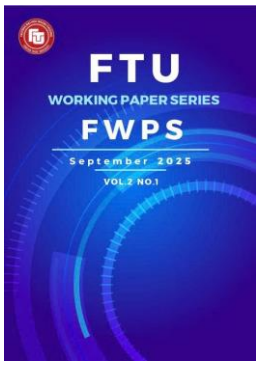

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VAI TRÒ CỦA GIỚI TÍNH TRONG VIỆC TIẾP NHẬN XE ĐIỆN: NGHIÊN CỨU TỔNG QUAN HỆ THỐNG SỬ DỤNG KHUNG TCCM

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Tóm tắt

Việc sử dụng xe điện (EV) đang ngày càng được quan tâm trên toàn cầu do những lo ngại về biến đổi khí hậu, ô nhiễm không khí và an ninh năng lượng. Tuy nhiên, quá trình tiếp nhận xe điện giữa nam và nữ lại có sự khác biệt đáng kể, xuất phát từ các yếu tố tâm lý, xã hội và kinh tế. Nghiên cứu này thực hiện tổng quan hệ thống các lý thuyết về việc tiếp nhận xe điện trong giai đoạn 2013 - 2024, tập trung phân tích vai trò của giới tính cũng như sự tương tác của nó với các yếu tố quyết định khác. Dựa trên khung Lý thuyết – Bối cảnh – Đặc điểm – Phương pháp luận (TCCM), nghiên cứu phân loại theo lý thuyết chính, khu vực địa lý, phương pháp nghiên cứu và các đặc điểm biến số. Kết quả cho thấy, nam giới thường ưu tiên hiệu suất và các đặc điểm công nghệ của xe điện, trong khi nữ giới lại chú trọng đến độ an toàn, hiệu quả về chi phí và lợi ích môi trường. Sự khác biệt về giới cũng có tác động đến các yếu tố quyết định chính trong việc tiếp nhận xe điện, bao gồm ảnh hưởng xã hội, rủi ro cảm nhận và các chính sách ưu đãi. Dù đã có nhiều nghiên cứu về việc sử dụng xe điện, vẫn còn khoảng trống trong việc làm rõ vai trò của giới tính đối với hiệu quả chính sách và sự thay đổi hành vi theo thời gian. Các nghiên cứu trong tương lai cần tập trung vào việc khám phá những khoảng trống này thông qua các nghiên cứu theo chiều dọc, nghiên cứu thực nghiệm và so sánh giữa các khu vực để xây dựng các chiến lược khuyến khích sử dụng xe điện hiệu quả hơn.

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Từ khóa: xe điện, EV, hành vi tiếp nhận, khác biệt giới tính, sở thích người tiêu dùng

THE ROLE OF GENDER IN ELECTRIC VEHICLE ADOPTION: A SYSTEMATIC REVIEW APPLYING TCCM FRAMEWORK

Abstract

The adoption of electric vehicles (EV) has gained global attention due to concerns over climate change, air pollution, and energy security. However, significant gender disparities exist in EV adoption, influenced by psychological, social, and economic factors. This study conducts a structured literature review of EV adoption research published between 2013 and 2024, with a focus on gender and its interactions with other determinants. Using the Theory – Context – Characteristics – Methodology (TCCM) framework, the study systematically categorizes key theories, regional influences, methodological approaches, and variable characteristics. Findings indicate that men prioritize performance and technological aspects, while women emphasize safety, cost efficiency, and environmental benefits. Gender differences also moderate key adoption determinants, including social influence, perceived risk, and policy incentives. Despite extensive research on EV adoption, gaps remain in understanding gender's role in policy effectiveness and behavioral shifts over time. Future research should explore these gaps using longitudinal studies, experimental research, and cross-regional comparisons to develop more inclusive EV adoption strategies.

Keywords: electric vehicles, adoption behavior, gender differences, consumer preferences

1. Introduction

The global transition towards sustainable transportation has accelerated in recent years, driven by concerns over climate change, air pollution, and energy security. Under such circumstances, electric vehicles have emerged as a key solution to reduce carbon emissions and dependence on fossil fuels (Knobloch et al., 2020; Tomšić et al., 2020). However, despite governmental efforts, the overall EV adoption rates remain relatively low, with significant demographic disparities (Sovacool et al., 2018). Among those, gender differences play a significant role in shaping consumer preferences, attitudes, and purchasing behaviors (Kurani, 2018). Understanding the influence of gender on EV adoption is crucial for developing targeted policies and marketing strategies that address the unique needs of different consumer segments.

Empirical studies have attributed gender differences in EV adoption to various psychological, social, and economic factors. Studies suggest that women tend to be more risk-averse and environmentally concious, and prioritize safety and practicality when purchasing vehicles, whereas men are often more driven by technological innovation, performance, and brand prestige (Shirgaokar, 2018; Wang & Zhao, 2019). Additionally, structural barriers such as income disparities, underrepresentation of women in technology-related industries, and differences in car ownership rates further contribute to gender-based variations in EV adoption (Berkeley et al., 2018; Sovacool et al., 2019).

Several reviews have explored EV adoption drivers, including gender. Bryła et al. (2022) summarized methodologies, theories, and variables used in recent EV adoption literature. Singh et al. (2020) categorized adoption determinants into demographic, situational, contextual, and psychological factors; comparing their relative importance. Meanwhile, Krishnaswamy and Deilami (2024) examined the psychological barriers to EV adoption, while Kumar and Alok (2019) analyzed more overlooked aspects like dealership experience, charging infrastructure resilience, and marketing strategies. Although some reviews included gender among the demographic factors that may drive EV adoption, they did not explore its interaction with other determinants in shaping EV adoption.

