

Article

Romania Residents' Attitude Investigation toward the Transition to Renewable Energy Sources through Importance-Performance Analysis

Olimpia-Iuliana Ban ^{1,*} , Simona Dzitac ², Attila Simó ³  and Adrian Florea ¹ 

¹ Department of Economics and Business, Faculty of Economic Sciences, University of Oradea, 1 University Street, 410087 Oradea, Romania; adiflorea01@gmail.com

² Department of Energy Engineering, Faculty of Energy Engineering and Industrial Management, University of Oradea, 410058 Oradea, Romania; simona.dzitac@gmail.com

³ Department of Power Engineering, Faculty of Electrical and Power Engineering, Politehnica University Timisoara, 300223 Timisoara, Romania; attila.simo@upt.ro

* Correspondence: oban@uoradea.ro; Tel.: +40-74-153-9267

Abstract: Romania, like the whole world, is facing a sustainable development challenge that now takes the form of the energy transition towards renewable energy sources. This transition also addresses industrial consumers as well as domestic consumers. The number of household prosumers of electrical energy from renewable sources reached above 63,000 in Romania in 2023, but there is a slowdown in the process with dissatisfaction from residents. The present research covers a gap in the specialty literature by investigating the perception of Romanian residents (from two cities, Oradea and Timișoara) regarding renewable energy sources and the barriers they identify to the adoption of these sources. The research enjoys a consistent sample of 1098 valid responses. The research method is the survey through a questionnaire applied with an operator and the use of a mix of data processing techniques, namely Importance-Performance Analysis with RStudio202207.1+554 and qualitative processing with Atlas.ti22. The results obtained are categorical by corroborating the two methods, which show valid results that express the position of the respondents. Immediate strategic measures that the Romanian state can take to remove barriers and accelerate the process of adopting renewable energy sources are suggested.

Keywords: renewable energy; residents; importance-performance analysis; barriers



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1. Introduction

The European Commission wants to accelerate the use of renewable resources in order to reduce net greenhouse gas emissions (by at least 55%) by 2030. This goal starts from finding the energy sector's contribution to more than 75% of emissions of greenhouse gases from the European Union. In 2022, the European Commission published the REPowerEU plan [1], which proposes energy measures to reduce dependence on Russian fossil fuels. The proposed ways to achieve this goal are reducing energy consumption, producing clean energy, and the EU's production of power from different sources.

The Global State of Renewable Energy in Cities (REC) report, from the REN21 series 1 [2], aimed to provide an overview of the current state, trends, and developments of renewable energy in cities. Among the above-mentioned aspects, citizens' actions are also presented, with a special focus on renewable energies in public, residential, and commercial buildings related to public and private urban transport. In the urban environment, as well as in the rural environment, the household consumer can get involved in the use of renewable energy if he is provided with access to several types of energy or the choice of an energy supplier. A prerequisite for allowing consumer choice is the liberalization of energy markets, which makes it possible for consumers to choose from a number of

different suppliers supplying energy to the city. Green tariff programs are initiated at the national level, but local municipal governments can support green tariff schemes through information and promotion campaigns that highlight the personal and social benefits of renewable energy users. According to REC 2021 [2] (p. 124), consumer choice can manifest itself in different ways:

- Through “green tariff programs” that have a variety of offers that include the supply of electricity or heating generated entirely or partially from renewable sources;
- Choosing “pay-as-you-go (PAYGo) services”, which offer customers an alternative to contracting with utilities (e.g., decentralized solar photovoltaic systems);
- Through “peer-to-peer energy trading programs” that allow urban consumers to buy renewable energy from other citizens or businesses rather than utilities.

Private energy consumers can be encouraged to use renewable energy sources (RES) through competitive tariffs, incentives, and subsidies from the state and greater shares of renewable energy.

Citizens can support the development of urban renewable energy through [2] (p. 123):

- The choice to buy energy from a supplier that offers electricity or thermal energy from renewable sources, where green tariffs are affordable;
- Total or partial production of their own energy needs;
- The association to form community energy projects;
- Involvement in development projects an urban energy system and
- Promoting energy consumption from renewable resources.

Digitization allows both consumers to choose and supports prosumerism (own production for own consumption), allowing greater flexibility and transparency for customers (through blockchain technology, for example) but also a higher return for prosumers. Prosumer support measures: feed-in tariffs, net metering schemes, and policies ensure total compensation for electricity or heat fed back into the grid.

Europe is the champion of initiatives and measures regarding the adoption of renewable energy sources. At the end of 2020, “more than 10,000 cities in 43 European countries signed the Covenant of Mayors for Energy” and Climate, and more than 6700 of these have also submitted action plans, many of which also involve renewable sources [2].

European cities have also committed to solutions for the decarbonization of activities in urban areas, inclusive of the extension of renewable sources to municipal buildings, the use of waste and wastewater as inputs to produce renewable sources and the integration of solar energy and geothermal heating.

The interest in householders’ attitudes, intentions, and perceived barriers regarding renewable energy sources has been the subject of much research in the last ten years, as the literature shows. These researches were usually carried out at the country level with the intention of identifying ways to increase the adoption of these energy sources. In Romania, too, research was carried out related to renewable energy sources, but the householders’ perception was not captured in any previous study. This research comes to cover this gap and provides a fresh and complex picture of this subject.

The paper is organized into six sections, as follows: in the first section, the European Commission’s objectives regarding the adoption of renewable energy sources until 2030 were presented in the “Introduction”; in the second section, “Background: adoption of renewable energy sources”, the current state is presented Romania in the process of adopting renewable energy sources and possible causes and similar or different positioning of homeowners in Europe, as it results from the specialized literature. In the third section, “Methodology”, an empirical study conducted among homeowners in two important cities in western Romania (Oradea and Timișoara) is presented, followed by the presentation of the “Results and Discussions”, “Conclusions” and “Limits and future research”.

2. Background: Adoption of Renewable Energy Sources

2.1. Adoption of Renewable Energy Sources by Romania

Support schemes for renewable energy were introduced in Romania in 2008 and were represented by the system of mandatory quotas and the purchase of green certificates from electricity suppliers, and supported by Law 220/2008, with subsequent amendments and additions authorized by the European Commission. This quota mechanism applies to energy produced from the following sources: solar, wind, geothermal, biomass, and hydropower with an installed power equal to or less than 10 MW but also biogas, waste gas, or wastewater. The additional condition is that the generating station operates or is modernized after 2004. Subsequently, in 2012, 2013, and 2017, various legislative changes took place to improve the application of these measures, with the aim of preventing fraud in the system and increasing the predictability of the scheme of support. As shown in the full report by Bankwatch Romania [3], these changes made the support schemes offered by the government unpredictable in the public perception, which led to a decrease in the confidence of potential investors and limited access to the energy system of small producers. In the report made by Bankwatch Romania [3], it is shown that Romania has set an achievable share of renewable energy of 30.7%, although the recommendation of the European Commission was 34%. Romania has a large unused renewable energy potential due mainly to the lack of awareness of the population and companies regarding the importance of this aspect, in addition to the insufficient government measures taken.

