

**CUSTOMERS' PROPENSITY TO PAY FOR EVs AND
VEHICLE-TO-GRID (V2G) TECHNOLOGY WITH
REFERENCE TO COIMBATORE DISTRICT**

**1Ms. Sneha M, 2Dr. K. Lakshmi Priya, Dr. G. Gomathi
Jawahar**

1PhD Scholar

¹Division of Commerce and International Trade,
Karunya Institute of Technology and Sciences
Coimbatore, Tamil Nadu, India

Email: snehasweetym05@gmail.com

<https://orcid.org/0009-0009-5734-4131>

²Assistant Professor

Division of Commerce and International Trade,
Karunya Institute of Technology and Sciences,
Coimbatore, Tamil Nadu, India

Email: priya2012suresh@gmail.com

ORCID ID : 0000-0003-0699-8775

³Assistant Professor

Department of Mathematics,
Karunya Institute of Technology and Sciences,
Coimbatore, Tamil Nadu, India

Email: gomathi@karunya.edu

ORCID ID : 0000-0002-0361-7116

Abstract

Increased environmental awareness and the need to adopt sustainable transportation have led to a shift towards the use of EVs and V2G. The current piece of work analyses the factor influencing the willingness to buy EVs and vehicle-to-grid (V2G) technology in District Coimbatore. This paper would give an understanding of how the consumers perceive that these emerging technologies could be expected to work and how the concern about the environment/ economic advantages/ awareness of technology and aesthetics/ Influence of social media/ government initiatives / electric chargers/ reliability could all be considered as dimensions to describe the perception the consumers have against these emerging technologies. The findings

suggest that the trend of paying a premium for EVs is predominantly driven by environmental concerns, as the question of sustainability assumes greater importance in customer actions. However, economic benefits, especially long-term practicality and lower maintenance costs, are also important determinants of consumer preferences. The complexity of consumer attitudes toward EVs and V2G technology, as outlined in this research, can help policymakers, manufacturers, and marketers ensure that a sustainable form of transportation gains popularity.

Keywords: EVs, V2G Technology, Propensity to Pay, Environmental Concerns, Economic Benefits, Government Incentives, Consumer Attitudes, Sustainable Transportation.

Introduction

The global ecological problem of climate change is severe, and the transport industry is the largest source of CO₂ emissions [1]. Developing states, including India, have overtaken industrialized states in terms of emissions. The introduction of electrified means of transportation has been driven by urbanization and population growth [2]. However, urban development continues to cause environmental issues, such as air pollution and global warming [3]. In addressing these issues, the most crucial step is to promote cleaner, low-carbon-emitting vehicles as an alternative to conventional four-wheelers [4]. EVs can maximize the utilization of clean energy, minimize the amount of greenhouse gases emitted, and can be combined with renewable sources of energy [5].

Statement Of The Problem

Enhancements in technology and awareness of environmental issues are some factors fueling the global movement towards sustainable transport solutions, such as EVs and V2G. Nevertheless, the adoption level remains low due to such problems as high levels of ignorance, the perception that it is expensive, a lack of proper infrastructure, and insufficient encouragement at the governmental level. Understanding these factors is essential for developing effective adoption strategies. Going by the factors mentioned above, the following will be the areas of research on the investigation:

- What are the demographic differences in the awareness about EVs and the V2G technology in Coimbatore District?
- How is the issue of sustainability and awareness of environmental problems influencing the module of changes in consumer relations to EVs/V2G applications?
- Which are the significant variables that define the willingness to pay by customers in Coimbatore District on EVs?
- What suggestions can be given to the stakeholders in the industry as a resolution towards consumer willingness to pay for EVs and the V2G technology, based on the main factors?

Objectives Of The Study

The goal is to test the depth of awareness among potential consumers regarding electric cars

(EVs) and Vehicle-to-Grid (V2G) technology.

- This is done to examine the role that the interests in environmental concerns and the knowledge of sustainability play in shaping customer attitudes towards EV and V2G technology.