To address this gap, the authors conduct a structured review of EV adoption research published between 2013 and 2024, with a particular focus on gender and its interactions with other factors. The TCCM (Theory, Context, Characteristics, and Methodology) framework is employed to provide a comprehensive analysis. This framework enables a systematic evaluation of conceptual and empirical insights, while the 13-year study period aligns with systematic literature review standards (Paul & Criado, 2020). The review examines theoretical perspectives, contextual influences, determinant characteristics, and methodological approaches in studies on gender differences in EV adoption.

This literature review contributes to EV adoption research by (a) identifying theoretical perspectives used in studies on EV adoption intention and behavior, (b) analyzing the research context (region, subjects, and study scope), (c) describing variable characteristics with a focus on gender, (d) examining methodological approaches, and (e) identifying research gaps and proposing future research directions.

The study addresses the following research questions using the TCCM framework:

RQ1. What are the key theories, contexts, characteristics, and methodologies used in existing studies on EV adoption?

RQ2. How has gender been incorporated into research models on EV adoption intention and behavior?

RQ3. What research gaps exist regarding gender and EV adoption, and what future research directions can be proposed?

The paper is structured as follows: a discussion of research methodology, including the pilot search for selected articles and the application of the TCCM framework; a descriptive overview of the literature; an analysis of theories, context, characteristics, and methodologies in the reviewed studies; and a conclusion outlining theoretical implications and future research directions.

2. Research methodology

2.1. Data collection

We conducted a comprehensive database search in February 2025 to identify relevant literature on the role of gender in the adoption of electric vehicles. The search was performed using the Scopus database, focusing on studies published within the subject areas of Sociology, Business, Decision Sciences, and Economics (Table 1). To ensure the retrieval of essential and relevant research, we applied a structured search query targeting gender in relation to electric vehicle adoption. Specifically, the search terms included "gender" in combination with "electric vehicle" OR "electric car" OR "electric motorbike", as well as behavioral and psychological aspects captured through "adopt" OR "behavior" OR "attitude" OR "intention". These keywords were applied to the title, abstract, and keyword sections of the research papers, yielding a total of 85 documents.

Table 1: Search query structure and interpretation applied on Scopus database

	Search query	**Respective interpretation**
Search Focus	(TITLE-ABS-KEY("gender"))	Gender
	TITLE-ABS-KEY ("electric vehicle" OR "electric car" OR "electric motorbike")	Studies related to electric vehicles in various forms: Electric vehicle Electric car Electric motorbike
Search string	AND TITLE-ABS-KEY ("adopt" OR "behavior" OR "attitude" OR "intention")	Studies on adoption, behavior, attitude, or intention related to these vehicles
Field searched	AND (LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "DECI") OR LIMIT-TO (SUBJAREA , "ECON"))	Restricted to specific academic disciplines: SOCI → Sociology BUSI → Business DECI → Decision Sciences ECON → Economics

Source: Authors (2025)

2.2. Data extraction

To refine the selection of relevant studies, we established a set of data collection and screening criteria based on the PRISMA Protocol.

Table 2: Data extraction process using PRISMA Protocol.

Stage	**Search**	**Number of records remained**

Identification	Data gathered from Scopus database	85
Screening	Time frame: 2013 - 2025 Language: English Eligibility: ABCD indexed journals or Scopus Exclude: duplicates	70
Include	Studies with relevant content	36

Source: Authors (2025).

The inclusion criteria focused on research published between 2013 and 2025, covering articles, review papers, and conference papers that contribute to the understanding of gender influences on electric vehicle adoption to maintain a consistent focus on peer-reviewed academic literature. Only papers published in English were considered for this review.

By implementing these criteria, we ensured that the final dataset contained high-quality studies that provide valuable insights into how gender shapes attitudes, behaviors, and decisions related to electric vehicle adoption.

3. Descriptive overview

This section presents a descriptive overview of the papers selected for the literature review. The selected studies span from 2013 to 2024, indicating an increasing academic interest in EV adoption over recent years, the line graph below represents the number of research conducted as more attention is directed toward differences in the adoption of EVs. These studies have been published in well-regarded journals, reflecting a focus on sustainability, energy policies, and transportation economics.

