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Analyzing purchase intentions of used electric vehicles through consumer experiences: A structural equation modeling approach

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ABSTRACT

The transition rate to electric vehicles (EVs) has accelerated globally as indicated by a notable rise in the number of used EVs in the market. However, most existing studies focused on the attributes related to the new EVs. This study explores the factors influencing consumer purchase intentions of used EVs using structural equation modeling (SEM). Drawing on a survey of 992 used EV owners in the United States, the research examines the impact of sociodemographic characteristics, purchase details, information sources, pre-purchase concerns, current driving and charging experiences, and future purchase intentions. The findings reveal that charging ease has the strongest positive direct effect on future purchase intentions, while information sources and driving experience show negative direct effects. Sociodemographic characteristics and pre-purchase concerns indirectly influence future intentions through other factors. More specifically, income level, education, and Hispanic ethnicity positively contribute to the sociodemographic profile of EV owners. Further, traditional media plays a significant role in disseminating EV information, although online searches show a negative relationship with information source engagement. This comprehensive approach provides a nuanced understanding of the dynamics within the used EV market, ultimately supporting sustainable transportation initiatives. The study highlights the importance of addressing charging infrastructure, battery performance, and affordability concerns to enhance the used EV market's growth.

1. Introduction

The global automotive industry is transitioning significantly towards Electric Vehicles (EVs). By 2023, there were over 26 million EVs on roads worldwide, with approximately 3 million in the United States (IEA, 2024). This trend is expected to continue as more countries and regions implement stringent emissions regulations and offer incentives for EV adoption to further accelerate the transition to electric mobility. This rapid growth in the EV market has led to an increasing number of used EVs (Tal et al., 2017), creating a new segment within the automotive sector.

While much research has focused on new EV adoption, less attention has been given to the used EV market. Understanding consumer intentions to purchase second-hand EVs is crucial as used EVs can make electric mobility more affordable and accessible to a wider range of consumers, expanding adoption beyond early adopters and high-income buyers (Hagman et al., 2016). Recent studies have highlighted the significance of various factors in the adoption of both new and used EVs, including the presentation of GHG (Greenhouse Gas) information (Farajnezhad et al., 2024; Vega-Perkins et al., 2023), behavioral attitudes and personal beliefs about climate change (Bhutto et al., 2022; Irfan, 2024) which provides consumers with insights into the environmental benefits of EVs. Additionally, moral foundations motivate consumers with pro-environmental values to exhibit stronger intentions to purchase electric vehicles (Dong et al., 2024).

Knowledge of used EV adoption patterns can inform charging infrastructure expansion and provide insights into consumer perceptions of evolving EV technology. This information is valuable for future product development and addressing concerns specific to used EVs, such as battery degradation (Woody et al., 2020). Furthermore, a robust used EV market can have significant economic effects on traditional used car markets, maintenance services, and battery recycling industries (Tal

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et al., 2017). Moreover, a healthy used EV market supports overall EV adoption by providing more options for buyers and creating upgrade pathways for current EV owners (Liao et al., 2017). From an environmental standpoint, promoting second-hand EVs can extend vehicle lifecycles, potentially reducing overall environmental impact (Guzek et al., 2024; Sitcharangsie, 2022). This understanding can also help policymakers create effective incentives and regulations specific to the used EV market (Hardman et al., 2017).

Therefore, this study explores the factors influencing consumers' intentions to purchase used EVs. By examining these intentions, the current study provides insights into the potential growth of the second-hand EV market and identifies strategies to support its development. To achieve this, a comprehensive dataset collected through a survey of 992 owners of used EVs in the United States is utilized (Loh et al., 2024). The survey captured various aspects of used EV ownership, including sociodemographic characteristics, purchase details, information sources, pre-purchase concerns, current driving and charging experiences, and future purchase intentions. This rich dataset allows for a nuanced analysis of the used EV market from the perspective of current owners. The findings will contribute to the broader understanding of EV adoption patterns and help inform policy decisions and industry strategies in the evolving EV landscape.

2. Literature review

The growing popularity of EVs and the emerging 'used EV market' necessitate a comprehensive understanding of factors influencing consumer adoption and satisfaction. Understanding the factors that influence consumers to purchase used EVs is crucial for predicting market trends and shaping policy decisions. The related literature examined several factors that affect EV adoption and user experience, including information quality, charging convenience, customer satisfaction, GHG information, moral foundations, climate change, and demographic and external factors.

Recent literature has expanded the understanding of consumer behavior toward EVs by identifying new factors influencing adoption. For instance, the presentation of GHG information has been found to play a pivotal role in shaping consumer decisions, as it enhances awareness of the environmental benefits associated with EVs, making them a more attractive option for environmentally conscious consumers (Farajnezhad et al., 2024). Studies such as Naseri et al. (2024) and Naseri et al. (2023)highlight that environmental attitudes, purchase price, and climate change awareness strongly influence EV purchase intentions. Similarly, Wang et al. (2023) emphasize that tailored GHG communication strategies can enhance consumer willingness to adopt climate-friendly choices. Moreover, moral foundations contribute to consumers' willingness to pay for EVs, with pro-environmental values significantly driving purchase intentions (Dong et al., 2024). Behavioral attitudes toward climate change and individuals' environmental awareness have emerged as critical variables influencing EV adoption (Bhutto et al., 2022; Irfan, 2024).

Several studies have highlighted the importance of information quality in shaping consumer attitudes towards EVs. High-quality information significantly influences positive attitudes toward EVs (Rezvani et al., 2015). Similarly, the impact of social interactions, media exposure and accurate information on EV adoption is emphasized (Axsen et al., 2012; Javadnejad et al., 2023). Moreover, social media interactions and media exposure through shared experiences, informative content, and the persuasive power of advertisement help debunk myths, alleviate concerns, and highlight the benefits of EVs (Li et al., 2023). These findings underscore the necessity of providing accurate and comprehensive information to address consumer concerns and promote the adoption of both new and used EVs.

The convenience of charging is a critical factor in EV adoption and user satisfaction. Charging infrastructure, including the availability and convenience of stations, significantly enhances EV user satisfaction by alleviating range anxiety and reducing charging times (Al-Hanahi et al., 2021; Anderson et al., 2018).

Easy access to charging stations and availability of public charging stations positively affects adoption rates (Franke et al., 2013a; Bonges et al., 2016). Although battery range has been a persistent concern, user satisfaction with range tends to improve over time as users become more accustomed to their EVs' capabilities (Franke et al., 2017). The causal factors of EV adoption were examined and it was found that charging time, driving range, and price are the most important criteria for an EV purchase (Sonar et al., 2023). These insights are particularly relevant for the used EV market, where concerns about battery degradation are more pronounced.

Customer satisfaction and psychological factors play pivotal roles in determining repurchase intentions within the automotive industry (Bryła et al., 2023). Studies have identified several types of motivations influencing EV adoption that go beyond mere economic considerations (Chakraborty, 2022; Noppers et al., 2014): instrumental (e.g., costs, practicality), environmental (e.g., emissions reduction) (Axsen et al., 2015; Barbarossa et al., 2015), symbolic (e.g., status, identity), risk perception (Schmalfuβ et al., 2017). While consumers often cite instrumental motives, symbolic and environmental motivations are actually stronger predictors of EV adoption intention (Noppers et al., 2014). Moreover, Range anxiety often decreases with experience, indicating that it is partly a psychological barrier that can be overcome through familiarity and positive experiences with EVs (Franke et al., 2015, 2017). A study found a strong link between customer satisfaction and the likelihood of repurchasing the same brand (Herrmann et al., 2007). This finding was extended to the EV market, demonstrating that positive experiences with EVs increase the likelihood of future EV purchases (Langbroek et al., 2016). Additionally, some consumers view EV ownership as an extension of their personal identity, associating it with being environmentally responsible or technologically savvy (Rezvani et al., 2015). These studies collectively suggest that enhancing customer satisfaction is essential for fostering loyalty and repeat purchases in the used EV market.

