

DETERMINANTS OF THE USE OF RENEWABLE ENERGY SOURCES IN AGILE ORGANIZATIONS

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Purpose: The purpose of this paper is to identify and analyze the key determinants that influence the decisions of agile organizations to implement renewable energy sources. The study aims to understand which socio-economic and technological factors have the greatest impact on these decisions.

Design/methodology/approach: The research was based on quantitative analysis conducted through a survey among representatives of agile organizations. The collected data was then subjected to statistical analysis, including the calculation of the Gini coefficient to assess the concentration of respondents' preferences.

Findings: Research has shown that the development of new technologies and job creation are the most important determinants influencing decisions regarding the implementation of renewable energy sources. The results suggest that agile organizations give equal weight to different factors, which indicates a balanced approach to the energy transition.

Research limitations/implications: The limitations of the research are the subjective nature of respondents' answers and the limited representativeness of the sample, which may affect the generalization of the results. In addition, dynamically changing technologies and regulations may affect the validity of the results in the future.

Practical implications: The research results suggest that agile organizations should develop strategies that balance multiple determinants when implementing renewable energy sources. Investments in modern technologies and job creation can contribute to improved operational efficiency and market competitiveness.

Social implications: The implementation of renewable energy sources supports sustainable development and contributes to environmental protection, which is gaining increasing public support. Organizations that engage in such activities can build a positive image as socially and ecologically responsible.

Originality/value: The article adds value through a comprehensive analysis of the determinants influencing the use of renewable energy sources in agile organizations, emphasizing the importance of a sustainable approach. The study provides new conclusions that can support further development of energy strategies in a dynamically changing business environment.

Keywords: renewable energy sources, agile organizations, enterprise, energy transformation, energy.

Category of the paper: research paper.

1. Introduction

In the face of growing environmental challenges and the need to reduce greenhouse gas emissions, organizations around the world are increasingly turning to renewable energy sources (Adan & Fuerst, 2016). Agile organizations that are flexible and adaptable are particularly well-positioned to effectively implement these green solutions (Torres, 2023). Using renewable energy sources not only reduces carbon footprints but also brings economic benefits, such as lower operating costs and improved energy efficiency (Kemp, Foxon, 2023). Despite their numerous advantages, decisions regarding the implementation of renewable energy sources are complex and dependent on many factors. Socioeconomic determinants, such as job creation, regional economic development, and the availability of natural resources, play a key role in shaping these decisions. Additionally, increasing pressure from society and regulatory institutions to adopt pro-ecological actions is forcing organizations to change the way they manage energy (Rahimi, Mansouri, 2019).

In undertaking research on the determinants of renewable energy use in agile organizations, the goal was to understand what factors have the greatest impact on the decisions of these organizations and how they can support sustainable development. Analyzing these determinants is important not only for understanding the motivations of organizations, but also for developing effective strategies to promote the use of renewable energy sources on a large scale.

2. Literature Review

2.1. Organizational agility as a key factor in adapting to market and technological changes

Organizational agility is a key factor that enables organizations to effectively adapt to dynamically changing market and technological conditions. In the context of the modern economy, characterized by high volatility and uncertainty, the ability to quickly respond to changes in the business environment is becoming an indispensable element of the survival and development of companies (Mrugalska, Ahmed, 2021). Organizational agility, defined as the ability to flexibly adapt to new conditions, not only promotes effective change management, but also enables a proactive approach to challenges and the use of opportunities that technological progress brings (Akkaya, 2021).

Organizational agility is based on several foundations that together create the ability of an organization to adapt (Doz, Kosonen, 2008). First of all, agile organizations are characterized by a flexible organizational structure that allows for the rapid redirection of resources, decision-making at various levels and effective management of teams (Capgemini, 2024). Decentralization of decisions and shortening the decision-making process promotes rapid

response to changes, and also increases the ability of the organization to experiment and implement innovative solutions. In practice, this means that organizations are able to quickly adapt their operational strategies, products or services to new market or technological requirements, which is crucial in the context of competitiveness in the global market (Kt, Sivasubramanian, 2023).

