



Electric Vehicles' Consumer Behaviors. Evidence from Romania

Marian Gigi Mihu^{*}, Florina Oana Virlanuta^{**}, Daniel Zinica^{***}, Radu Octavian Kovacs^{****}

ARTICLE INFO

Article history:

Received July 29, 2025

Accepted August 21, 2025

Available online September 2025

JEL Classification

Q55, R41, D12, M31

Keywords:

electric vehicles, consumer behavior, Romania, PLS-SEM

ABSTRACT

In the context of accelerated urbanization and the need to reduce the carbon footprint, the transition to electric vehicles (EVs) is becoming a central element of modern sustainable urban mobility strategies. The adoption of electric cars globally has seen exponential growth over the past decade. According to the International Energy Agency (IEA), electric vehicle sales reached more than 17 million units in 2024, accounting for about 25.6% of total car sales. This shift is driven by factors such as environmental concerns, government incentives, and technological development. The aim of our research is to investigate consumer behavior regarding electric vehicles acquisitions. We use PLS- SEM as research method for testing the six hypotheses of the designed conceptual model. Five out of six hypothesis are validated. The research is important for decision makers from the automotive industry as it provides data-driven insights into the key determinants that influence consumer decisions, enabling the development of targeted marketing strategies, product improvements, and policy recommendations aimed at accelerating the adoption of electric mobility solutions.

Economics and Applied Informatics. © 2025 is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/).

1. Introduction

By adopting the European Green Deal announced in December 2019, the EU is currently aiming to reduce greenhouse gas emissions from transportation by 90% by 2050, compared to 1990 levels, as part of a broader effort to transform into a climate-neutral economy. Transport accounts for about a quarter of total greenhouse gas emissions in the EU, primarily (72%) through road transport (European Court of Auditors, 2023). An essential element of the effort to reduce greenhouse gas emissions from road transport is the transition to alternative fuels, such as electricity, hydrogen, biofuels, or biogas, which produce lower carbon emissions. However, road transport continues to rely almost entirely on fossil fuels, with "about 95% of total road vehicles still consuming traditional fuels" (European Court of Auditors, 2023). Alongside the higher purchase costs of electric vehicles, the insufficient number of charging and refueling stations hinders the development of the alternative fuels market. According to the European Automobile Manufacturers Association, 89.4% of all new vehicles registered in the EU in 2019 ran on gasoline or diesel, while electric hybrid vehicles accounted for 6% of this total, battery electric vehicles accounted for 3%, and all other non-electric vehicles running on alternative fuels (such as gas or hydrogen) accounted for only 1.6% (ACEA, 2019). In 2020, the segment with an external power source (battery electric vehicles and plug-in hybrid electric vehicles) significantly increased its market share amid a global decline in new car registrations, as a result of the COVID-19 pandemic. Electric vehicles accounted for 10.5% of new registrations in 2020 (ACEA, 2021).

More than 50 million electric vehicles will be on the roads in Europe by 2030, representing 15% of the total fleet, according to a new report by EY and Eurelectric – Plugging into potential: unleashing the untapped flexibility of EV (Eurelectric & EY, 2025).

In the context of accelerating electrification, ensuring the profitability, stability, and efficiency of the electricity grid will require managing the timing and manner in which electric vehicles are charged, as well as utilizing the energy stored in batteries to provide valuable flexibility services to the grid. Unidirectional smart charging, which allows electric vehicles to draw power from the grid at optimal times, and the "vehicle-to-grid" (V2G) technology, which enables electric vehicles to both draw and send electricity back to the grid, can reduce the total cost of vehicle ownership for consumers, provide solutions for balancing the grid, and accelerate the adoption of renewable energy.