Social, economic, demographics and external factors play a significant role in shaping EV adoption patterns. Age, income, education, access to charging infrastructure, and government incentives substantially affect EV satisfaction and purchase intention (Singh et al., 2020). Early EV adopters are typically middle-aged, well-educated individuals with higher incomes (Plötz et al., 2014). Expanding on these findings, the impact of external factors such as vehicle range, charging time, total cost of ownership, government subsidies, and charging infrastructure availability on consumer decisions regarding EVs was highlighted (Ivanova et al., 2023). Moreover, a comprehensive review of consumer preferences for EVs, highlights the importance of socio-economic, psychological, and mobility-related factors (Liao et al., 2017). These studies collectively underscore the critical influence of both demographic characteristics and external market conditions on EV adoption rates and consumer preferences. These insights provide a more nuanced understanding of the factors that influence EV adoption and highlight the intersection between them for predicting market trends and developing targeted strategies to promote EV adoption across diverse consumer segments.

2.1. Research gap and objectives

While much of the existing research has focused on new EV purchases, there is a growing need to understand the dynamics of the used EV market. The research on used EV adoption has some gaps. There's little long-term research on how EV ownership experiences change over time, especially for used EV owners. While studies have looked at individual factors affecting EV adoption, examining various aspects of ownership, from pre-purchase information to post-purchase satisfaction and future intentions seems necessary. Utilizing a collected dataset through a survey of 1167 used EV owners in the US, conducted from

September to October 2022, this paper has employed Structural Equation Modeling (SEM) due to its unique capabilities in analyzing complex relationships among multiple variables simultaneously (Hair, 2009; Kline, 2023).

The primary objective of this study is to explore the factors influencing consumer purchase intentions in the used EV market, a rapidly growing segment that has not received sufficient attention in the existing literature. While considerable research has been conducted on the adoption of new EVs, the transition to the used EV market presents unique challenges and opportunities that require distinct analysis. The rationale for focusing on used EVs is driven by the increasing availability of these vehicles in the market, the different decision-making processes involved in purchasing second-hand technology, and the potential implications for sustainable transportation initiatives. This study is necessary because the dynamics of the used EV market differ significantly from those of new EVs, particularly in terms of consumer concerns about battery life, depreciation, previous ownership, and the reliability of older technology. Existing literature predominantly addresses the adoption of new EVs, often overlooking the growing segment of consumers who are turning to used EVs as a more affordable and accessible entry point into electric mobility. By identifying and analyzing the specific factors that influence used EV purchase intentions, this research fills a critical gap, offering insights that are vital for stakeholders looking to promote the broader adoption of EVs across all market segments. Ultimately, this study contributes to the understanding of how to support the growth of the used EV market, thereby advancing the overall goals of sustainable transportation.

3. Methods

3.1. Survey design & data

This study is based on the data collected through 'Questionnaire for owners of used EVs' developed by Rutgers University (Loh et al., 2023, 2024). It targeted U.S. residents aged 18 years or older who owned used EVs, with data collection occurring from September 28 to October 26, 2022, using a Qualtrics-designed questionnaire. Participants were recruited through various channels, including nine EV-related Facebook groups, five Reddit subreddits, Facebook advertisements, and collaboration with local EV associations. The survey link was distributed in two rounds, with some variations in group participation between rounds. The final sample consisted of 1167 responses. Responses were filtered to ensure participants were considered adult U.S. residents who owned used EVs. The questionnaire captured various aspects of used EV ownership, including demographics, vehicle information, pre-purchase concerns, charging infrastructure, purchase experience, ownership experience, and future intentions (Table 1 and Table 2). The survey used a combination of multiple-choice questions, Likert scales, and open-ended responses, with a median completion time of 12.8 min.

3.2. Methodology

The study employed advanced statistical techniques to ensure scientific rigor and credibility. Data analysis was conducted using IBM SPSS Statistics. Before analysis, the initial dataset of 1167 responses with missing or incomplete data was removed, resulting in a final sample of 992 valid responses. In addition, outlier detection was conducted to identify and remove extreme values that could skew the results (e.g., unrealistic driving mileage). Descriptive statistics were initially performed to summarize demographic information and general trends. SEM was employed using AMOS to explore complex relationships between variables and test the theoretical model. SEM allows for simultaneous examination of relationships among observed and latent variables, accounting for measurement error and testing direct and indirect effects (Hair, 2009). The analysis followed a two-step approach. First, a confirmatory factor analysis assessed the measurement model's validity

Table 1
Descriptive statistics.

	N_{total}	N	Percent
Socio-Demographic Characteristics			
Gender (SD_gen)	992		
Male		690	69.9
Female		282	28.4
Other		11	1.1
Prefer not to say		9	0.9
Age Groups (SD_age)	992		
18–34		428	43.1
35–64		546	55.0
65+		18	1.8
Education Level (SD_edu)	992		
No diploma		30	3.0
High school diploma/GED		99	10.0
Some college, but no degree		204	20.6
Technical/Associate/Junior College		174	17.5
Bachelor's degree		323	32.6
Graduate/Professional degree		162	16.3
Employment Status (SD_emp)	992		
Full-time employee		706	71.2
Part-time employee		57	5.7
Self-employed or small business owner		125	12.6
Unemployed and looking for work		43	4.3
Not currently working and not looking for work		27	2.7
Retired		28	2.8
Other		6	0.6
Housing type (SD_hht)	992		
A one-family house detached from any other house		706	71.2
A one-family house attached to one or more houses		57	5.7
A building with 2–6 apartments		125	12.6
A building with 7 or more apartments		43	4.3
A mobile home		27	2.7
Other		28	2.8
Household size (SD_hhs)	992		
1		35	3.5
2		159	16.0
3		310	31.3
4		338	34.1
5 or more		150	15.1
Race	992		
White		848	85.5
Black or African American		34	3.4
Asian or Pacific Islander		65	6.6
American Indian or Alaska Native		31	3.1
Multi-Racial		11	1.1
Other		3	0.3
Hispanic (SD_his)	992		
Yes		311	31.4
No		681	68.6
Household Income (SD_inc)	992		
< $50,000		239	24.1
$50,000 – $74,999		161	16.2
$75,000 – $99,999		157	15.8
$100,000 – $149,999		186	18.8
$150,000 or more		249	25.1
Purchase Details			
Year Purchased	992		
Before 2011		21	2.2
2011–2015		124	12.5
2016–2020		536	54.0
After 2020 (2021 & 2022)		311	31.3
Charger Type	992		
Standard household 120-V outlet		491	49.5
240-V outlet		429	43.2
I do not have a home charger for my EV		72	7.3
Location Purchased	992		
Car dealership		432	43.5
Online retailer (e.g. CarMax)		248	25.0
eBay/Craigslist/Facebook Marketplace		210	21.2
Family/Friend		84	8.5
Other		18	1.8

Table 2
Survey statistics.