Another important aspect of organizational agility is an organizational culture that promotes innovation and continuous improvement. Agile organizations are characterized by openness to change and encouraging employees to engage in innovation processes (Deloitte, 2024). Such a culture not only supports the rapid implementation of new technologies, but also enables the creation and adaptation of new business models that can better meet changing customer needs. As a result, organizations are able to not only respond to changes, but also anticipate and initiate new market trends (Kocot, Kwasek, 2022).

Organizational agility is also closely related to effective knowledge and information management (Kurnia, Chien, 2020). Modern organizations must be able to quickly process large amounts of data and translate them into practical conclusions. The use of modern information and communication technologies, such as artificial intelligence, data analysis or decision support systems, allows organizations to respond agilely to market and technological changes (Borowski, 2021). Quick access to information and the ability to use it effectively allows for real-time decision-making, which is essential in a dynamically changing environment (Nath, Agrawal, 2020).

In the context of organizational agility, the approach to project management is also key. Traditional management methods, based on rigid plans and structures, are giving way to agile methodologies, such as Agile, which assume an iterative and flexible approach to project implementation (He, Harris, 2021). Thanks to this, organizations are able to quickly adapt to changing requirements and conditions, which is especially important in sectors where the pace of technological change is very high (Skyrius, Valentukevič, 2020).

Organizational agility is therefore not only a response to the challenges of the modern economy, but also a necessary condition for achieving long-term success (Chen, Siau, 2020). Organizations that can effectively manage change, quickly adapt to new conditions and use technological innovations are better prepared to compete in the global market and achieve sustainable development. In the face of increasingly rapid technological progress and changing consumer preferences, organizational agility is becoming a key factor of competitive advantage.

2.2. The Role of Technology in the Energy Transformation of Agile Organizations

Technologies play a fundamental role in the energy transformation of agile organizations, acting as both a catalyst for change and a tool enabling an effective transition to more sustainable energy sources (Munodawafa, Johl, 2019). Contemporary technological innovations, including both the development of new energy production methods and advanced energy management systems, enable organizations to effectively use renewable energy sources

and optimize energy consumption in operational processes. In the context of agile organizations that are characterized by the ability to quickly adapt and innovate, technologies become a key element of transformation strategies (Dsilva, Ashritha, Paramanik, 2024).

The first aspect of the role of technology in energy transformation is the ability to integrate renewable energy sources into the operational structures of organizations. Modern technologies such as photovoltaic panels, wind turbines, and energy storage systems enable organizations to generate energy from renewable resources more efficiently and cost-effectively (Van der Nat et al., 2024). In addition, the development of technologies related to smart energy networks (smart grids) allows for better management of energy distribution, minimizing losses and maximizing the use of available resources. Agile organizations that are able to quickly implement these technologies not only gain operational efficiency, but can also significantly reduce their energy costs and environmental impact (Eleogu, Okonkwo, Daraojimba, 2024).

Another important element is the automation and digitalization of energy management processes. Advanced energy management systems (EMS) enable real-time monitoring and optimization of energy consumption, which is particularly important for agile organizations that must respond to changes in energy demand quickly and effectively (Varshney, 2020). By using artificial intelligence and data analysis, organizations can predict energy consumption trends and adjust their operations to minimize costs and maximize efficiency. Technology becomes not only an operational tool here, but also a strategic element of management, allowing for long-term planning and adaptation to changing market and regulatory conditions (Lambri, Sironi, Teti, 2024).

The energy transformation of agile organizations is also closely related to the development of technologies that enable the decentralization of energy production (Rosário, Raimundo, 2021). In traditional energy models, energy production was concentrated in large, central units (Ramadhana, 2021). However, the development of microgeneration technologies, such as micro-wind farms, rooftop solar cells or cogeneration systems, allows organizations to produce energy on a smaller scale, closer to the points of its consumption. Such decentralization not only increases the energy independence of organizations, but also reduces the risk associated with power outages and allows for better resource management in a more sustainable and resistant way to external disturbances (Gao, Zhang, Gong, Li, 2020).

