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A strategic analysis of green energy projects using SWOT Method

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Abstract. In today's rapidly evolving world, the negative impact on our environment and biosystem is widely recognized, making the need for sustainable practices and cultures a highly relevant topic. This study aims to conduct a strategic analysis of Romania's potential to implement renewable and green projects. It focuses on the country's environmental performance to date, its prospects for future green development, and the key factors that could serve as strengths for upcoming renewable initiatives. The strategic analysis was carried out using the SWOT analysis. As a result, the internal and external factors influencing companies and governments to invest in sustainable projects in Romania were identified, analysed, and utilized to determine the most effective strategies for the country's specific context. Therefore, companies that operate and invest in green projects in Romania should pay close attention to the country's infrastructure while also taking advantage of its high renewable energy potential.

Key words: green projects; sustainability; strategic analysis; environment.

1. Introduction

In today's world, climate change and global warming remain urgent challenges that are driven by excessive pollution with an impact in all aspects of life. In Europe in 2024, the energy sector is the leading contributor to greenhouse gas emissions in the EU, accounting for 28%, followed by the transport sector (24%) and the metallurgical industry (20%) (Parliament, 2025). In response, policymakers have introduced stringent emission reduction measures. Central to these efforts is the EU Green Deal, which targets net-zero emissions by 2050 and is backed by substantial financial investments to support the shift to clean energy.

The share of renewables in the European energy mix has grown substantially, increasing from 26.1% in 2012 to 29.5% in 2022, driven by massive investments in new generation capacities, advanced technologies, and the phasing out of fossil fuel plants from 1.1 trillion dollars to 1.4 trillion dollars (World Economic Forum, 18). Also, beyond its impact on the climate, pollution from toxic emissions degrades air quality and contributes to the growing incidence of respiratory diseases, especially in heavily affected regions (Hernández Serrano, 2020).

Moreover, the transition to green energy is not merely about replacing fossil fuel-based power plants with renewables; it represents a fundamental societal shift in how energy is perceived and utilized. This

transformation requires government policies, technological innovation, and evolving market dynamics. The EU has already introduced subsidies for green energy, carbon taxation, and stricter energy efficiency regulations to facilitate this shift (Hernández Serrano, 2020).

Nevertheless, the purpose of this paper is to describe both internal and external aspects to characterize the energy sector regarding the opportunity to invest in green projects that contribute to environmental protection and combating climate change in Romania. In this context, a green project is defined as "a project that makes products or develops technologies that are primarily aimed at reducing greenhouse gas emissions or supporting the use of clean energy (Turguttopbas, 2022). Also, in the context of Romania, green projects are generally understood to encompass renewable energy initiatives, efforts to improve energy efficiency, and projects aimed at the sustainable management of natural resources (Ministerul Energiei, 2025).

To thoroughly analyse and describe the situation in Romania, it is important to apply the SWOT analysis method. This tool plays a vital role in strategic planning by identifying internal and external factors that affect the achievement of goals, such as the successful implementation of green projects in Romania. By using this method, policymakers can create effective strategies that make the most of internal strengths and external opportunities.

2. Analysis of the European energy industry structure

To develop a comprehensive overview of current renewable energy consumption in Europe and to assess environmental performance, it is essential to use various analytical tools, including key indicators such as: renewable energy percentage from gross final energy consumption or renewable energy in net electricity generation of total net electricity generation, etc.

To ensure easy access to information related to these indicators, the NACE Rev. 2 classification can be used. According to this system, activities within the renewable energy industry are categorized under Section D – *Electricity, gas, steam and air conditioning supply*, specifically under code **35.12: Production of electricity from renewable sources**. These classification codes are applied at the European level to monitor the development of the sector and assess the impact of sustainability policies.

Knowing this NACE Rev.2 code, it is possible to access data regarding the production of electricity from renewable sources from the statistical office of the European Union, namely Eurostat (Eurostat, 2025). That being said, in the European Union, the share of electricity generated from renewable sources in 2024 was at a relatively good percentage (40% from total net electricity generation) and it is in continuous growth, as can be seen in Figure 1.