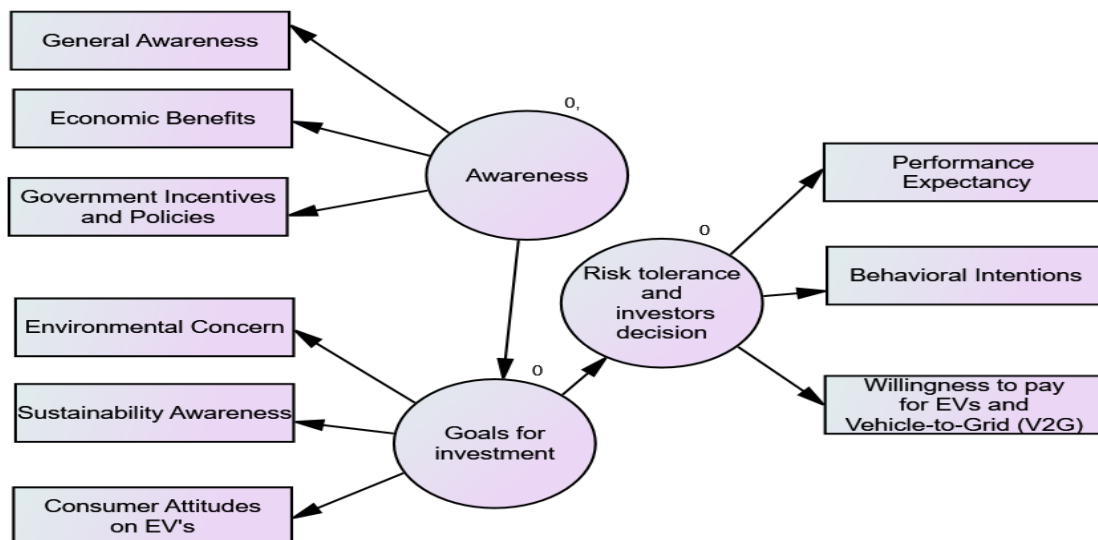
The purpose would be to identify the factors that influence the willingness of consumers to buy EVs and vehicle-to-grid applications.

- This will provide policymakers and industry players with all the information and guidance on the most effective strategies to make electric cars (EVs) and V2G applications popular. The analysis will be based on customers' willingness to pay for EVs and V2G.

Conceptual Framework

The paper focuses on the consumer attitude of EVs (EVs) and vehicle-to-grid (V2G) technology based on their environmental concerns and awareness of sustainability [6]. The opportunity afforded by EVs includes environmental benefits, partly through reduced carbon use and improved health for the majority of the population, as well as other associated benefits such as energy security and noise reduction [7]. However, they are failing in the global market due to their expensive prices [8]. Research should aim to understand consumer willingness to accept the cost of EVs in exchange for being remunerated. [9]

The usage of EVs and V2G systems is influenced by their total cost of ownership (TCO) [10]. Consumer propensity is determined by other factors which include disposable income, financing options, and long term economic gains [30]. Regarding factors that use demographics, adoption also depends on age, sex, education, and occupation. However, there has been very minimal research on them in India. [11]



This feature is the so-called total cost of ownership (TCO), which is a crucial variable in the consumer readiness to invest in EVs and vehicle-to-grid (V2G) technologies [13]. The incomes that people can afford, financing rates, and the perception of long-term economic benefits also

contribute to the adoption of EVs [12]. There have been other demographic factors, such as age, gender, education, and employment, that have been found to influence the adoption of EV; however, there are minimal studies in India. [14]The present paper attempts to address the willingness of individuals to make investments in EVs and V2G by deploying a holistic approach.[15]

Scope Of The Study

- Evaluates potential customers' awareness of EVs and V2G technology.
- Investigates how climate change, air pollution, and resource conservation affect consumer preferences.
- Identifies factors influencing customers' propensity to pay for EVs and V2G applications.
- Examines economic factors like purchase costs, fuel and maintenance savings, and incentives availability.
- Provides tips policymakers and interested parties can adopt to increase the adoption of EV and V2G, depending on the propensity of customers to pay.

Research Methodology

Type of research: Due to the quantitative nature of the study, a descriptive research design was adopted as the suitable methodology for the research.

Data collection:

Primary data were collected by administering a questionnaire to consumers. This chapter has two sections. The first section discusses the demographic characteristics of the respondents, and the second section examines the awareness and factors that affect the propensity of consumers to pay for EVs and V2G applications.

Secondary data were compiled from various sources, including journals, articles, and websites.

Sampling design: The present descriptive study aims to answer the question of whether customers in the Coimbatore district would be willing to pay for purchasing EVs and V2G applications, and whether these customers would be willing to pay more based on their preferences, attitudes, and investment prospects.

Sampling Universe: The District of Coimbatore was used as the location for the research project.

Sample size: The research will involve 350 respondents. This sample is chosen to achieve statistical significance and to account for the variability in the population.