In the context of agile organizations, technology is also becoming a key tool to adapt to increasing regulatory requirements related to environmental protection and sustainable development (Harraf, Wanasika, Tate, Talbott, 2015). Regulations regarding greenhouse gas emissions, energy efficiency, and the use of renewable energy sources are becoming increasingly stringent, requiring organizations not only to comply with standards but also to take a proactive approach to energy management (Abdmouleh, Alammari, Gastli, 2015). Technologies enable monitoring and reporting of compliance with these regulations, as well as implementing solutions that allow for achieving higher environmental standards (Reyes-Mercado, 2023).

In summary, the role of technology in the energy transformation of agile organizations is multifaceted and includes the integration of modern energy solutions, automation of energy management processes, decentralization of energy production, and adaptation to regulatory requirements. Thanks to the rapid implementation and adaptation of innovative technologies, agile organizations are able not only to effectively implement the energy transformation, but also to gain a competitive advantage in an increasingly demanding market, while contributing to environmental protection and achieving sustainable development goals.

2.3. Socio-economic determinants of the use of renewable energy sources

Socioeconomic determinants of renewable energy use play a key role in shaping the strategies of agile organizations, influencing their decisions regarding investments in green technologies. In the context of sustainable development, organizations not only strive to implement technological innovations, but also consider a wide range of social and economic factors that determine their approach to renewable energy sources. One of the important socioeconomic factors is job creation (Masoud, Basahel, 2023). Investments in renewable energy sources often lead to the creation of new jobs in various sectors, from production to installation and servicing of energy technologies. Organizations see in this the potential to support local economies and improve the situation on the labor market, which in turn can increase their acceptance in local communities (Fiddler, 2017). Moreover, creating new jobs can also contribute to building a positive image of organizations as socially responsible, which is important in the context of growing pressure from stakeholders for pro-ecological activities (Gkeka-Serpetsidaki, 2024).

The economic development of the country and region is another important socio-economic aspect that influences the decisions of agile organizations to implement renewable energy sources. Investments in green energy can contribute to stimulating local economies by creating new industries and increasing demand for local services and products (Luthra, Kumar, Kharb, Ansari, Shimmi, 2015). Organizations, by engaging in renewable energy projects, can therefore not only realize their goals related to sustainable development, but also support the economic development of the regions in which they operate. Such a strategy can also lead to an increase in their competitiveness in the market, especially in the face of the growing importance of ecology and sustainable development in the decisions of consumers and business partners (Liu, 2024).

The use of available and natural energy sources is another important factor that is important from both an economic and social perspective. Organizations strive to maximize the efficiency of their operations, which often involves the use of local energy resources (Attar, Almusharraf, Alfawaz, Hajli, 2022). Such an approach not only reduces the costs associated with the transportation and distribution of energy, but also minimizes the impact on the natural environment, which is increasingly valued by societies and regulators. The location and availability of energy resources can therefore be a key element in making investment decisions,

and organizations that effectively manage these resources can gain significant competitive advantages (Prieto, Talukder, 2023).

Reducing the consumption of non-ecological energy sources and reducing the emission of harmful pollutants are other socio-economic determinants that are of great importance in the strategies of agile organizations (Joiner, 2019). Modern societies are increasingly aware of the impact of economic activity on the environment, which leads to increasing pressure on organizations to implement more ecological solutions (McNamee, Schoch, Oelschlaeger, Huskey, 2012). Reducing pollutant emissions is not only a legal requirement, but also an element of building trust and loyalty of customers, who increasingly prefer environmentally friendly brands and products. Organizations that effectively implement these goals can not only meet regulatory expectations, but also gain an advantage on the market by creating an image of leaders in the field of sustainable development (Sedej, Justinek, 2020).