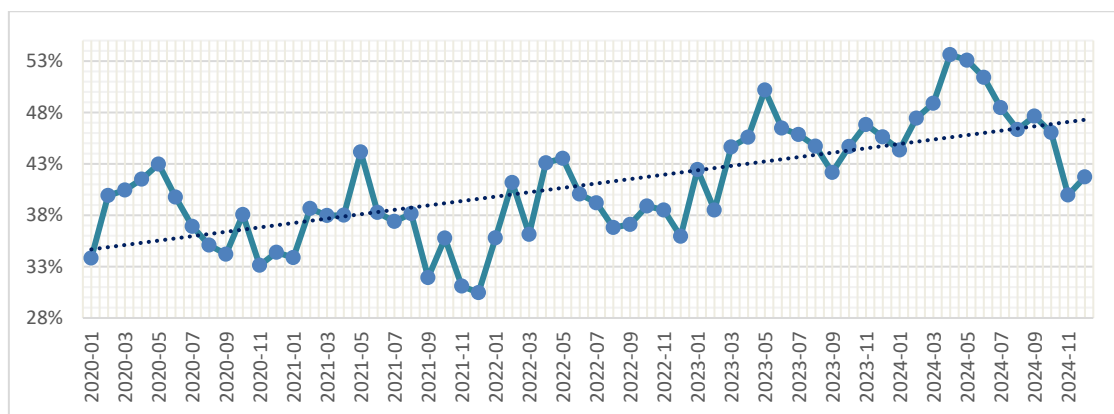


Figure 1. Renewable energy in net electricity generation of total net electricity generation in Europe

Also, the percentage of renewable energy from gross final energy consumption is growing from approx. 20% in 2019 to approximately 25% in 2023 (Eurostat, 2025), as presented in Figure 2 below.

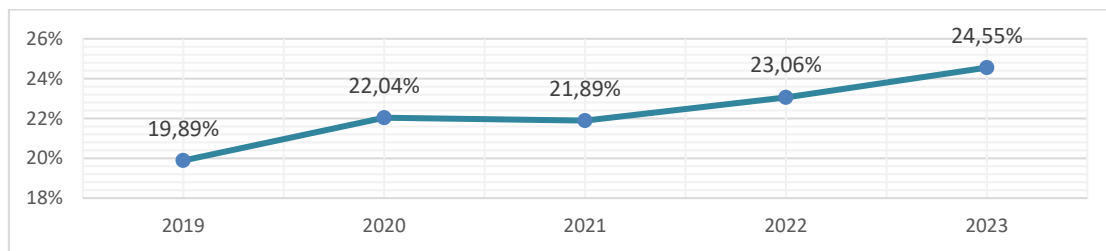


Figure 2. Renewable energy percentage from gross final energy consumption

All the values of these indicators showed us that the trend of renewable energy production and consumption is in continuous development.

Also, another indexes that can be analysed to understand the energy industry structure are the FTSE Russell Indexes. The FTSE Russell (London Stock Exchange Group, 2025) is a company that manage stock market indices, located in London, United Kingdom and founded in 1995. The indexes that are relevant for this paper are: FTSE4Good Europe Index, FTSE4Good Europe 50 and FTSE Developed Europe. The FTSE4Good Europe Index tracks European companies that meet ESG (Environmental, Social, and Governance) criteria. A subset of this, the FTSE4Good Europe 50, includes the 50 largest ESG-compliant companies. In contrast, the FTSE Developed Europe index represents the broader developed European market without a specific ESG focus.

According to the January 2025 FTSE4Good Europe Index Factsheet (London Stock Exchange Group), the index has grown overall from 2015 to 2025, despite volatility during events like the 2020 COVID-19 pandemic. Since 2021, it has followed an upward trend, reaching record highs by 2024–2025. ESG-focused indices such as FTSE4Good Europe and FTSE4Good Europe 50 have performed on par with—or better than—the broader FTSE Developed Europe index, highlighting the competitiveness of sustainable investments.