Variable name	Description	N	Percent	Mean	Std. dev
Information Source					
info_tvradio (In_tvr)	**Information source - TV/radio**			0.276	0.447
	Yes	274	27.6		
	No	718	72.4		
info_newspaper_magazine (In_nws)	**Information source - Newspapers/magazines**			**0.273**	**0.445**
	Yes	271	27.3		
	No	721	72.7		
info_internet_socialmedia (In_net)	**Information source - Internet/social media**			**0.683**	**0.465**
	Yes	678	68.3		
	No	314	31.7		
info_onlineresearch (In_ons)	**Information source - Online research**			**0.489**	**0.500**
	Yes	486	49.0		
	No	506	51.0		
info_dealership (In_dlr)	**Information source - Dealership**			**0.204**	**0.403**
	Yes	203	20.5		
	No	789	79.5		
info_wordofmouth (In_wom)	**Information source - Word of mouth**			**0.264**	**0.441**
	Yes	262	26.4		
	No	730	73.6		
correct_info_dummy (In_crt)	**Whether correct information was received**			**0.971**	**0.165**
	Yes	964	97.2		
	No	28	2.8		
Pre-purchase Concerns					
concern_price_dummy (Co_prc)	**Concern about price**			**0.366**	**0.482**
	Yes	364	36.7		
	No	628	63.3		
concern_drivingrange_dummy (Co_rng)	**Concern about driving range**			**0.302**	**0.459**
	Yes	300	30.2		
	No	692	69.8		
concern_charging_dummy (Co_crg)	**Concern about charging**			**0.445**	**0.497**
	Yes	442	44.6		
	No	550	55.4		
concern_battery_dummy (Co_bat)	**Concern about battery**			**0.551**	**0.497**
	Yes	547	55.1		
	No	445	44.9		
concern_installcost_dummy (Co_ins)	**Concern about installation costs**			**0.237**	**0.426**
	Yes	236	23.8		
	No	705	76.2		
concern_evavailability_dummy (Co_eva)	**Concern about EV availability**			**0.289**	**0.453**
	Yes	287	28.9		
	No	705	71.1		
difficult_affordableEV_5cat (Co_afr)	**Difficulty finding affordable EV**			**3.217**	**1.219**
	Totally Disagree	99	10.0		
	Somewhat Disagree	210	21.2		
	Neither Agree nor Disagree	205	20.7		
	Somewhat Agree	332	33.5		
	Totally Agree	146	14.7		
difficult_batteryrange_5cat (Co_btr)	**Difficulty with battery range**			**3.392**	**1.126**
	Totally Disagree	63	6.4		
	Somewhat Disagree	168	16.9		
	Neither Agree nor Disagree	231	23.3		
	Somewhat Agree	377	38.0		
	Totally Agree	153	15.4		
dealersfamiliar_EVtech_5cat (Co_dle)	**Dealers' familiarity with EV technology**			**3.385**	**1.260**
	Totally Disagree	118	11.9		
	Somewhat Disagree	134	13.5		
	Neither Agree nor Disagree	170	17.1		
	Somewhat Agree	388	39.1		
	Totally Agree	182	18.3		
Driving Experience					
driving_mileage (De_mil)	**Miles driven on a typical day**			**3.336**	**1.675**
	Less than 100 miles	589	59.4		
	101-200 miles	292	29.4		
	201-300 miles	81	8.2		
	More than 300 miles	30	3.0		
mileage_recharge (De_rch)	**Miles driven before recharging**			**1.701**	**0.883**
	Less than 100 miles	545	54.9		
	101-200 miles	232	23.4		
	201-300 miles	181	18.2		
	More than 300 miles	34	3.4		
battery_decline_3cat (De_dec)	**Battery decline over time**			**1.758**	**0.535**
	No, it has not declined	291	29.3		
	Declined somewhat	650	65.5		
	Declined a lot	51	5.1		

(*continued on next page*)

Table 2 (*continued*)

Variable name	Description	N	Percent	Mean	Std. dev
drive_200miles_5cat (De_200)	**Times a year the used EV has driven 200 miles or further in one day**			**2.711**	**1.386**
	I never drive more than 200 miles in one day	283	28.5		
	Once a year	155	15.6		
	Twice a year	252	25.4		
	Three times a year	169	17.0		
	Four or more times a year	133	13.4		
use_publicchargers_5cat (De_pch)	**Times that the owner have used a public charging station in the past two weeks**			**2.778**	**1.095**
	None	153	15.4		
	Once	237	23.9		
	Twice	312	31.5		
	Several times a week	257	25.9		
	Nearly everyday	33	3.3		
Ease of Charging					
easy_charging_5cat (Es_chr)	**Ease of finding a public charger**			**3.317**	**1.162**
	Totally Disagree	74	7.5		
	Somewhat Disagree	198	20.0		
	Neither Agree nor Disagree	201	20.3		
	Somewhat Agree	377	38.0		
	Totally Agree	142	14.3		
satistfied_batteryhold_5cat (Es_bts)	**Satisfaction with battery hold**			**3.628**	**1.082**
	Totally Disagree	49	4.9		
	Somewhat Disagree	108	10.9		
	Neither Agree nor Disagree	216	21.8		
	Somewhat Agree	409	41.2		
	Totally Agree	210	21.2		
num_chargers_5cat (Es_nch)	**Number of public chargers (within a 15-min drive)**			**3.076**	**0.903**
	None	52	5.2		
	1	176	17.7		
	2 to 4	445	44.9		
	5 or more	282	28.4		
	I don't know	37	3.7		
buy_usedfullev_4cat (FuturePurch)	**Likelihood of buying a used full EV in future**			**2.854**	**0.882**
	Very Unlikely	63	6.4		
	Unlikely	279	28.1		
	Likely	389	39.2		
	Very Likely	261	26.3		

and reliability. Second, the structural model examined hypothesized relationships between constructs. Multiple fit indices were used to assess model fit. These rigorous methodological approaches enhance the credibility and generalizability of the findings, providing a solid foundation for understanding used EV market dynamics (Fig. 1 provides the study flow diagram).

3.2.1. Structural equation modeling (SEM)

SEM is a comprehensive statistical approach used to test hypotheses about relationships among observed and latent variables. Unlike traditional regression models, SEM allows for the examination of complex variable interdependencies and the inclusion of measurement error. SEM integrates factor analysis and path analysis, enabling researchers to construct, estimate, and test models that reflect both the direct and indirect relationships among variables. SEM is particularly valuable in social sciences, behavioral sciences, and market research, where it facilitates the testing of theoretical constructs that are not directly observable but inferred from multiple indicators. The method involves two main components: the measurement model, which defines the relationships between latent variables and their indicators, and the structural model, which specifies the relationships among the latent variables themselves. A key advantage of SEM is its flexibility in modeling and its ability to provide a detailed understanding of complex phenomena. However, it requires large sample sizes and careful consideration of model fit indices to ensure valid and reliable results. For a comprehensive overview on SEM, readers are referred (Kline, 2023).

4. Results & discussion

4.1. Survey results

Table 1 presents the respondents' demographic characteristics and EV experience-related information, comprising 992 individuals. These descriptive statistics provide a comprehensive overview of used EV owners' demographic, socioeconomic and purchase behavior characteristics. Gender distribution among participants was skewed, with males constituting the majority (69.9%), followed by females (28.4%), while a small proportion identified as other (1.1%) or preferred not to disclose their gender (0.9%). This gender imbalance may reflect a broader trend in the automotive market, where males are more likely to adopt new automotive technologies, including EVs. The sample was predominantly middle-aged, with 55.0% in the 35–64 age bracket, followed by 43.1% in the 18–34 category. Only 1.8% of respondents were 65 years or older. These results suggest a higher inclination towards EV ownership among younger and middle-aged adults. Racially, the sample was predominantly White (85.5%), with smaller representations of Asian or Pacific Islander (6.6%), Black or African American (3.4%), and American Indian or Alaska Native (3.1%) participants. Regarding ethnicity, 31.4% of respondents identified as Hispanic. Furthermore, regarding educational attainment, the participants demonstrate a relatively high level of education. Only 3.0% have no diploma, 10.0% possess a high school diploma or GED, and 20.6% have attended some college without obtaining a degree. Notably, 17.5% hold an associate degree, 32.6% have earned a bachelor's degree, and 16.3% have graduate or professional degrees, reflecting a well-educated cohort. The high level of education among current EV owners suggests that this group have a better understanding of the benefits and technical aspects of EVs, which could influence their intention to purchase used EVs. Higher educational attainment might correlate with greater environmental awareness and financial capability to invest in EVs. Similarly, a study shows early EV adopters in Germany tend to be among highly educated, middle-aged men (Trommer et al., 2015).