Finally, aspects such as obtaining tax revenues from investors and the development of wastelands also play an important role in decisions regarding renewable energy sources (Wells, Lin, 2024). Tax revenues generated by green energy investments can be an important source of income for local governments, which in turn can translate into better investment conditions and greater support for ecological projects. The development of wastelands, such as degraded or abandoned land, by installing renewable energy sources on them contributes to the improvement of the landscape and the value of these lands, which has positive economic and social implications (Schneider Electric, 2024).

In summary, the socio-economic determinants of renewable energy use in agile organizations cover a wide spectrum of factors, from job creation and stimulating local economic development, to optimal use of local resources and meeting growing social expectations regarding environmental protection. These determinants not only shape the investment decisions of organizations, but also play a key role in their long-term strategy for sustainable development and building a competitive advantage in the market.

2.4. Research Methodology

The aim of the conducted research was to identify the key determinants influencing the decisions of agile organizations regarding the use of renewable energy sources. The research aimed to check which factors are the most important in the decision-making process regarding the implementation of renewable technologies. The hypothesis was put forward that the development of new technologies and job creation are the main determinants that have the greatest impact on the decisions of organizations regarding renewable energy sources. The following research questions were formulated as part of the research: Which factors have the greatest impact on the decisions of agile organizations regarding the implementation of renewable energy sources? Are the preferences of organizations focused on one or several main factors, or are they evenly distributed across many different aspects? What are the implications

for agile organizations resulting from the concentration of responses on individual determinants?

The research was carried out using a research tool in the form of a survey conducted among representatives of agile organizations in June-July 2024. The survey contained questions regarding the importance of various determinants influencing decisions to implement renewable energy sources. The collected data were then analyzed, which included calculating the Gini coefficient. The purpose of calculating this coefficient was to determine the degree of concentration of respondents' responses to individual factors and to assess how evenly distributed the preferences of the respondents were in relation to various determinants. The results obtained were aimed at better understanding the distribution of preferences of organizations and identifying areas with the greatest potential to attract attention in the context of implementing renewable energy sources.

The study obtained sociodemographic data that allowed for a detailed characterization of the research sample of 432 respondents. In terms of the gender variable, 41.9% of respondents were women and 58.1% were men, which indicated a slight predominance of men in the study group. Analysis of the age of respondents showed that the largest group were people aged 21-30, who represented 41.2% of the respondents. The next largest group were people aged 31-40, who constituted 21.8% of the sample. Respondents under 20 years of age constituted 20.6% of the respondents, while people aged 41-50 and 51-60 years represented 7.2% and 6.9% of the sample, respectively. The smallest percentage, only 2.3%, were people over 61 years of age.

In terms of place of residence, the majority of respondents, as many as 50.2%, lived in medium-sized cities with 50 to 200 thousand inhabitants. Smaller groups were residents of small towns (19.2%), towns with up to 20 thousand inhabitants (13.7%), and villages (10.0%). The smallest group, 6.9%, were residents of large cities.

2.5. Presentation of Research Findings

The research aimed to identify the determinants of the use of renewable energy sources in agile organizations (see Table 1). The obtained results indicate diverse factors influencing the decisions of organizations in this area. In first place, with a result of 129 indications, which constitutes 21.1% of the total, was the development of new technologies, which suggests that technological innovations play a key role in the implementation of renewable energy sources. In second place, with 123 indications, or 17.9%, was the creation of jobs. This suggests that organizations see an important role in generating new jobs thanks to investments in renewable energy sources. The economic development of the country and region, with 80 indications, constituting 10.8%, is also an important factor, which indicates that organizations see the potential to stimulate the local economy. The use of available and natural energy sources received 66 indications, which corresponds to 10.5%, which may suggest that organizations prefer a sustainable approach based on local resources.

Reducing the consumption of non-ecological energy sources was indicated by 64 respondents, which is 10.1%, and reducing the emission of harmful pollutants by 49, which is 9.3%, which may mean that organizations pay attention to issues related to environmental protection. Obtaining tax revenues from investors, with 58 indications (9.0%), indicates the importance of financial benefits for the public budget, and the development of wastelands, with 39 indications (5.9%), and the promotion of the region, with an identical result of 39 indications (5.5%), indicate additional, although less important, factors influencing organizations' decisions regarding renewable energy sources.

