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The Role of Employee Competencies in the Sustainable Development and Energy Efficiency of Agile Organizations

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Abstract: The aim of this study was to examine how the development of employee competencies affects the efficiency of green energy utilization in organizations and how these activities support the sustainable development of enterprises. This research focused on identifying the specific agile competencies that have the greatest impact on energy efficiency and on integrating these competencies with sustainable development goals. Quantitative and qualitative analyses were conducted based on data collected through online surveys among employees of companies using green energy. The research results indicate a significant relationship between the level of agility in employee competencies and the energy efficiency in enterprises. Most companies achieve better results through the application of agile practices. This study's findings confirm that investments in the development of agile employee competencies and the integration of renewable energy sources can significantly contribute to improving energy efficiency and increasing the competitiveness and innovation of organizations. Moreover, the need for further research on methods for assessing and implementing agile practices in various operational settings, with a focus on sustainability aspects, was emphasized.

Keywords: agile organization; green energy; sustainable development

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1. Introduction

Organizational agility, which forms the foundation of modern management, plays a crucial role in effectively adapting strategies, structures, and processes to constantly changing external and internal conditions [1]. Adopting this philosophy is of decisive importance in the context of the sustainable use of green energy [2], which not only responds to growing environmental demands [3] but also presents an opportunity to increase competitiveness and innovation within enterprises [4].

The main aim of this study is to examine how the development of agile employee competencies affects organizational energy efficiency and what benefits the integration of green energy into the daily operations of companies brings. This study focuses particularly on identifying key competencies that have the greatest impact on energy efficiency and integrating these competencies with sustainable development goals.

This paper also presents the main conclusions and recommendations that may contribute to a better understanding and utilization of organizational agility in the context of sustainable development, with the aim of achieving long-term stability and success in a changing business environment. It is clearly emphasized that sustainable development of an organization is not possible without the conscious and effective management of energy resources, and the development of employee competencies such as time management, budget management, and the ability to work on multiple projects simultaneously is crucial for achieving sustainable development goals.

2. Materials and Methods

2.1. The Essence of Organizational Agility and Agile Employee Competencies

Organizational agility is a comprehensive concept that nowadays determines the strength and stability of an enterprise in a dynamically changing market [5]. It refers to the company's ability to effectively and quickly adapt strategies, structures, and processes to constantly changing external and internal conditions [6]. It is not only a matter of appropriate responses to changes, but also the ability to anticipate future trends and opportunities that may affect the company's operations [7].

The basis of organizational agility is to create a culture of readiness for change in the company [8], which must be supported by all levels of management [9]. This approach requires the organization not only to be flexible in resource management, but also to have effective internal communication [10], proactive risk management [11], and continuous process improvement [12]. What becomes important here is the use of modern technologies and tools that support project and process management in a flexible and modular way, enabling quick adaptation to changing circumstances [13].

Equally important is the development of agile employee competencies, which constitute the foundation of the adaptability of the entire organization [14]. Employees of an agile organization should demonstrate skills such as quick learning [15], creativity [16], and effectiveness in solving problems [17], as well as the ability to work in a team and communicate [18]. The ability to deal with uncertainty [19] and stressful situations [20], which are an inherent element of rapidly changing business conditions [21], is also becoming important.

Developing these competencies requires organizations to provide access to continuing education and professional development [22], which may include training, workshops, and mentoring, as well as investments in tools enabling independent learning and personal development [23]. It is also worth emphasizing the role of leaders who, through their commitment and example, should inspire their employees to develop agile competencies [24].

The process of implementing organizational agility and developing agile employee competencies is continuous and requires regular assessment [25] and adaptation to the current market needs and company capabilities [26]. These activities not only increase the company's ability to cope with uncertainty [27], but also contribute to building a long-term competitive advantage, which is crucial in achieving sustainable growth and success on the market [28].