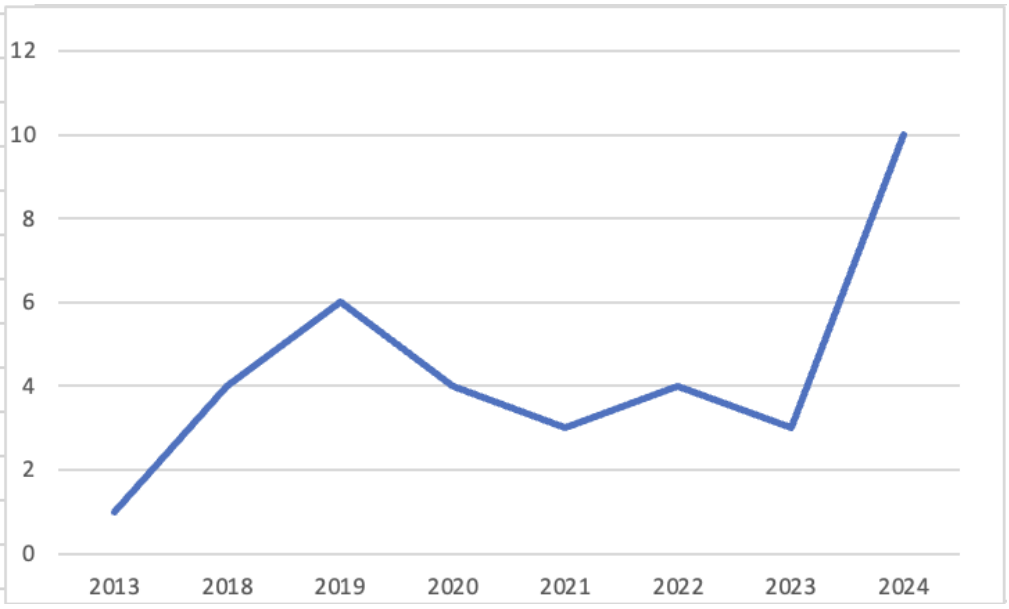

Figure 1: Number of studies conducted on the adoption of EVs.

Source: Authors (2025).

Table 3: Most cited articles

Authors	Journal	Citations
Xiangqian Huang, Jianping Ge (2019)	Journal of Cleaner Production	443
Wang D.; Ozden M.; Tsang Y. P. (2023)	International Journal of Engineering Business Management	11
Murugan & Marisamynathan (2022)	Case Studies on Transport Policy	13
Sovacool B. K.; Kester J.; Noel L.; Zarazua de Rubens G.(2019)	Transportation Research Part D	135
Tran V.; Zhao S.; Diop E.B.; Song W. (2019)	Sustainability (Switzerland)	79
Daramy-Williams E.; Anable J.; Grant-Muller S. (2019)	Transportation Research Part D: Transport and Environment	97

Source: Authors (2025).

EV adoption research spans multiple regions. Studies in China (Huang & Ge, 2019; Wang et al., 2023) focus on using intentions and adoption factors in Beijing and broader Chinese markets. In India, Jaiswal et al. (2024) and Murugan & Marisamynathan (2022) analyze gender and policy effects. European studies (Buhmann et al., 2024; Sovacool et al., 2019) provide insights into EV adoption and gender dynamics in Spain and the Nordic countries.

The studies utilize different types of data to support their findings. Survey data was commonly employed, as seen in Huang & Ge (2019) and Jaiswal et al. (2024), where structured questionnaires capture consumer attitudes toward EVs. Secondary data, sourced from government reports, industry statistics, and prior research, is leveraged in studies such as Sovacool et al. (2019) and Buhmann et al. (2024). Additionally, some research incorporates experimental and simulation-based methodologies, like the structural equation modeling approach used by Wang et al. (2023) to predict adoption trends.

Based on the document reviewed, we derive two distribution tables of the information collected: Distribution of Studies by Region and Distribution of Studies by Methodology which are presented below:

Table 4: Distribution of studies by region

Region	Number of studies
Asia	20
Europe	10
America	6
Global Review	1

Source: Authors (2025).

Several studies have significantly contributed to the understanding of EV adoption. Sovacool et al. (2019) provided a comprehensive assessment of gender and mobility in Nordic countries, highlighting differences in adoption behavior. Huang & Ge (2019) conducted a seminal study on consumer EV purchase intention in China, emphasizing policy incentives and personal attitudes. Jaiswal et al. (2024) focus on gender-based behavioral models in India, offering insights into socio-cultural factors affecting EV adoption. Wang et al. (2023) examine the role of policy incentives, analyzing how financial and regulatory measures impact consumer decisions. Finally, Buhmann et al. (2024) extend the theory of planned behavior to EV adoption in Spain, integrating environmental concerns and behavioral intent into their model.

The overview indicates that gender disparities, policy incentives, and socio-psychological factors significantly influence EV adoption. However, research gaps remain in exploring gender interactions with policy effectiveness, behavioral shifts over time, and comparative studies across regions. These gaps can be solved by integrating psychological models with emerging data analytics techniques to better understand evolving consumer behaviors.

4. Literature analysis under TCCM framework

4.1. Theoretical foundations

Table 5: Different theories extracted from the literature.

Theory	Quantity of articles	% of articles	Examples
Theory of Planned Behaviour	5	23.81	Huang & Ge (2019), Gautam V. (2023), Buhmann et al. (2024)

Theory	Quantity of articles	% of articles	Examples
Unified theory of acceptance and use of technology	5	23.81	Wang et al. (2023), Tran et al. (2019)
Technology acceptance model	2	9.52	Thurner et al. (2022)
Other theories (Behavioral Reasoning Theory, Diffusion of Innovation Theory, etc.)	9	42.86	Prakhar et al. (2024), Kaplan et al. (2018)

Source: Authors (2025).

4.1.1. Theory of Planned Behaviour

The theory of planned behavior is an extension of the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) made necessary by the original model's limitations in dealing with behaviors over which people have incomplete volitional control. Intentions to perform behaviors of different kinds can be predicted with high accuracy from attitudes toward the behavior, subjective norms, and perceived behavioral control; and these intentions, together with perceptions of behavioral control, account for considerable variance in actual behavior.