Electric vehicle users in Europe can save between 450 and 2,900 euros annually through smart and bidirectional charging (Eurelectric & EY, 2025). This technology allows excess electricity to be stored and sold

^{*}, ^{**}, ^{***}, ^{****} Dunarea de Jos University of Galati, Romania. E-mail address: florina.virlanuta@ugal.ro (F. O Virlanuta – Corresponding author).

back to the grid during peak times. However, the lack of clear economic incentives prevents users from taking full advantage of this system. As a result, the lack of incentives hinders the adoption of electric vehicles. Estimates suggest that by 2030, electric vehicle batteries could provide 114 TWh of energy, equivalent to the annual consumption of 30 million households. However, this potential remains largely untapped, and the need for energy flexibility is expected to double in the next five years with the increasing integration of renewable sources.

Despite these promises, the high initial cost of electric vehicles remains a major obstacle. This factor led to a slight decline in sales in 2024, with a rebound forecast for 2025, according to a report by Eurelectric and EY. Similarly, the lack of charging infrastructure is another significant issue. Although the number of public stations grew by 30% in 2024, reaching 820,000, the installation pace remains insufficient to meet the target of 3.5 million units by 2030.

Regarding distribution networks, energy flexibility could bring savings of approximately 4 billion euros annually, reducing the need for infrastructure expansion. However, this will only be possible if operators have access to real-time digital monitoring and interoperable data, aspects dependent on European legislation regarding electric vehicles.

In Romania, electric vehicle sales experienced a negative trend in 2024, marking a significant decrease compared to the previous year. In the first nine months of the year, only 7,378 new electric vehicles were registered, a decrease of approximately 32% compared to the same period in 2023 (ACAROM, 2024). This decrease was mainly caused by a halving of the Eco bonus offered by the state through the "Rabla Plus" program, which dropped from about 10,000 euros in 2023 to only 5,100 euros in 2024. However, it is estimated that the electric car fleet will exceed 60,000 units by the end of the year, compared to approximately 42,000 vehicles registered in 2023 (Gubandru, 2024). The research study aim is to analyze consumer behavior in Romania regarding the purchase of electric vehicles.

2. Theoretical background and hypothesis

The research on favorable perception and market readiness of EVs has been increasing over the past decades. To forecast the market penetration rate of EVs, multiple variables are measured on their correlations with consumers' tendencies of EVs. The ease of use of EVs is a variable that induces travel demand and stimulates urban mobility. (Xiao and Goulas, 2022) Perceived usefulness are an essential constructs of user acceptance of information technology. The unified theory of acceptance and use of technology (UTAUT; Venkatesh et al., 2003), highlights the idea that perceived usefulness is a direct determinant of behavioral intention. According to these findings, we projected the following hypotheses:

H1: Ease of Use positively influences Perceived Usefulness (EU - PU).

H3: Perceived Usefulness positively influences the Intention to Purchase an Electric Vehicle (PU - IAEV).

Many studies have explored the citizen's opinion about electric vehicles in recent years, but these studies focused mostly on developed nations (Smith et al., 2017, Fett et al., 2018, Krishnan and Koshy, 2021). Electric vehicles (EVs) are expected to become a sustainable way for the actual challenges, as an eco-friendly innovation. Environmental concern is an emotional characteristic of citizens that incorporates their concerns on the quality of the environment. Researcher findings suggest that environmental concern is positive related to pro-environmental behavior (He et al., 2018) Consumers with a stronger concern for the environment are more interested in accepting EVs. We proposed the following hypotheses, in line with these findings:

H2: Social Influence positively influences Environmental Concern (SI - EC).

H4: Environmental Concern positively influences the Intention to Purchase an Electric Vehicle (EC - IAEV)

The success of emerging products and pro-environmental technologies is influenced by consumer preferences and perceptions. Many researchers analyzed the impact of social influence in the development of consumer perceptions and preferences for EVs (Goetzke and Rave, 2011; Axsen et al., 2013; Wahl et al., 2020). According to these findings, we projected the following hypothesis:

H5: Social Influence positively influences the Intention to Purchase an Electric Vehicle (SI - IAEV).