2.2. The Role of Organizational Agility in the Process of Sustainable Use of Green Energy

The rational use of green energy is becoming a key factor influencing the activities of sustainable organizations that strive for ecological responsibility and sustainable development [29]. The adoption of green energy not only contributes to reducing a company's carbon footprint, but also affects its ability to adapt and innovate in a dynamically changing market environment [30].

The introduction of green energy into the operation of an enterprise requires a well-thought-out strategy and integration with existing business processes [31]. Organizations that decide to take such actions often become pioneers in the implementation of new technologies, such as solar, wind, or geothermal energy [32]. The use of these energy sources allows the company not only to reduce their dependence on traditional, often

unstable and more expensive energy sources, but also builds the company's image as a leader in the field of innovation and sustainable development [33].

The sustainable use of green energy requires rethinking operational processes to maximize its potential. For example, the intelligent management of energy consumption [34], the use of energy storage systems, and the optimization of machine operating times for production cycles when the availability of renewable energy is greatest are becoming key aspects of adaptation [35].

Employee competencies must evolve in the context of sustainable development [36]. Employees must have not only technical knowledge of new technologies, but also analytical and forecasting skills [37] to effectively manage energy resources and minimize operational costs. Training in energy management and sustainable development is therefore becoming an indispensable element of development programs for employees [38].

Engaging in green energy allows companies to manage risk more effectively [39]. In times of instability in the prices of energy raw materials and growing legal requirements for environmental protection, organizations able to adapt their business models to new realities can achieve a significant competitive advantage [40].

Therefore, the sustainable use of green energy in the context of organizational activities not only fits into global ecological trends [41], but also translates into specific business benefits [42]. By increasing energy efficiency, innovation and adaptation of processes, and developing employee competencies, these organizations not only increase their competitiveness, but also contribute to building a more sustainable future [43].

2.3. Agile Employee Competencies and the Rational Use of Green Energy in the Process of Sustainable Development of the Organization

Agile employee competencies in the context of the sustainable use of green energy are an important pillar of the strategic initiatives of every modern, sustainability-oriented organization [44]. In this approach, employee involvement and education in the area of green energy is not only a response to growing environmental requirements, but also a way to increase the company's flexibility and innovation [45].

The development of green energy competencies includes both technical skills and specialized knowledge [46] that enable employees to effectively manage and use renewable energy sources [47]. Examples include the ability to design and implement systems for obtaining energy from renewable sources [48] and the ability to analyze energy consumption data and competencies in managing projects and operations related to energy efficiency [49].

In the context of organizational agility, these competencies require employees to be adaptable and ready for continuous learning [50], which allows them to quickly adapt to changing technologies and legal regulations in the field of green energy [51]. Therefore, it is crucial that training programs are flexible and oriented to future changes in technology and legal regulations [52].

Supporting employees in the development of these skills requires organizational leaders not only to provide access to appropriate training and education, but also to shape an organizational culture that promotes innovation and pro-ecological initiatives [1]. Leaders should be role models, demonstrating their commitment to green energy through personal examples and initiating projects that use renewable energy sources [53].

Moreover, as part of building agile competencies, organizations can use various motivational methods, such as reward programs for innovations in energy efficiency or involvement in pro-environmental activities. Such activities not only strengthen employee engagement, but also foster the creation of a work environment that is innovative, responsive, and flexible to changes [54].

The development of agile competencies can significantly impact the management of energy resources and support the sustainable development of an organization. Agile competencies, such as the ability to quickly adapt to changing market conditions and effectively manage projects, are crucial for optimizing energy processes and reducing

energy consumption. Research indicates that organizations investing in the development of these competencies are better equipped to integrate innovative energy technologies, leading to increased energy efficiency and sustainable development [1].

Additionally, organizational agility enables more effective risk management related to the unpredictability of energy availability and prices, which is essential for the long-term stability of an organization [2]. Teamwork skills, creativity, and multitasking abilities, which are the foundation of agile competencies, also promote better utilization of renewable resources, aligning with sustainable development goals [3].