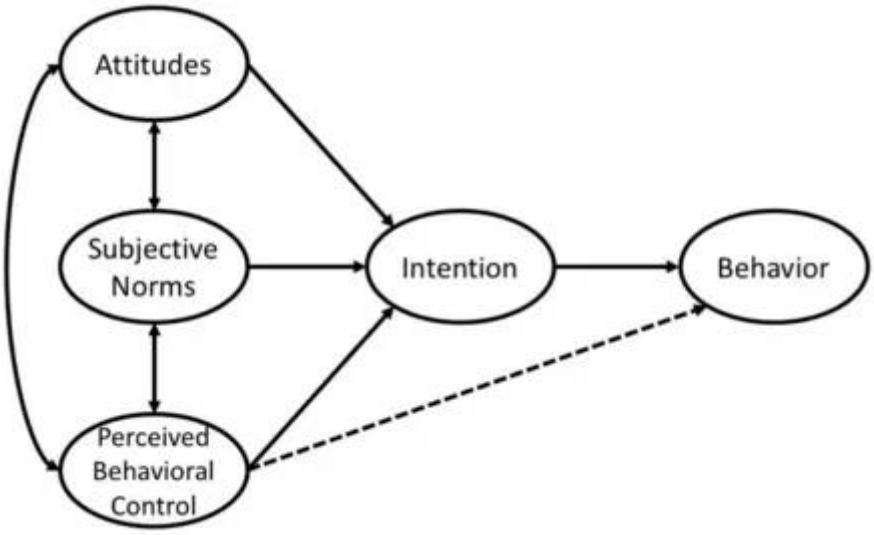

Figure 2: Theory of Planned Behaviour

Source: Ajzen (2005).

4.1.2. Technology acceptance model

Technology Acceptance Model (TAM), developed by Davis (1986, 1989), is one of the most influential frameworks for understanding user acceptance of technology. TAM posits that perceived usefulness - the degree to which a user believes a system will enhance their performance - and perceived ease of use - the degree to which a user expects the system to be free of effort - are the primary determinants of technology adoption. These factors influence attitude toward use, which in turn affects behavioral intention and actual system use. Later refinements (TAM2, TAM3) added constructs like social influence and enjoyment (Venkatesh & Davis, 2000). While TAM is widely used, it faces criticism for oversimplification and lack of contextual factors (Ajibade, 2018; Bagozzi, 2007).

4.1.3. Unified theory of acceptance and use of technology

Recently, the unified theory of acceptance and use of technology has taken place as one of the most developed and intensive models to test technology adoption and acceptance. The model was developed by Venkatesh et al. (2003), integrating eight prior models of technology adoption to provide a comprehensive framework for understanding user acceptance of technology. It identifies four key determinants: performance expectancy, effort expectancy, social influence, and facilitating conditions, with their effects moderated by gender, age, experience, and voluntariness of use. UTAUT has been widely applied in various fields, including healthcare, e-learning, and mobile banking, to analyze user adoption behavior.

4.1.4. Other theories

Other theories are used in the literature to examine electric vehicle adoption and user behavior. These include Behavioral Reasoning Theory used in Xingjun et al. (2024), explaining how reasoning influences decision-making; Theory of Consumption Values (Yu et al., 2023) which explores the role of perceived value in consumer choices; and Technology Continuance Theory (Prakhar et al., 2024). Psychological frameworks such as Maslow's Hierarchy of Needs (Lusk et al., 2023) and ERG Theory of Needs (Kaplan et al., 2018) provide insights into motivational factors driving technology use. Additionally, Gender Socialization Theory (Sovacool et al., 2019) and the Diffusion of Innovation Theory (Daramy-Williams et al., 2019), among others, contribute to a broader understanding of user behavior.

4.2. Contextual applications

4.2.1. Vehicle Types

Table 6: Electric vehicle types examined in the literature on electric vehicle adoption.

Vehicle type	Quantity of articles	% of the articles	Examples
Electric vehicle	18	50	Huang & Ge (2019); Murugan & Marisamynathan (2022)

Vehicle type	Quantity of articles	% of the articles	Examples
Electric car	1	2.78	Bridi & Al Hosani (2020)
Electric motorbike	1	2.78	Jou et al. (2023)
Electric bicycle	1	2.78	Kaplan et al. (2018)
Battery electric vehicle	6	16.67	Jaiswal et al. (2024); Buhmann et al. (2024)
Public electric vehicle	3	8.33	Almannaa et al. (2024); Yan et al. (2023)
Plug-in hybrid electric vehicle (PHEV)	3	8.33	Sugihara et al. (2021); Daramy-Williams et al. (2019)
Electric Carsharing	2	5.56	Yu et al. (2023); Tran et al. (2019)
Autonomous Vehicle	1	2.78	Widyanti et al. (2024)
Total	**36**	**100**	

Source: Authors (2025).

This section reviews EV types studied in the literature, emphasizing adoption trends and gender differences. General EV studies (50%) explore key adoption drivers and barriers. Battery electric vehicles (BEVs) (16.67%) are linked to technological advancements and policy incentives, with men prioritizing performance and women favoring cost efficiency (Liu et al., 2021). Plug-in hybrid EVs (PHEVs) and public EVs (each 8.33%) cater to different consumer needs—women prefer PHEVs for fuel flexibility, while public EVs align with urban mobility trends (Mohammad et al., 2020; Tafesse & Wood, 2021). EV-sharing services (5.56%) attract more women due to cost savings and lower ownership risks (Pongpaew et al., 2017). Studies on electric motorbikes, bicycles, and autonomous vehicles (each 2.78%) highlight adoption in dense regions and gendered trust concerns (Grover & Kar, 2020; Shawky et al., 2022). Overall, gender plays a significant role in shaping EV preferences, with men valuing performance and innovation, while women focus on affordability, safety, and convenience.

