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The Role of Project Managers in an Efficient Energy Transition Process: An Exploratory Study

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Abstract: In recent years, studies have examined the energy market, and a significant need has emerged to conserve limited natural resources and protect the environment. Therefore, the transition to renewable energy is necessary, but it is fraught with many challenges. A key role in this process is played by project managers, who must possess a range of skills, focus on relevant tasks, and fit within a certain budget. This transition necessitates a move away from traditional project frameworks and toward strategies that take into account developing regulatory environments, dynamic market situations, and rapid technological change. In the energy industry, effective project management is essential to success, yet it faces different difficulties. Whether building massive power plants or creating renewable energy systems like solar farms, these projects usually require several intricate parts and sizable teams. We shall examine a number of important facets of energy project management. Furthermore, the contribution of professional training and digitization to improving project efficiency will also be examined. Using a survey-based methodology with a standardized questionnaire, this study provides clarity on the perceptions, challenges, and skills required by project managers in Romania involved in the transition to a sustainable energy system. The analysis highlighted several gaps in this transition process, including an unstable legislative framework and educational offerings not aligned with the specific challenges. It also outlines the profile of a productive project manager who can work in an uncertain, dynamic environment, but still able to ensure a smooth path towards energy transition. Beyond technical expertise, navigating this new reality calls for agility, strategic vision, and a systems-based mindset for project managers.

Keywords: energy transition; renewable energy; fossil fuels; sustainable; project managers; Romania.

Introduction

The transition to sustainable energy is a transformative shift in how energy is produced, distributed, and consumed, aimed at moving away from fossil fuels toward a system centered on renewable energy sources. The transition to renewable energy is a crucial issue for the future of the energy sector. However, this process is not without pitfalls. Various challenges stand in the way, ranging from technological and economic considerations to political and social issues (Chang et al., 2021).

In the context of European efforts to implement an energy transition towards more sustainable, particularly green, sources that encourage local production and reduce the challenges arising from dependence on imports, countries should also consider the current geopolitical framework. Global uncertainties pose obstacles to the energy transition, causing price volatility and disrupting supply chains for critical materials used by the green energy industry, often leading decision-makers to favour energy sources that meet short-term consumption needs rather than adopt long-term sustainable measures (Zhu et al., 2025). Zhu et al. (2025) also emphasize that countries' energy resilience can be strengthened through robust renewable energy production capacity, the adoption of

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effective fiscal mechanisms, and a flexible labor market that can keep pace with technological changes in the green energy sector.

A relevant issue for energy resilience is the intertwining of the legislative framework and the implementation of the energy transition process. Although the steps taken to create an optimal legislative framework for the energy transition and to implement renewable energy production capacities do not have visible effects in the short term, they increase states' energy resilience in the face of external challenges (Zhang et al., 2025). However, in low- and lower-middle-income countries, the impact of adopting energy transition legislation is more limited due to low institutional capacity and dependence on fossil fuels.

Reducing carbon emissions and adopting green technologies depend on how policymakers choose to implement rigorous environmental governance alongside a sophisticated economic structure. The pace of the energy transition does not rely solely on these factors; it is also shaped by geopolitical risks, which act as an asymmetric source of disruption. These risks can create uncertainty in capital markets or affect international trade. Thus, the implementation of green technologies and the establishment of environmental policies should be decoupled from global geopolitical volatility (Wu & Hussain, 2025).

Concerns about climate change, air quality, and energy security are driving a global shift away from fossil fuels toward renewable energy sources. An unprecedented urgency for systemic change distinguishes the contemporary energy transition. While the ascendancy of coal occurred over more than a century, as a prelude to and during the Industrial Revolution, the current energy transition requires immediate action.

Almost all economic sectors will undergo significant modifications, though the impact will be asymmetrically distributed. Sectors characterized by the highest greenhouse gas emissions, including transportation, residential heating, heavy industry, agriculture, and electricity generation, will experience the most profound structural transformations. Consequently, an increasing number of organizations are designing and implementing robust decarbonization strategies, with the most intensive activity currently observed within the energy and transport sectors (Zhu et al., 2025).

This article focuses on the energy transition in Romania, analyzing responses to a questionnaire completed by twenty project managers working in sectors relevant to the decarbonization process, such as energy, transport, and IT. The companies from which the respondents work are specialized and highly knowledgeable, enabling them to identify strategic needs in the context of the national energy transition.

This paper aims to answer the following research questions:
RQ1. How do project managers view the strategic importance of the energy transition within their companies in their respective sectors?
RQ2.What are the main challenges and difficulties faced within the process of implementation of energy transition projects?
RQ3. How complex do project managers perceive the energy projects that they are working on, and what managerial competencies do they consider to be essential to manage these projects effectively?
RQ4. How do professional training and digitalization contribute to preparing project managers for the challenges posed by the energy sector during a period of systemic transition?