Concerning energy saving and the environmental impacts of CO₂ emissions have supported the expansion of the electric vehicles (EVs) market. One of the principal barriers for the expansion of the EV market is the charging infrastructure insufficiently developed (Zhang et al., 2018; Kim et al., 2022). Studies about EV adoption have analyzed the impact of charger accessibility on EV adoption, driving range and recharging time being important decisional factors for consumers (He et al., 2022). According to these findings, we projected the following hypothesis:

H6: Infrastructure Availability positively influences the Intention to Purchase an Electric Vehicle (IA - IAEV).

3. Research methodology

Modeling through Structural Equation Modeling (SEM), using the Partial Least Squares (PLS) method, allows researchers to simultaneously configure and estimate complex relationships between multiple dependent and independent variables. The variables considered are usually measured indirectly through several indicators (latent variables). In estimating the relationships, SEM PLS accounts for measurement error in the observed variables. As a result, the method provides a more accurate measurement of the conceptual models in socio-economic research.

Structural models are diagrams used to visually display hypotheses and relationships between latent variables, which are examined when applying SEM PLS (Hair, Hult, Ringle, and Sarstedt, 2021). The structural model presented in Figure 3 shows six latent variables, represented as ovals (IDC, INOV, CSE, REZ, GIE, PERF). The indicators, also referred to as items or manifest variables, are the variables measured directly, containing the research results based on questionnaires. These are represented in path models as rectangles (with three indicators associated with each latent variable). The relationships between the variables, as well as between the variables and their assigned indicators, are represented by unidirectional arrows, considered predictive relationships but may also be interpreted as causal relationships. All items in the questionnaire were evaluated using a 5-point Likert scale (1 – Strongly Disagree to 5 – Strongly Agree).

The research was conducted based on a questionnaire, applied to a sample of respondents from diverse socio-economic backgrounds. We obtained 103 valid responses and the collected data were analyzed using Smart PLS 4 software, which enabled the identification and quantification of relationships between the latent variables. In the conceptual model (figure 1), the variables studied included Ease of Use (EU), Perceived Usefulness (PU), Social Influence (SI), Environmental Concern (EC), Infrastructure Availability (IA), and Intention to Purchase Electric Vehicles (IAEV).