Table 1.

Determinants of the use of renewable energy sources in agile organizations

Development of new technologies	129	21.1%
Creating jobs	123	17.9%
Economic development of the country and the region	80	10.8%
Use of available and natural energy sources	66	10.5%
Reducing the use of non-ecological energy sources	64	10.1%
Reducing emissions of harmful pollutants	49	9.3%
Obtaining tax revenues from investors	58	9.0%
Development of wastelands	39	5.9%
Promotion of the region	39	5.5%

Source: Own study based on research.

In order to assess the degree of concentration of respondents' responses to individual determinants of the use of renewable energy sources, the Gini coefficient was calculated. This coefficient is a measure of distribution inequality, allowing to determine how evenly distributed the preferences of respondents are with respect to various factors. The higher the value of the Gini coefficient, the greater the concentration of responses on one or several determinants, which suggests that these factors are of particular importance in the decision-making process of organizations. In turn, a low Gini coefficient indicates a more even distribution of responses, which means that organizations assign similar weight to many different factors.

Calculating the Gini coefficient allows for a better understanding of the distribution of respondents' preferences and identifying key factors influencing decisions regarding the implementation of renewable energy sources. Such analysis is important because it allows for identifying areas with the greatest potential to attract the attention of the organization and focusing activities on those elements that can bring the greatest benefits.

Data on the number of indications for individual determinants were sorted in ascending order, as presented in Table 2.

Table 2.

Cumulative values of the number and percentage shares for the determinants of the use of renewable energy sources

Determinant	Multiplicity	Cumulative Count	Cumulative percentage (%)
Development of wastelands	39	39	5.5
Promotion of the region	39	78	11.4
Reducing emissions of harmful pollutants	49	127	20.7
Obtaining tax revenues from investors	58	185	30.8
Reducing the use of non-ecological energy sources	64	249	41.0
Use of available and natural energy sources	66	315	51.4
Economic development of the country and the region	80	395	64.1
Creating jobs	123	518	84.3
Development of new technologies	129	647	100.0

Source: Own study based on research.

Based on the above data, the Gini coefficient was calculated using the following formula:

$$G = 1 - \sum (p_i + p_{i-1}) \times q_i$$

where:

p_i is the cumulative percentage for the i -th value,

q_i is the percentage for the i -th value.

After substituting the values into the formula, we get:

$$G = 1 - [(0 + 0.055) \times 0.055 + (0.055 + 0.114) \times 0.059 + \dots + (0.843 + 1.000) \times 0.157]$$

The sum of the calculated values is 0.941848, which after subtracting from 1 gives a Gini coefficient of 0.058. The obtained Gini coefficient value of 0.058 indicates an even distribution of responses among the examined determinants. This means that the examined organizations assign similar importance to many different factors, which suggests a balanced approach to the implementation of renewable energy sources. Such results may indicate the lack of a clearly dominant factor, which may require a multi-faceted approach in strategies for promoting renewable energy sources.

3. Discussion

The conducted research allows us to formulate several fundamental conclusions regarding the determinants of the use of renewable energy sources in agile organizations. First, the development of new technologies has been identified as a key factor influencing the decisions of organizations. This indicates the important role of technological innovations in the process of implementing renewable energy sources, which suggests that organizations see in them the potential to improve their operations and improve energy efficiency. Another important conclusion is the importance of job creation as a factor determining investments in renewable energy sources. Organizations see the benefits resulting from the possibility of

generating new jobs, which can have a positive impact on local communities and economies. This indicates that social issues are an important element of the sustainable development strategy in these organizations.