In 2020, electricity production in Romania was 12.4% from wind energy, 3.4% from solar photovoltaic panels, and 27.6% from hydropower [4].

Considering this reality of the year 2023, the present study aims to investigate the positioning of the Romanian population owning independent houses or shared living spaces towards the aspects/attributes of the adoption of renewable energy sources. Thus, it will be possible to identify the measures on which to march to stimulate the more accelerated adoption of renewable energy sources. The next support measure pursued by Romania for the year 2030 is to replace green certificates with Contracts for purchasing energy outside the centralized market and also programs to encourage the prosumer and new capacities of renewable energy sources built by state companies.

2.2. Literature Review on Resident Perception

Renewable energy sources are those sources/resources that come from the local environment and that contribute to reducing economic costs, the impact on the environment, contributing to social well-being. This category includes wind, solar, water, geothermal, biomass, and ocean energy.

The empirical studies with residents and homeowners have mainly focused on the attitude towards these resources or purchase intentions and the decision, influencing factors, or barriers to their adoption. Table 1 summarizes some similar studies from the last ten years.

Table 1. Empirical studies investigating the factors that influence the decision to adopt renewable energy resources among residential homeowners.

Authors	Sample/Method/Country	Motivational Factors/Predictors of Positive Attitude towards the Adoption of Renewable Energy Sources
Sardianou, Genoudi [5]	a survey of 200 consumers (150 valid), stratified sampling method in Greece	socio-demographic factors that have a positive influence (middle age, high income, higher education) and economic factors that have a positive influence (tax deductions)
Engelken Römer, Drescher, Welpé [6]	20 interviews and 395 questionnaires among owners of single-family houses and apartments in Germany	financial and autarkic benefits, environmental awareness, technological affinity

Table 1. Cont.

Authors	Sample/Method/Country	Motivational Factors/Predictors of Positive Attitude towards the Adoption of Renewable Energy Sources
Ropuszyńska-Surma, Węglarz, [7]	960 questionnaires applied to homeowners in Poland	segmentation criteria used: gender, age, economic status, knowledge about energy, attitudes towards RES *, and pro-environmental behavior
Szakály, Balogh, Kontor, Gabnai, Bai [8]	1002 people in Hungary	higher level of studies, high income, intellectual profession, and awareness of one's own health and the environment
Djurisic, Smolovic, Misnic, Rogic [9]	Questionnaire applied to 1012 respondents in Montenegro	other variables being equal, RES behavior is influenced first by RES perception and then by awareness
Irfan, Elavarasan, Hao, Feng, Sailan [10]	351 households in Pakistan	awareness, self-efficacy perception, and neighbors' participation have significant and positive effects, the cost has a negative effect, and environmental impact has no insignificant effects

(Source: created by authors, * RES—renewable energy source).

Considering the rate of adoption of renewable sources, numerous articles [11–16] have focused on identifying the barriers that block the adoption of these sources, these barriers being also influencing factors because the way they are manipulated turns them into brakes or stimulators. For example, in the study by Štreimikienė et al. [13], it is shown that the majority of Lithuanians want to adopt renewable energy sources but have financial problems and lack of infrastructure as essential barriers.

In Engelken et al. [6], not only the attitude towards renewable energy sources is followed, but also the purchase intention. The identified solutions are:—personalized information strategies with an emphasis on autarky and financial benefits;—subsidies and a stable political and financial regulatory framework. In an article [8], the main determinants of willingness to install small-scale SRE among households were considered to be the socio-demographic and behavioral criteria.

The need for comprehensive, consistent, and constant communication from the government regarding renewable energy sources has emerged in many studies [6,10,17]. The population not only does not fully understand the benefits of renewable energy resources but even believes that they could have negative effects on health or the land [10]. There are also other situations [18] when the awareness of environmental issues and the desire to contribute to environmental protection are the main reasons these renewable energy sources are expected. In the study by Motz et al. [18], a third of the Swiss surveyed were already prosumers.

The analysis of the intention to adopt renewable electricity sources in relation to trust in the government was discussed in an article [19] and proposed a scale with the following questions: “1. I trust that the government will support the public's interest in the decision-making process regarding renewable energy resources”, “2. Control of renewable energy sources is in good hands with the government” and “3. The government is competent with regard to renewable energy sources”. In another case [20], they suggest that there is evidence that trust in responsible agencies is positively related to public acceptance of sustainable energy technology and renewable energy projects. When people have more trust in the agencies that are responsible for developing renewable energy projects, they tend to rate these projects as more acceptable, which makes them easier to implement. Conversely, when people have less trust in responsible agencies, they tend to rate projects as less acceptable and even become more difficult to implement.

The influencing factors of the adoption of renewable energy sources selected for this study, from a review of the literature, are those in Appendix A, Table A1.

Romania's concerns about the adoption of renewable energy sources by industrial and household consumers are obvious. We observe recently increased academic interest in home consumers, an interest reflected in research conducted on this topic. Thus, [21] studied residents' willingness to pay for renewable energy. [22] investigated the feasibility of residential PV systems, while [23] studied the depreciation of energy-efficient residential buildings. The energy transition in marginalized urban areas was investigated by [24], and Romanians' habits regarding energy consumption were investigated by [25].

However, we found no recent research on residents' attitudes and perceptions of renewable energy sources and their perceived barriers to adoption. This topic and its relevance for the year 2023 makes the information brought by this research valuable.

3. Methodology

3.1. Population of Survey

At the level of 2022, Bihor had an installed electric power of 11.8 (in MW), while Timiș county had 25.4. At the national level, of the 42 counties that Romania has, 27 have less than 10 installed electrical power and a maximum of 42.9, Ilfov county [26]. Both Bihor County (which has Oradea as its county seat) and Timiș County (which has Timișoara as its county seat) are above the national average, although the level of economic development is above average (Table 2).