With the targeted research questions mentioned above, a clear direction and balance are set for the research process, allowing for a relevant interpretation of the data collected through the questionnaire and a rigorous correlation with the previously formulated literature review. The study presents another perspective on the abilities and challenges encountered by energy industry experts during a period of systemic change.

The research adopts a more quantitative approach, using an opinion poll conducted through a standardized questionnaire comprising 20 closed questions. The data were collected electronically in October 2025 to identify the technical, economic, and social obstacles perceived by managers in implementing sustainability solutions. This approach allows correlating professionals' experience levels with the use of modern digital tools, providing a statistical basis for assessing the effectiveness of management processes in the context of greenhouse gas emission mitigation (Glaser-Segura et al., 2018; Watahiki et al., 2020).

The main objective of this paper is to explore the barriers to the energy transition in Romania, from legislative instability to economic and infrastructure constraints. By analysing the responses, the study aims to define the efforts needed to overcome these obstacles, with a particular focus on the role of digitization and the need for specific adaptive management skills. Ultimately, the results aim to provide practical solutions to improve managers' professional training and optimize corporate environmental strategies.

Literature review

The energy transition is a broad and multifaceted process aimed at reducing global reliance on fossil fuels (coal, oil, and natural gas) and replacing them with cleaner, renewable energy sources (Blazquez et al., 2020). It involves a shift toward technologies like solar, wind, hydroelectric power, and nuclear energy, as well as an increasing focus on improving energy efficiency and storage solutions (Gielen et al., 2019).

The International Energy Agency (IEA, 2021) illustrated a projected energy transition in the global energy mix from 2020 to 2050, highlighting a significant shift from carbon-intensive sources to cleaner alternatives. In 2020, fossil fuels accounted for approximately 80% of the market, but they are forecast to decline to just 20% by 2050. This gap is primarily filled by renewables, which are projected to become the largest energy source, supported by a steady contribution from nuclear energy sources and the emergence of hydrogen and Carbon Capture and Storage (CCS). Meanwhile, the International Energy Agency suggests that the energy efficiency focus will remain constant, highlighting that the total consumption goals rely on both a shift in energy sources and sustained efforts to meet climate targets.

Challenges of the energy transition

Technological challenges

The transition to renewable energy represents a major technological challenge, requiring considerable advances to integrate these new energy sources into our existing infrastructure effectively. This is where one of the main challenges lies: the seamless integration of renewable energy into existing electricity grids (Campana et al., 2025). Integrating renewable energy into the power grid requires significant adaptation and modernization of our current systems. Energy sources such as solar and wind are inherently intermittent, depending on the sun and wind, leading to significant fluctuations in energy production. To overcome this variability, it is essential to develop efficient storage technologies and smart systems capable of adjusting supply to demand in real time. All these innovations require substantial investment in research and development to achieve sufficient technological maturity (Buksh et al., 2025).

Beyond grid integration, the energy transition also relies on continually improving the efficiency of renewable technologies. Optimizing photovoltaic solar panels and wind turbines is crucial to maximizing their energy efficiency while minimizing their environmental footprint. Research is currently focused on developing more efficient and durable materials to increase energy conversion while reducing associated costs, such as

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for solar panels and wind power (Sovacool et al., 2025). However, these advances must be accompanied by a collective willingness to invest in these promising technologies so that they can play a central role in the future energy mix.

According to a recent study by Khan Baloch et al. (2025), integrating renewable energy into urban power grids faces technical barriers, such as intermittency and reduced grid stability, which can drop from 95% to 65%. The article highlights the long-term benefits of implementing energy storage units and leading smart grid solutions to maintain grid reliability, while emphasizing their importance for local energy security (Khan Baloch et al., 2025).

Economic challenges

Industrial companies, farmers, and local authorities face a major challenge: the upfront cost of adopting renewable energy. Installing solar panels, wind turbines, or energy storage systems requires significant capital. However, this investment could be seen as a crucial step toward reducing dependence on fossil fuels and controlling energy costs in the long term (Ahmad et al., 2025).