4.2.2. Countries

Table 7: Countries examined in the literature on electric vehicle adoption

Countries	Quantity of articles	% of the articles
Asia	18	52.94
Africa	0	0
Europe	10	29.41
America	5	14.71
Australia	0	0
Two or multiple continents	1	2.94
Total	**34**	**100**

Source: Authors (2025).

The geographical distribution of EV studies highlights regional differences in adoption patterns, infrastructure, and policies. Asia dominates with 52.94% of the literature, led by China's strong EV policies, charging infrastructure, and incentives (Carlson et al., 2019). Other Asian nations, like India, Thailand, and Indonesia, focus on affordability and regulatory support (Naqvi et al., 2021). Gender disparities in these regions are notable, with women facing financial and infrastructural barriers (Chiang et al., 2020).

Europe accounts for 29.41% of studies, emphasizing policy-driven EV adoption, particularly in Germany, France, and Norway (Marbach et al., 2019). Men prioritize technical aspects, while women focus on environmental and cost factors (Schivinski, 2021). North America contributes 14.71%, mainly from the U.S. and Canada, examining consumer willingness, incentives, and brand marketing (Bento et al., 2018). Men dominate the high-performance EV market, while women prefer hybrid and compact models (Lee & Park, 2021). Comparative studies across continents make up 2.94% of research, while Africa and Australia remain underrepresented, signaling a need for further study (Hammedi et al., 2015).

4.3. Characteristics features

This section examines the literature on electric vehicle adoption, focusing on gender's role in existing models. It identified various characteristics, which are to be presented in Table 1. It also

proposes a conceptual framework for the factors directly associated with EV adoption intention or behavior.

Table 8: Characteristics related to the literature on electric vehicle adoption

Variable	No of studies	% of articles	Examples	Articles	Contributing theory
Independent variables					
Demographic & Socioeconomic Factors	14	43,75	Socioeconomic factors, Transport availability; Car ownership	Lusk et al. (2023), Sovacool et al. (2019)	
Psychological & Behavioral Factors	22	68,75	Attitude; Subjective norms; Perceived behavioral control; Environmental concern; Familiarity with type of vehicle	Tran et al. (2019), Prakhar et al. (2024)	Theory of Planned Behavior; Behavioral Reasoning Theory; Theory of Reasoned Action
Performance & Technology Factors	17	53,13	Performance expectancy; Effort expectancy; Range consciousness; Charging infrastructure; Perceived Usefulness; Perceived Ease of Use	Yu et al. (2023), Montian & Suthikarnnarunai (2018)	Technology Acceptance Model; Unified Theory of Acceptance and Use of Technology
Policy & Financial Factors	11	34,38	Monetary & non-monetary incentive policy measures; Government support	Wang et al. (2023), Bridi & Al Hosani (2020)	
Safety & Social Influence	9	28,13	Social influence; Image; Privacy concerns	Bridi & Al Hosani (2020), Kawgan-Kagan (2020)	
Dependent variables					
Usage Behaviour	7	21,88	Usage; Transport mode choice; Mobility patterns	Sugihara et al. (2021), Daramy-Williams et al. (2019)	
Adoption & Purchase Intention	12	37,50	Intention to adopt; Intention to purchase; Intention to switch		
Intention to Use or Participate	9	28,13		Higueras-Castillo et al. (2020), Gautam (2022)	
Willingness to Pay or Pay more	9	28,13		Prasetio et al. (2019), Bhutto et al. (2021)	
Perceptions & Interest	7	21,88	Perceptions of Safety; Attitude; Preferences to types of vehicles	Almannaa et al. (2024), He et al. (2020)	
Moderating variables					
Gender	7	21,88		Tran et al. (2019), Prakhar et al. (2024)	
Other demographics	5	15,63	Gender; Income; Education level	Montian & Suthikarnnarunai (2018), Tran et al. (2019)	
Psychological & Behavioral Factors	4	12,50	Herd mentality; Trust; Environmental concern; Experience with EVs	Prakhar et al. (2024), Daramy-Williams et al. (2019)	
Mediating variables					
Demographics	1	3,13	Age; Gender; Income; Education level	Huang & Ge (2019)	Theory of Planned Behavior; Behavioral Reasoning Theory; Theory of Reasoned Action
Psychological & Behavioral Factors	6	18,75	Reasons for and against; Attitude; Subjective norm; Perceived behavioural control; Moral norm; Environmental concern	Jaiswal et al. (2024), Bhutto et al. (2021)	
Decision-Making & Intentions	2	6,25	Purchase Intention; Adopt Intention	Gautam (2022), Kant et al. (2024)	
Control variables					
Gender	5	15,63		Almannaa et al. (2024), Xingjun et al. (2024)	
Other demographics	10	31,25	Age; Income; Education level	Daramy-Williams et al. (2019), Higueras-Castillo et al. (2020)	
Mobility factors	5	15,63	Public transport availability; Driving experience; Travel frequency; Prior EV experience	He et al. (2020), Yu et al. (2023)	

Source: Authors (2025).

4.3.1. Framework of Electric Vehicle Adoption

After synthesizing the characteristics of various models within the existing literature on EV adoption, the authors discovered a variety of variables that have been tested and proved statistically significant. Based on such findings, this review presented a conceptual framework as depicted in Figure 1. The framework contributed to the existing literature by systematically identifying the dependent, independent, mediating, and moderating variables that can be employed in future research on EV adoption behavior and intention.