Regarding prosumers, i.e., persons who choose to partially or totally procure their necessary energy from renewable sources, Romania had, in 2021, 12,000 prosumers, and in 2022, 40,159 with the forecast that they will reach 100,000 in 2023 [26]. At the level of 2022, 89% of prosumers were individuals and 11% companies. For now, in June 2023, according to Profit.ro [27], the number of prosumers in Romania reached 63,162. The program launched for prosumers in 2019, "Green Photovoltaic House," encountered difficulties due to the slow processing of submitted files, which made consumers cover the costs of the panels themselves. This program will relaunch in 2023 with the goal of processing 100,000 cases. In the year 2023, Timiș County was in 2nd place in the country in terms of the number of prosumers, while Bihor County was in 11th place (Table 2).

Oradea and Timișoara are two of 266 cities in Romania and are located in the west of the country. Oradea is part of Bihor County, which is the second largest in the Northwest Region of Romania in terms of GDP and the 11th in the top counties of Romania in terms of contribution to national GDP. The analysis of the specialization index of the county shows that the economic sub-sectors in which the county is more developed, compared to the national level, belong to the secondary sector. Thus, the processing industry stands out, in particular: computers, electronics, and optics; textile and clothing industry; plastics and non-metallic products, as well as the furniture industry. Timișoara is an important economic pole in the west of the country, and IT is among the performing sectors.

The reasons for choosing the two cities for the study, to find out the attitude of the residents of the two cities towards the implementation of green projects, are related to their economic development, positioning in the same geographical area, and their performance in increasing the number of green energy prosumers. Timișoara is a more developed city than Oradea from all points of view, which is why Oradea wants to reach its level, which is possible considering that the differences are not great. We wanted to discover the nuanced differences that would allow Oradea to make progress as well. These cities are located in the west of the country and are above the national average in the adoption of renewable energy sources by residents. Being also economically developed counties, we want to find out what are the barriers to the adoption of renewable energy sources here so that the discussion is not limited only to financial resources.

Table 2. Statistics about Oradea and Timișoara.

	Oradea	Timișoara
Population *	183,105	250,849
Rank among cities in Romania according to the number of inhabitants *	11	4
The share of the economy of the county of which the city is a part in the GDP **	2.4 (Bihor County)	4.6 (Timiș County)
GDP per capita (as a percentage of the national average) **	81.5 (Bihor County)	123.4 (Timiș County)
Net salary gain (percentage of the national average) **	82.2 (Bihor County)	113.7 (Timiș County)
Installed power in KW ***	2551 (Bihor County)	4337 (Timiș County)
Number of prosumers in 2021 ***	443 (Bihor County)	549 (Timiș County)

(Source: * according to the 2021 census; ** [28]) *** [26] (p. 25).

3.2. Survey

Considering the current real and growing interest in the adoption of renewable energy sources at the European level and the still modest results that Romania has, despite the measures taken by the Romanian government, we propose to investigate the attitude towards these sources of the residents of two important cities in western Romania, Oradea, and Timișoara. The pursued objectives of the study are the following:

- Identifying the general attitude of residents towards renewable energy sources;
- Assessing the level of direct and indirect personal experience of residents with the types of renewable energy sources;
- Discovering the main barriers to the adoption of renewable energy sources, according to the respondents;
- Identifying the influencing factors of the adoption of renewable energy sources that are important and in which Romania has a good performance, in the opinion of the residents;
- Identifying the influencing factors of the adoption of renewable energy sources that the Romanian government must focus on, according to the residents;
- Identifying the influencing factors of the adoption of renewable energy sources that are less priority or even unimportant in the adoption of renewable energy sources by residents.
- Identifying possible significant differences between the respondents of the two cities.

The research is based on an empirical study carried out through a questionnaire survey among the residents of Oradea and Timișoara in the year 2023, between March and June. A Google Forms questionnaire applied with an operator was used as a tool. The sampling method was that of the snowball. The statistical data of the respondents can be found in Table 3. The questionnaire had three parts. The first part was that of obtaining consent to participate in the study, according to Regulation no. 679/2016. The second part had seven questions, six of which were multiple-choice and one open-ended. It was identified for the respondents the quality of being a resident owner of a house or apartment in Oradea or Timișoara, the previous direct or indirect experience with renewable energy sources, the attitude towards them, the importance attributed to the influencing factors of the adoption of renewable energy sources and the evaluation of how they perform Romania to these factors and the identification of the main barrier in the adoption of these sources (open question). Twenty-two factors of the adoption of renewable energy sources were selected from the specialized literature (Table 4). Answers were recorded on a 5-point Likert scale. The third part of the questionnaire recorded the socio-demographic data of the respondents, namely age, gender, income level, and education level. One thousand one hundred thirty-seven questionnaires were applied, and after verification, 1098 remained. The internal consistency of the answers to the two questions related to the importance and performance of the influencing factors was carried out with α Cronbach and obtained for importance 0.92 and for performance 0.95, which shows very good internal consistency. The data were

analyzed with a mix of methods. The answers to the open question were processed with Scientific Software\ATLAS.ti.22\Atlasti22. The analysis of influence factors was carried out with an Importance-Performance Analysis (IPA).

Table 3. Statistics about respondents.

Gender	Absolute Frequency	Relative Frequency (%)
men	467	42.53
woman	584	53.18
I prefer not to say	47	4.28
Education		
secondary, or under	15	1.36
high school, including professional, complementary, apprentice, post-high school	241	21.94
university degree	627	57.1
postgraduate, including master's, doctorate	215	19.58
Age		
20–24	424	38.61
25–34	242	22.04
35–44	196	17.85
44–65	206	18.76
above 65	32	2.91
Own		
apartment in a block in Oradea	491	44.71
house in Oradea	429	39.07
apartment in a block in Timișoara	123	11.20
house in Timișoara	55	5.00
Total respondents		
Oradea	920	83.78
Timișoara	178	16.21

(Source: created by authors).

Table 4. The values assigned by the total respondents to the influencing factors of the adoption of renewable energy sources.

Factors	Code	Performance	Importance
Solving the problem of grid-connected energy production of renewable energy systems and the electricity company	A	3.088	3.864
Overcoming legislative regulation issues	B	3.036	3.342
Extending the scale of the renewable energy market/offer	C	2.717	3.902
Construction of public facilities in the place where renewable energy is installed	D	2.754	3.866
Increasing the effectiveness of the government administrative process (time and cost)	E	2.69	3.869
Existence of a professional authority for the correct certification of the design of renewable energy equipment	F	2.78	3.899
Resolving relevant requirements for renewable energy installation (e.g., environmental assessment)	G	2.735	3.942
Coordination between institutions to support the production and consumption of renewable energy	H	2.592	4.127

Table 4. Cont.