Sampling framework: The sample framework employed is a Stratified Random sample. This approach involves segmenting the population into distinct strata or subgroups based on specific

criteria, followed by the random selection of samples from each stratum. The stratification for this study will be determined by key demographic variables, including age, income level, occupation, and residential location within Coimbatore.

Reliability of the study

Dimensions	No of items	Cronbach alpha value
General Awareness	4	0.879
Economic Benefits	3	0.912
Government Incentives and Policies	2	0.815
Environmental Concern	3	0.741
Sustainability Awareness	2	0.981
Consumer Attitudes towards EVs and V2G Technology	4	0.894
Performance Expectancy	2	0.904
Behavioural Intentions	4	0.845
Propensity to pay for EVs and V2G Technology	4	0.799

To determine the dependability of the research, a total of 50 samples were collected and analyzed. The Cronbach's alpha value for all dimensions is higher than 0.7, indicating that the data may be processed further for data gathering.

Tools used for the study: Analysis by percentage (To research the demographic factors affecting the study, One-way ANOVA (to find the difference between age and dimensions related to propensity to pay for EVs and vehicle-to-grid technology), and SEM analysis (to see the impact of consumer awareness towards EVs and V2G applications on factors influencing on propensity to pay for EV and V2G based on role of environmental concerns and sustainability awareness).

Limitations Of The Study

- The study may be conducted in specific regions or cities, and the results might not be generalizable to other areas with different economic, social, and cultural contexts. Regional variations in infrastructure, government policies, and environmental awareness can significantly impact consumer attitudes and WTP.
- The representativeness of the sample population can be a limitation.
- While the study aims to cover a broad range of factors influencing WTP, it might not capture all possible variables. Unexamined factors such as cultural influences, psychological factors, and specific local policies could also play significant roles in shaping consumer attitudes and behaviors.

Analysis And Interpretation**Demo-Sociographic variables of the respondents**

Demo-Sociographic	Particulars	Frequency	Percent
Gender	Male	177	50.6
	Female	173	49.4
	Total	350	100
Age	18-25	72	20.6
	26-35	141	40.3
	36-45	65	18.6
	46-55	72	20.6
	Total	350	100.0
Education Level	High School	72	20.6
	Undergraduate	139	39.7
	Postgraduate	76	21.7
	Doctorate	63	18.0
	Total	350	100.0
Income Level	Less than 20,000	58	16.6
	20,000 - 40,000	116	33.1
	40,001 - 60,000	87	24.9
	60,001 - 80,000	49	14.0
	More than 80,000	40	11.4
	Total	350	100.0
Occupation	Student	51	14.6
	Employed	130	37.1
	Self-employed	88	25.1
	Unemployed	51	14.6
	Retired	30	8.6
	Total	350	100

The majority of respondents are male (50.6%), with 40.3% falling within the 26 -35 age range. Most completed their undergraduate degree (39.7%), followed by postgraduate (21.7%), high

school (20.6%), and Ph.D. (18%). The majority reported an income between Rs. 20,000 and Rs. 40,000, with a significant portion falling within the Rs. 40,000-60,000 range. The majority are employed (37.1%), followed by 25.1% who are self-employed, 14.6% who are students or unemployed, and 8.6% who are retired.

Consumer awareness towards EVs and V2G applications

General Awareness: The respondents are aware of the basic concept of EVs (2.59), familiar with various electric vehicle models available on the market (2.47), how V2G technology enables vehicles to interact with the power grid (2.62), and the working mechanism of EVs, including their battery technology (2.41).

Economic Benefits: The respondents are aware of significant savings on fuel costs offered by the EVs compared to gasoline or diesel vehicles (2.85), EVs are more energy-efficient and provide cost savings through features like regenerative braking (2.97), and maintenance savings provided by the EVs compared to gasoline or diesel vehicles (2.15).

Government Incentives and Policies: The respondents are aware of the tax credits or rebates available for purchasing EVs (2.31) and are unaware of the regulations and policies related to V2G technology (3.19).

The Role of Environmental Concerns and Sustainability Awareness in Shaping Consumer Attitudes towards EVs and V2G Technology

Environmental Concern: The respondents disagree with concerns about the impact of climate change on the environment (2.95), support the use of renewable energy sources to reduce carbon footprints (2.96), and agree with being willing to purchase an electric vehicle due to its environmental benefits (3.56).

Sustainability Awareness: The respondents strongly disagree that adopting sustainable practices is essential for protecting the environment (1.71), and disagree that V2G technology can contribute to a more stable and sustainable power grid (2.81).