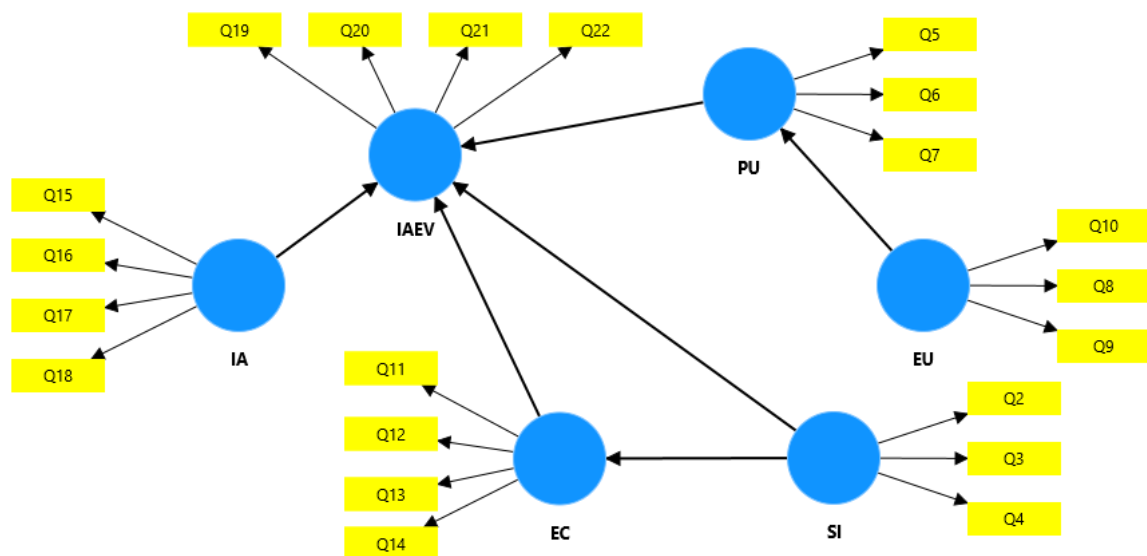


Figure 1. Conceptual model of the research based on structural equation modeling

Source: own contribution

4. Results and Discussions

Figure 2 highlights the relationships between the latent variables included in the research model, indicated by arrows pointing from the exogenous latent variable considered a predictor to the endogenous latent variable. Additionally, the diagram illustrates the variables that can be measured in a reflective approach, with arrows pointing from the variables to the indicators.

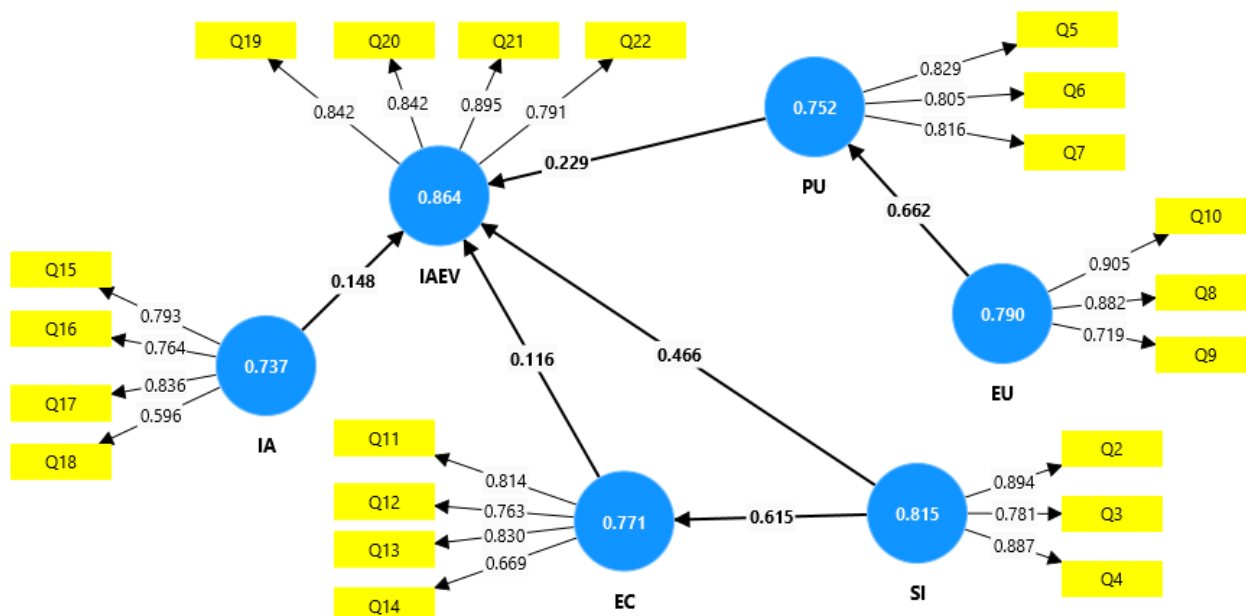


Figure 2. Determination of effect sizes, indicator contributions to reflective latent variables

Source: Smart PLS 4 software processing

The Intention to Purchase Electric Vehicles (IAEV) is the main dependent variable, while the explanatory variables are ease of use (EU), social influence (SI), perceived usefulness (PU), environmental concern (EC), and infrastructure availability (IA).

Ease of Use (EU) reflects how easy it is for an individual to use electric vehicle technology. The relationship between EU and PU (perceived usefulness) is one of the key relationships, suggesting that as the perception of ease of use increases, perceived usefulness also increases. The coefficient of this path is 0.662, indicating a strong and positive relationship between the two variables.

