

Exploring the Purchasing of Electric Vehicles in the Context of European Green Deal. A Survey among Romanian Citizens

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Abstract

The Green Deal is the European weapon against pollution, focusing on less resource utilization and sustainability. The transport sector is the only one in which there were registered increases of greenhouse gases emissions between 1990 and 2019 and therefore the initiative included in the Green Deal which aims to combat this phenomenon is the adoption of electric vehicles, reaching 0 net greenhouse gases emissions until 2050. In this context, the purpose of this study is to examine the perception of Romanian citizens regarding the purchase of electric vehicles, providing relevant insights, and focusing on both positive attitudes regarding environmental benefits and major concerns about economic issues and logistical hurdles. Thus, quantitative research was conducted using a sample of 150 Romanian citizens. While the results show that only 8% of the respondents own a hybrid car and 1,3% an electric one, perceiving high barriers hindering the adoption of electric vehicles, such as small range, long time for charging, high purchase price, and the small number of charging stations, being the biggest obstacle, the respondents have a favorable perception regarding the environmental advantages of adopting electric vehicles. Therefore, the results indicate the importance of approaching barriers and boosting public awareness to encourage the extensive uptake of electric vehicles in Romania, aligning with the requirements of the European Green Deal. Also, the paper serves as a starting point for future research in the field and for the Romanian authorities to improve the actual system of charging stations and to find more ways to attract and help citizens to adopt electric vehicles.

Keywords

Electric vehicles, European Green Deal, sustainability, purchasing process, Romanian citizens.

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Introduction

Due to the traffic intensity growth on the roads, mainly in big cities, and global warming, the protection of our natural environment became more important and conducted to the current methods of adapting transport policy, on a micro and macro level, which are determined by factors as technology, environment, social factors, and economic nature (Jacyna et al., 2021). These transport policies are in continuous evolution, trying to set the pollution levels to the standards agreed in the Green Deal initiative.

Therefore, there are many studies focused on the environmental protection and adoption of electric vehicles (EVs) when it comes to public transportation, personal cars, or heavy vehicles. For example, Patil et al. (2024) have shown that the primary attributes of EVs identified by users in urban areas relate to reduced emission and silent operation. However, some aspects such as charging infrastructure and the lifespan of EV batteries are still challenging. Also, Witkowski et al., (2024) did research in the ten largest cities in Poland to find out whether the adoption by local authorities of a reduced taxation system for hybrid and

electric vehicles motivates their usage, and their research indicated that there was no positive correlation between the amount of tax exemptions and the rate of growth in the number of reduced-emission vehicles.

The adoption of EVs is the EU's strategy and most powerful weapon for a cleaner environment to achieve 0 greenhouse gases emissions from vehicles by 2050. A lot of studies support the implementation of EVs focusing on zero net emissions, but Vrabie (2022) sustains that this strategic direction of many car manufacturers, governments, and institutes to develop and implement EVs has not yet been seen how sustainable is to move completely to electric. Vrabie (2022) wants to prove that if all private transport will be electric, the consumption of energy will be so high that it will be impossible to be satisfied by the current energy production companies.

In this context, this paper, through its associated research, aims to investigate the motivator factors and the barriers or demotivator factors for the Romanian citizens in the purchasing process of an electric car. This subject is less treated in the literature, so this article comes with the citizen's opinion in front of the study, focusing only on Romania. The paper is structured into 5 chapters, starting with the introduction, followed by a review of the scientific literature, research methodology, results, and discussion, and in the end, the conclusions are presented.

1. Review of the scientific literature

In line with the World Health Organization, it seems that the pollution of the air is the first environmental risk for people's health in the European Union, which causes around 400 000 premature deaths which are also reflected in a lot of billions of euros for health costs (European Court of Auditors, 2018).

In 2008, the European Parliament and the European Council came up with the Ambient Air Quality Directive and set air quality standards in order to reduce the concentrations of pollutants in the air, and in the last decades, these EU policies had a positive impact to the emission reduction, but the quality of the air has not improved in the same rate (European Court of Auditors, 2018). Air pollution causes over 1.000 premature deaths each day and that means more than 10 times the number of deaths by road accidents (European Court of Auditors, 2018).

Based on these statistics, Green Deal was born in 2019. The objective of the Green Deal is to transform the EU into a modern economy, competitive and efficient from the perspective of resource utilization ensuring at the same time: zero net emissions of greenhouse gases until 2050, economic growth dissociated from resource use, and no person and no place left behind (European Commission, 2019).