Sector analysis shows Financials dominate both ESG and general indices, underscoring their economic importance. Health Care carries more weight in the FTSE4Good Europe index, reflecting stronger ESG alignment, while Industrials are underrepresented, suggesting a need for greater sustainability efforts. Technology has a slightly larger presence in the ESG index, emphasizing its role in clean energy innovation and energy efficiency. Collectively, these sectors are pivotal in shaping sustainable energy futures.

Also, from the World Economic Forum, we can extract some information such as the evolution of key indicators in the energy transition, comparing the pre-pandemic (2019) with the post-pandemic (2022) situation. Between 2019 and 2022, several key trends have shaped the global energy landscape. Investment in clean energy rose from \$1.1 trillion to \$1.4 trillion, while electricity consumption increased from 23,718 TWh to 25,530 TWh. The share of renewable energy in total electricity production grew from 26.1% to 29.5%, reflecting a positive shift toward cleaner energy. Energy efficiency improved as global energy intensity decreased from 4.44 MJ/\$ to 4.24 MJ/\$. However, global greenhouse gas emissions increased slightly, from 52.6 Gt CO₂ eq to 53.8 Gt CO₂ eq, signalling ongoing pollution challenges. CO₂ emission intensity per unit of energy saw a small reduction. The adoption of electric vehicles surged, with their market share growing from 2.6% to 14%. Despite progress, fossil fuel subsidies dramatically increased from \$441 billion to \$1 trillion, highlighting continued government support for fossil fuels amid the energy crisis. Other positive developments included a slight decrease in average commute time and a small reduction in the number of people without access to electricity. So, even though more greenhouse gases were emitted overall, each unit of energy generated was less polluting than in the past (World Economic Forum, 18).

3. Analysis of the Romanian energy industry structure

Looking at Romania's performance, the Eurostat source places Romania in the category of countries that produce between 3 154 to approximately 14 000-Megawatt electricity from renewable energy. This sets the country in a very good position among European countries. That means, according to Figure 3,

that Romania has between 23% and 28% of the energy from renewable sources in European Union, which represents a position of 13 out of 37 countries, a very good positions, that means a high rate of rentability of renewable energy projects that are already operating here (Eurostat, 2025).

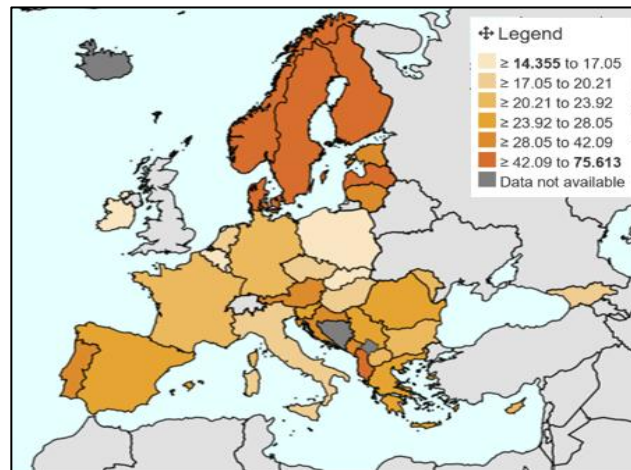


Figure 3. Share of energy from renewable sources in European Union

Also, from the World Economic Forum, we have information about G20 countries. G20 countries are the countries (Romania is also here) that have invested significantly in sustainable technologies, but challenges remain, such as dependence on fossil fuels and the equitable distribution of the benefits of the energy transition. The G20 countries have closed the gap with the rest of the world, but price shocks (such as the energy crisis in Europe) have created equity challenges. Romania is in the emerging and developed Europe and faces infrastructure and resource challenges, with a score of 57.5.

Clean energy investments and political commitments have increased, accelerating the energy transition, and countries such as France, China, and Brazil have demonstrated significant progress in adopting sustainable practices. Just transition has become an important issue, ensuring that the benefits and costs of the energy transition are distributed equally. G20 countries have invested significantly in sustainable technologies, but challenges remain, such as dependence on fossil fuels and the equitable distribution of the benefits of the energy transition.