The respondent's employment status shows a predominance of full-time employment, with 71.2% employed full-time, 5.7% part-time,

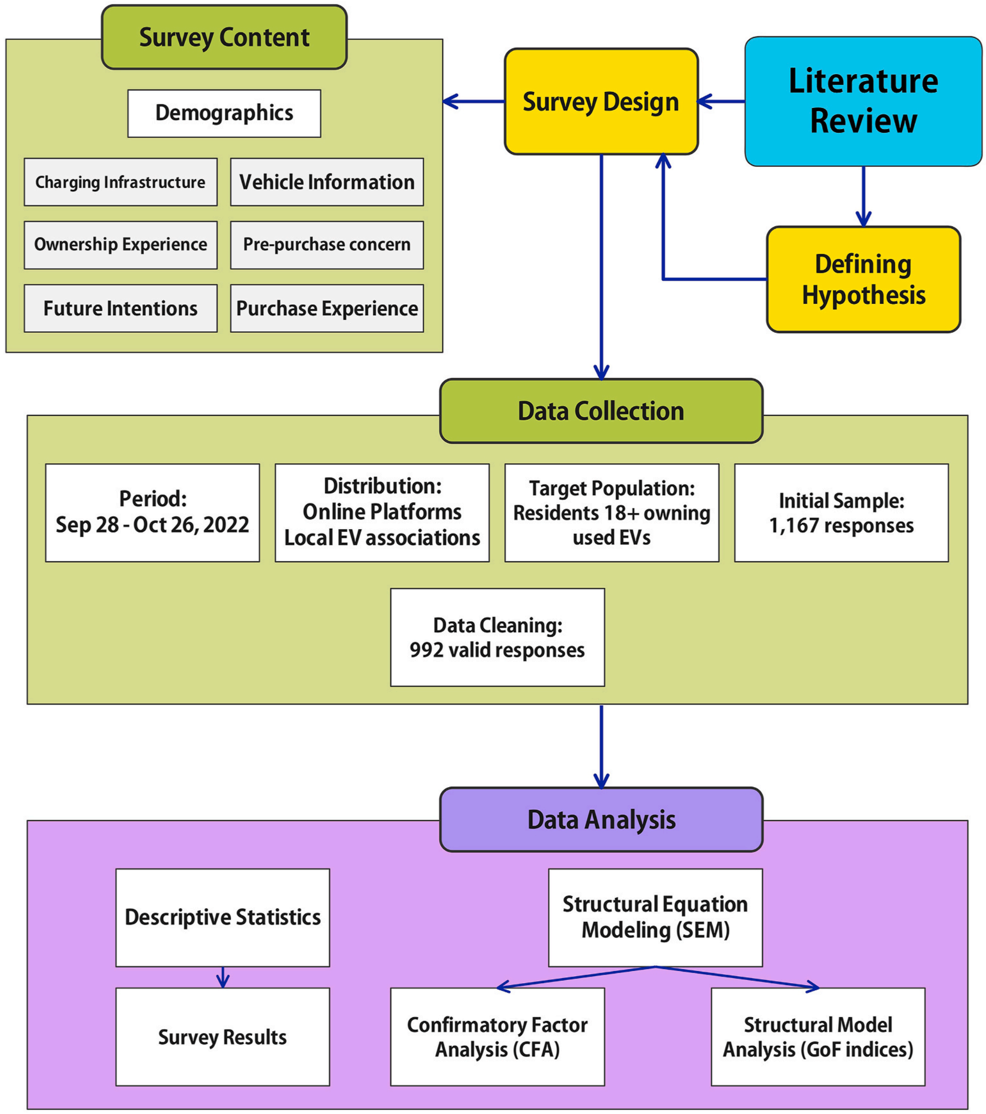

Fig. 1. Study process.

and 12.6% self-employed or small business owners. A minority of 4.3% are unemployed and seeking work, 2.7% are not currently working and not looking for work, 2.8% are retired, and 0.6% fall into other categories. Housing type data indicates that a significant majority of the respondents, 71.2%, live in a one-family house detached from any other home. Others reside in a one-family house attached to other houses (5.7%), a building with 2–6 apartments (12.6%), a building with seven or more apartments (4.3%), or a mobile home (2.7%). Additionally, 2.8% reported other types of housing. Household size varies among the respondents, with 3.5% living alone, 16.0% in two-person households, 31.3% in three-person households, 34.1% in four-person households, and 15.1% in households of five or more individuals. The income distribution among participants was relatively balanced across categories. 25.1% reported household incomes of $150,000 or more, followed by 24.1% earning less than $50,000 annually. The middle-income brackets ($50,000 to $149,999) accounted for 50.8% of the sample. This balanced income distribution indicates a diverse economic representation among participants, which is important for understanding the potential market across different economic strata. Economic diversity within the sample suggests that insights gained from the study can be generalized to various income groups, highlighting the affordability and appeal of used EVs to both higher and lower-income households.

Concerning EV-specific information, most respondents (54.0%) purchased their used EVs between 2016 and 2020, with 31.3% acquiring their vehicles after 2020. Nearly half of the participants (49.5%) reported using a standard household 120-V outlet for charging, while 43.2% utilized a 240-V outlet. Notably, 7.3% of respondents needed a home charger for their EVs. Finally, regarding the purchase location of their used EVs, 43.5% of participants obtained their vehicles from car dealerships, followed by online retailers (25.0%) and peer-to-peer platforms such as eBay, Craigslist, or Facebook Marketplace (21.2%).

Table 2 provides the survey results of a total of 992 participants. These findings highlight the diverse experiences and perspectives of current used EV owners, shedding light on information sources, pre-purchase concerns, driving experiences, charging ease, and future buying intentions. The survey investigated various sources from which respondents obtained information about used EVs. The most prevalent sources were the Internet and social media, with 68.3% of participants relying on them for reviews, user experiences, and the latest updates on EV models and technologies. Online research was also significant, with nearly half (49.0%) using this method to compare prices, check availability, and read expert opinions. Conversely, traditional media such as TV/radio and newspapers/magazines were less frequently consulted, with only 27.6% and 27.3% respectively, often providing general information and news related to EV trends and market growth. Dealerships and word-of-mouth were used by a smaller proportion of respondents, at 20.5% and 26.4% respectively, typically offering first-hand accounts, test drives, and personal recommendations. Notably, 97.2% of respondents reported receiving correct information about EVs before their purchase, indicating a high level of confidence in the information obtained from these various sources.

The study also examined potential buyers' concerns before purchasing a used EV. Price was a concern for 36.7% of respondents, likely due to the initial higher cost of EVs compared to traditional vehicles. Driving range worried 30.2% of respondents, reflecting anxiety over the distance an EV can travel on a single charge, which is critical for long-distance travel and daily commutes. Charging availability and battery longevity were significant concerns for 44.6% and 55.1% of respondents, respectively, due to the current infrastructure gaps and the perceived need for frequent battery replacements, which can be costly and inconvenient. Installation costs for home charging stations and the availability of EVs were less pressing, with 23.8% and 28.9% of respondents expressing concern, possibly because these factors can be managed with proper planning and financial resources. Additionally, 33.5% somewhat agreed, and 14.7% agreed that finding an affordable EV was difficult, indicating that the market for used EVs is still maturing, and affordable options are limited. Battery range concerns were also prominent, with 38.0% somewhat agreeing and 15.4% agreeing, emphasizing the importance of technological advancements to increase range and reduce range anxiety. The familiarity of dealers with EV technology was a moderate concern, with 39.1% somewhat agreeing and 18.3% agreeing that dealers were knowledgeable, suggesting that more training and expertise are needed to support customers effectively. These concerns highlight the key factors influencing the decision-making process, including cost, technological limitations, infrastructure, and the level of support from dealerships.