Social Influence (SI) represents the pressure exerted by the social environment on the individual to adopt electric vehicles. The model suggests two significant paths for SI:

- SI → EC This path has a significant coefficient of 0.615, indicating that social pressure directly impacts environmental awareness.
- SI → IAEV Social influence has a direct and strong effect on the intention to purchase, with a significant coefficient of 0.466. This suggests that individuals who perceive greater social pressure are more likely to adopt eco-friendly behaviors, such as purchasing an electric vehicle.

Perceived Usefulness (PU) is the variable that captures the perceived benefits of electric vehicles. According to the model, PU → IAEV has a coefficient of 0.229, suggesting that perceived usefulness positively influences the intention to purchase, but to a moderate extent compared to social influence.

Environmental Concern (EC) reflects the degree to which a person is concerned about the environmental impact of vehicles. Although it is assumed that environmental concern will influence the intention to purchase (EC → IAEV), the coefficient for this path was insignificant in our model (0.116), suggesting that while people are aware of environmental issues, other factors such as social influence and perceived usefulness play a more significant role in the purchase decision.

Infrastructure Availability (IA) represents easy access to charging stations and other facilities for electric vehicles. The results suggest that IA → IAEV has a positive effect on the intention to purchase, with a coefficient, for example, of 0.148, indicating that infrastructure availability plays an essential role in the decision to buy an electric vehicle.

Figure 2 illustrates the complex relationships between the explanatory variables and the intention to purchase electric vehicles. Among the hypothesized relationships tested, social influence (SI) and perceived usefulness (PU) had the strongest effects on the purchase intention, suggesting that the purchase decision is more influenced by social and practical perceptions than by environmental concern.

The relationship coefficients are shown in Figure 3. The strongest correlation is between the latent variables EU and PU (coefficient of 0.662), while the weakest correlation is between the latent variables EC and IAEV (coefficient of 0.116).

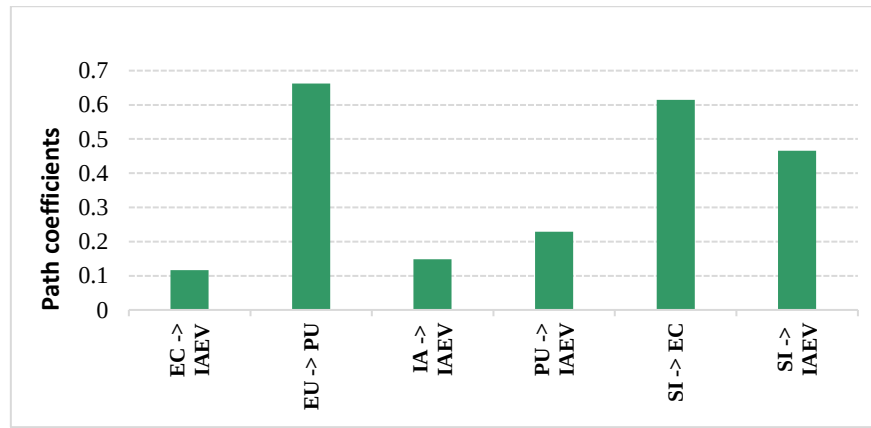


Figure 3. Graphical representation of relationship coefficients

Source: processed using Smart PLS software

The structural model generated after applying the bootstrap procedure (Figure 4) highlights the relationships between the latent variables based on the asymptotic significance values (p-value).