Also, according to information from Eurostat (Eurostat, 2025) in Figure 4, renewable sources accounted for 45.3% of the EU's gross electricity consumption, meaning nearly half of the electricity used came from renewables. Norway led with nearly 100%—primarily from hydropower—followed by Austria (~79.7%) with strong hydropower and wind contributions. Sweden, Denmark, and Portugal also surpassed 50%. On the lower end, Malta had the smallest share at 10.7%, with Hungary, the Czech Republic, Cyprus, Luxembourg, and Belgium also below 20%. Romania has a significantly higher percentage than many countries in the region, surpassing countries such as Hungary, the Czech Republic and Belgium, which means that Romania has an advantage with important hydropower resources, but also a significant growth of wind and solar energy from the last years. So, Romania is doing well in terms of renewable energy, but it needs to continue investing to align with the countries at the top of the European ranking.

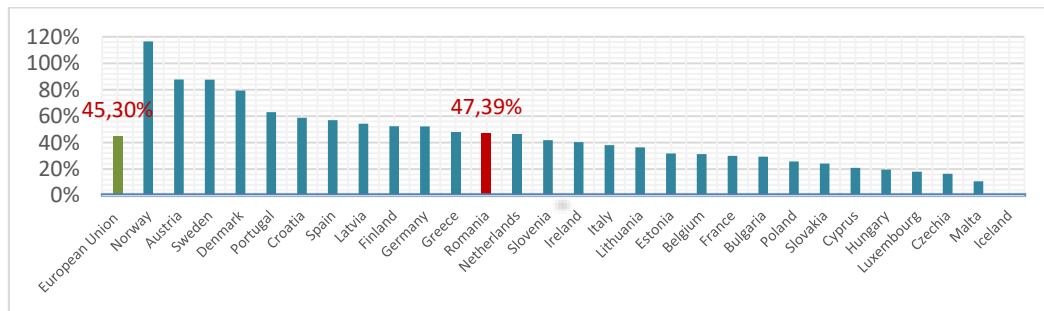


Figure 4. Share of energy from renewable sources in gross electricity consumption

Although Romania is currently in a favourable position regarding the energy transition, the future presents both numerous opportunities and significant challenges in terms of decarbonizing the energy sector. In the medium term, the document issued by the Ministry of Energy, "Romania's Energy Strategy 2025-2035 with a Perspective to 2050", forecasts an increase in installed capacity to 40 GW by 2035, effectively doubling the current installed capacity and raising the share of renewable energy in the national energy mix to 80%, compared to 28% at present (Ministerul Energiei, 2025). To achieve this objective, it is necessary to install new capacities at a rate of 1.3 GW per year between 2026 and 2030, followed by 1.2 GW per year from 2031 to 2035 (Ministerul Energiei, 2020).

4. SWOT Analysis of green energy projects in Romania

In this paper, the focus is on performing a strategic analysis by examining the internal and external factors affecting the organization's business environment. Based on this analysis, it aims to identify the most effective strategy to guide the development of energy projects in Romania. So that, for small organizations, identifying the SWOT quadrant (Figure 5) and formulating a strategy can often be done intuitively (Militaru, 1998). However, larger companies require a more structured approach, relying on tools like assessment matrices to systematically evaluate internal and external factors. In the case of this paper, the situation of large organizations that want to invest in their own green energy projects is addressed and, thus, the Internal Factors Evaluation Matrix and the External Factors Evaluation Matrix are used.