One of the main obstacles is the scale of investment required to deploy renewable infrastructure effectively. Companies often have to mobilize considerable resources before the first kilowatt-hour is produced. However, this financial barrier can be mitigated by incentive mechanisms such as government subsidies or tax incentives that ease the initial burden (Dinca et al., 2025). According to research conducted by Wojtaszek (2025), the energy transition will also be affected by a global increase in electricity demand of over 2,200 TWh by 2035, caused by the deployment of data centres for Artificial Intelligence, heat waves during the hot season, and the electricity-based transport system. In the context of rising electricity demand, risks in the operation of the existing electricity grid are highlighted, requiring significant investment. The author suggests that investments should be made in modernizing electricity grids, with funds redirected from the natural gas sector. The article suggests that, in Poland, these investments would amount to approximately 5-6 billion USD annually (Wojtaszek, 2025).

To encourage widespread adoption of renewable energy, it is essential to develop innovative and viable business models. Initiatives such as crowdfunding or power purchase agreements (PPAs) can offer companies an alternative way to finance their energy projects while actively involving the local community. These approaches not only promote wider adoption but also strengthen social acceptance of these new technologies (Ghimire et al., 2025).

Social and political challenges

Political and social issues are crucial to ensuring the smooth adoption of renewable energy. Government policies play a decisive role in facilitating this transition. Tax incentives, subsidies, and clear regulations can encourage companies to invest in green energy. However, without a robust legislative framework, these initiatives risk stagnating (Gazmararian et al., 2025).

For the energy transition to become a tangible reality, governments must implement proactive policies. These could include: 1) tax incentives for the installation of solar panels and wind turbines; 2) the implementation of mandatory renewable energy quotas for businesses; 3) support for research and technological development in the renewable energy sector. Some states, such as China, have already successfully taken this step, demonstrating that strong political leadership can transform the national energy landscape (Barragan-Contreras et al., 2025).

Social acceptance is another fundamental pillar, and awareness-raising must go beyond simply sharing information (Dincă et al., 2019); it must also inspire collective awareness

of the ecological and economic benefits of renewable energy. Education plays a key role here (Stăiculescu et al., 2022). For example, incorporating modules on sustainable energy into school curricula could prepare a future generation to embrace these changes. In addition, holding regular public meetings would not only provide information but also allow citizens to actively listen to their concerns (Marshall & Pearse, 2025). Addressing these political and social challenges therefore requires synergy among governments, businesses, and citizens to build a sustainable energy future together.

Environmental and resource challenges

Reducing greenhouse gas emissions is one of the challenges of the energy transition, as it is crucial to limiting the impacts of climate change, such as rising temperatures, melting glaciers, extreme weather events, and rising sea levels. The energy transition offers a unique opportunity to mitigate these impacts by reducing our dependence on fossil fuels and promoting the use of lower-emission energy sources (Ibrahim et al., 2025).

The use of fossil fuels is also a challenge for the energy transition, as it can cause considerable damage to biodiversity through air, water, and soil pollution. By promoting less-polluting renewable energy, we can protect natural habitats, reduce ecosystem fragmentation, and preserve our planet's biological diversity. Fossil fuels are a limited resource, and excessive use can lead to their depletion (Zhang et al., 2025). By promoting renewable energy, we can reduce our consumption of natural resources and preserve them for future generations. That is why preserving natural resources is a challenge in the energy transition.

The IEA's Global Critical Minerals Outlook (2024) report highlights the strategic importance of critical minerals for achieving climate goals, pointing to unprecedented growth in demand, with a 30% increase in lithium demand alone in 2023, but warns of structural vulnerabilities in the supply chain. Although prices for these minerals fell significantly in 2023 due to a temporary oversupply, the medium-term outlook indicates a major risk of copper and lithium shortages after 2030, as current and announced mining projects cover only about 75% of projected demand under stated policy scenarios. The IEA argues that, in order to maintain the stability of the energy system, it is important to accelerate investment in exploration and extraction, diversify production geographically to reduce dependence on concentrated hubs, and implement rigorous sustainability standards, thereby preventing mineral resources from becoming new bottlenecks for the global transition to a low-emission economy (International Energy Agency, 2024)

The report published by the PBL Netherlands Environmental Assessment Agency analyses the ecological impact of extracting and processing critical minerals needed for the energy transition such as lithium, copper, nickel and rare earth elements, highlighting that although the energy transition will reduce mining by eliminating coal, specific demand for these specific metals will increase significantly, generating environmental risks (De Haes & Lucas, 2024). The study identifies four main categories of impact: water scarcity and pollution, particularly for lithium and copper in areas without significant water resources, 2) soil erosion and contamination caused by poor management of mining waste, 3) biodiversity loss through habitat destruction and ecosystem fragmentation and 4) climate change, with the metals industry responsible for approximately 10% greenhouse gas emissions. The authors warn that declining ore concentrations require increasing energy and water consumption, produce large volumes of toxic waste, and call for stricter regulations, post-mining land rehabilitation, and greater circularity (De Haes & Lucas, 2024).