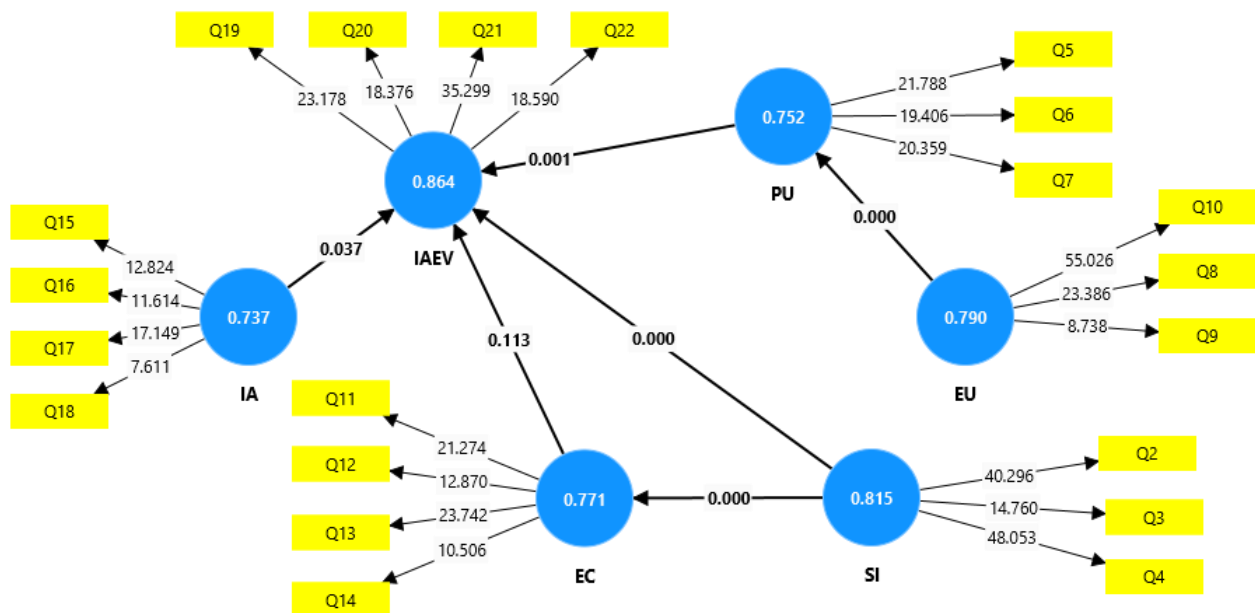


Figure 4. Determination of p-values associated with the relationships between the variables in the model, after applying the bootstrap procedure

Source: processed using Smart PLS software

All latent constructs (EU, PU, SI, EC, IA, IAEV) have Average Variance Extracted (AVE) values above 0.70, indicating very good convergent validity. These values show that the items corresponding to each variable explain a large proportion of the variation in the respective construct. We can observe that H1 (EU → PU), with a coefficient of 0.737 and p of 0.037, is validated, as ease of use positively influences the perception of usefulness. Similar results are highlighted for H2, H3, H5, and H6, reflecting that perceived usefulness, social influence, and infrastructure availability have a strong impact on purchase intention. Regarding H4 (EC → IAEV) (coefficient = 0.771, p = 0.113), no direct influence was found, and the hypothesis was invalidated.

The asymptotic significance values of p and the T-test for the six hypotheses in the structural model are shown in Table 1.

Table 1. Asymptotic significance (p-values) and T-test results for the six hypotheses in the structural model

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
EU -> PU	0.662	0.669	0.053	12.438	0.000
SI -> EC	0.615	0.620	0.069	8.866	0.000
PU -> IAEV	0.229	0.221	0.072	3.180	0.001

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
EC -> IAEV	0.116	0.121	0.073	1.585	0.113
SI -> IAEV	0.466	0.463	0.087	5.384	0.000
IA -> IAEV	0.148	0.157	0.071	2.088	0.037

Source: processed using Smart PLS software

The relationship between ease of use (EU) and perceived usefulness (PU) is significantly positive ($\beta = 0.662$, $p = 0.000$), confirming hypothesis H1 and suggesting that the perception of the simplicity of using an electric vehicle plays a crucial role in reinforcing the idea of its usefulness. Furthermore, the analysis confirms hypothesis H2, demonstrating that social influence (SI) has a positive and significant effect on environmental concern (EC) ($\beta = 0.615$, $p = 0.000$). This relationship highlights the important role of social norms and interpersonal networks in shaping ecological attitudes, indicating that social pressure or support from relevant groups can enhance concern for the ecological impact of mobility choices.