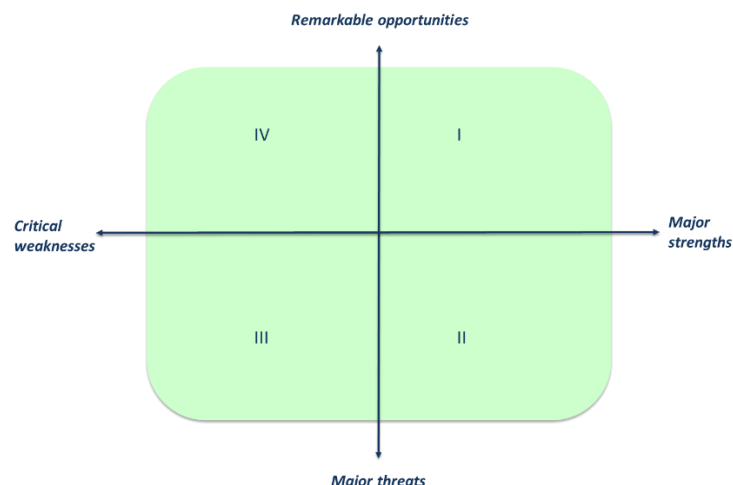


Figure 5. SWOT Model and Grand Strategies (I – Growing strategy, II - Propulsive strategies in risk conditions, III – Restriction strategy, IV – Overcome weaknesses strategy)

Regarding the SWOT (Strengths, Weaknesses, Opportunities and Threats) Model, it helps describe the environment in which the entity operates, considering both internal and external factors. So, that is

why it was considered the best model to be applied for analysing the Romanian situation of green projects. The model contains strengths and weaknesses, which are components related to the internal environment, and in this regard, we evaluated Romania's internal context regarding the encouragement or discouragement of green projects. Opportunities and threats, also part of the SWOT Models, pertain to the external environment, thus, we assessed Romania's external context in terms of creating a favourable environment for green projects. It was also considered the European market, the regional geopolitical context, and the broader geopolitical context.

In the following section, a qualitative analysis was conducted, where some internal and external factors relevant to the Romanian context of implementing green projects were identified (Table 1). Each factor was carefully selected to address key elements that should be considered when a company conducts an analysis for such projects.

Table 1. Key Internal and External Factors Identified for the SWOT Analysis of green energy projects in Romania

INTERNAL FACTORS	
• Share of energy for gross electricity consumption from renewable sources • The trend among consumers and companies regarding sustainability • Availability and accessibility of areas with renewable energy potential • The existence of targets for decarbonization of multinational companies	• The existence of regional legislative changes • The complexity of the bureaucratic process to obtain the necessary permits • Availability and accessibility of grid infrastructure
EXTERNAL FACTORS	
• Availability and accessibility of clean energy investments, regulation and political commitments • The trend of growing the regional renewable green capacity and external financing sources for green projects • The focus on enhancing grid infrastructure • The know-how regarding decarbonization projects • The international approach regarding polluting sources and low-efficiency technologies	• Availability and accessibility of interconnectivity for electrical grids with EU markets • The uncertain geopolitical context • Availability and accessibility of processes for the government to access EU funds • Current political context at the EU and NATO levels

For each factor listed above, Romania has a current situation that is specifically defined in relation to it. For instance, Romania has a good share of energy (e.g. producing approx. 23% to 28% of renewable energy from Europe) for gross electricity consumption from renewable sources (Eurostat, 2025) and has a trend among consumers and companies to become more sustainable (Avacaritei, 2021). Also, areas with renewable energy potential are located in accessible regions (plains and hills) (Ghinararu, 2025) and there are decarbonization targets of multinational companies (SNTG Transgaz S.A., 2025), as well as CO₂ taxes (Parlamentul Romaniei, 2013). Additional taxation on polluting sources, such as coal or oil-based energy production, aims to discourage their use and encourage electricity and thermal energy producers to seek alternative, less polluting sources, promoting the implementation of green projects (Parlamentul Romaniei, 2013). Considering the EU's ambition of achieving CO₂ neutrality, it is well

known that the Union discourages the production of energy from polluting sources. Consequently, developed economies are planning to shut down thermal power plants and replace them with green energy sources (Ministerul Energiei, 2025).

Romania offers opportunities for companies and individuals to obtain non-reimbursable funding through national schemes, focusing on both electricity production and its use via heat production technologies. A relevant example is the ELECTRIC-UP project, a financing program for SMEs in Romania aimed at installing electricity production systems (photovoltaic panels) and storage systems, helping companies maximize self-consumption and reduce pressure on the grid.