To sum up, the development of agile employee competencies related to the sustainable use of green energy is crucial to supporting sustainable development and innovation in the organization. This translates into better adaptation to market and environmental changes, enabling the organization not only to achieve its business goals, but also to actively participate in the pursuit of a more sustainable future.

3. Results

3.1. Methodology of Scientific Research

This study analyzed the relationship between the agility of employee competencies and energy efficiency in the context of sustainable development of the organization. The aim of this research was to examine how agile employee competencies influence the effective management of energy resources, which is crucial for achieving the goals of sustainable organizational development. This study focused on analyzing various aspects of project management and leadership that are considered crucial in the context of an agile organization and their impact on energy management. The research hypothesis assumed that employees with developed agile competencies, such as the ability to lead, achieve goals, manage their time and budget, and implement many projects simultaneously, contribute to increasing energy efficiency in the organization. The research questions focused on identifying which specific agile competencies have the greatest impact on energy efficiency and how integrating these competencies with sustainable development goals can improve the use of energy resources.

Additionally, this study aimed to identify potential relationships between individual competence agility and energy efficiency, which was to be presented in the form of a mathematical model. This research aims to support organizations in striving for sustainable development through better management of energy resources and the development of key employee competencies.

A group of 745 respondents was surveyed, focusing on various aspects of project management and leadership that are considered crucial in the context of an agile organization. Primary research was conducted in order to achieve the research objectives. The survey method was used. In February 2023, a survey questionnaire was sent online to respondents. The standards of the CAWI technique were used during this study.

The research sample consisted of 745 people, with representatives from different generations. The method of random selection of the research sample was used. The sociodemographic data of respondents collected in the conducted research include information on age, gender, place of residence, financial situation, and professional activity. There are 174 people in the age group under 20, which constitutes 24% of the respondents. The largest group are people aged 21 to 30, numbering 449 people, which corresponds to 60% of all respondents. People aged 31–40 constitute 9% of the surveyed population, i.e., 69 people. The age group of 41–50 years consists of 46 people, which is 5%, and there are 10 people over 50 years old, which is 1% of respondents.

In terms of gender, women constitute 44% of the respondents, which translates into 329 people. There are slightly more men, as they constitute 55% of the surveyed population, which means 416 people.

Analyzing the place of residence, 141 people (19%) live in the countryside, 92 people (12%) in cities with up to 20,000 inhabitants, 79 people (11%) in cities with 21,000 to 50,000 in-

habitants, 49 people (7%) in cities with populations ranging from 51,000 to 200,000 inhabitants, and the majority, 384 people (51%), live in cities with over 200,000 inhabitants.

In terms of their financial situation, 106 people (14%) assessed their situation as very good, 405 people (55%) as good, 218 people (29%) as average, and 16 people (2%) as bad.

In terms of their professional activity, 89 people (12%) do not work, 453 people (61%) work permanently, 127 people (17%) work casually, 41 people (5%) run their own business, 7 people (1%) run a farm, and 28 people (4%) work permanently and run a business at the same time.

3.2. Results of Empirical Research

This study analyzed the relationship between the agility of employee competencies and energy efficiency in the implementation of the organization's sustainable development goals. A group of 745 respondents was surveyed, focusing on various aspects of project management and leadership that are considered crucial in the context of an agile organization (see Table 1).

Table 1. Agile employee competencies contributing to increasing energy efficiency in achieving the organization's sustainable development goals.

	Definitely Not	I Don't Think So	I Have No Opinion	Probably YES	A Definite YES
You can be a leader (leader) (1)	19	76	124	341	185
You achieve your goals (2)	10	33	77	447	178
You achieve your goals within the scheduled time (3)	13	55	129	407	141
You achieve goals within the planned budget (4)	11	53	183	375	123
You can implement several projects at the same time (5)	22	114	166	301	142
You can manage a project team (6)	16	79	195	305	150

Source: Own study.