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Energy management issues

An efficient project management approach can guarantee timely completion under budget while upholding regulatory compliance. Energy management is a well-defined set of measures intended to reduce energy use, energy costs, and greenhouse gas emissions (Terenzi et al., 2024).

Managing projects in the energy sector involves careful planning, execution, and oversight of complex initiatives. Project managers for the energy sector support producers, suppliers, and general managers and should be familiar with the context of these markets and understand the challenges they face. They master the techniques specific to the sector, provide feedback based on their experience, and have knowledge of the network and the competition (Odebode, 2025; Pelau et al., 2010), skills which enable them to operate in an environment that faces issues such as: Regulatory obligations, economic and socio-environmental challenges, changing business models and the search for sustainable development methods, energy efficiency and energy management, information technology, digital technology, security of supply or price volatility (Chukwuma-Eke et al., 2021). This can be a challenging undertaking given the industry's size and the stringent laws it must adhere to. Effective project management is therefore essential, especially for major infrastructure projects such as those in renewable energy, which often require meticulous coordination (Daramola et al., 2024).

Successfully managed projects are guaranteed to be completed on schedule, within budget, and to the required quality level (Mitan et al., 2024). Nevertheless, to succeed, it is essential to focus on the full accomplishment of the core activities; otherwise, a project might not fulfil its objectives at each stage (development, construction, operations, and maintenance). Understanding what each project component requires is essential to ensuring the project remains on course and management procedures remain efficient (Vătămănescu et al., 2014): from resource allocation, timelines, and milestone tracking, to considering and managing potential risks, to budgeting and cost control, not forgetting stakeholder engagement. This is why having the right project manager is vital to the project's success. They can proactively manage these requirements to ensure that the project progresses without financial or operational setbacks. Moreover, with appropriate workflow management software and/or professional training, this process becomes much easier.

Research methodology

The role of project managers has become more challenging and significant amid a rapid shift to a sustainable energy system. A thorough grasp of how these professionals respond to ongoing industry changes is necessary to adapt to organizational, technical, and legislative shifts. This article aims to provide a current perspective on how project managers in Romania perceive, manage, and adapt to the challenges posed by the energy transition.

Sample and data collection

Twenty project managers from representative organizations in Romania make up the sample chosen for this study. Twelve distinct companies that operate in the domains of energy (11), transport (5) and IT (4) and pay attention to the changes needed in the energy transition process are represented by the twenty respondents. Sixteen respondents develop their activities in Bucharest, two in Cluj-Napoca and one in Brașov. When it comes to age and genre, the participants were 14 men and 6 women, with 15 between 40 and 49 years old, 1 between 30 and 39, and 4 between 50 and 59 years old. Another characteristic explored was the level of study: 13 respondents hold a master's

degree, and the other 7 a bachelor's degree. Regarding the city they live in, 16 respondents are in Bucharest, 3 in Cluj-Napoca, and 1 in Brașov.

Given the focused sample size of 20 participants, this research is positioned as a preliminary exploration, serving as a foundational pilot phase for a more extensive subsequent investigation.

The standard of professional relevance—that is, their direct engagement in coordinating projects with technological, modernization, sustainability, or digitalization components within the energy transition—was used to select participants. The goal was to ensure a sample that is diverse in terms of professional experience, corporate profile, and project types managed, but homogeneous in job function (project manager).

Each respondent received a separate questionnaire (in the period of October 2025), and participation was entirely optional. This method was designed to capture a variety of viewpoints on the difficulties, skills, and resources associated with managing energy projects, particularly regarding the shift to a more sustainable energy system.

The applied and exploratory nature of the study, together with the field's specificity—there are not many project managers actively involved in such initiatives—justify the relatively small sample size. However, the variety of organizations represented by the respondents offers a strong basis for deriving pertinent and significant conclusions.

Method and technique

Conducting research activities fosters the development of an analytical and critical approach to the phenomena that characterize professional reality, particularly the dynamics of the energy transition and how project management is used to address them in this instance. Such an approach offers a formal framework for the careful research of a field that is always changing and enables one to go beyond subjective views.

To gather pertinent information on project managers' perspectives, difficulties, and skills, this study uses a standardized survey. The topic's applied character and the requirement for responses that were logical, comparable, and statistically analysable led to the selection of this approach. While surveys provide objectivity in data collection, their interpretation and analysis depend on a deep understanding of the professional context. As a result, while interpreting the findings, the researcher must use theoretical rigor and analytical judgment appropriately.