Factors	Code	Performance	Importance
Informing and educating the population about renewable energy. Awareness of environmental issues	I	2.533	4.387
Government's provision of a subsidy for the installation of renewable energy equipment	J	2.666	4.648
Government's provision of a reasonable buy-in rate for electricity produced by renewable energy equipment	K	2.592	4.027
Government's provision of incentives for those who produce energy from renewable sources	L	2.615	4.162
Government provision of tax exemptions	M	2.542	4.02
Reducing the bureaucracy of related procedures	N	2.447	4.702
Equipment acquisition costs	O	2.557	4.167
Existence of standards for installation and design	P	2.693	3.762
Existence of reliable energy equipment installation companies	Q	2.786	3.468
Existence of energy equipment monitoring services after installation	R	2.705	3.926
Desire for the independence of household consumers to produce their own energy	S	2.866	3.951
Independence from the energy sources of other countries (Russia) but even from other states	T	2.675	3.906
Have other home producers of renewable energy nearby	U	2.683	3.715
People's ability to change habits	V	2.563	4.009
MEAN		2.696	3.984

(Source: created by authors).

3.3. Importance-Performance Analysis

Importance-Performance Analysis is a widely used marketing technique that can assist practitioners in decision-making and formulating marketing strategies to increase consumer satisfaction. It is a tool that allows one to visualize a picture of the measures that managers need to take to improve customer satisfaction in different areas. Important-Performance Analysis (IPA) was launched in 1977 by Martilla and James [29], also named classic or original IPA, and analyzes the quality attributes of products/services/destinations/amusement parks and others, taking into account perceived importance and performance evaluation.

Original importance-performance analysis assumes the partitioning of a set of attributes into four sets (A/Quadrant I—"Concentrate here", B/Quadrant II—"Keep up the good work", C/Quadrant III—"Low priority" and D/Quadrant IV "Possible overkill") with respect to the level of performance and importance.

This method is widely used but has some disadvantages. Numerous revisions have been made to the application of this method to increase its accuracy and simplicity in application [30]; we mention here only the significant revisions proposed by Caber et al. [31], Deng et al. [32], and Deng [33].

Ban et al. [34] propose a method (9Q-IPA) to solve one of the most pressing problems of standard importance-performance analysis: the positioning of attributes in quadrants. They used a mathematical approach found in the tools of classification theory to apply the attribute/factor division in the importance-performance plane to the nine categories. They [34] improve the 9Q-IPA method by introducing a parameter that gives a certain elasticity to our approach (9Qc-IPA). The efficiency of this method is seen when there are a large number of attributes/factors, and the positioning of many of them near the matrix axes makes it difficult and questionable to assign them to one quadrant or another.

However, revised versions continue to be successfully applied alongside the classic or original version. Importance-performance analysis has already been used in many areas, including green energy [35–39]. In this material, IPA classic was applied due to the form of presentation of the results in the matrix, and the matrix representation was done with RStudio202207.1+554.

4. Results

Respondents' attitude towards renewable energy sources was tracked through two items of the questionnaire: one in the form of a Likert scale question and the second in the form of an open question regarding the identified barriers to the adoption of renewable energy sources. On a 5-point Likert scale, the attitude is positive, with a score of 4.312 for all respondents, with a better score of 4.443 for Timișoara and 4.286 for Oradea. In Figure 1 you can see the distribution of responses by total respondents regarding the attitude towards renewable energy sources, responses whose average is 4.312.