According to some statistics from the European Parliament (2019), transport was the source of almost a quarter of the total emissions of CO₂ in the EU in 2019, and from this quarter, 71,7% came from road transport. Between 1990 and 2019, in EU was registered an increase with 33,5% of greenhouse gases emissions in the transport sector, which is the single area where this phenomenon has happened, while for the other sectors like agriculture, energy production, and industry, a decrease of greenhouse gases emissions was recorded (European Parliament, 2019). Thus, the transport sector requires immediate actions and collective efforts, both on the part of the citizens and on the part of the EU and the member countries through the implementation of the laws, the change of the legislation, and most important, through respecting and adopting these laws by the citizens, in order to reduce the greenhouse gases emissions.

The European Green Deal means to regulate all industries, improving the lives of people; therefore, in the literature are multiple studies done in this area, many of them focusing on the food industry considering it is also a big and important contributor to environmental pollution (Baicu et al., 2022; Chiripuci, Popescu and Constantin, 2022; Popescu et al., 2022; Vasiliu, 2022; Vegheş and Strâmbu-Dima, 2022), while Shpak et al. (2022) consider that environmental pollution through CO₂ emissions is also an economic problem and not only an environmental one, so the authors conducted a multi-econometric study of the impact of macroeconomic factors like gross domestic product, imports, exports, unemployment and inflation, on CO₂ emissions in the EU region.

On the other hand, Jacyna et al. (2021), presented an analysis method to study the reduction of exhaust emissions by introducing EVs in Bielsko-Biala, a city from Poland, showing that the using of EVs inside the city reduces significantly harmful emissions and increases the clean air in the city. As Carteni et al. (2020) also mention, the usage of EVs in cities is among the best practices for achieving sustainability plans and mobility needs. The development of electric vehicles can also improve the country's energy security, achieve sustainable development, and meet the requirements of various policies (Xu et al., 2021).

In the specialized literature, there are also papers which studied "the interaction between electric vehicle energy consumption and power battery capacity attenuation during acceleration" (Liu, Zhang and Zhang,

2024) and the exposure of taxi drivers “to black carbon and nitrogen dioxide in electric and diesel vehicles” (Bos et al., 2021). Other authors examined consumers’ point of view from the United Arab Emirates from the geographic and economic perspectives regarding the adoption of EVs for light-duty transport, through a unique approach by understanding the correlation between geographic and economic factors (Bridi et al., 2024), while Buhmann, Rialp-Criado and Rialp-Criado (2024) extended through their study the theory of planned behavior to find which factors are shaping consumers adoption intentions for EV in Spain showing that attitude emerges as the strongest influencer, emphasizing the significance of personal beliefs. In this context, environmentally conscious consumers may lean toward EV adoption due to positive attitudes.

In addition to this area of subjects, Tsai et al. (2024) wrote a paper about the critical barriers encountered in the adoption of EVs in Thailand, and Jagani, Marsillac and Hong (2024) looked into the automotive industry’s change to the EV and future supply chain modification, focusing on the suppliers’ roles which are in continuous change.

Considering the evolution of the transport sector and the high level of pollution caused by it, Sechel and Mariasiu (2022) consider that maybe a good option to reduce or eliminate some of the greenhouse gases emissions caused by the transport sector is the use of electric vehicles. Abbasi et al. (2021) have the same opinion and consider that EVs are the response to the environmental degradation caused by transport, but despite the multiple eco-friendly benefits, the EV market penetration ratio is still very low, mostly in developing countries.

Also, in the research done by Sechel and Mariasiu (2022), an analysis was conducted to find the effectiveness of Romanian government policies regarding the pollution reduction caused by transportation (CO2 emissions), focusing on the effect of the Rabla Plus program through which the government offers financial subsidies for the purchase of a new electric vehicle or a new plug-in hybrid electric vehicle. Analyzing the data presented by Sechel and Mariasiu (2022), is it clear that in Romania, the CO2 emissions followed the European trend increases in 2015-2019, from 15,714 thousand tons in 2015 to 18,935 thousand tons of CO2 in 2019.

Another paper (Brătucu et al., 2019) studied Romanian students’ behavior regarding electric vehicle acquisition and discovered that only half of the subjects are familiar with the meaning of green consumption, and 37,8% of these students are interested in buying an electric vehicle, pointing the fuel consumption as the main reason for the acquisition, while the high price of EV was identified as a barrier for acquisition.