Consumer Attitudes towards EVs and V2G: The respondents disagree that the long-term cost savings of EVs make them a good investment (2.69), but agree that EVs are reliable and perform well compared to gasoline vehicles (2.41), and that V2G technology can provide economic benefits to EV owners through energy trading (2.27).

The Factors Influencing Customers' Propensity to Pay for EVs and Vehicle-to-Grid Technology

Performance Expectancy: The respondents disagree that using EVs will enhance eco-friendly behavior (2.57) and also disagree that using EVs will improve learning and technical activities (2.68).

Behavioural Intentions: The respondents hold a negative view towards the use of EVs in both personal and professional contexts (mean = 2.68). However, they show a substantial likelihood of adopting fully EVs in the future (2.12), expressing a strong commitment to using such

vehicles (2.91), and recommending them to others (2.88).

Propensity to pay for EV and V2G Technology: The respondents have a pessimistic perception of the financial viability of buying an electric car, with a rating of 2.85. Nevertheless, their inclination for electric cars surpasses that towards gasoline-powered vehicles (2.89). The primary factor influencing the choice to buy an electric car is its environmental sustainability (2.24). Moreover, participants express a readiness to rent an electric vehicle if they lack adequate funds (2.51).

Comparison between the age of customers and dimensions related to propensity to pay for EVs and vehicle-to-grid technology

H01: The Age of customers has a significant difference in dimensions related to propensity to pay for EVs and vehicle-to-grid applications

The study found that economic benefits, government incentives, environmental concern, sustainability awareness, performance expectancy, propensity to pay for EVs and hydrogen fuel cells (EVs and V2Gs), and age of respondents significantly differ. However, there was no significant difference in general awareness, consumer attitudes, behavioral intentions, or age. The respondents aged 18-25, 26-35, 36-45, and 46-55 were more aware of EVs and V2Gs.

Conceptual Model

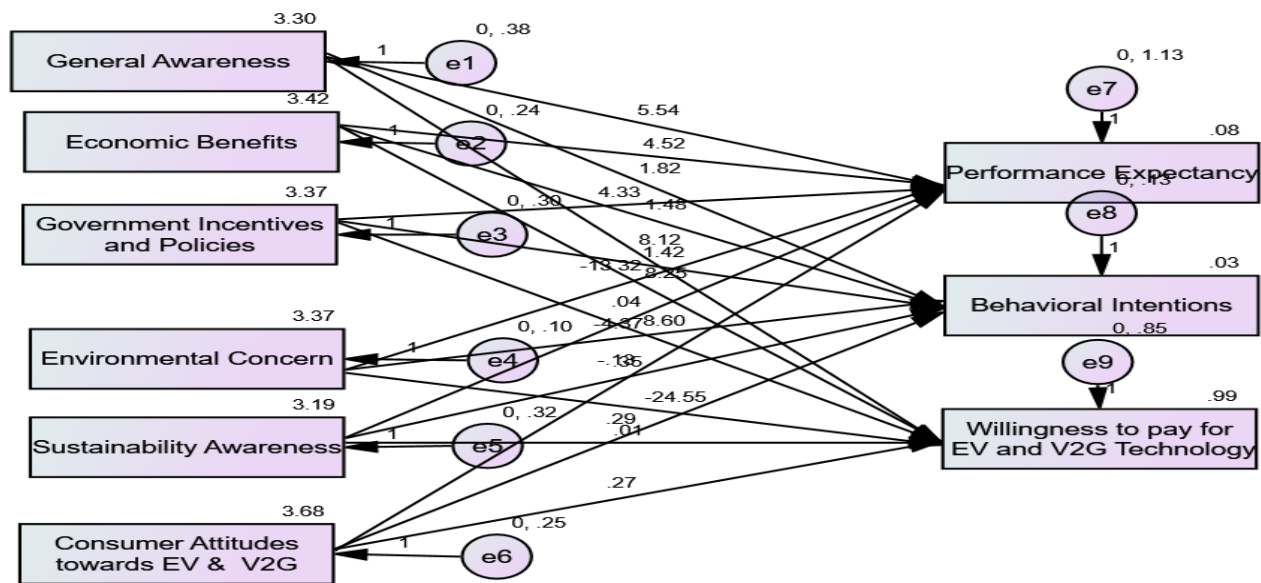
Impact of Consumer awareness towards EVs and V2G applications on factors influencing the propensity to pay for EV and V2G based on the role of environmental concerns and sustainability awareness