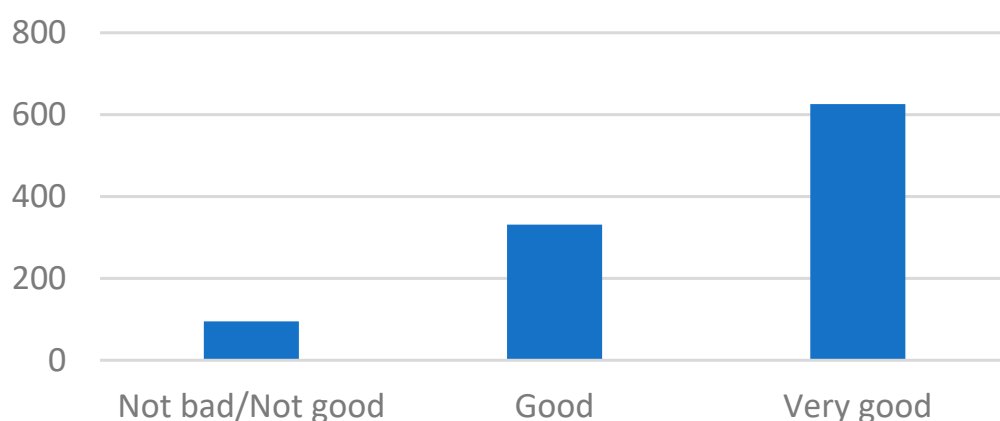


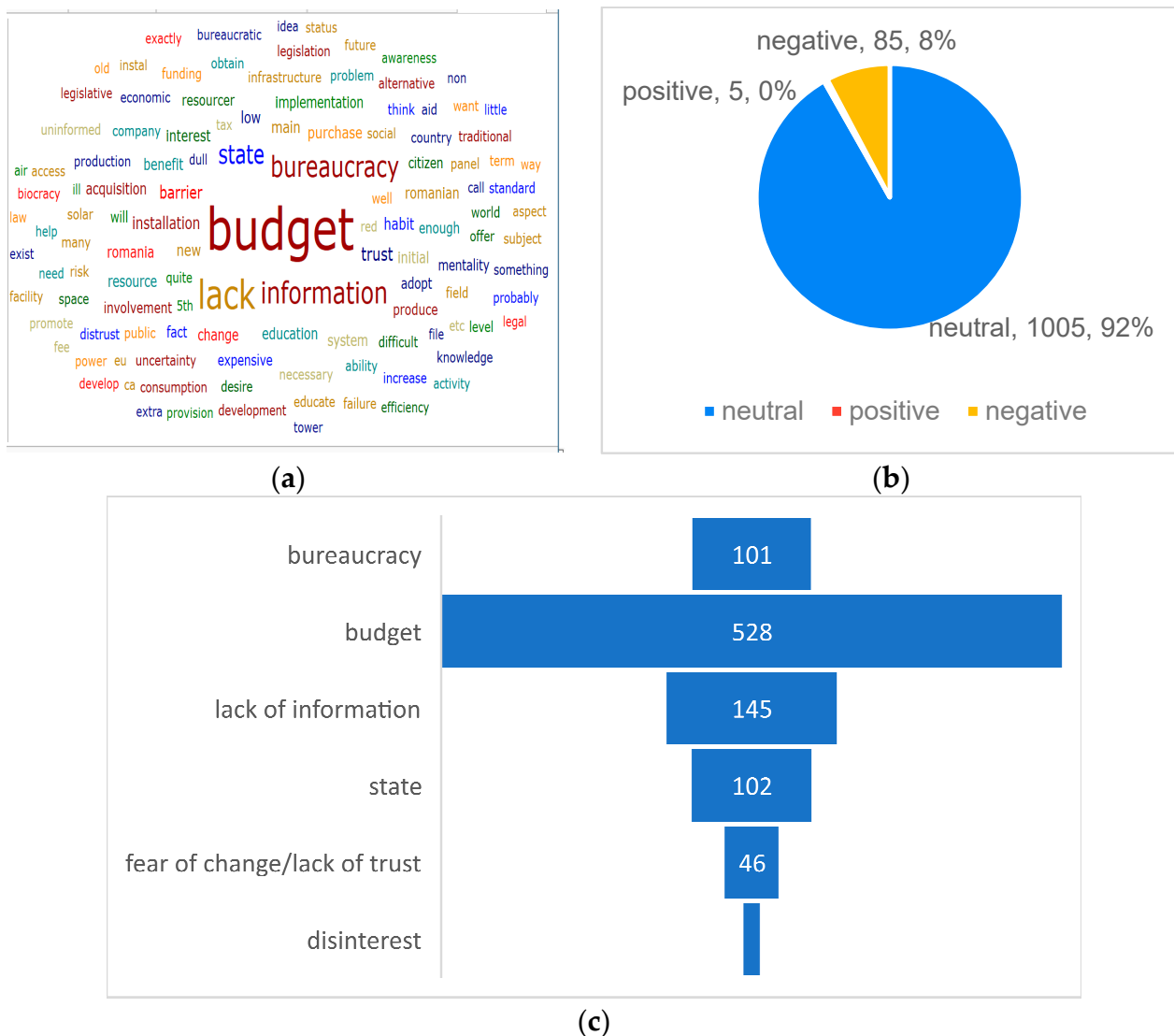
Figure 1. Global attitude towards renewable energy sources. (Source: created by authors).

We separated the answers into two categories: (a) university, including master's degree, doctorate (first category), and (c) high school, including professional, complementary, apprentice, post-high school d. secondary school, or below (second category), and we analyzed the answers given to the question related to the opinion regarding renewable energy sources.

For the first category, a score of 4.39 was obtained on the Likert scale, which is higher than the average of 4.31, and for the second category, a score of 4.03 was obtained. A slight difference is observed in the sense that people with higher education have a better attitude towards renewable energy sources than people with medium or lower education.

The obtained score shows a generally positive attitude towards renewable energy sources, but the same is not seen regarding their adoption. Although 92% of the comments are neutral and only 8% negative, the nature of the comments and their content converge towards several conclusions regarding the serious problems identified (Figure 2).

The coding and grouping of answers in order to process them with Atlas.ti22 (Figure 2a,c) revealed several major groups of answers: those related to the budget (embedded answers: budget, costs, prices, money, financial resources, income, wages, tax, investment, purchases, etc.), those related to bureaucracy, those related to lack of information and even misinformation, those related to fear of change and lack of trust in new solutions, those related to the state (built-in answers: distrust in legislation, regulations, stability legislation and existing policies, lack of support). A last category is that of the population's disinterest in these solutions, the cause of which could be the lack of information. These answers reflect problems related to the budget involved in this transition, respectively the costs of the transition supported more or less by the state, the bureaucracy that procrastinates and discourages the transition, the state that does not have constant measures, the lack of



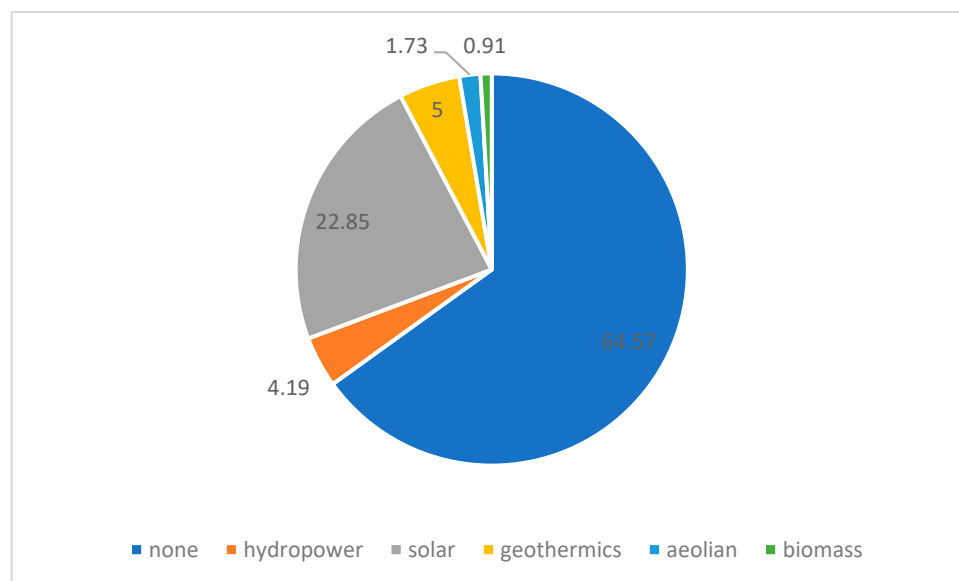


Figure 3. Percentage distribution of renewable energy users among total respondents. (Source: created by authors).

We note the small but significant share of our study, of 35.43% of respondents who have used or are currently using such renewable energy sources. The largest share (22.85%) has those who use solar energy, a situation also reflected at the national level.

The contribution of the 22 influencing factors of the adoption of renewable energy sources, selected from the specialized literature, was studied using the IPA matrix. The coding of the factors and the values assigned by the respondents on the 5-point Likert scale can be found in Table 4, and the distribution of the quadrants can be found in Figure 4 and Table 4. The distribution of the factors (Figure 4) shows a very sad situation for Romania in 2023, with no factors included in the “Keep up to Good Work” category. Romania does not perform at the level of any factor considered sufficiently important for the respondents. Factors are considered important and on which the state’s efforts should be focused, and include Reducing the bureaucracy of related procedures, The government’s provision of a subsidy for the installation of renewable energy equipment, Informing and educating the population about renewable energy, Awareness of environmental issues, Equipment acquisition costs, The government’s provision of incentives for those who produce energy from renewable sources, Coordination between institutions to support the production and consumption of renewable energy, Government provision of tax exemptions, People’s ability to change habits, and The government’s provision of a reasonable buy-in rate for electricity produced by renewable energy equipment.