In Europe, based on the data published by the European Parliament (2019), most cars use gasoline (52%) and diesel (37%) but an important thing to note is that the number of EVs has increased constantly, for example, with 51% in 2017 compared to 2016. In parallel, Dabija, Postelnicu and Dinu (2018), believe that consumers in emerging countries are more likely to have a sustainable behavior, showing more interest in environmental conservation.

In Romania, the total number of vehicles has nearly doubled from 2012 to 2023, with an increase of 4.662.520 vehicles during this period (Table no.1). The highest year-over-year growth rate occurred in 2017, with an 8.92% increase and 625.167 registered vehicles (Table no.1). In 2022, Romania exceeds the psychological threshold of 10 million vehicles, from which 7.865.186 are cars, representing 78,61% from the total number (Table no.1). 2023 has ended up with 327.885 more vehicles registered and analyzing the share of cars in the total number of vehicles, only a small deviation is visible for the full period, 2023 (78,45%) being under 2012 (78,54%) from this point of view. The growth of the cars comes from the registration of the new cars bought either directly or through the Rabla program and from second-hand imports.

Table no. 1. Evolution of Romanian vehicles park

Indicators/Years	2012	2013	2014	2015	2016	2017
Total no. vehicles	5.710.773	5.985.085	6.270.615	6.600.325	7.010.608	7.635.775
Growth Yoy %		4,80%	4,77%	5,26%	6,22%	8,92%
Growth YoY Volume		274.312	285.530	329.710	410.283	625.167
Share of cars in the total number of vehicles	78,54%	78,42%	78,23%	78,07%	78,03%	78,53%
Indicators/Years	2018	2019	2020	2021	2022	2023
Total no. vehicles	8.193.278	8.749.390	9.222.280	9.661.483	10.005.408	10.333.293
Growth Yoy %	7,30%	6,79%	5,40%	4,76%	3,56%	3,28%
Growth YoY Volume	557.503	556.112	472.890	439.203	343.925	327.885

Share of cars in the total number of vehicles	78,73%	78,88%	78,88%	78,78%	78,61%	78,45%
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Source: data.gov.ro, 2023

From the statistics shown by DRPCIV (data.gov.ro, 2023), vehicles are segmented into 6 categories: 0-2 years, 3-5 years, 6-10 years, 11-15 years, 16-20 years, and over 20 years, presenting an overview regarding the age of the Romanian vehicles park. Therefore, at the end of 2023, in Romania, from the total number of 10.333.293, 6.640.135 vehicles were older than 15 years. Also, from the total number of vehicles, 41,4% were using petrol, 55,5% diesel and only 2,3% were electric and hybrid.

The number of electric and hybrid vehicles is still too small, 2,3% of the total number of vehicles isn't representing a big success, especially since almost 56% are diesel vehicles. On top of that, the share of vehicles older than 15 years in the total number of vehicles has almost doubled from 2012, when those represented only 32,69% to 2023 when the result is 64,26% (Figure no. 1).

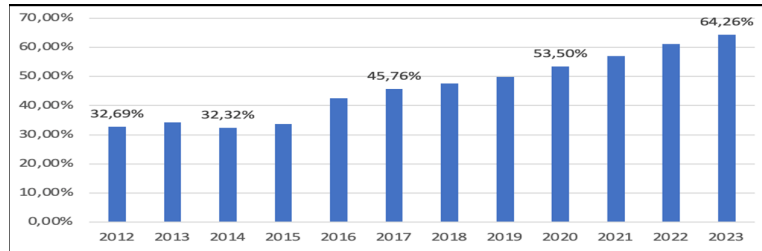


Figure no. 1. The share of vehicles older than 15 years in the total number of vehicles

Source: data.gov.ro, 2023

2. Research methodology

This study was based on a quantitative research design. The general objective of this research is to investigate the perception of Romanian citizens regarding the purchase of EVs in the context of sustainability. To achieve the aim of this study, the following specific objectives have been formulated:

- O1: To determine the distribution of car ownership and engine types among Romanian citizens.
- O2 To examine the perception of the Romanians regarding the economic issues associated with purchasing an EV.
- O3: To assess the attitudes of the Romanians regarding the environmental issues related to purchasing an EV.
- O4: To evaluate the perception of the Romanians concerning the barriers encountered in the process of purchasing of an EV.

In alignment with these objectives, the following hypotheses have been formulated:

- H1: Most Romanian citizens own personal vehicles with traditional petrol or diesel engines.
- H2: Romanian citizens hold favorable perceptions regarding the economic benefits of purchasing EVs.
- H3: Romanian citizens exhibit positive attitudes towards the environmental advantages of adopting EVs.
- H4: Romanian citizens perceive significant barriers hindering the adoption of EVs.