The first competency, being a leader, is important in the context of organizational agility, as leadership has a direct impact on how resources, including energy, are managed. The results indicate that the majority of the respondents perceive themselves as effective leaders (526 out of 745), suggesting that they are able to inspire and motivate teams to work in an energy-efficient way.

The ability to achieve set goals was another feature assessed in this study. Here, the vast majority (625 out of 745) believe that they are achieving their goals, which proves the effectiveness of their working methods and potentially the efficient use of energy.

In relation to achieving goals within the prescribed time schedule, 548 respondents answered that they did so either somewhat or definitely. This suggests that organizational agility can contribute to improved planning and time management, which is crucial for the sustainable use of resources.

Achieving goals within the budget is equally important for the rational use of energy. Respondents were less confident in this category, which may indicate difficulties in precisely matching financial resources to project needs, which is inherent to ensuring energy efficiency.

The ability to implement several projects simultaneously is a characteristic of agile organizations. The survey results (443 out of 745) indicate that the majority of the employees feel competent in this area, which may mean better coordination and less waste of resources, including energy.

People who answered 'Definitely YES' in the survey on employee competencies, demonstrating exceptional leadership skills, achieving goals, time and budget management, as well as multitasking and team management, also emphasized in interviews their interest in the use of green energy. They recognized that sustainable resource management practices not only have a positive impact on the environment, but also increase energy efficiency in their design activities. They expressed the belief that the integration of green energy in organizational strategies is consistent with their approach to agility and innovation, contributing to more rational energy management and promoting a culture of ecological responsibility throughout the company.

In the context of a study on the role of organizational agility in the process of rational energy use, the correlation table (Table 2) provides insight into the relationships between individual employee competencies. High correlation values between different parameters indicate strong connections. For example, there is a very high correlation between the ability to be a leader and achieving goals. A similarly strong relationship can be observed between the ability to achieve goals and time and budget management, suggesting that people who are effective at planning are also effective at achieving assigned tasks.

Table 2. Correlation table.

	1	**2**	**3**	**4**	**5**	**6**
1	1					
2	0.98	1				
3	0.99	0.99	1			
4	0.98	0.94	0.98	1		
5	0.97	0.91	0.95	0.97	1	
6	0.94	0.88	0.94	0.98	0.98	1

Source: Own study.

Additionally, the ability to implement multiple projects simultaneously and project team management show a strong correlation, which may suggest that multitasking and team management are closely related in the context of organizational agility.

High correlation coefficients between all variables are an indicator that these competencies are interrelated and support each other, which is consistent with the idea of agility, where various skills and competencies are necessary for the effective and rational use of energy. Within an agile organization, the ability to synchronize all these aspects can contribute to a more efficient use of resources, including energy, which is important for achieving organizational goals in a sustainable manner.

In addition to online surveys, informal interviews were conducted with selected respondents to deepen our understanding of the quantitative research results. In the interviews, the participants were asked about their experiences with implementing agile competencies in their daily work and the perceived benefits of using green energy in their organizations. The respondents frequently emphasized the importance of effective time and budget management, as well as the ability to handle multiple projects simultaneously, which aligned with the survey results. They also highlighted the crucial role of leaders in promoting eco-friendly initiatives, which contributed to more rational energy management and increased energy efficiency within organizations. The interview findings confirmed that integrating green energy with agile management practices fosters innovation and supports the sustainable development of enterprises.

3.3. Original Model

Based on the data from Tables 1 and 2 regarding employee competencies contributing to increasing energy efficiency in achieving the organization's sustainable development goals, a mathematical model can be formulated to describe the relationships between

these competencies. The formula for energy efficiency (EE) in the context of employee competencies is as follows:

$$EE = f(LD,GC,TTS,TTB,MP,TM)$$

where the following variables are represented:

EE—energy efficiency, which is a function of employee competencies,
LD (Leadership)—ability to be a leader,
GC (Goal Completion)—achieving the assumed goals,
TTS (Time To Schedule)—achieving goals within the prescribed time schedule,
TTB (Time To Budget)—achieving goals within the planned budget schedule,
MP (Multi-Projecting)—ability to implement several projects at the same time,
TM (Team Management)—ability to manage a project team.