The study method was conducted in multiple phases, each of which clearly contributed to the accomplishment of the stated goals: 1) establishing the study research questions in accordance with the paper's subject and the energy industry's present requirements; 2) creating and validating the questionnaire, which is divided into five sections: professional skills, digitalization, obstacles and complexity, respondent profile, and perceptions of the energy transition process; 3) choosing the sample and giving the questionnaire to a group of twenty project managers from twelve Romanian businesses; 4) gathering data by having respondents fill in the questionnaire within a predetermined amount of time (the month of October 2025); 5) Evaluating and interpreting the findings in light of response rates, and their applicability to the developed research questions.

In addition to capturing the current viewpoint of energy project managers, this study advances knowledge of how the energy transition affects their roles and responsibilities in a setting characterized by organizational, legislative, and technological changes.

Research instrument

The questionnaire is a commonly used research instrument in surveys, comprising a logical, cohesive series of written questions intended to elicit pertinent responses from

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participants in accordance with the study's goals and research questions. Its goal is to gather crucial data about the attitudes, experiences, and viewpoints of a certain group. The questionnaire instrument enables standardized responses and a more quantitative approach to data analysis. The one used in this study was designed specifically to investigate how project managers across industries view and engage with the energy transition process. The questionnaire's core questions comply with the four main directions of research: Perceptions of the energy transition process (1), Difficulties and challenges within the company along this process (2), Complexity level of energy projects and professional skills needed (3), and The impact of digitalization and professional training on project management for the energy transition process (4).

The questionnaire, comprising up closed-ended questions, was designed to facilitate responder comparisons. To ensure a high degree of comprehension and accuracy in answers, the questions were prepared in plain, understandable language.

In accordance with confidentiality guidelines, the questionnaire was delivered electronically and completed individually. The information gathered was used only for scholarly purposes in order to accomplish the goals of the study. The research questions we aim to address throughout our research reflect current trends in the energy sector and the structural transformations emerging from the use of sustainable energy sources. Gaining a better understanding of how project managers handle these difficulties is crucial in an environment where energy projects are becoming more complex and sustainability and digitalization expectations are becoming more pronounced.

Data analysis and interpretation

Several important outcomes have been drawn from the distribution of the questionnaire to a group of 20 project managers working in the energy, transport, and IT industries in Romania. The results of the analysis offer detailed insights into their professional backgrounds, their engagement with complex green initiatives, and the specific skills required to navigate the specific industry's rapid shift towards renewable energy.

In this section, each question will be taken separately, and the responses will be discussed in comparison with similar studies in the field. Regarding the first question - *What is your ongoing function within the company?* - most respondents reported serving as Senior Project Managers (7) or Directors (4). The group possesses deep expertise in high-level coordination. Their input offers a reliable window into the practical realities of the sector in which they work, because they are managing these complex transitions with full implication. Focusing on the second item - *What is your professional experience in your sector?* **-** most participants have 5 to 10 years of experience in the respective industry (7), blending experienced insight with openness to new technology. The inclusion of senior staff with over 10 years of experience (5 people with over 10 years and 3 with over 20 years) strengthens the findings by providing a perspective grounded in long-term decision-making. However, this extensive experience may also lead to rigidity. As the sectors shift towards sustainable practices, the key challenge is to ensure that this valuable knowledge enhances organizational flexibility rather than impedes it.

Going further to the third question - *What is the usual dimension of the project team that you coordinate?* - most teams in this study have between 5 and 10 members (7 respondents answered like this), while 4 respondents mentioned teams between 11 and 20 members and 3 respondents' teams with more than 20 members. This reflects the varied nature of projects from the energy, transport, and IT sectors today. We see everything from small squads to large groups. Small teams generally move faster while big teams need strict coordination to succeed. This headcount changes how complex a project feels. It also dictates which management tools a project manager can use.

Concerning the fourth question - *Do you perceive the energy transition process as a strategic priority within your company?* **-** most of our respondents view the energy transition process as a full (9 people) or partial (7 people) top priority. This confirms they understand global trends and strict regulations. This positive feedback, however, may be influenced by the fact that eleven of our participants are active in the energy sector, and these respondents are therefore constantly exposed to information about the necessity of the energy transition. A study that confirmed similar outcomes is that by Cherepovitsyn and Rutenko (2022), which underlined that companies operating in the energy sector are the most prone to being open and prepared from multiple perspectives for the energy transition process.

Based on the survey results for the fifth question - *In what measure are you implicated in projects directly related to the energy transition?* - the data reveals a high level of engagement in energy transition projects, with 70% of respondents reporting at least a moderate level of involvement. The largest single group (6 participants) is involved "to a great extent", while an additional 4 respondents are "fully involved", highlighting a strong professional commitment to the sector. Only a small minority, representing 15% of the total, reported no involvement at all, suggesting that the energy transition has become a central focus for most of the surveyed group.

