key contributions of this research.

Environmental concerns are an important area for all automakers and it is here to stay. With the UNEP flagging emission norms, manufacturers are aggressively coming up with innovations to stay afloat on this front. Despite earlier studies having focused on this aspect, our study highlights financial cost and vehicle performance as purchase drivers (even more than just the environmental concern). It is learned that the cost of buying an EV, especially the frequent battery change required, is indeed a barrier to its ownership. This is a long-term game-changer for the industry as initially it was touted that EVs were a more cost-efficient option. So, it is important to address this by way of more incentives to be given to consumers to encourage purchase.

As part of future research, a longitudinal study can be carried out, considering the rapid changes in technology and innovations in the marketplace. The conceptual model proposed could be further validated across other sustainable new products in various countries and geographies. Also, hybrid vehicles are fast making an entry and it would be interesting to learn how the model gets modified in that context. Finally, the concept of sustainability itself is dynamic, and the variables need to be adapted according to a specific context (Pingali, 2020). Given a COVID scenario where access to the population is difficult, the future study could be expanded to a large group of samples across demographics.

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