All nine are the factors that could be removed from the discussion, not being relevant at this stage of the transition. They are Resolving relevant requirements for renewable energy installation (e.g., environmental assessment), Existence of energy equipment monitoring services after installation, Extending the scale of the renewable energy market/offer, The existence of a professional authority for the correct certification of the design of renewable energy equipment, Construction of public facilities in the place where the renewable energy is installed, The existence of reliable energy equipment installation companies; The desire for independence of household consumers to produce their own energy, Solving the problem of grid-connected energy production of renewable energy systems and the electricity company, and Overcoming legislative regulation issues.

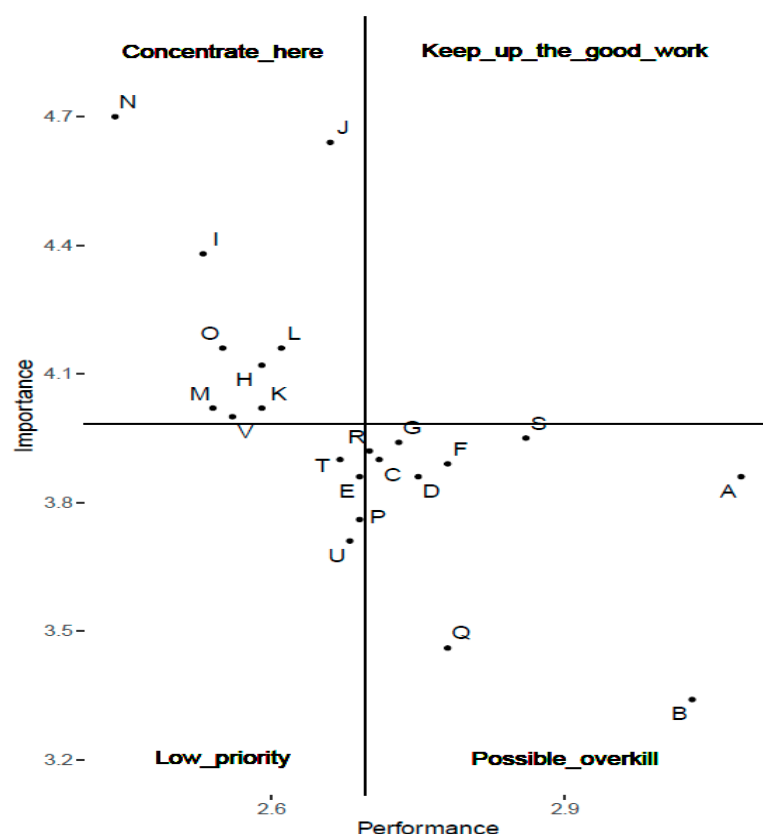


Figure 4. IPA original for total respondents. (Source: created by authors).

Low priorities include Independence from the energy sources of other countries (Russia) but even from other states, Increasing the effectiveness of the government administrative process (time and cost), Existence of standards for installation and design, and Having other home producers of renewable energy nearby.

The analysis of the differences of opinion on the two cities (Table 5) (Figure 5) and Table 6 does not show much different positioning, but still at the level of the city of Timișoara, with more prosumers (15.94 prosumers/1000 inhabitants compared to 10.92/1000 in Oradea), we discover a positioning on the border between quadrants 1 and 2 of factor “The government’s provision of a subsidy for the installation of renewable energy equipment” (Figure 5) which could mean a more positive attitude of the people of Timișoara towards the state’s effort to support the installation of green energy equipment. Moreover, the factor “The desire for independence of household consumers to produce their own energy” is better positioned in the case of the people of Timișoara, which can make us believe that they want energy independence to a greater extent. The barriers to the adoption of renewable energy sources for Oradea are *Government provision of tax exemptions, Reducing the bureaucracy of related procedures, Equipment acquisition costs, Informing and educating the population about renewable energy, Awareness of environmental issues, Coordination between institutions to support the production and consumption of renewable energy, The government’s provision of a subsidy for the installation of renewable energy equipment, The government’s provision of a reasonable buy-in rate for electricity produced by renewable energy equipment, and The government’s provision of incentives for those who produce energy from renewable sources.*

Table 5. The values of the influencing factors of the adoption of renewable energy sources assigned by the respondents from Oradea and Timișoara.

ORADEA Code	Performance	Importance	TIMIȘOARA Code	Performance	Importance
A	3.11	3.90	A	3.17	3.94
B	3.07	3.41	B	3.06	3.23
C	2.75	3.94	C	2.72	3.95
D	2.80	3.90	D	2.71	3.93
E	2.73	3.90	E	2.66	3.95
F	2.82	3.93	F	2.74	4.01
G	2.78	3.98	G	2.67	4.03
H	2.62	4.16	H	2.61	4.21
I	2.56	4.41	I	2.57	4.57
J	2.69	4.69	J	2.7	4.72
K	2.61	4.07	K	2.64	4.09
L	2.65	4.20	L	2.59	4.24
M	2.58	4.07	M	2.51	4.02
N	2.48	4.76	N	2.43	4.74
O	2.59	4.21	O	2.56	4.21
P	2.70	3.79	P	2.85	3.85
Q	2.82	3.47	Q	2.78	3.69
R	2.75	3.95	R	2.64	4.05
S	2.89	3.98	S	2.93	4.05
T	2.70	3.95	T	2.7	3.92
U	2.72	3.76	U	2.67	3.74
V	2.61	3.83	V	2.5	3.93
MEAN	2.728	4.011	MEAN	2.293	3.543

(Source: created by authors).