Moreover, in Romania are many clean energy investments (World Economic Forum, 18) and regulation and political commitments have grown a lot in the last decades (World Economic Forum, 18). This creates opportunities to implement green solutions to reduce emissions, as seen with Saint-Gobain, which commissioned an 8.6 MW photovoltaic park for its factory in Călărași, and Philip Morris Romania, which installed a 3.6 MW photovoltaic system at its cigarette factory, among other companies striving to meet decarbonization targets (SNTG Transgaz S.A., 2025). For complex projects, there are also experienced specialists capable of managing the complexity and characteristics of such projects (Ghinăaru, 2025). The country register also sustained growth in renewable green capacity (World Economic Forum, 18), for example, absorption of European Funds and has a focus on enhancing grid infrastructure (World Economic Forum, 18). Given the unpredictable nature of renewable energy production, the grid faces significant challenges in balancing supply and demand. When production imbalances occur, they are penalized heavily on the intraday market, generating high costs for wind and solar park operators. There are also external financing sources available for green projects (Consiliul National pentru Supravegherea Macroprudentială, 2023) and advanced technologies with high efficiency at optimal costs (Ministerul Energiei, 2020), (Banca Europeana pentru Reconstructie si Dezvoltare (BERD), 2023).

Furthermore, Romania has a know-how regarding decarbonization projects from Western European countries (Ministerul Energiei, 2020), (Banca Europeana pentru Reconstructie si Dezvoltare (BERD), 2023) and its development is sustained by the discouragement of using the polluting sources and low-efficiency technologies (Ministerul Energiei, 2025) in country.

Related to the legislative environment, there are real and unpredictable legislative changes ("pillar tax") (F., 2024) and a complex bureaucratic process to obtain the necessary permits (Asociatia Romana pentru Energie Eoliana, 2025) for green projects and a complex bureaucratic process for the government to access EU funds (Ministerul Investitiilor si Proiectelor Europene, 2024). Also, there is an underdeveloped grid infrastructure in the country, making it difficult to transport electricity in the country (Jigoria-Oprea, 2010) and a lack of interconnectivity of electrical grids with EU energy markets (Ministerul Energiei, 2020). A great influence on the Romanian energy sector is the geopolitical context, which influences the technology prices, i.e. customs duties (Ministerul Energiei, 2020) and the uncertain current political context at the EU and NATO levels (Christian Năsulea, 2024).

Going further, given that the analysis was addressed to large organizations, it was noted that a more structured approach is needed, such as the Internal Factors Evaluation Matrix and the External Factors Evaluation Matrix. To draft the Internal Factors Evaluation Matrix, the following steps should be followed:

1. Create a list of factors (F_j) that represent both strengths and weaknesses;
2. Assign importance coefficients (γ_j) to each factor, with values ranging from 0 to 1, based on the degree of influence each factor has on the company's success, ensuring that:

$$\sum \gamma_j = 1; \quad (1)$$

3. Assign each factor an N_j score between 1 and 4 to indicate its strength or weakness ($N_j=1$ is assigned for a very weak factor, $N_j=2$ if the factor is weak, $N_j=3$ for a strong factor and $N_j=4$ for a major strong factor);
4. For each factor, multiply its importance coefficient γ_j by its N_j score to obtain the weighted score. Then, sum all the weighted scores to calculate the overall weighted score (P) at the company level.

Also, If the overall P score is below 2, the company is considered internally weak. The closer the score is to 4, the stronger the company's internal (Militaru, 1998). In the context of Romanian companies regarding the implementation of green projects, Table 2 presents the internal factors (both strengths and weaknesses), structured according to the criteria outlined above.