Respondents were asked about their driving habits and experiences with their used EVs. Most used EV owners (59.4%) reported driving less than 100 miles on a typical day, indicating that their daily usage fits well within the range capabilities of most EVs, making them suitable for commuting and local travel. Meanwhile, 29.4% drove between 101 and 200 miles daily, suggesting a need for vehicles with longer ranges or more frequent charging. Regarding recharging habits, 54.9% recharge before reaching 100 miles, highlighting a tendency to avoid letting the battery deplete too much, which could be due to range anxiety or a preference for maintaining battery health. Another 23.4% recharge between 101 and 200 miles, indicating a confidence in the vehicle's range or fewer charging opportunities. A significant majority (70.6%) reported some battery decline over time, which is a common characteristic of EV batteries, though only 5.1% experienced a substantial decline, suggesting that most used EVs still perform adequately over time. Long-distance driving patterns varied, with 28.5% never driving more than 200 miles daily, implying that these owners rarely need to consider range limitations for longer trips, while 13.4% did so four or more times a year, indicating occasional long-distance travel. Public charging station usage was common, with 60.7% of respondents using them at least twice in the past two weeks, reflecting the importance of public charging infrastructure in supporting daily EV use and providing flexibility for longer journeys.

Attitudes towards charging infrastructure were generally positive. Around 52% of respondents found it easy to locate public chargers, which suggests that charging networks are becoming more widespread and accessible, easing concerns about range anxiety and the ability to recharge on the go. Conversely, only 27.5% disagreed, indicating that the majority are satisfied with the current infrastructure. Battery performance satisfaction was high, with 62.4% expressing satisfaction versus 15.8% dissatisfaction, underscoring the reliability and efficiency of EV batteries in real-world conditions. Most respondents (73.3%) reported having 2 or more chargers available, indicating good access to charging infrastructure both at home and in public spaces. This widespread availability and ease of access to charging stations foster confidence among current and potential EV owners, suggesting that charging infrastructure is effectively supporting EV adoption and daily use.

Finally, the survey assessed the respondents' intentions to purchase a used full EV in the future. Regarding future buying intentions for used full EVs, the outlook appears positive. A substantial 65.5% of current used EV owners indicated they were either likely or very likely to purchase another used full EV in the future. In contrast, only 34.5% expressed unlikelihood, with a mere 6.4% being unlikely to make such a purchase.

4.2. SEM results

The research utilizes SEM to investigate the interrelationships among constructs, addressing both measurement and structural components. Path analysis is employed to evaluate construct validity and to examine the predictive connections between capability and its sub-dimensions, which include individual characteristics and environmental factors (such as living conditions and mobility variables). The primary goal is to better understand the key factors impacting processes in this area. This section presents the SEM results and discussion.

4.2.1. SEM Model performance

Several goodness-of-fit (GoF) indices are used to assess the model's fit and one-dimensionality (see Table 3) (Kline, 2023; Bagozzi et al., 1988; Deng et al., 2013; Hu and Bentler, 1999; Koufteros, 1999; Marsh et al., 1985).

Table 4.

Table 5 presents the Confirmatory Factor Analysis results, showing the relationships between observed variables and their latent constructs. It provides standardized regression weights (β), t-values, and p-values for each relationship. These statistics offer insights into the measurement model's validity, indicating the strength and statistical significance of each observed variable's representation of its intended construct.

Two key measures are employed to evaluate the reliability of latent constructs: Composite Reliability (CR) and average variance extracted (AVE). Composite reliability assesses the internal consistency of a construct, indicating how well the observed variables collectively represent the underlying concept. Researchers generally consider a composite reliability value exceeding 0.50 acceptable (Fornell et al., 1981). This study revealed that the constructs of Sociodemographic characteristics, Information sources, Pre-purchase concerns, Driving experience, and Ease of charging demonstrated acceptable reliability, with values of 0.744, 0.701, 0.703, 0.710, and 0.696, respectively. On the other hand, the AVE quantifies the proportion of variance in the observed variables attributable to the latent construct. A threshold of 0.50 or higher for AVE is typically deemed satisfactory (Hair, 2009; Bagozzi et al., 1988). In this study, the AVE values for Sociodemographic characteristics, Information sources, Pre-purchase concerns, driving experience, and ease of charging were 0.538, 0.512, 0.519, 0.523, and 0.501, respectively, surpassing this threshold. These findings, combined with the results from the GoF analysis and overall measurement model evaluation, provide robust evidence supporting the validity of our

Table 3
Goodness-of-fit measures.

Goodness-of-fit measure	Acceptable range	Model measurement	Validity
Goodness-of-fit (GFI)	>0.90	0.971	OK
Adjusted goodness-of-fit (AGFI)	>0.90	0.945	OK
Tucker Lewis Index (TLI)	>0.90	0.910	OK
Comparative Fit Index (CFI)	>0.90	0.922	OK
Root Mean Square Residual (RMR)	<0.05	0.050	OK
Root-mean-square error of approximation (RMSEA)	<0.05	0.042	OK
Normed Chi-square (CMIN/DF)	<5.0	2.755	OK

Table 4
Validation of factor constructs.

Construct	Number of Items	Composite Reliability (CR)	Average Variance Extracted (AVE)	Cronbach's Alpha	Validity
Sociodemographic	5	0.744	0.538	0.73	OK
Information Sources	2	0.701	0.512	0.70	OK
Pre-Purchase Concerns	5	0.703	0.519	0.72	OK
Driving Experience	3	0.710	0.523	0.71	OK
Ease of Charging	3	0.696	0.501	0.69	OK
Overall Model Fit	—	–	–	–	Good Fit

Table 5
Confirmatory factor results.

Construct		Observed Variable/ Construct	Standardized Regression Weight (β)	t-value	p-value
SocioD	→	SD_inc	0.664	–[a]	***
	→	SD_age	0.372	0.235	***
	→	SD_edu	0.586	0.483	***
	→	SD_hhs	0.149	0.095	***
	→	SD_his	0.473	0.133	***
InfoSource	→	In_tvr	0.390	–	***
	→	In_ons	−0.326	−0.939	***
PreConcerns	→	Co_dle	0.106	–	
	→	Co_non	−0.106	−0.044	0.011
	→	Co_afr	0.860	2.698	***
	→	Co_btr	0.588	1.689	***
	→	Co_bat	0.315	0.135	0.030
Drivingexp	→	De_mil	0.498	–	
	→	De_rch	0.611	0.645	***
	→	De_200	0.490	0.809	***
Chargingease	→	Es_chr	0.771	–	
	→	Es_bts	0.571	0.689	***
	→	Es_nch	0.456	0.330	***
SocioD	↔	InfoSource	−0.510	−0.145	***
SocioD	↔	PreConcerns	−0.068	−0.043	***
SocioD	↔	Drivingexp	0.301	0.412	***
SocioD	↔	Chargingease	0.154	0.226	***
PreConcerns	↔	Drivingexp	0.202	0.066	***
PreConcerns	↔	Chargingease	0.300	0.105	***
InfoSource	→	FuturePurch	−0.312	−1.158	***
Drivingexp	→	FuturePurch	−0.150	−0.158	***
Chargingease	→	FuturePurch	0.456	0.446	***

[a] Indicates a parameter fixed at 1.0 in the original solution.

proposed model. It's worth noting that while these metrics offer valuable insights, they should be interpreted in conjunction with other validity assessments and theoretical considerations to provide a comprehensive evaluation of the model's reliability.

The final fitted structural model is depicted in Fig. 2, showing only the significant standardized path coefficients. The results indicate that the defined dimensions significantly affect the individual's intention to buy a used EV in the future. Sociodemographic characteristics, information sources, pre-purchase concerns, driving experience, and ease of charging demonstrate various effects on owners' likelihood of purchasing a used EV. This supports the multi-faceted approach to understanding EV adoption, which considers a range of personal, social, and informational factors (Liao et al., 2017).

4.2.2. *Ease of charging and battery reliability (Chargingease)*

Chargingease has a moderate direct positive effect on FuturePurch ($\beta_{\text{Chargingease}\rightarrow\ \text{FuturePurch}} = 0.456$). This positive relationship indicates that when EV owners perceive the charging process as convenient and accessible, their satisfaction with their current EV increases, leading to a higher propensity to consider purchasing a used EV in the future. This finding aligns with previous studies highlighting the importance of charging convenience and robust, user-friendly charging infrastructure in promoting EV adoption and user retention (Funke et al., 2019; Hardman et al., 2018).