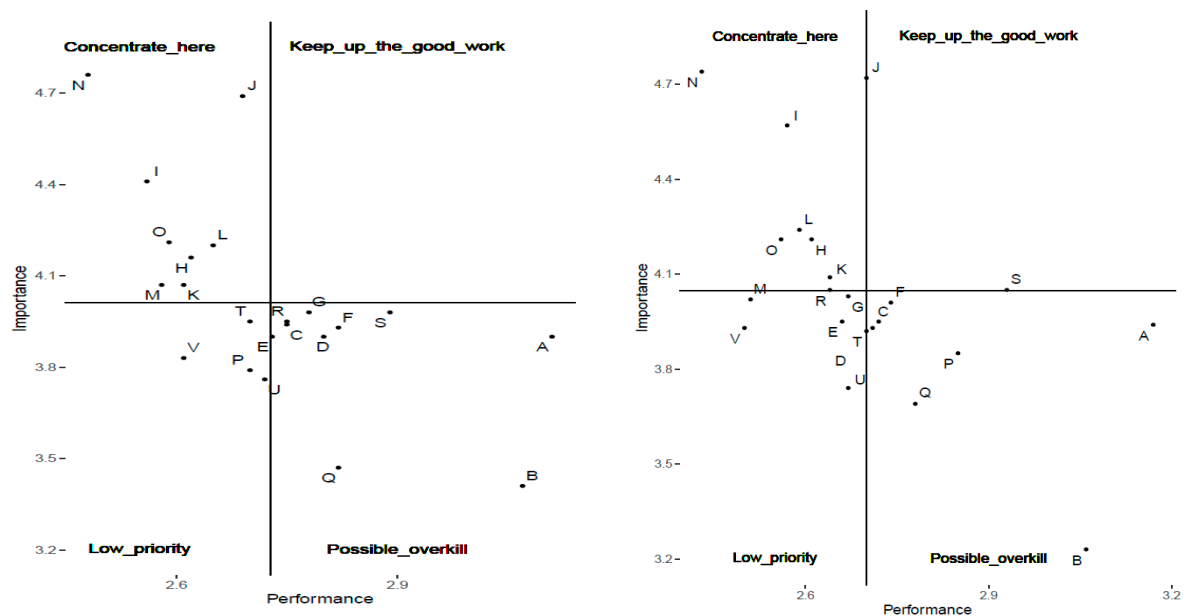
**Figure 5.** IPA original for respondents from Oradea (left) and Timișoara (right). (Source: created by authors).

Table 6. Distribution of factors in quadrants according to respondents.

Quadrant	Global	Oradea	Timișoara
Concentrate here	N, J, I, O, L, H, M, V, K	N, J, I, O, L, H, M, K	N, I, L, O, H, K
Keep up the Good Work	-	-	J, S
Low Priority	T, E, P, U	T, P, U, V	T, E, U, M, R, G, V, D
Possible Overkill	G, R, C, F, D, Q, S, A, B	G, R, C, F, D, Q, S, A, B, E	C, F, A, B, P, Q

(Source: created by authors).

The barriers to the adoption of renewable energy sources for Timișoara are *Reducing the bureaucracy of related procedures and equipment acquisition costs, Informing and educating the population about renewable energy, Awareness of environmental issues, Coordination between institutions to support the production and consumption of renewable energy, The government's provision of a reasonable buy-in rate for electricity produced by renewable energy equipment, and The government's provision of incentives for those who produce energy from renewable sources.*

Comparing the results obtained by processing the open question (Figure 3) and those from the IPA (Table 6), we observe an obvious corroboration, which strengthens the credibility of the results. Thus, we find aspects related to bureaucracy in both results, as well as those related to costs, state support, information, and even the population's interest and desire for change.

In the category "Possible overkill", we find a large number of factors from the category of installation design, companies that offer services, post-installation monitoring, etc. The lack of interest can be explained by the fact that this stage has not been reached, and the face of adoption is not being fully resolved.

We further investigated whether there is a differentiation of views on prosumers and non-prosumers. Analyzing the responses, separately by prosumers and non-prosumers, regarding the importance and performance of the 22 factors, we see no significant difference (Table 7, Figure 6).

Table 7. The values assigned to factors of the adoption of renewable energy sources.

Code	Performance Prosumers	Importance Prosumers	Performance Non-Prosumers	Importance Non-Prosumers
A	3.223	3.881	3.07	3.926
B	3.177	3.357	3.015	3.368
C	2.881	3.943	2.677	3.952
D	2.925	3.93	2.71	3.902
E	2.874	3.892	2.636	3.928
F	2.946	3.92	2.74	3.959
G	2.835	4.005	2.73	3.98
H	2.712	4.19	2.574	4.169
I	2.616	4.413	2.534	4.454
J	2.807	4.722	2.638	4.692
K	2.755	4.087	2.55	4.067
L	2.76	4.213	2.583	4.21
M	2.73	4.05	2.486	4.073
N	2.588	4.714	2.414	4.782
O	2.737	4.228	2.504	4.21
P	2.73	3.845	2.722	3.785
Q	2.917	3.483	2.765	3.524
R	2.874	3.982	2.662	3.697
S	2.958	4	2.868	3.997
T	2.763	3.935	2.677	3.961
U	2.776	3.753	2.681	3.763
V	2.673	3.75	2.55	3.902
Mean	2.829	4.013	2.672	4.013

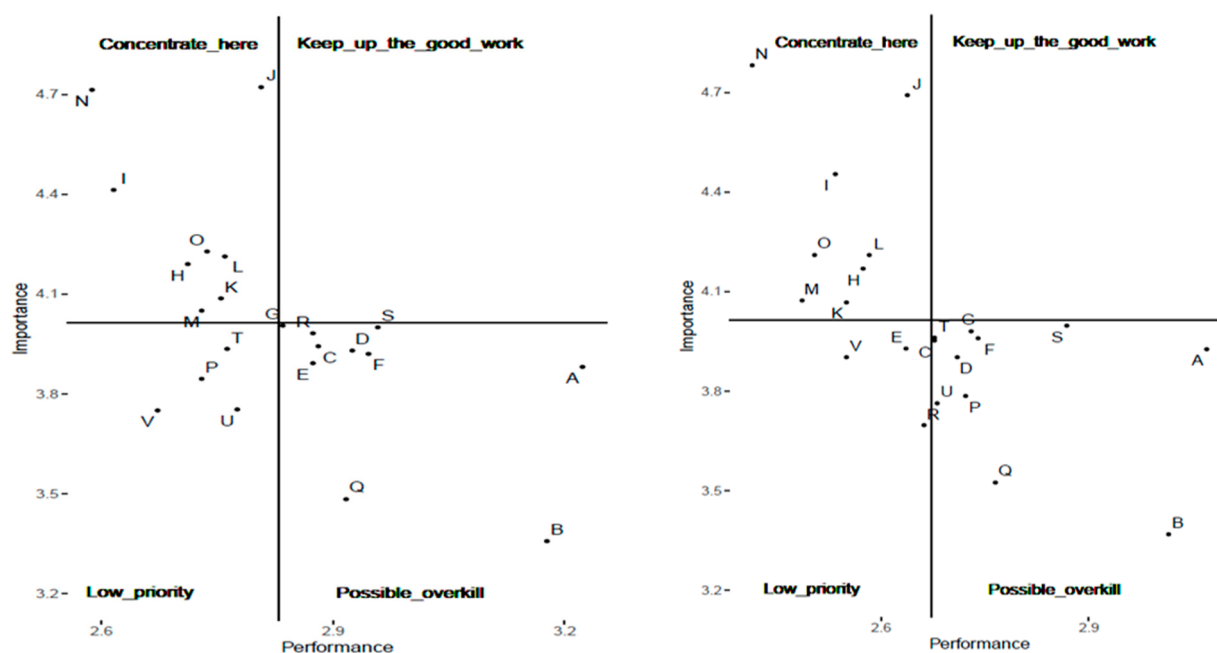


Figure 6. IPA for prosumers (left) and IPA for non-prosumers (right).