Results of the goodness-of-fit test for the sub-concept model

Full Model	CMIN/DF	P	RMR	GFI	AGFI	IFI	CFI	RMSEA
Obtained value	2.256	0.000	0.238	0.961	0.901	0.812	0.813	0.045
Observed value	≤ 5	$<.05$	<1	>0.90	>0.90	0.7-1.0	0-1	$<.08$

The table shows a CMIN value of 2.256, a p-value of 0.000, and an RMR value of 0.238, indicating that the model has an acceptable structure. The GFI and AGFI values exceed 0.9, and the RMSEA is 0.045, confirming the model's robustness in explaining consumer propensity to pay for EVs and V2G applications.

Coefficients for Consumer awareness towards EVs and V2G applications on factors influencing the propensity to pay for EV and V2G based on the role of environmental concerns and sustainability awareness



The study reveals that general awareness, economic benefits, and government incentives positively influence consumer propensity to pay for EVs (EVs) and vehicle-to-vehicle (V2G) technology. However, high environmental concern negatively impacts propensity to pay, possibly due to skepticism about the technology's actual ecological benefits. Consumer attitudes towards sustainability, EVs, and V2G tend to enhance positive behavioral intentions, but an indirect effect exists concerning the propensity to pay.

The research also reveals that the tendency to follow EVs, as well as V2G technology, is significantly higher in cases where supportive governmental incentives and policies are in place. The performance expectation, however, is lower with a high degree of environmental concern, and this may be attributed to a low belief in the effectiveness of the technology.

Based on the study's findings, general awareness, financial benefits, and governmental incentives are likely to enhance payment tendencies among EV consumers and V2G technology users.

Nonetheless, the prevalence of high environmental concern negatively affects the tendency to pay, which is likely attributed to a sense of doubt regarding the actual environmental benefits. These insights can be used to inform policies that enhance consumer education strategies and policy-making, thereby supporting the adoption of EVs and V2G technology.

Findings

Electric Vehicle Consumers in India

- The majority of consumers are male, aged 26-35, with an undergraduate degree.
- Most are employed with monthly incomes between Rs. 20,000-Rs.40,000.
- Market awareness influences the adoption of EVs.
- Consumers are generally aware of the technology used in electric cars and V2G systems.

- There is a positive awareness about the fuel cost and energy efficiency benefits of EVs.
- Consumers have moderate awareness of tax credits or rebates for EVs.
- The consumers have moderate concerns about climate change and renewable energy, but they are mostly optimistic about the environmental advantages of EVs.
- There is substantial disagreement regarding the importance of sustainable practices and the advantages of V2G technology in terms of grid stability.
- Consumers are not confident about the financial aspect, reliability, and economic upside of EVs and the V2G technology.
- Next, the use of EVs lacks the perceived improved eco-friendly behavior and self-growth.
- The general behavior of consumers towards fully EVs is characterized by resistance or a weak positive desire to adopt and promote fully EVs.

Suggestions

Focus on the transparency and availability of information related to the performance, safety, and reliability of EVs and V2G technology to eliminate fears and foster trust.

- Organize test driving regularly, which will allow future clients to get genuine feelings of the EVs and V2G technology. This can be employed to reduce fears and perceptions about the technologies.
- Highlight that EVs and V2G technology are offering phenomenal environmental benefits, which include reduced greenhouse gas emissions, cleaner air, and propagation of renewable energy.
- Encourage implementation of policies that will help in ensuring sustainability of the environment, such as exemptions made when acquiring EVs, tax-free introduction of the V2G phenomenon, and reducing the intensity of emissions.

Future Implications

The study makes another point that says that there is a need to educate consumers on EVs and the vehicle-to-grid (V2G) technology. The implication is that when we increase our knowledge on consumers and their demands, informed decisions will be made, and consequently, such technologies will be integrated. The study also names environmental beliefs and an awareness of sustainability as such factors, which affect consumer attitudes towards EVs and V2G. It implies that policymakers can use this knowledge to develop policies and incentives that resonate with the growing environmental idealism of citizens. Secondly, the research proposes that, in addition to creating more desirable financial products and marketing solutions, it is also essential to address factors that can increase customers' willingness-to-pay (WTP).

Conclusion

The paper findings could be of help to policymakers in developing programs or projects to

increase consumer awareness, identify barriers, and focus on the most influential factors that can assist in shifting to a green car industry in Malaysia.

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