The data for the sixth item - *What types of energy transition projects have you managed in the past 3 years?* - illustrates a diverse portfolio in energy transition projects managed over the last three years: the renewable energy (solar and wind) leading the way with 13 mentions. Significant activity is also noted in categories such as energy storage (batteries), hydrogen, and electric vehicle integration, each cited by 10 respondents. At the same time, specialized areas like grid digitalization and energy efficiency received fewer mentions, at 7 and 4, respectively. Renewable projects are common for three reasons: 1) regulations demand decarbonization; 2) the maturity of available technologies; 3) access to funding sources. At the same time, the push for digitalization and efficiency shows a clear desire for flexibility. "Electric vehicles" is not a topic frequently mentioned. This suggests the approach is still in its early days of implementation. Companies often lack the necessary infrastructure or policy support. Interest is growing, but high costs and technical hurdles still hold it back. On this specific topic, a study that can be mentioned here as a parallel is the one developed by Sechel and Mariasiu (2022), which corroborates the fact that electric vehicles in Romania are a subject of interest but are still in their early phase.

Analysing the survey results for question referring to the predominant difficulties faced within energy transition projects, the primary impediments are financial and regulatory instability, with "insufficient funding" and a "lack of a clear legislative framework", both reaching a peak of 9 mentions. These obstacles are followed by "technological complexity" (8 mentions) and "organizational resistance to chance (7 mentions), indicating that the energy transition process is as much technical and cultural challenge as it is a financial one. Nevertheless, the "shortage of qualified personnel" (5 mentions) illustrates a landscape where progress is necessary alongside regulatory, economic and human resources constraints. The respondents cited unclear laws, complex technology, and organizational resistance. Insufficient funding and a shortage of qualified staff also rank high. These results highlight a dual burden. Companies face external pressure from regulators and internal friction from their own culture.

Unpredictable laws also prevent managers from building long-term strategies. At the same time, complex technology is difficult to integrate (Polzin et al., 2019). Internal resistance acts as a major red flag. It proves that organizations need a big mentality change, not just new tools. Finally, the gaps in money and talent require public support. Policymakers must step in to fix the ecosystem. These problems are systemic. Solving them requires a coordinated mix of institutional reform, training, and modern management.

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The eighth item - *How would you rate the complexity level of recent energy projects you have worked on?* – showed that most respondents viewed recent projects as either "high" (6 respondents) or "very high" (the other 5 respondents), with 6 participants answering medium in complexity. This view highlights that the energy, transport, and IT sectors in Romania are experiencing rapid change, driven by factors such as the green transition, digitalization, regulatory pressures, and the adoption of new technologies.

Regarding the survey responses to the question regarding the main sources of complexity in the projects, it stems that the main sources of complexity are driven by three significant factors, each receiving the maximum of 9 mentions: stakeholder diversity, changing regulations, and emerging technologies. These drivers are followed by "risk management" and "IT system integration," both cited 8 times. These data suggest that project complexity is predominantly driven by the need to navigate varied human interests and shifting legal landscapes. Thus, companies seeking to implement the energy transition often face complexity stemming from stakeholder diversity, evolving regulations, and new technologies. This corroborates the findings of Manesh Rad et al. (2017), which state that these elements heighten uncertainty and require better stakeholder coordination, ongoing adaptability, and stronger organizational learning. Without clear governance and effective integration of innovations, complexity can become overwhelming. Therefore, moving from reactive to proactive management, anticipating and strategically handling sector shifts, is a vital concept.

Analysing the survey results for the question - *How do you handle complexity in energy projects?* – findings show that complexity in energy projects is primarily managed through "stakeholder engagement in decision-making", which is the most prominent strategy with 9 mentions. This leadership approach is reinforced by "continuous team training", "specialized project management software," and "detailed planning and frequent updates", each receiving 7 mentions. Furthermore, the adoption of "agile methodologies" accounts for 6 mentions, suggesting that the flexibility remains a key component in managing such projects. Most managers still rely on the traditional playbook to handle complexity. From the participants' responses, we can confirm that they prioritize detailed planning, frequent updates, and continuous training. Stakeholder engagement is also standard practice. While these methods show discipline, they lack modern flexibility.

A study by Kazemzadeh et al. (2023) found that few organizations have truly embraced agile methodologies or specialized software, leading to a disconnect. Teams know that projects are becoming more volatile. However, they cling to rigid models that often fail when plans change. As a result, digital transformation remains in its incipient stages, and companies have yet to unlock the real potential of managerial agility.