An online survey was administered to Romanian citizens via email and social networks. Participants were also informed that involvement in the research was entirely voluntary and guarantees anonymity. The measuring instrument was a questionnaire divided into three sections. The first section collected data regarding the respondents' education, gender, occupation, living environment and monthly income. The second section comprised questions about respondents' car ownership and frequency of car usage. The third part consisted of multi-item measures on a six-point Likert scales (from 1 totally disagree to 6 totally agree) regarding to the economic and environmental issues to purchase an electrical vehicle as well as the barriers encountered in the buying process. Data collection occurred over a three-week period in February 2024 and was subsequently analyzed using SPSS (Statistical Package for the Social Sciences).

3. Results and discussion

The exploratory research was conducted on a sample of 150 Romanian citizens. The information about the participants is presented in Table no. 2. The respondents have a high level of education, the majority (60,7%) have a master's degree, while only 6,7% of the total number of participants finished only high school. Most of them were female (54,7%) and the vast majority was employed, 87,3%. Almost all the participants (90,7%) lived in an urban area. Regarding the monthly income, 30% of the respondents fit into the category of 801-1200 EUR, 23,3% having a monthly income over 2000 EUR followed by another 21,3% who are earning monthly between 1201-1600 EUR.

Table no. 2. Socio-demographic characteristics of the respondents

Characteristics		Respondents (N = 150)	Percent
Education	High School	10	6,7%
	Bachelor's degree	47	31,3%
	Master's degree	91	60,7%
	PhD	2	1,3%
Gender	Female	82	54,7%
	Male	68	45,3%
Occupation	Employee	131	87,3%
	Entrepreneur	11	7,3%
	Self employed	6	4,0%
	Unemployed	2	1,3%
Living environment	Urban	136	90,7%
	Rural	14	9,3%
Monthly income	Under 800 EUR	17	11,3%
	801-1200 EUR	45	30,0%
	1201-1600 EUR	32	21,3%
	1601-2000 EUR	21	14,0%
	Over 2000 EUR	35	23,3%

Source: Processed by the authors based on research results

The results indicate that 92.7% of respondents own a personal vehicle, with the majority being powered by petrol or diesel engines (83.3%). Only a small fraction of respondents reported owning hybrid (8%) or electric (1.3%) vehicles. In terms of car usage frequency, 41.3% of respondents reported daily usage, while 31.3% indicated usage only when necessary. These findings confirm the acceptance of hypothesis H1, indicating a prevalent ownership of traditional internal combustion engine vehicles among Romanian citizens.

To identify respondents' perceptions regarding the economic and environmental issues for buying an EV, participants were requested to respond to 10 statements on a six-point Likert scale from strongly disagree (1) to strongly agree (6). The alpha reliability coefficient of the scale was found to be 0.854. Cronbach's Alpha coefficient values indicate a high statistical reliability for all statements categories (Table no. 3).

Table no. 3. Reliability Coefficients (Cronbach's Alpha)

Respondents' perceptions regarding the economic issues	0.746
Respondents' perceptions regarding the environmental issues	0.821
Total value of the reliability	0.854

Source: Processed by the authors based on research results

The respondents' perceptions about the two categories of issues for the acquisition of an electric vehicle were analyzed in terms of the average mean score as follows: 4.51 – 6.00 (Favorable: Agree and Strongly Agree); 2.51 – 4.50 (Neutral: Somewhat Disagree and Somewhat Agree); 1.00 – 2.50 (Unfavorable: Strongly Disagree and Disagree. Table no. 4 shows the means and the value for each statement and for overall.

Table no. 4. Respondents' perceptions towards the purchasing of an EV

Issue	Statement	Mean	Value	Overall Mean	Overall Value
Economic	EV offers new technology and a quiet engine	4.5667	Favorable	4.190	Neutral
	EV are suitable only for city ride	3.5333	Neutral		
	EV help me to save money for fuel	4.1533	Neutral		
	EV have purchase subsidy and tax benefits	4.5067	Neutral		
Environmental	I think about sustainability and want to pollute the environment as little as possible	4.5667	Favorable		

I feel a much more responsible citizen knowing that my car emits 0 grams of CO2	4.3667	Neutral		
I want to contribute to the collective effort to reduce CO2 emissions and slow down global warming	4.6133	Favorable	4.603	Favorable
I fully understand what the Green Deal means and what it refers to	4.0933	Neutral		
I am aware of the high level of global pollution	5.2733	Favorable		
I believe that I can have a positive impact on the environment	4.7067	Favorable		

Source: Processed by the authors based on research results

The results show that the Romanians' perceptions regarding the economic issues related to purchasing of an EV was neutral (Mean=4.19) so the hypothesis H2 was rejected. On the other side, the respondents have a favorable perception regarding the environmental issues related to purchasing of an EV (Mean=4.603), therefore the hypothesis H3 was accepted.