It is worrying that no category of respondents evaluated any factor in the “Keep up the good work” category; thus, prosumers still do not have a worse impression than non-prosumers.

5. Conclusions

The year 2023, the current year, is the year in which Romania wants a substantial increase in the number of household green energy prosumers from over 60,000 to 100,000. The present research makes a complete foray into the perception of current and potential prosumers regarding their attitude towards renewable energy sources and the barriers they see in their adoption. In the research conducted among the residents of the two cities, Oradea and Timișoara, prosumers and non-prosumers of energy from renewable energy sources show a dominantly positive attitude towards these sources, with a score of 4.43 out of a maximum of 5, with very small differences on the two cities (4.44 Timișoara and 4.28 Oradea). However, they show many dissatisfactions with the implementation of these sources in Romania.

The processed answers to the open question corroborate with those modeled through the Importance-Performance Analysis and highlight several major barriers to implementation: the budget required for implementation, bureaucracy, poor information, lack of consistent support from the state, lack of confidence in this energy variance and resistance to change and disinterest in new and change.

The practical implications of the study are clear and unequivocal, showing the direction of strategic measures that the state must take to accelerate the adoption of these sources. We find the factors that must be acted upon in quadrant I, “Concentrate here”. These factors concern the costs related to the adoption of the sources (with the equipment, the installation, taxes, and support from the state), the reduction of the bureaucracy related to the adoption process, the transmission of the trust that the state must inspire through coherent, constant and encouraging legislative measures, the information and educating the population about the need and impact of adopting these renewable energy sources and understanding the population’s psychological sources of reluctance to change, to the new and the fear of unwanted consequences. The fact that there is no factor in the “Keep up the good work” category is an alarm signal for the Romanian governors because it shows the dissatisfaction of current and potential household prosumers regarding the

existing factors/measures for the adoption of renewable energy sources. Also, the fact that 13 factors, i.e., more than half of those proposed, are in the “Low priority” and “Possible overkill” categories shows the early stage in which Romania is. These factors were selected from the specialized literature, being relevant in other countries, but in Romania, they still have no impact. Between the two cities, there are no significant differences among the respondents; they are located in the first half of performing counties in the adoption of renewable energy sources, but Timișoara is a better place than Oradea. The barriers represent those attributes considered important by the respondents and on which the cities do not perform accordingly, the attributes listed in the “Concentrate here” quadrant. We note that for Oradea, eight attributes are included in this quadrant, and for Timișoara, six attributes. They are listed below. The two additional attributes found in Oradea are The government’s provision of a subsidy for the installation of renewable energy equipment and the Government’s provision of tax exemptions. It is surprising that these two attributes are considered barriers by the people of Oradea but not by the people of Timisoara because they do not refer directly to the local administration but to the same government. The explanation would be that there are problems at the local level due to poor communication or the processing of requests at the level of the city of Oradea, which has become difficult and created dissatisfaction, and the people of Oradea did not get to benefit from these advantages offered by the government.

The scientific implications of the proposed approach relate to the chosen work methodology that combines quantitative (Importance-Performance Analysis) and qualitative methods of text analysis (Atlas.ti22), and that shows a picture of reality that is easy to understand by both theorists and practitioners. The present research covers an existing gap in the specialized literature regarding the attitude of Romanian residents regarding renewable energy sources.

6. Limits of the Paper and Future Research

The limits of the paper are given by taking into account only two cities in Romania with different sample sizes, 920 in Oradea and 178 in Timișoara, respectively. The sample consists of two-thirds of people with higher education, which, according to specialized literature, could have influenced the opinion of the respondents in the sense of a more positive opinion towards these energy sources. Keeping these limitations in mind, the information obtained is nevertheless valuable. Future research can pursue a differentiation of opinions on prosumers and potential prosumers, direct experience providing useful and revealing information and taking into consideration. We propose to research the opinions of the inhabitants of other areas of the country. The north-eastern area of Romania, for example, is less developed economically and it would be interesting to discover the attitudes there.

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Appendix A

Table A1. Factors influencing the adoption of renewable energy sources.

Factors Category	Factors	References
Administrative support factors	1. Solving the problem of grid-connected energy production of renewable energy systems and the electricity company	[35]
	2. Overcoming legislative regulation issues	[12,35]
	3. Extending the scale of the renewable energy market/offer	[35]
	4. Construction of public facilities in the place where renewable energy is installed	[35]
	5. Increasing the effectiveness of the government administrative process (time and cost)	[35]
	6. The existence of a professional authority for the correct certification of the design of renewable energy equipment	[35]
	7. Resolving relevant requirements for renewable energy installation (e.g., environmental assessment)	[35]
	8. Coordination between institutions to support the production and consumption of renewable energy	[14,35,40]
	9. Informing and educating the population about renewable energy. Awareness of environmental issues	[6,8,10,12,13,40]
Government financial support	1. The government's provision of a subsidy for the installation of renewable energy equipment	[14,35,40]
	2. The government's provision of a reasonable buy-in rate for electricity produced by renewable energy equipment	[35]
	3. The government's provision of incentives for those who produce energy from renewable sources	[6,35]
	4. Government provision of tax exemptions	[5,35]
	5. Reducing the bureaucracy of related procedures	[41]
Market factors	1. Equipment acquisition costs	[10,13]
	2. Existence of standards for installation and design	[14,40]
	3. The existence of reliable energy equipment installation companies	[42,43]
	4. Existence of energy equipment monitoring services after installation	[44]
Factors related to the culture of the community	1. The desire for independence of household consumers to produce their own energy. Independence from the energy sources of other countries (Russia) but even from other states	[6,18]
	2. Have other home producers of renewable energy nearby	[10]
	3. People's ability to change habits	[13]

(Source: created by authors).

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