The economic development of the country and region also plays an important role in decisions regarding investments in renewable energy sources. Organizations understand that these investments can help to stimulate the local economy, which is important from both an economic and social perspective. The preference of organizations to use available and natural energy sources suggests a sustainable approach to resource management. This is consistent with the desire to minimize environmental impact and promote sustainable development practices.

The research results also indicate growing environmental awareness among organizations, which is reflected in the desire to reduce the consumption of non-ecological energy sources and reduce the emission of harmful pollutants. These aspects emphasize the involvement of organizations in environmental protection and promoting more ecological solutions. Additionally, the research highlights the importance of financial benefits for the public budget resulting from investments in renewable energy sources, which can motivate organizations to undertake such activities. This indicates the important role of economic factors in making investment decisions.

Calculation of the Gini coefficient allows for drawing several important conclusions regarding the concentration of respondents' responses to individual determinants of the use of renewable energy sources. A low Gini coefficient value indicates an even distribution of preferences of organizations with respect to the examined factors. This means that organizations do not clearly favor any specific factor, which suggests that the decision-making process regarding the implementation of renewable energy sources is multi-faceted and takes into account a wide range of determinants.

This result may indicate a balanced approach of the organization to various aspects of implementing renewable energy sources, which in turn may indicate the need for a comprehensive approach in creating a strategy for promoting these energy sources. Organizations take into account many different factors, which may make it difficult to identify one, key element to focus on. Therefore, in order to effectively support the development of renewable energy sources, it may be necessary to address many different areas at the same time, instead of focusing on a single aspect.

These results also suggest that organizations are aware of the multiple benefits and challenges associated with implementing renewable energy sources, which can lead to more sustainable and informed investment decisions. In the context of promoting renewable energy sources, it is therefore worth considering an approach that takes into account a wide range of determinants, rather than focusing on one dominant factor. Such a strategy can bring more comprehensive and lasting effects, responding to the diverse needs and priorities of organizations.

Knowledge of research results regarding the even distribution of preferences of organizations towards various determinants of the use of renewable energy sources has significant practical value for companies. Thanks to this knowledge, companies can better understand that effective investment decisions in the area of renewable energy sources require taking into account a wide range of factors, and not focusing on one, dominant aspect. Companies can therefore optimize their strategies, taking into account both technological, social, economic and ecological aspects. Such a comprehensive approach allows for better adjustment of activities to diverse market needs, which increases the chances of achieving long-term benefits and competitive advantage in the dynamically developing renewable energy sector.

Based on the research, several key recommendations can be formulated for agile organizations that are considering or are already involved in the use of renewable energy sources. First, organizations should adopt a holistic approach to the implementation of renewable energy sources, taking into account various determinants, such as technology development, job creation, economic development, and environmental benefits. The research indicates that none of these determinants clearly dominates over the others, which suggests the need for a comprehensive approach in the investment decision-making process.

Second, agile organizations should invest in the development of new technologies, which have been identified as one of the key factors influencing decisions to implement renewable energy sources. Investments in technological innovations can bring significant benefits, such as improved operational efficiency and competitive advantage. In addition, organizations should pay attention to the social and economic aspects of their activities, such as creating jobs and stimulating local economic development. Promoting these aspects can increase public acceptance and support for renewable energy projects, which in turn can facilitate their implementation.

It is also worth it for agile organizations to consider using available, natural energy sources in a sustainable way, which can bring both ecological and economic benefits. The growing environmental awareness among stakeholders emphasizes the need for responsible management of natural resources. Finally, it is recommended that organizations monitor and analyze changing preferences and needs of the market and stakeholders, adapting their strategies to the evolving environment. Flexibility and the ability to quickly respond to market changes are key to achieving success in the dynamically developing renewable energy sector.

In summary, agile organizations should strive to integrate various aspects of sustainability into their strategies, which will allow them not only to effectively implement renewable energy sources, but also to achieve a sustainable competitive advantage.