When focusing on the skills necessary for a project manager dealing with energy transition issues, the most essential attribute is "leadership and communication skills," which received the highest frequency (15 mentions). This interpersonal skill is complemented by technical expertise, "technical knowledge in renewable energy" (14 mentions) and an "understanding of energy policies and regulations" (13 mentions), highlighting the need for a multidisciplinary profile. Furthermore, the ability to navigate shifting environments received 12 mentions, while "analytical and decision-making skills" received 9 mentions, and to complete the necessary toolkit.

The respondents identified a specific toolkit for success, prioritizing leadership and communication alongside hard technical skills and knowledge, which aligns with the ideas supported by Hariyani et al. (2025). This study supports the ethical implementation of technology within managerial activities. Analytical rigor and change management also ranked highly. This concurrence defines a "complete project manager". We are seeing the rise of a hybrid professional. Technical capability is now just the baseline.

Concerning the nest question - *Have you had any specific training in overseeing energy transition initiatives?* – a few participants have had specific training for energy transition

projects (6 out of 20 respondents). However, a large number plan to get this type of training soon (7 respondents). This highlights a clear gap. Professionals know that specific skills are necessary, but training programs are not easy to find. This shortage underlines real risk. Without proper training, executing these projects becomes difficult. The energy industry needs better educational support to close this gap and help managers adapt.

When it comes to the next question - *How much do you think energy transition concerns are included in professional training programs in 2025?* - most respondents feel that current training programs fall short (6 people responded insufficiently, 3 people partially, while 2 people not at all). They describe the exposure of energy transition topics as partial at best. This reveals a distinct delay, and that the industry is transforming rapidly. However, educational content has not kept pace, as the study by Bondin and Zammit (2025) notes, highlighting the need for curriculum updates. To bridge this divide, curricula require a significant update. The industry needs specialized programs that actually address the complexities of a digitized, sustainable system.

Going further, to the primary resources for knowledge and career advancement (the option of selecting multiple answers was available), professionals are essentially investing in their own education. They rely on a diversity of certifications (15 answers), participation at conferences and seminars (15 answers), and involvement in industry networks (14 answers). Most respondents answered that they remain informed by consulting industry publications (17 answers). This autonomous learning approach offers flexibility, but it also entails hidden costs, such as fragmentation (CEDEFOP, n.d.). Without a standardized framework, knowledge becomes uneven. Skill levels vary wildly across the energy sector, creating highly isolated knowledge areas. The industry cannot rely on dispersed learning. The industry needs a cohesive development ecosystem to ensure that every professional has equal access to the core competencies required for the transition. Over the next five to ten years, the greatest potential for project managers in the energy sector lies in expanding financial resources and pioneering technological solutions.

In terms of the biggest potential for project managers in the energy sector, “more funding and investments” is identified as the most significant area (7 respondents). Furthermore, “access to advanced technologies” and “development of innovative projects” received 5 mentions, suggesting a future market in which technical innovation and capital circulation are complementary. The “increasing demand for green energy” received 3 mentions. Thus, respondents see a clear road ahead. They identify the flow in green energy demand and innovative projects as primary opportunities. Better access to funding and technology also made the list. This reveals that managers view the energy transition as a genuine opening, not just a regulatory barrier. Innovation and digitalization are no longer optional, as a report by the OECD (2025) (on Employment and Skills Policies for the Green Transition) acknowledged; they have become the main drivers. In this landscape, the ability to adapt and to rebuild professional skill sets becomes the defining factor for success.

Based on the survey results for the question asking about the biggest obstacle facing project managers in the same time frame, the main challenge for project managers in the energy sector is “navigating regulatory changes” (11 mentions). This regulatory volatility outweighs other challenges such as “managing project complexity” (4 mentions) and “adapting to emerging technologies” (3 mentions). Furthermore, 2 respondents noted “ensuring team competencies” as a concern. Looking ahead, respondents point to a series of challenges, including new technology, rising complexity, and legislative flux. The same observation was made in a study by Rongali and Budda (2023), who underscored the importance of software for managing large volumes of technological and legislative changes. Developing team competencies also ranks high. These concerns reflect a realization that instability is now a systemic feature of the sector. Success will depend on the ability to manage technical shifts and regulatory pressures simultaneously. This demands an integrated strategy. The future of project management relies on technical leadership, agility, and a persistent focus on team development.