Chargingease is defined by three observed variables: ease of finding a public charger (Es_chr), satisfaction with battery hold (Es_bts), and the number of chargers available in a 15-min drive (Es_nch). The highly positive regression weight ($\beta_{\text{Es\_chr}} = 0.771$) for ease of finding a public charger underscores its significant impact on the overall perception of charging ease. This finding aligns with previous research indicating that the availability and accessibility of public charging infrastructure are critical factors in EV adoption (Hardman et al., 2017; Gnann et al., 2018; Hackbarth et al., 2016). The positive regression weight ($\beta_{\text{Es\_bts}} = 0.571$) for satisfaction with battery hold indicates that satisfaction with battery hold reflects the owner's confidence in the battery's capacity to maintain a charge over time and its ability to support the vehicle's range requirements. Previous studies have shown that battery performance and reliability are critical determinants of EV user satisfaction (Franke et al., 2013a; Neubauer et al., 2014). The positive regression weight ($\beta_{\text{Es\_nch}} = 0.456$) for the number of chargers available indicates that the sheer quantity of charging points reduces the likelihood of waiting times and increases the convenience of finding a charging spot, particularly in high-demand areas. This finding is supported by research that emphasizes the importance of a robust charging infrastructure network to accommodate the growing number of EVs on the road (Funke et al., 2019; Neaimeh et al., 2017).

4.2.3. *Information sources (InfoSource)*

The negative direct effect of InfoSource on FuturePurch ($\beta_{\text{InfoSource}\rightarrow\text{FuturePurch}} = -0.312$) suggests that reliance on information sources, such as TV, radio, and online searches, might not be as effective in positively influencing EV owners' purchase intentions. Therefore, enhancing the quality and reliability of information disseminated through traditional media could be crucial in shaping future purchase decisions.

InfoSource is defined by two observed variables: TV and radio (In_tvr) and online search (In_ons). The positive regression weight ($\beta_{\text{In\_tvr}} = 0.390$) for TV and radio shows a moderate positive relationship with information sources for EVs. This suggests that traditional media channels still play a significant role for disseminating information about EVs, likely due to their broad reach and ability to convey information in an engaging manner. This finding aligns with previous studies that have highlighted the role of mass media in shaping public perceptions and knowledge about new technologies, including sustainable transportation options, such as EVs (Axsen et al., 2015; Jansson et al., 2017; Krause et al., 2013; Lane et al., 2007). Interestingly, the negative regression weight ($\beta_{\text{In\_ons}} = -0.326$) for online search suggests that increased reliance on online searches for EV information is associated with lower overall engagement with information sources. However, it can be explained by the nature of online content, which consumers may encounter conflicting or misleading information online, leading to confusion or skepticism about EVs. This contrasts with findings of some studies that emphasize the growing importance of online information in EV adoption decisions (Rezvani et al., 2015; Axsen et al., 2015). However, the negative relationship could indicate information overload or exposure to conflicting information online, potentially leading to confusion or skepticism among consumers (Özkan et al., 2015).

4.2.4. *Driving experience (Drivingexp)*

Drivingexp has a negative direct effect on FuturePurch ($\beta_{\text{Drivingexp}\rightarrow}$

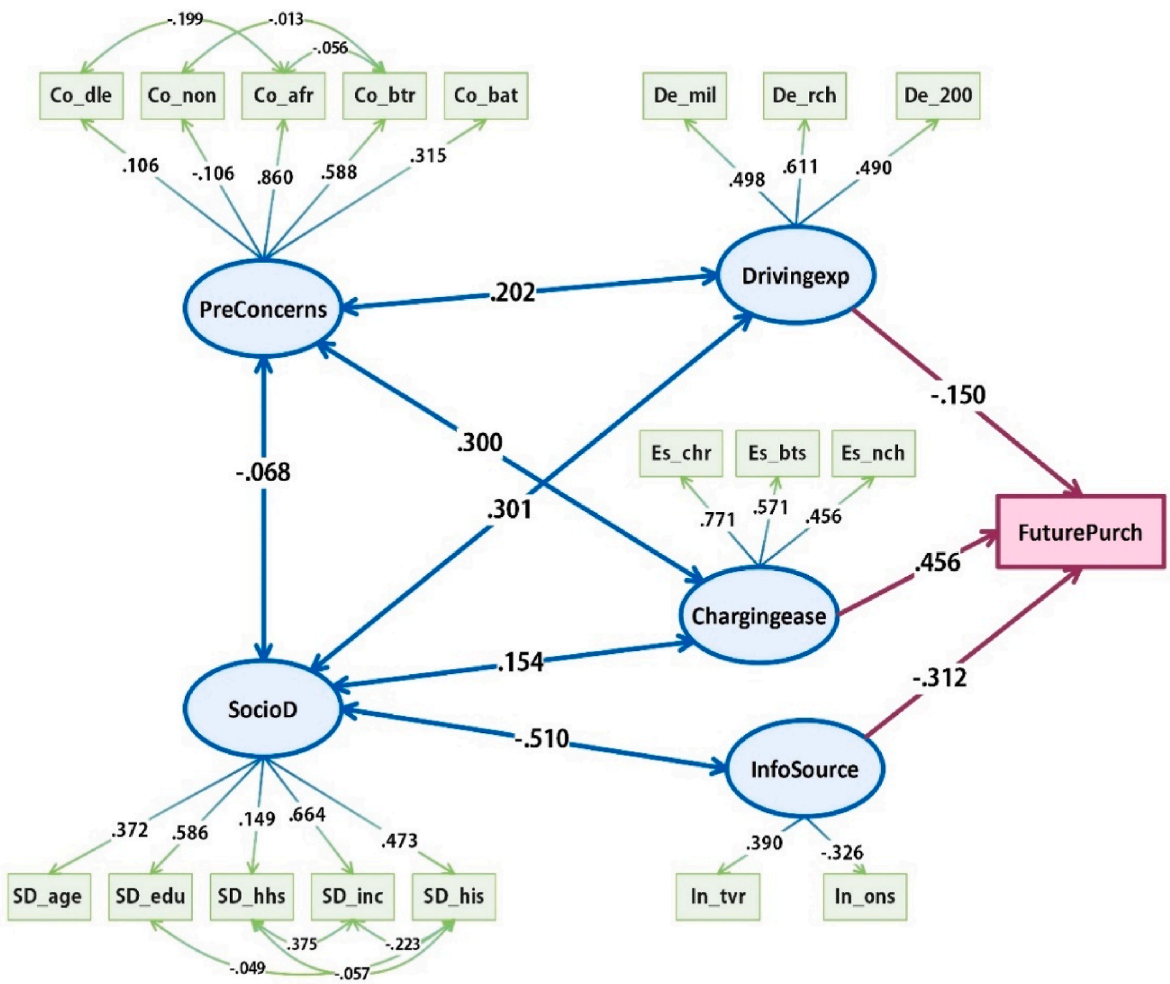

Fig. 2. Structural model of EV owners' likelihood of purchasing a used EV in the future.

FuturePurch = −0.150), indicating that certain aspects of the driving experience, such as range limitations or charging inconveniences, may contribute to this negative perception. Research has shown that negative experiences with battery range and charging infrastructure can significantly impact overall satisfaction and future purchase intentions (Franke et al., 2013a; Bühler et al., 2014).