Perceived usefulness (PU) directly and significantly influences the intention to purchase electric vehicles (IAEV) ($\beta = 0.229$, $p = 0.001$), confirming hypothesis H3. This result shows that when consumers perceive an electric vehicle as valuable and beneficial in daily life, they are more likely to express the intention to purchase it.

Hypothesis H4, which suggests a direct effect of environmental concern (EC) on the intention to purchase (IAEV), was not statistically supported ($\beta = 0.116$, $p = 0.113$). This result is noteworthy, as it suggests that, despite a favorable climate for sustainability ideas, ecological motivations alone are not a sufficiently strong predictor of purchase behavior. This finding implies that strategies for promoting electric vehicles should not rely solely on ecological arguments but should also emphasize tangible and functional benefits.

In contrast, social influence (SI) has a direct and significant impact on the intention to purchase (IAEV) ($\beta = 0.466$, $p < 0.001$), supporting hypothesis H5. This underscores the importance of public opinion, social trends, and recommendations in the decision-making process, especially in an innovative field such as electric mobility.

The results support hypothesis H6, demonstrating that infrastructure availability (IA) has a positive effect on the intention to purchase (IAEV) ($\beta = 0.148$, $p = 0.037$). This indicates that the perception of functional infrastructure (charging stations, accessibility) is a key factor in determining purchase intention, serving as a critical indicator of the market's readiness for the transition to electric mobility.

5. Conclusion

Based on the results of the SEM PLS analysis, we can conclude that the implementation of electric vehicle technology is strongly influenced by factors such as ease of use, social influence, perceived usefulness, and the availability of infrastructure. Among all the relationships analyzed, environmental concern was not found to have a significant direct impact on purchase intention, suggesting that consumer motivations are more pragmatic and social than strictly ecological. This highlights the importance of creating a favorable social context, informing the public, and developing the necessary infrastructure to encourage the widespread adoption of electric vehicles. Therefore, public policies and marketing strategies should focus on educating perceptions about utility and building support networks and social influence.

One of the limitations of the study relates to the size and structure of the sample, which may affect the external validity of the study. If respondents come from a single region, age group, or educational level, the generalization of the results to the broader population is limited. Another limitation could be the omission of important contextual factors from the analysis, such as the price of electric vehicles, current public policies, or brand recognition.

Future research directions will focus on analyzing how behavioral variables (such as perceived usefulness, social influence, environmental concern, etc.) differ across countries or regions.

References:

1. Axsen, J., Orlebar, C., & Skippon, S. (2013). Social influence and consumer preference formation for pro-environmental technology: The case of a UK workplace electric-vehicle study. *Ecological Economics*, 95, 96-107.
2. Association of European Automobile Manufacturers (2021). BEVs have 10.5% of all new car registrations in the EU for 2020. (<https://www.evspecifications.com/en/news/fa873dc>)
3. Association of European Automobile Manufacturers (2019). Vehicles in use – Europe 2019. (<https://www.acea.auto/publications/report-vehicles-in-use-europe-2019/>)
4. Commission Staff Working Document SWD(2020) 331 final, accompanying the document COM(2020) 789 final: "Sustainable and Smart Mobility Strategy – putting European transport on track for the future" (<https://eur-lex.europa.eu/legal-content/RO/TXT/?uri=SWD:2020:331:FIN>).
5. European Commission. (2020). Annual strategy for 2021 on sustainable growth (COM(2020) 575 final). (<https://eur-lex.europa.eu/legal-content/RO/TXT/?uri=CELEX%3A52020DC0575>)
6. European Court of Auditors. (2023). Intermodal freight transport – Achieving an underutilized potential. Luxembourg: Publications Office of the European Union. (<https://www.eca.europa.eu/ra>)