To investigate the perception of the Romanians regarding the barriers encountered in the purchasing of an EV, was used the same six-point Likert scale from strongly disagree (1) to strongly agree (6). (Table no. 5). The alpha reliability coefficient of the scale was acceptable at 0.727.

Table no. 5. Respondents' perceptions towards the purchasing of an EV

Statement	Strongly Disagree	Disagree	Somewhat disagree	Somewhat Agree	Agree	Strongly Agree	Mean
EV range is too short	1.3%	4 %	18 %	21.3 %	23.3 %	32 %	4.5733
EV takes too much time to charge	1.3 %	7.3 %	10.7 %	14 %	30 %	36.7 %	4.7400
There are not enough charging stations for EV	0.7 %	3.3 %	4 %	18.7 %	29.3 %	44 %	5.0467
The purchase price for EVs is very high	0.7 %	4.7 %	8.7 %	18 %	32.7 %	35.3 %	4.8333
There are not enough auto repair shops for EV	5.3 %	13.3v	18.7 %	22 %	20.7 %	20 %	3.9933

Source: Processed by the authors based on research results

The measurement results show that the most respondents strongly agree with the statements about range, time to charge, number of charging stations and purchase price for EV. These results are in line with those of other studies and research (Patil et al., 2024; Vrabie, 2022; Brătucu et al., 2019). According to the means (3.9933), the Romanians had a neutral perception regarding to the statement about auto repair shops. Overall, these findings lead to the acceptance of hypothesis H4.

In summary, the study provides valuable insights into the perceptions of Romanian citizens regarding EV adoption, highlighting both favorable attitudes towards environmental benefits and significant concerns regarding economic issues and logistical challenges. These results underscore the importance of addressing barriers and enhancing public awareness to promote the widespread adoption of electric vehicles in Romania in order to meet European Green Deal requirements.

Conclusions

The high levels of pollution are no longer an unknown issue, so collective and complex efforts are required. To achieve the desired result at the global level, the changes need to come from each country, step by step. In Romania, the total number of vehicles older than 15 years has doubled in 2023 compared to 2012, representing a big concern when it comes to greenhouse gases emissions. Therefore, the paper explores the purchase of electric vehicles, contributing to the specialty literature by bringing important insights regarding the Romanian citizens' perception of EV adoption in the context of sustainability, focusing on two major issues, economic and environmental, to achieve the Green Deal requirements.

The research results show that 83,3% of the respondents own a car with a traditional internal combustion engine. Yet, Romanian citizens have neutral perceptions regarding the economic benefits of purchasing EVs, being interested and showing a positive attitude for the environmental advantages. Also, the results confirm the results of another study from the literature (Brătucu et al., 2019), identifying the purchase high price of EVs as a barrier for Romanian citizens. Furthermore, from this paper, emerges that the small range, long time for charging, and the small number of charging stations represent obstacles as well encountered by Romanian citizens when it comes to purchasing an EV.

The research conducted among Romanian citizens has allowed a deeper understanding of the dynamics of electric vehicle acquisition and the identification of possible directions for future policies and research in the field. The results present an opportunity for Romanian authorities to find solutions for the barriers encountered and for the private entities to adapt their policies, prices, and investments. Government, businesses, and communities can effectively encourage the adoption of electric vehicles and contribute to a more sustainable transportation future. Measures that can be considered to encourage the use of electric vehicles may include: expand charging infrastructure through building more charging stations in urban areas, highways, and rural regions to alleviate range anxiety; collaboration between industry stakeholders, including automakers, utilities, and infrastructure providers, to develop and implement comprehensive strategies for promoting electric vehicle adoption and launch awareness campaigns to educate consumers about the benefits of electric vehicles; encourage businesses to install EV charging stations at workplaces and provide incentives or subsidies for homeowners to install EV charging stations at their residences; offer tax credits, rebates, or subsidies for purchasing electric vehicles to make them more affordable for consumers.

This paper serves as a starting point for future academic research which should be based on a much larger sample and exploring the level of public awareness and knowledge of the requirements of the Green Deal and the benefits of EVs in more detail. Also, the benefits and barriers encountered by the people who already own an EV can be treated and analyzed using a qualitative method.

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