Drivingexp includes miles driven daily (De_mil), miles driven before recharging (De_rch), and long-distance trips (De_200). Miles driven before recharging has the highest positive impact ($\beta_{De\_rch} = 0.611$), highlighting it as a critical factor in shaping the driving experience of EV owners. This variable is closely related to "range anxiety" (Pevec et al., 2019, 2020), which refers to the fear of the battery running out of power before reaching a charging station. Studies have shown that increasing battery range and improving charging infrastructure significantly reduce range anxiety and enhance user satisfaction (Franke et al., 2013b; Rauh et al., 2015). The miles driven on a typical day show a moderate positive impact ($\beta_{De\_mil} = 0.498$) and indicates that the distance EV owners typically travel influences their perception and satisfaction with their vehicles. Previous research supports this finding, indicating that EV owners who drive longer distances daily may have a more positive experience due to their ability to utilize the cost-saving benefits of EVs more effectively (Bühler et al., 2014). Also, a research found that daily driving patterns influence EV adoption and usage (Jensen et al., 2013). The number of times per year that the used EV has driven 200 miles or more in one day ($\beta_{De\_200} = 0.490$) demonstrates that long-distance driving can test the EV's battery range and charging infrastructure limits. Positive experiences in these scenarios can reinforce confidence in the vehicle's performance. This finding aligns with findings, which found that experience with longer trips positively influences EV acceptance and reduces range anxiety (Franke et al., 2013a; Neubauer et al., 2014; Rauh et al., 2015).

4.2.5. *Pre-purchase concerns (PreConcerns)*

PreConcerns indirectly influence FuturePurch through Drivingexp and Chargingease. The positive correlations between PreConcerns and both Drivingexp ($\beta_{PreConcerns \leftrightarrow Drivingexp} = 0.202$) and Chargingease ($\beta_{PreConcerns \leftrightarrow Chargingease} = 0.301$) suggest that addressing initial concerns related to battery range, charging availability, and affordability can positively impact the overall EV ownership experience. By mitigating these pre-purchase worries, owners are more likely to have a satisfactory driving experience and find charging their EVs easier and more convenient. This improved experience can lead to higher satisfaction levels among EV owners, making them more likely to consider purchasing another EV in the future (Carley et al., 2013). This potential for a positive impact is significant, as it highlights the importance of addressing consumer concerns early in the decision-making process. Effective communication and solutions to these concerns can enhance the perception and reality of EV ownership, fostering greater confidence in the technology and increasing the likelihood of future purchases.

PreConcerns include various concerns such as dealers' familiarity with EV technology (Co_dle), affordability (Co_afr), battery range (Co_btr), battery issues (Co_bat), and having no concern (Co_non). Difficulty finding affordable EVs ($\beta_{Co\_afr} = 0.860$) shows a moderate positive correlation and suggests affordability remains a notable concern for potential used EV buyers. This finding is consistent with previous research indicating that the high upfront cost of EVs is a major barrier to adoption (Liao et al., 2017; Rezvani et al., 2015; Egbue et al., 2012). The result also underscores the continued need for financial incentives and market strategies to address cost-related barriers (Hardman et al., 2017). Financial incentives such as subsidies, tax rebates, and low-interest loans can make EVs more affordable to a broader audience, lowering the initial cost and making them competitive with traditional vehicles (Roberson et al., 2022). Additionally, market strategies such as offering more affordable used EV models, enhancing trade-in values, and providing lease options can attract budget-conscious consumers. These measures can significantly reduce the financial burden on buyers, encouraging more widespread adoption of EVs. Battery-related concerns exhibit a moderate positive impact ($\beta_{Co\_bat} = 0.588$) among potential EV buyers. This concern is well-documented in the literature as a significant deterrent to EV adoption, which is consistent with the range anxiety phenomenon (Franke et al., 2013a). Consumers are often worried about the limited range of EVs compared to conventional internal combustion engine vehicles, fearing that they might be unable to complete their daily commutes or longer trips without frequent recharging. Similarly, the positive weight ($\beta_{Co\_btr} = 0.315$) for concerns about battery issues corroborates with previous studies that have highlighted those concerns about battery degradation, replacement costs, and overall battery reliability influencing consumer hesitancy (Axsen et al., 2015; Lieven, 2015; Noel et al., 2019). Concern about dealers' familiarity with EV technology ($\beta_{Co\_dle} = 0.106$) and having no concern ($\beta_{Co\_non} = 0.106$) show weak relationships with pre-purchase concerns. Findings of dealers' familiarity align with the literature, suggesting that the knowledge and expertise of sales personnel can influence consumer confidence and their purchase decisions (Matthews et al., 2017; Morton et al., 2016). Moreover, the absence of concerns logically reduces the overall level of pre-purchase anxiety. Studies have shown that consumers who enter the EV market with fewer reservations are generally more confident and satisfied with their purchase decisions (Carley et al., 2013; Egbue et al., 2012).

4.2.6. Sociodemographic characteristics (SocioD)

Sociodemographic characteristics indirectly influence Future Purchase intention through InfoSource and Chargingease. The negative correlation between SocioD and InfoSource ($\beta_{SocioD \leftrightarrow InfoSource} = -0.510$) and the significant positive effect of Chargingease on FuturePurch ($\beta_{Chargingease \leftrightarrow FuturePurch} = 0.456$) indicate that sociodemographic factors can shape future purchase intentions by influencing information sources and charging perceptions. Higher-income and more educated individuals might rely less on traditional information sources and more on personal networks, which could positively impact their perceptions of charging ease and, consequently, their future purchase intentions (Rezvani et al., 2015; Axsen et al., 2015).

SocioD encompasses income level (SD_inc), age group (SD_age), education level (SD_edu), household size (SD_hhs), and Hispanic ethnicity (SD_his). Income level exhibits the highest positive impact ($\beta_{SD\_inc} = 0.664$), highlighting that higher income levels are a critical determinant of the sociodemographic profile of EV owners. Higher income allows for greater financial flexibility to invest in new technologies, including EVs (Axsen et al., 2012; Plötz et al., 2014; Krause et al., 2013; Hardman et al., 2016; Javid et al., 2017). Education level shows a substantial positive correlation ($\beta_{SD\_edu} = 0.586$), suggesting that more educated individuals are more inclined towards used EV purchases. This aligns with previous studies suggesting that higher education levels correlate with a greater likelihood of adopting new and sustainable technologies, including EVs (Carley et al., 2013; Egbue et al., 2012; Sovacool et al., 2018). Hispanic ethnicity demonstrates a moderate positive relationship with sociodemographic characteristics ($\beta_{SD\_his} = 0.473$), indicating that being Hispanic positively contributes to the sociodemographic characteristics of EV owners. This result may reflect targeted outreach and marketing efforts towards Hispanic communities or a growing interest in sustainable technologies within these communities. This finding contrasts with previous research (Muehlegger et al., 2018; Turrentine et al., 2011), which found lower EV adoption rates among minority communities. Conversely, previous studies have highlighted the importance of cultural factors and community-specific outreach in influencing EV adoption (Carley et al., 2013). The age group exhibits a moderately positive impact ($\beta_{SD\_age} = 0.372$), suggesting that older individuals contribute positively to the socio-demographic profile of EV owners. This finding also contrasts with previous studies (Hidrue et al., 2011; Hjorthol, 2013) who found that younger age groups were likelier to adopt EVs. This discrepancy could indicate a shift in EV adoption patterns or reflect specific characteristics of our sample. Our results suggest that the used EV market may attract a different age demographic due to factors such as financial stability or changing attitudes towards EVs among older populations. Also, household size shows a relatively low positive weight ($\beta_{SD\_hhs} = 0.149$), which suggests larger households have a slight tendency toward EV ownership. This result partially supports by findings of some studies (Jensen et al., 2013; Hackbarth et al., 2013; Nayum et al., 2016) that found that household size influenced EV adoption, albeit with mixed effects depending on the number of children.