7. European Parliament, & Council of the European Union. (2014). Directive 2014/94/EU on the deployment of alternative fuels infrastructure. Official Journal of the European Union, L 307, 1–20. (<https://eur-lex.europa.eu/legal-content/RO/TXT/?uri=CELEX%3A32014L0094>)
8. EY & Eurelectric. (2025). Plugging into potential: unleashing the flexibility of EVs. Industrial News. <https://industrialnews.co.uk/ev-batteries-can-provide-114twh-capacity-by-2030-finds-ey-and-eurelectric/>
9. Fett, D., Ensslen, A., Jochem, P., & Fichtner, W. (2018). A survey on user acceptance of wireless electric vehicle charging. *World Electric Vehicle Journal*, 9(3), 36.
10. Goetzke, F., & Rave, T. (2011). Bicycle use in Germany: Explaining differences between municipalities with social network effects. *Urban studies*, 48(2), 427-437.
11. Gubandru, C. (2024). Câte mașini electrice ar putea fi vândute în 2024. EVmarket.ro. <https://evmarket.ro/masini-electrice/cate-masini-electrice-ar-putea-fi-vandute-in-2024-41552/>
12. He, S. Y., Sun, K. K., & Luo, S. (2022). Factors affecting electric vehicle adoption intention. *Journal of Transport and land use*, 15(1), 779-801.
13. He, X., Zhan, W., & Hu, Y. (2018). Consumer purchase intention of electric vehicles in China: The roles of perception and personality. *Journal of Cleaner Production*, 204, 1060-1069.
14. Kim, S., Choi, J., Yi, Y., & Kim, H. (2022). Analysis of influencing factors in purchasing electric vehicles using a structural equation model: focused on Suwon city. *Sustainability*, 14(8), 4744.
15. Krishnan, V. V., & Koshy, B. I. (2021). Evaluating the factors influencing purchase intention of electric vehicles in households owning conventional vehicles. *Case Studies on Transport Policy*, 9(3), 1122-1129.
16. Peste 50 de milioane de vehicule electrice vor circula pe șoselele din Europa, până în 2030, arată un raport de specialitate, 10 martie 2025, *agerpres.ro* (<https://agerpres.ro/2025/03/10/peste-50-de-milioane-de-vehicule-electrice-vor-circula-pe-soselele-din-europa-pana-in-2030-raport--1429282>)
17. Smith, B., Olaru, D., Jabeen, F., & Greaves, S. (2017). Electric vehicles adoption: Environmental enthusiast bias in discrete choice models. *Transportation Research Part D: Transport and Environment*, 51, 290-303.
18. Transport & Environment. (2019, iulie 18). Electric surge: Carmakers' electric car plans across Europe 2019–2025. (<https://www.transportenvironment.org/articles/electric-surge-carmakers-electric-car-plans-across-europe-2019-2025/>)
19. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.
20. Wahl, L. S., Hsiang, W. H., & Hauer, G. (2020). The intention to adopt battery electric vehicles in Germany: driven by consumer expectancy, social influence, facilitating conditions and ecological norm orientation. *Innovations for Metropolitan Areas: Intelligent Solutions for Mobility, Logistics and Infrastructure designed for Citizens*, 79-92.
21. Xiao, J., & Goulias, K. G. (2022). Perceived usefulness and intentions to adopt autonomous vehicles. *Transportation research part A: policy and practice*, 161, 170-185.
22. Ye, F., Kang, W., Li, L., & Wang, Z. (2021). Why do consumers choose to buy electric vehicles? A paired data analysis of purchase intention configurations. *Transportation Research Part A: Policy and Practice*, 147, 14-27.
23. Zhang, Q., Li, H., Zhu, L., Campana, P. E., Lu, H., Wallin, F., & Sun, Q. (2018). Factors influencing the economics of public charging infrastructures for EV—A review. *Renewable and Sustainable Energy Reviews*, 94, 500-509.