It should be noted that the research had some limitations. The limitations of the conducted research were related to several important factors that could have influenced its results and conclusions. First, the subjectivity of the respondents' answers was one of the main limitations, as the participants of the research could interpret the questions in different ways, which could

affect the consistency of the obtained data. In addition, the representativeness of the research sample was limited, which means that the results may not fully reflect the views and preferences of all agile organizations. The sample was relatively small and also geographically limited, which could affect the generalization of the results to a wider population.

Another significant limitation was the dynamics of technological and regulatory changes, which may affect the validity of the data obtained. The rapid pace of technological development in the field of renewable energy sources and changing legal regulations may cause the research results to soon become outdated. Additionally, the research was based on quantitative analysis, which limited the possibility of an in-depth analysis of the motivations and behaviors of respondents, which could be better understood using qualitative methods.

The applied analysis methods, such as the calculation of the Gini coefficient, although useful, may not fully capture the complexity of decisions made by agile organizations in the context of implementing renewable energy sources. Finally, the research focused on a specific time period, which could have influenced the obtained results in the context of seasonal or short-term changes in the preferences and actions of the studied organizations. All these factors should be taken into account when interpreting the research results and planning further research activities in this area.

4. Conclusions

It is worth comparing the research results with those of other authors. The research results presented in this article indicate that the development of new technologies and job creation are key determinants influencing decisions regarding the implementation of renewable energy sources. Similar conclusions can be found in the literature on the subject. For example, Borowski (2021) emphasizes that digitalization and modern technologies, such as digital twins and blockchain, play a fundamental role in managing processes in the energy sector, which supports the implementation of sustainable solutions. Further research conducted by Luthra et al. (2015) also confirms that technological innovation is a key factor driving the energy transformation, especially in the context of switching to renewable energy sources. These findings are consistent with the results of Kocot et al., who emphasize that agile organizations perceive new technologies as an important tool supporting their activities for sustainable development.

Another important aspect, which is reflected in both this research and the literature, is the growing environmental awareness and the desire to reduce pollutant emissions. Luthra et al. (2015) indicate that organizations investing in renewable energy sources not only contribute to environmental protection, but also build a positive image among stakeholders,

which is consistent with the results of this research, which emphasize the importance of ecological initiatives in the context of sustainable development of organizations.

Future directions of research in the area of renewable energy sources in agile organizations may focus on several key areas, taking into account both the dynamic development of technology and changing socio-economic conditions. One of the main directions may be the further improvement and optimization of technologies related to energy production and storage. Research may focus on the development of more efficient photovoltaic panels, wind turbines and energy storage systems that will allow for the maximum use of renewable energy resources. Integration of these technologies with intelligent energy management systems (smart grids) may also be a key area in which future research may bring significant innovations. In particular, research may concern the development of systems enabling better management and optimization of energy consumption in real time, which is particularly important for agile organizations that must quickly respond to changes in energy demand.

Another direction of research may be the development of technologies enabling the decentralization of energy production. In this context, future research may focus on micro-power plants and cogeneration systems, which will allow energy production closer to the places of its consumption, which will increase the energy independence of the organization and reduce the risk associated with power outages. Research may also explore new business models based on the concept of energy communities, in which local users will be able to exchange energy at a local level.

At the same time, the growing importance of sustainable development and green legal standards may direct future research into the area of regulatory compliance and risk management related to energy transition. Research may include the development of tools and systems for monitoring greenhouse gas emissions and other aspects related to environmental protection. In the context of agile organizations, this research may also address methods for integrating green standards into daily business operations, enabling better adaptation to increasing regulatory requirements.

An important direction of research may also be the socio-economic aspects of energy transformation. Future studies may analyze the impact of investments in renewable energy sources on the development of local economies, job creation and social acceptance of such investments. In particular, research may focus on assessing the long-term economic and social benefits of energy transformation, which may help organizations better understand and communicate the value of their pro-ecological activities.

In summary, future research could focus on further technology development, decentralization of energy production, compliance with legal norms, and socio-economic implications of energy transformation. These areas can provide new tools and strategies that will help agile organizations effectively implement renewable energy sources and achieve competitive advantage in a changing business environment.

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