4.2.7. Structural relationships

The moderate negative correlation between SocioD and InfoSource ($\beta_{SocioD \leftrightarrow InfoSource} = -0.510$) suggests that individuals with specific sociodemographic characteristics are less likely to rely on information sources such as TV, radio, and online searches for EVs. This finding aligns with research indicating that higher-income and more educated individuals rely more on personal networks and less on traditional media for information (Brossard et al., 2013). It suggests that targeted informational campaigns might be necessary to reach different socio-demographic groups effectively. The positive correlation between Pre-purchase concerns and Chargingease ($\beta_{PreConcerns \leftrightarrow Chargingease} = 0.301$) indicates that individuals who had concerns before purchasing an EV also perceive ease of charging as an important factor in their ownership experience. This is consistent with literature highlighting that addressing range anxiety and improving charging infrastructure can mitigate initial concerns and improve overall EV adoption (Carley et al., 2013). The positive correlation between driving experience and Charging Ease ($\beta_{Drivingexp \leftrightarrow Chargingease} = 0.301$) highlights that a positive driving experience is likely influenced by convenient and accessible charging infrastructure that reduces the stress associated with owning an EV. Reliable and widespread charging options allow drivers to recharge their vehicles without significant detours or waiting times, contributing to a seamless and enjoyable driving experience. This finding is supported by research indicating that a positive charging experience is crucial for overall satisfaction with EVs (Bühler et al., 2014). The positive correlation between PreConcerns and Drivingexp ($\beta_{Drivingexp \leftrightarrow PreConcerns} = 0.202$) suggests that initial concerns before purchasing an EV are related to the subsequent driving experience. Studies have shown that initial concerns, such as range anxiety and charging availability, can impact user experience, and addressing these concerns can lead to higher satisfaction (Franke et al., 2013b). Studies show that consumers systematically underestimate EV range compatibility with their needs, leading to reduced willingness to adopt (Herberz et al., 2022). By proactively resolving issues related to battery range, charging infrastructure, and affordability, manufacturers and policymakers can significantly enhance the appeal of EVs (Kar et al., 2013). For instance, expanding charging stations, implementing battery swapping techniques, and improving battery technology can alleviate prospective buyers' worries (Alanazi, 2023). This, in turn, leads to a more positive driving experience, as owners feel more confident and secure in their vehicle's capabilities and support systems.

5. Discussions

The findings of this study underscore the critical importance of charging infrastructure in shaping future purchase intentions for used EVs. Charging ease, particularly the availability and accessibility of public chargers, emerged as a significant factor that positively influences consumer satisfaction and their likelihood of considering another EV purchase. This aligns with existing literature that emphasizes the role of a robust charging network in mitigating range anxiety and enhancing the overall ownership experience. The positive correlation between pre-purchase concerns and charging ease further highlights the need for addressing these concerns early in the consumer journey to foster greater confidence in EV technology and promote long-term adoption. To address this, policymakers can prioritize the expansion and accessibility of public charging networks. This can be achieved through targeted investments in charging infrastructure, particularly in areas with high EV adoption potential, to ensure that chargers are conveniently located and easily accessible. Additionally, implementing incentives for businesses and property owners to install charging stations could further enhance the network's reach. Alongside infrastructure development, public awareness campaigns should focus on educating consumers about the availability and benefits of the charging network to alleviate pre-purchase concerns and build confidence in the practicality of EV ownership.

On the other hand, the negative impact of information sources, particularly online searches, on future purchase intentions presents a nuanced challenge. While traditional media channels still play a role in disseminating EV information, the potential for misinformation and information overload online can lead to confusion and skepticism among consumers. This suggests a critical need for improving the quality and reliability of information available to potential EV buyers, particularly in the digital space. To address this, policymakers and industry stakeholders can focus on developing and enforcing standards for accurate and transparent information dissemination about EVs. This could include establishing official certification or endorsement programs for online content related to EVs, ensuring that consumers have access to reliable sources of information. Additionally, partnerships between government agencies, industry leaders, and trusted organizations could be formed to create centralized, authoritative platforms where consumers can easily find verified information about EVs, including details on charging infrastructure, battery performance, and financial incentives. Finally, the negative effect of driving experience on future purchase intentions, linked to range limitations and charging inconveniences, underscores the ongoing need for advancements in battery technology and the expansion of charging networks to alleviate these persistent barriers to EV adoption. This can be improved with increased investment in research and development to improve battery range and efficiency, thereby reducing range anxiety among EV users. Additionally, expanding the charging network, particularly in underserved and high-demand areas, can significantly enhance the convenience of EV ownership. Policies that incentivize the installation of fast-charging stations in urban and rural areas, as well as along major travel routes, would further alleviate charging inconveniences.

6. Conclusions

The current study addresses the distinct needs of used EV buyers, focusing on battery longevity, charging access, and affordability—factors crucial to this market but often overlooked other EV studies. Unlike new EV consumers, used EV buyers prioritize vehicle reliability, depreciation, and previous ownership history. For example, the S&P Global Mobility Survey (7500 participants) shows that affordability is a top concern among new EV buyers (S&P Global Mobility Survey Finds). By analyzing sociodemographic influences, information sources, and pre-purchase concerns, this study provides a detailed profile of these consumers, who are driven more by practicality than by cutting-edge technology. The study's findings show that the ease of charging and battery reliability have a significant positive effect on future purchase intentions of used EVs. Convenient and accessible charging infrastructure, satisfaction with battery performance, and the availability of numerous charging points contribute substantially to this positive perception. Conversely, reliance on information sources such as traditional media and online searches has a negative direct effect on future purchase intentions, indicating potential issues with the quality and reliability of disseminated information. Additionally, certain aspects of the driving experience, particularly related to range limitations and charging inconveniences, negatively impact future purchase intentions. Pre-purchase concerns about battery range, affordability, and charging availability indirectly influence future purchase intentions by affecting the overall ownership experience. Lastly, sociodemographic characteristics like income, education level, and age significantly shape perceptions of charging ease and information sources, indirectly impacting future purchase intentions.

The implications of these findings are broad. First, enhancing charging infrastructure and battery reliability is crucial for promoting EV adoption. Policymakers and manufacturers should prioritize expanding the network of public chargers, improving battery technology, and ensuring the reliability of charging infrastructure. Second, the negative impact of information sources on future purchase intentions suggests a need for improving the quality and reliability of information about EVs. Accurate, and trustworthy information dissemination through traditional and online media is essential to avoid misinformation and consumer confusion. Third, addressing pre-purchase concerns early in the decision-making process can lead to a more positive ownership experience. Effective communication strategies and solutions targeting affordability, battery range, and charging availability can enhance consumer confidence and satisfaction, thereby increasing the likelihood of future EV purchases. Lastly, targeted outreach and educational campaigns designed for different sociodemographic groups can effectively address specific concerns and promote the benefits of EV ownership.

Despite the valuable insights provided by this study, several limitations remain. While this study provides valuable insights into the factors influencing consumer purchase intentions in the used EV market, it is important to acknowledge a key limitation. The research does not include a direct comparison between the factors affecting new and used EV purchases. This distinction could offer a more comprehensive understanding of how consumer motivations and concerns differ across these two segments of the EV market. Future research should aim to address this gap by conducting comparative analyses between new and used EV buyers. Such studies could explore how factors like technology advancements, warranty coverage, and manufacturer incentives impact the purchase decisions differently for new and used EVs. In addition, the study relies on survey data. It is acknowledged that the survey sample used in this study reflects a specific, engaged subset of used EV owners, particularly those active in online communities. This targeted approach was intentional to capture detailed insights from informed users who are likely to have meaningful experiences with used EVs. While this may limit generalizability, the diverse recruitment channels—ranging from social media to local EV associations—helped to broaden the sample. One limitation of our study is the potential lack of representativeness due to the targeted sampling of engaged EV owners from online communities. Future studies could address this by employing broader, more randomized sampling techniques to capture a more diverse and representative population of used EV owners.

CRediT authorship contribution statement

Abbas Sheykhfard: Writing – original draft, Software, Formal analysis, Conceptualization. **Mohammad Azmoodeh:** Writing – original draft, Formal analysis, Conceptualization. **Subasish Das:** Writing – review & editing, Writing – original draft, Formal analysis. **Boniphace**

Kutela: Writing – review & editing, Writing – original draft, Formal analysis.

Data availability

Data will be made available on request.

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