4.3.2. Dependent variables - the research subject

EV adoption research primarily focuses on adoption and usage intention. Huang & Ge (2019) identified key adoption drivers in China, while Higueras-Castillo et al. (2020) examined early adopters in Spain. Murugan & Marisamynathan (2022) studied India's shift to electric two-

wheelers. Other studies explore EV usage in car-sharing, ride-hailing, and public transport (Tran et al., 2019; Yu et al., 2023).

Some research extended beyond intention, bridging it with actual behavior. Almannaa et al. (2024) analyzed the temporal shifts in the e-scooter usage of residents in Riyadh, while Gautam (2022) identified the determinants of purchase behavior in an emerging economy. Several other studies, such as that of Kant et al. (2024) or Sovacool et al. (2019), attempted to predict the willingness to pay or to pay more for electric vehicles compared to traditional means of transportation. Less commonly, some studies analyzed the perceptions and interests of consumers towards electric vehicles, such as by studying their attitude (Bennett & Vijaygopal, 2018), or their perceptions of safety for an EV (Almannaa et al., 2024).

4.3.2.1. Independent variables - the determinants of EV adoption

The drivers of EV adoption identified in existing literature can be categorized into several groups. The psychological & behavioral factors, often derived from the Theory of Planned Behavior, are frequently analyzed. Its main variables, including attitude, subjective norms, and perceived behavioral control are incorporated into various studies (Huang & Ge, 2019; Gautam, 2022; Buhmann et al., 2024). Other factors, such as environmental concern (Murugan & Marisamynathan, 2022; Bhutto et al., 2021), or familiarity with EVs (Tran et al., 2019), are also recurring determinants in the EV adoption literature. Performance & technology factors, rooted in the TAM and the UTAUT, have been linked to EV adoption. Tran et al. (2019) and Yu et al. (2023) both identified performance expectancy and effort expectancy as determinants of behavioral intention to use electric carsharing. Prakhar (2024) linked perceived usefulness and perceived ease of use with tourists' intention to use electric vehicles for sustainable tourism.

Demographic and socioeconomic factors, including transport availability (He et al., 2020) and car ownership (Sovacool et al., 2019, have been explored. Policy and financial factors, in monetary and non-monetary incentives (Huang & Ge, 2019), and government support (Montian & Suthikarnnarunai, 2018) have also been found to influence adoption. The least common group of factors is the safety & social influence, which includes the ways in which consumers can be affected by external factors into or against adopting an EV: through social influence (Jaiswal et al., 2024; (Wang et al., 2023), image (Prakhar et al., 2024), or privacy concerns (Xingjun et al., 2024).

4.3.2.2. Moderating variables

Among the studies that incorporate moderating variables into their models, the majority hypothesized that demographic factors, including age, gender income, and education level, have a moderating effect on the relationship between EV adoption and its determinants (Montian & Suthikarnnarunai, 2018; Pandita et al., 2024).

Several other studies found that psychological & behavioral factors have significant moderating effects. Xingjun et al. (2024) discovered that herd mentality positively moderates the relationship between reasons against, but not reason for, private charging pile sharing and intention.

Yu et al. (2023) reported trust as a positive moderator between personal attitude and behavioral intention toward EV car-sharing.

4.3.2.3. Mediating variables

Demographic and psychological factors also mediate EV adoption determinants. Xingjun et al. (2024) found that reasons for and attitude mediate the link between the desire to share and intention to share private charging piles, while reasons against mediate privacy concerns and intention. Jaiswal et al. (2024) also identified attitude as a key mediator between UTAUT variables and behavioral intention.

4.3.2.4. Control variables

Common control variables include demographic factors (age, gender, income, education) (Xingjun et al., 2024; Yu et al., 2023; Prakhar et al., 2024) and mobility-related factors such as public transport availability (He et al., 2020), driving experience, travel frequency, and prior EV experience (Prakhar et al., 2024).

4.3.3. The role of gender in existing literature

In the existing body of literature, gender appears as a descriptive statistic, moderating, mediating, and control variable. This section will focus on the role of gender as a descriptive statistic and a moderating factor, as such incorporation of gender allows studies to clearly and thoroughly analyze its impact on EV adoption, and interaction with other variables.

4.3.3.1. Gender as a descriptive statistic

Seventeen studies report gender-based EV adoption differences: 13 found men more likely to adopt, while 4 reported higher adoption in women.

Table 9: Descriptive statistics - Gender differences in EV adoption.

Gender reported as more likely to adopt EV	Quantity of articles	% of the articles
Men	13	40.63
Women	4	12.5

Source: Authors (2025).

Murugan & Marisamynathan (2022) reported that Indian male users showed greater interest in shifting their travel from conventional two-wheelers to electric bikes. In a 2019 study, Sovacool et al. surveyed an approximately gender-balanced sample, and found that twice as many men as women owned an EV. McQueen & Clifton (2022) conducted a choice experiment and discovered that women were significantly less likely than men to choose the e-scooter.

Other studies reported an opposite trend in gender influence on EV adoption. Higueras-Castillo et al. (2020) performed a cluster analysis, and found that while gender differences are minimal, young, high-income women could be profiled as the segment most likely to adopt EVs. Similarly, Kaplan et al. (2018) reported that female respondents had a preference for electric vehicles as a technological innovation.