Table 2. Internal Factors Evaluation Matrix for the Romanian context of green projects

Nr.	Internal factor (F_j)	Importance coefficients (γ_j)	Score (N_j)	Weighted score (P)
1	Share of energy for gross electricity consumption from renewable sources	0,05	4	0,2
2	The trend among consumers and companies regarding sustainability	0,1	2,5	0,25
3	Availability and accessibility of areas with renewable energy potential	0,3	3,5	1,05
4	The existence of targets for decarbonization of multinational companies	0,1	4	0,4
5	The existence of regional legislative changes	0,2	1	0,2
6	The complexity of the bureaucratic process to obtain the necessary permits	0,2	1,5	0,3
7	Availability and accessibility of grid infrastructure	0,05	1,5	0,075
-	-	1	-	2,48

In the same logic, the External Factors Evaluation Matrix is made up, following the similar steps:

1. Create a list of factors (F_j) that represent both opportunities and threats;
2. Assign importance coefficients (γ_j) to each factor, with values ranging from 0 to 1 (greater importance coefficients are assigned to the most significant factors, regardless of whether they represent opportunities or threats to the company's operations), ensuring that:

$$\sum \gamma_j = 1; \quad (2)$$

3. Assign each factor an N_j score between 1 and 4 to indicate whether it represents an opportunity or a threat ($N_j=1$ is assigned if the factor represents a significant threat, and $N_j=4$ is given if the company has responded appropriately to the factor; $N_j=3$ is awarded for an above-average response, while a score of $N_j=2$ is given if the company's response is considered average for the respective factor).
4. For each factor, multiply its importance coefficient γ_j by its N_j score to obtain the weighted score. Then, sum all the weighted scores to calculate the overall weighted score (P) at the company level.

Since the weighted scores range from 1 to 4, a score of 4 indicates significant opportunities for the company to meet the demands of external factors, capitalize on development opportunities, and avoid threats. A score of 1 reflects extremely low capacity for the company to adapt to its environment. A score of 2.5 suggests an average level of adaptability to the requirements of the external environment (Militaru, 1998). The External Factors Evaluation Matrix is presented in Tabel 3, structured according to the criteria outlined above.

Table 3. External Factors Evaluation Matrix for the Romanian context of green projects

Nr.	External factor (F_j)	Importance coefficients (γ_j)	Score (N_j)	Weighted score (P)
1	Availability and accessibility of clean energy investments, regulation and political commitments	0,1	4	0,4
2	The trend of growing the regional renewable green capacity and external financing sources for green projects	0,05	2	0,1
3	The focus on enhancing grid infrastructure	0,1	3	0,3
4	The know-how regarding decarbonization projects	0,1	3	0,3
5	The international approach regarding polluting sources and low-efficiency technologies	0,05	2,5	0,13
6	Availability and accessibility of interconnectivity for electrical grids with EU markets	0,2	1	0,2
7	The uncertain geopolitical context	0,1	1	0,1
8	Availability and accessibility of processes for the government to access EU funds	0,2	1,5	0,3
9	Current political context at the EU and NATO levels	0,1	1	0,1
-	-	1	-	1,93

For both matrices, the scores for the factors were assigned based on the analysis of Romania's energy sector (Chapter 3) and the analysis of the energy sector's international situation at the European level (Chapter 2). The importance coefficients for the factors in both matrices were determined by consulting a group of experts in green project implementation, during the same period in which the analysis of Romania's ranking relative to these factors was developed.

Therefore, considering the two weighted scores calculated for internal and external factors above, it can be identified that the strategy the organizations in Romania should address according to the SWOT quadrant in which the country is. So, as can be seen in Figure 6, organizations that want to develop green projects in Romania should adopt a strategy from the second quadrant of the SWOT Model, namely *propulsive strategies in risk conditions*.