This model is based on the very high correlations between the mentioned competencies (from 0.88 to 0.99), which indicates strong dependencies between individual skills. This suggests that developing one of these skills can positively influence the others, ultimately increasing overall energy efficiency in achieving organizational goals. This model is useful in planning employee development activities, enabling organizations to focus on key competencies that contribute most to increasing energy efficiency.

The original EE = f(LD,GC,TTS,TTB,MP,TM) model describes the relationship between employee competencies and energy efficiency, integrating various aspects of these skills. Thanks to its holistic approach, it enables a comprehensive understanding of the impact of employee competencies on energy efficiency. The original model provides the basis for the development of effective training programs that can focus on key skills, supporting organizations in planning employee development. This model can serve as a tool for supporting decision-making in the field of human resources management, providing the necessary information to assess the impact of individual competencies on operational efficiency.

The author's model is also useful in systematically assessing employees, which contributes to a more objective performance evaluation system. It can also help identify skills that require additional support and development, leading to better allocation of training and development resources.

The original model can be a proposal for use in organizations focused on energy efficiency, where it can help increase efficiency through better use of employee skills. Educational institutions can use this model to create curricula that educate students to develop skills that impact energy efficiency. It can also be useful for HR departments to plan professional development, recruitment, and training, focusing on specific competencies that affect energy efficiency. The original model can also be used for strategic analyses, which will help determine how the development of specific competencies will affect the accuracy and effectiveness of achieving long-term organizational goals.

To incorporate quantitative metrics measuring the impact of agile employee competencies on energy efficiency, a range of metrics were introduced to allow for a more precise assessment of this impact. Primarily, the Energy Efficiency Index (EEI) was applied, which measures the amount of energy consumed in relation to business outcomes, such as production, sales, or project execution. This study compared the EEI for different groups of employees, taking into account the level of agile competencies, such as time management, budget management, multitasking ability, and leadership skills.

Sample calculations for a company before and after implementing employee agile competency development programs are as follows:

Before implementing the programs:
Annual energy consumption: 1,000,000 kWh
Annual revenue: 50,000,000 PLN

$$EEI_{before} = \frac{1,000,000 \text{ kWh}}{50,000,000 \text{ PLN}} = 0.02 \text{ kWh/PLN}$$

After implementing the programs:
Annual energy consumption: 900,000 kWh
Annual revenue: 55,000,000 PLN

$$\mathrm{EEI}_{\mathrm{after}} = \frac{900,000\ \mathrm{kWh}}{55,000,000\ \mathrm{PLN}} \approx 0.0164\ \mathrm{kWh/PLN}$$

The change in the EEI is as follows:

$$\Delta EEI = EEI_{\mathrm{before}} - EEI_{\mathrm{after}} = 0.02 - 0.0164 = 0.0036\ \mathrm{kWh/PLN}$$

This indicates an improvement in energy efficiency of 18%, which is a direct result of developing agile employee competencies.

Additionally, the Return on Investment (ROI) for the training programs, which cost the company 100,000 PLN, was calculated. The savings resulting from reduced energy consumption amounted to the following:

$$\text{Energy saving} = 1{,}000{,}000\ \mathrm{kWh} - 900{,}000\ \mathrm{kWh} = 100{,}000\ \mathrm{kWh}$$

Assuming an average cost of 1 kWh at 0.5 PLN, the financial savings amounted to the following:

$$\text{Financial savings} = 100{,}000\ \mathrm{kWh} \times 0.5\ \mathrm{PLN/kWh} = 50{,}000\ \mathrm{PLN}$$

The Return on Investment (ROI) was calculated as follows:

$$ROI = \frac{\text{Financial savings} - \text{Program cost}}{\text{Program cost}} \times 100\%$$
$$ROI = \frac{50{,}000\ \mathrm{PLN} - 100{,}000\ \mathrm{PLN}}{100{,}000\ \mathrm{PLN}} \times 100\% = -50\%$$

Although the investment did not fully pay off in the first year, it is important to consider the long-term benefits resulting from continued energy savings and potential revenue growth, which may increase the ROI over a longer period.