4.3.3.2. Gender as a Moderating Variable

Gender is also frequently incorporated into research models of the chosen studies as a moderating variable. The characteristics of the moderating effects of gender are described in Table 10.

The studies that included gender as a moderator typically focused on either behavioral intention (Tran et al., 2019; Tran et al., 2019; Gautam, 2022), or willingness to pay ((Kant et al., 2024; Jaiswal et al., 2024), with limited research gender's moderation on the relationship between EV adoption behavior and its drivers.

Meanwhile, the studied determinants appear to be much more diverse. To analyze the pattern of gender-based moderation effects, the authors categorized these determinants into 4 groups.

Social & Moral Influence - includes factors related to societal expectations, moral values, and external pressure. Existing literature shows that women are more influenced by these external and ethical considerations when forming their EV adoption intention. Kant et al. (2024) demonstrated that subjective norm, personal moral norm, and affective attitude have a significantly stronger influence on women's willingness to pay for EVs. Bhutto et al. (2021) reported that environmental concern has a stronger impact on adoption intention in women.

Performance Expectations - emphasizes technical and functional aspects, typically prioritized by men when considering an EV. Jaiswal et al. (2024) proved that men's willingness to pay is more influenced by performance expectancy and effort expectancy; while Pandita et al. (2024) identified that range consciousness affects adoption intention more in men.

The third category - Attitude & Satisfaction - showed that men are more driven by excitement, pleasure, and overall satisfaction when considering EVs. Prakhar et al. (2024), Jaiswal et al. (2024), and Bhutto et al. (2021) all demonstrated that men are more impacted by attitude in terms of their willingness to pay, and intention to adopt electric vehicles.

Cognitive Factors - reflects the confidence in one's ability, awareness of EVs, and access to resources. Research shows that women respond more to these cognitive and logistical factors in EV adoption. Gautam (2022) reported that perceived efficacy and control over availability have a stronger impact on women's intention. Meanwhile, Kant et al. (2024) identified that women's willingness to pay is more strongly influenced by EV knowledge than men's.

Table 10: Characteristics of the moderating effect of gender in research models (Total number of moderated relationships = 19).

Characteristics	Examples	Stronger effect in men	Stronger effect in women
The determinants in the moderated relationship			
Social & Moral Influence	Subjective norm; Personal moral norm	1	4
Performance Expectations	Effort expectancy; Performance expectancy; Range consciousness	4	1
Attitude & Satisfaction	Attitude; Satisfaction; Hedonic motivation	6	1
Cognitive Factors	Perceived efficacy; Knowledge; Control over availability	0	3

Source: Authors (2025).

4.4. Methodology approaches

The reviewed studies include a variety of research approaches. Empirical studies, such as those by Huang & Ge (2019) and Jaiswal et al. (2024), utilize surveys and statistical modeling to analyze EV adoption behaviors. Systematic literature reviews, like that conducted by Daramy-Williams et al. (2019), synthesize previous research to offer a broader understanding of adoption patterns. Policy analysis papers, such as those by Murugan & Marisamynathan (2022) and Wang et al. (2023), focus on regulatory frameworks and policy effectiveness in promoting EV adoption.

Table 11: Distribution of quantitative studies by technique.

Analysis technique	Number of studies
SEM	12
Regression	11
Choice modeling	2
ANOVA	2
Chi-square test	4

Descriptive Statistics	8
T-test	1
Cluster Analysis	1
Factor Analysis	1

Source: Authors (2025).

Studies employed both descriptive and inferential methods. SEM (37.5%) and regression (31.25%) were the most common. Descriptive statistics (25%) were often combined with chi-square tests (18.75%). Other techniques included factor analysis, cluster analysis, choice modeling (3.13%), and ANOVA (3.13%).

These findings highlight the diverse methodological approaches used, with a strong emphasis on quantitative techniques such as SEM and regression, alongside supporting statistical tests for validation and comparison.

Quantitative research dominated the studies, accounting for 94.44% of the methodologies, while mixed-methods and qualitative approaches were each used in one case. The majority of studies relied on primary data, primarily collected through surveys and questionnaires, whereas only one research used secondary data sources

5. Conclusion

5.1. Theoretical implications

This study combines a systematic review with a structured analysis to provide a comprehensive understanding of gender's role in EV adoption. It contributes to the existing literature in multiple ways. The TCCM framework, which identifies theories, contexts (regions and consumer segments), characteristics (key determinants), and methodologies used in prior studies, offers a structured overview of past research. Moreover, we find that gender differences significantly influence EV adoption behaviors, with psychological, economic, and behavioral factors playing crucial roles. Further, we reviewed studies published between 2013 and 2025 to capture evolving trends in EV adoption. Additionally, we analyzed the methodological approaches employed in these studies, noting the predominance of regression and SEM techniques while highlighting the need for more qualitative and mixed-methods research. Following the TCCM framework, we outline future research directions to bridge existing gaps and enhance understanding of gender influences on EV adoption.

5.2. Future directions for research

Despite progress in EV adoption research, gaps remain in policy, methodology, regional disparities, gender influences, and sustainability.

First, several overlooked groups of determinants would require deeper exploration. While existing studies largely focus on behavioral and technological factors , elements such as policy incentives and social influence remain underexplored in EV adoption literature. Future research should also analyze the interaction of these policy and social factors with demographic variables such as gender, income, and education to provide a more comprehensive understanding of consumer decision-making.