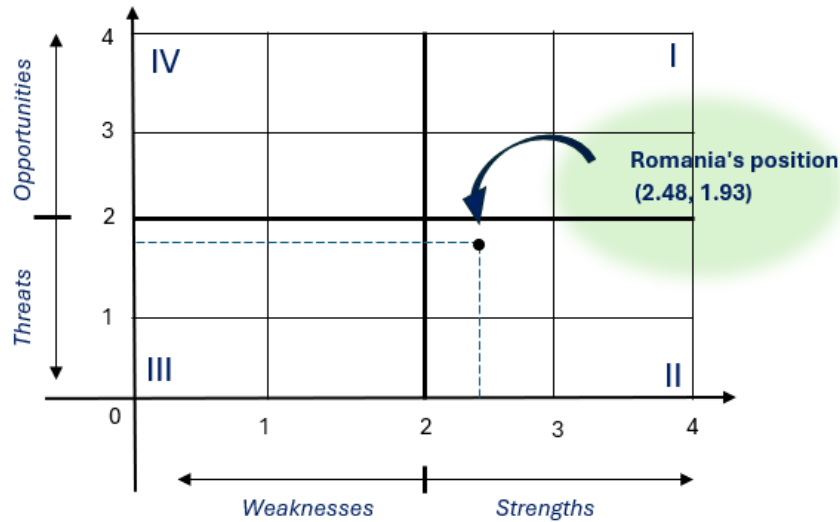


Figure 6. Romania's position in the SWOT Model (quadrant II: propulsive strategies under risk conditions)

So, investors in green projects in Romania should leverage the country's notable regional strengths while remaining mindful of potential threats—both national and international—that may arise during project implementation.

5. Results and discussions

As a result of the analysis conducted in this paper, it can be highlighted some key aspects that an organization could follow in the context of *propulsive strategies in risk conditions*. Organizations in Romania could address strategic direction in developing projects that integrate energy storage systems from the outset, thereby minimizing imbalances in the electricity grid and reducing penalties associated with such deviations. This is achievable by relying on existing technologies available on the Romanian market.

Also, the implementation of standardized investment guidelines can serve as a help for Romanian decision-makers to reduce bureaucracy and mitigate the risks of project delays caused by complex administrative procedures. This is a key aspect aimed at addressing internal weaknesses while minimizing external threats. Another key aspect is that Romania is in a position to access European funds. This is possible due to the experience of both national and private companies operating in the Romanian energy market. Their expertise can be leveraged to accelerate the installation of new renewable energy capacities through European programs such as the National Recovery and Resilience Plan (PNRR) and the Modernization Fund.

6. Conclusion

As observed, both the internal and external environments are complex from an economic, social, and political standpoint. As a result of the analysis carried out in this study, it can be concluded that organizations aiming to develop green energy projects in Romania should adopt a strategy corresponding to the second quadrant of the SWOT Model, namely propulsive strategies in risk conditions. This is supported by the scores obtained in the Internal Factor Evaluation Matrix (2.48) and the External Factor Evaluation Matrix (1.93), which reflect a strong internal environment but a more uncertain external context.

Given this setting, characterized by significant opportunities but also geopolitical and legislative uncertainty, organizations in the energy sector should consider strategic directions such as integrating energy storage systems from the project planning phase, thus minimizing grid imbalances and associated penalties.

Additionally, the implementation of standardized investment guidelines would assist Romanian decision-makers in reducing bureaucracy and mitigating the risks of project delays due to administrative complexity. Furthermore, the existing expertise of both public and private companies operating in the Romanian energy market represents a major asset in accessing and efficiently using European funding through programs such as the National Recovery and Resilience Plan (PNRR) and the Modernization Fund. For future actions and projects, it becomes essential for energy organizations to leverage their internal strengths to overcome external uncertainties. Strategies such as integrating energy storage systems from the early stages of development, utilizing EU funding opportunities through programs like PNRR, and simplifying bureaucratic procedures through standardized investment frameworks can support this objective. Moreover, Romania's geopolitical alignment with the EU and NATO further strengthens investor confidence, despite broader regional uncertainties.

The findings emphasize that success in Romania's energy transition relies on matching strategic planning to the current SWOT positioning—maximizing opportunities and internal capacities while managing risk through structural, policy, and investment interventions.

In conclusion, these findings support the adoption of proactive strategies, tailored to a volatile external environment, yet grounded in Romania's specific internal strengths and real development opportunities.

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