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Focusing on the nineteenth item - *How much do you think energy project management will be affected by digitalization?* - 16 respondents predict that digitalization will reshape the energy sector: 8 participants in a very significant way, 6 respondents in a moderate way, and 2 participants in a slight way. This is a sign of a clear shift in mindset, given that technology is no longer viewed as an optional upgrade but a reference point. These views support the results obtained in the study by Singh et al. (2022), who underscore that industrial technologization is an irreversible process. The energy grid generates massive data loads and demands real-time responses, making digital tools the only way to ensure adjustability. This reality sets a clear investment strategy. To be adaptable, organizations need to prioritize investments in IT and advanced analytics. These findings corroborate the results presented by Zhou et al. (2016), who put forward one of the most important studies on how to harness the potential of energy big data and derive insights to enable smart energy management.

Furthermore, analysing the survey results for the next question - *What digital tools do you use in project management?* - the data reveals a strong reliance on structured organizational systems, with "document management systems" being the most prevalent tool (18 mentions). This aspect is closely followed by "planning software" (collectively registered 17 mentions) and "collaboration platforms (e.g., Slack, Trello)" (16 mentions). In comparison, the application of "data analytics and BI tools" remains significant with 15 mentions. The answers showed that the participants in this study employ a variety of digital technologies for project management, with the most cited being planning software (such as MS Project and Primavera), collaboration platforms (e.g., Slack, Trello), document management systems, and, to a smaller degree, data analytics and business intelligence tools. This diversification reflects a high degree of operational maturity and a step-by-step integration of technology into regular project operations. However, it appears that digital transformation in project management remains primarily focused on executional efficiency rather than on strategic, data-driven decision support, as evidenced by the dominance of planning and communication tools over more sophisticated analytical solutions. This approach emphasizes the necessity of extending digitalization into higher-value-added domains, including risk assessment, decision optimization, and predictive analytics.

Conclusions

The article investigated the role of project managers in operationalizing the energy transition in Romania, offering a nuanced perspective on the challenges, skills, and resources required for success. The results emphasize that the transition to a sustainable energy system is not only a technological challenge but also a strategic management challenge, requiring continuous updating of project leaders' professional profiles.

Overall, the success of the energy transition in Romania depends on transforming project management from a rigid discipline into an adaptable process, supported by technology and continuous learning. The path to a sustainable energy future is difficult and uncertain. Energy project management must transition from inflexible, project-focused techniques to adaptable, system-based approaches that account for change and uncertainty. Project managers will be better able to manage complexity and produce significant outcomes by implementing scenario-based planning, staying abreast of changing policy environments, and promoting cross-sector collaboration. In the end, efficient energy project management may accelerate the world's energy transition, reduce risks, and generate possibilities that benefit the environment and society.

Research and practical implications

From a theoretical perspective, the study contributes to the literature by defining a hybrid profile of the project manager in the energy sector. The results highlight that indicators that ensure project success should be contextualized within technical, economic, and

managerial knowledge. The research shows that the main sources of complexity in energy projects in Romania are stakeholder diversity, regulatory volatility, and emerging technologies, each receiving a maximum score of mentions among respondents. The study supports the hypothesis that the successful implementation of green technologies depends on the ability to decouple environmental policies from global geopolitical volatility. In addition, the paper provides evidence that digitalization is perceived as an irreversible and fundamental process, with 80% of respondents predicting that it will significantly reshape the sector.

For organizations operating in the energy, transportation, and IT sectors, the study guides the optimization of environmental strategies and operational performance. There is a significant discrepancy between the pace of industrial transformation and current educational offerings. Organizations need to invest in cohesive development systems to avoid knowledge fragmentation.

Although the use of document management systems and planning software is widespread, professionals also need to approach advanced data analytics and BI solutions for strategic decision support. Given the legislative instability in Romania, identified as the main obstacle, managers should adopt scenario-based planning models to ensure the resilience of energy infrastructures. Leadership and communication skills were identified as the most essential attributes, surpassing even specific technical knowledge.

Research limitations

The study has an exploratory approach, based on a sample of 20 project managers from 12 companies. Although diverse, it cannot be considered representative of the entire energy industry in Romania, despite the respondents representing a variety of firms and areas of operation (such as production, distribution, supply, and consulting). The results reflect the participants' individual perceptions and experiences, which may be influenced by specific organizational culture or level of experience. Future research should be exploring 1) tracking how managers adapt to regulatory changes forecast for the next 5-10 years; 2) investigating how new technologies can optimize the management of data flows.

The subjective character of the questionnaire's responses is another drawback. The results may be influenced by respondents' positions within the organization, organizational culture, or professional experience, as they reflect individual ideas and perceptions. Therefore, rather than providing an impartial or direct assessment of project managers' performance or the success of particular initiatives, the data show how they relate to the energy transition.

Furthermore, it may be considered a methodological limitation to solely employ the questionnaire approach in the absence of interviews, direct observation, or case studies. This could limit the breadth of the study and the interpretation of the findings.

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