Second, a stronger emphasis on empirical data collection is needed. Many studies rely on secondary data or conceptual frameworks, limiting their real-world applicability. Future research should employ longitudinal studies, experimental research, and advanced statistical modeling to track shifts in consumer preferences over time (He et al., 2020; Lusk et al., 2023). Incorporating moderating and mediating factors such as trust, social influence, and perceived risk can enhance predictive accuracy in EV adoption models (Yu et al., 2023; Bhutto et al., 2021).

Third, regional disparities in EV adoption remain underexplored. Most studies focus on developed markets like North America and Europe, while adoption patterns in emerging economies such as India, Indonesia, and Thailand receive less attention (Pandita et al., 2024; Murugan & Marisamynathan, 2022). Research should investigate country-specific barriers, including infrastructure limitations, policy gaps, and socio-cultural influences, to develop tailored policy recommendations (Bridi & Al Hosani, 2020).

Fourth, gender-based adoption patterns require more targeted analysis. The present literature review indicated that the moderating effect of gender on EV adoption is mainly discussed in the context of adoption intention, showing a research gap related to adoption behavior. Future research can aim to fill this gap by incorporating gender as a moderating variable in a model to predict consumer behavior to adopt EVs.

Finally, sustainability challenges such as battery lifecycle management and environmental impact require urgent attention. While EVs contribute to carbon reduction, concerns about battery production, recycling, and disposal persist (Sugihara et al., 2021; Buhmann et al., 2024). Research should focus on circular economy models, regulatory interventions, and alternative battery technologies to ensure long-term sustainability in the EV sector. By addressing these gaps, future research can provide more actionable insights for policymakers and industry leaders, fostering a more inclusive, data-driven, and sustainable EV market.

References

Ajzen, I. (1991), *The theory of planned behavior*, *Organizational Behavior and Human Decision Processes*, Vol. 50(2), pp. 179-211.

Aggarwal, S., Rathee, P., Arya, V. & Roy, H. (2024), "Inside story of impact investing in emerging market: A systematic review to measure the responsible and sustainable investing pattern using the ADO framework", *Journal of Economic Surveys*.

Berkeley, N., Jarvis, D. & Jones, A. (2018), "Analysing the take up of battery electric vehicles: An investigation of barriers amongst drivers in the UK", *Transportation Research Part D: Transport and Environment*, Vol. 63, pp. 466–481.

Bryła, P., Chatterjee, S. & Ciabiada-Bryła, B. (2022), "Consumer Adoption of Electric Vehicles: A Systematic Literature Review", *Energies*, Vol. 16(1), pp. 205.

Eagly, A. H. (1987), *Sex differences in social behavior: A social role interpretation*, Lawrence Erlbaum Associates

Knobloch, F., Hanssen, S. V., Lam, A., Pollitt, H., Salas, P., Chewpreecha, U., Huijbregts, M. A. J. & Mercure, J. (2020), "Net emission reductions from electric cars and heat pumps in 59 world regions over time", *Nature Sustainability*, Vol. 3(6), pp. 437–447.

Krishnaswamy, A. & Deilami, S. (2024), "Psychological Hesitations of Electric Vehicle adoption: A Systematic Review", *Next Research*, Vol. 1(2), pp. 100056.

Kumar, R. R. & Alok, K. (2019), "Adoption of electric vehicle: A literature review and prospects for sustainability", *Journal of Cleaner Production*, Vol. 253, pp. 119911.

Kurani, K. S. (2018), "Gender Imbalance in the Plug-In Electric Vehicle Market Threatens to Slow Future Market Growth", *UC Davis: National Center for Sustainable Transportation*.

Olaleye, S. A., Mogaji, E., Agbo, F. J., Ukpabi, D. & Gyamerah Adusei, A. (2023), "The composition of data economy: A bibliometric approach and TCCM framework of conceptual, intellectual and social structure", *Information Discovery and Delivery*, Vol. 51(2), pp. 223-240.

Paul, J. & Criado, A. R. (2020), "The art of writing literature review: What do we know and what do we need to know?", *International Business Review*, Vol. 29(4), pp. 101717.

Saikia, W. & Bhattacharjee, A. (2024), "Digital consumer engagement in a social network: A literature review applying TCCM framework", *International Journal of Consumer Studies*, Vol. 48(1), pp. e12981.

Singh, V., Singh, V. & Vaibhav, S. (2020), "A review and simple meta-analysis of factors influencing adoption of electric vehicles", *Transportation Research Part D: Transport and Environment*, Vol. 86, pp. 102436.

Sovacool, B. K., Kester, J., Noel, L. & De Rubens, G. Z. (2018), "The demographics of decarbonizing transport: The influence of gender, education, occupation, age, and household size on electric mobility preferences in the Nordic region", *Global Environmental Change*, Vol. 52, pp. 86–100.

Sovacool, B. K., Kester, J., Noel, L. & De Rubens, G. Z. (2019), "Are electric vehicles masculinized? Gender, identity, and environmental values in Nordic transport practices and vehicle-to-grid (V2G) preferences", *University of Sussex*.

Tomšić, Ž., Raos, S., Rajšl, I. & Ilak, P. (2020), "Role of Electric Vehicles in Transition to Low Carbon Power System—CASE Study Croatia", *Energies*, Vol. 13(24), pp. 6516.

Wang, S. & Zhao, J. (2019), "Risk preference and adoption of autonomous vehicles", *Transportation Research Part A: Policy and Practice*, Vol. 126, pp. 215–229.