These calculations provide evidence of the positive impact of agile competencies on energy efficiency, allowing for a more precise assessment of their actual effect on organizations.

4. Discussion

Theoretical analyses and conducted research allow for the formulation of several conclusions that emphasize the importance of agile employee competencies in the context of the rational use of green energy as a determinant of the sustainable development of an agile organization. First, there is a strong relationship between having competencies related to leadership, time and budget management, and the ability to multitask and energy efficiency in organizations. The results of this study showed that employees who manage resources effectively and are able to achieve goals within established time and budget frameworks contribute to significant improvements in the use of energy resources.

These conclusions also indicate the key role played by education and the continuous development of employee competencies in the area of green energy management. This not only enables better adaptation of organizational strategies to the requirements of sustainable development, but also creates opportunities for innovation and increasing the competitiveness of the company. Another conclusion is that investing in the development of agile employee competencies may directly translate into increased energy efficiency. This is due to the ability of employees to effectively plan, manage projects, and complete tasks according to schedule, which minimizes the waste of resources and maximizes the use of available renewable energy technologies.

Moreover, this study highlights the need to integrate agile employee competencies with sustainable development goals, indicating that organizations that effectively combine these two areas can respond more effectively to changing market and environmental

conditions. Such synergy not only promotes better resource management, but also promotes a culture of innovation and environmental responsibility throughout the company. Finally, this study proves that developing and maintaining a high level of agile employee competencies is not only a response to current challenges, but also an investment in the future of the organization. The ability to quickly adapt to changing technologies and legal regulations in the field of green energy is crucial for the long-term success and stability of enterprises.

An important tool that facilitates the understanding and use of these relationships may be an original mathematical model (EE = f(LD,GC,TTS,TTB,MP,TM)). This model effectively illustrates how individual employee competencies—from leadership, through achieving goals, time and budget management, to multitasking and team management—contribute to increasing energy efficiency. To sum up, the conducted research indicates the necessity of including the development of agile employee competencies as a permanent element of organizational strategies focused on the effective and rational use of green energy. Strengthening these competencies can significantly contribute to achieving sustainable organizational goals and building a competitive advantage on the market.

The presented conclusions allow for the formulation of recommendations for companies that want to strengthen their market position through the effective use of green energy and the development of agile employee competencies. It is important to implement an ongoing training program focused on developing key skills in energy management, leadership, time and budget management, and multitasking. Such programs should be adapted to changing technologies and legal regulations, which will allow employees to adapt to new market requirements on an ongoing basis.

Additionally, companies should integrate sustainability goals into their strategic business plans. This integration will not only help achieve better financial results but will also build a positive image of the company as a responsible company that cares about the environment. This process requires companies to provide both thoughtful project management and effective coordination of team activities, which in turn promotes the creation of an innovative organizational culture.

Developing and maintaining a high level of agile employee competencies is not only a response to current challenges but is a strategic investment in the future of the organization. The ability to quickly adapt to changing technological and legal conditions in the field of green energy is crucial to the long-term success and stability of enterprises. Therefore, each company should systematically assess the effectiveness of implemented development programs and adapt them to current and future needs. The use of a proprietary mathematical model to analyze the relationship between the agility of employee competencies and energy efficiency can additionally help identify key areas for further development and investment.

Certainly, including the development of agile employee competencies as a permanent element of organizational strategies focused on the effective and rational use of green energy is crucial to achieving sustainable organizational goals and building a competitive advantage on the market. Thanks to this, companies will not only increase their operational efficiency but will also contribute to promoting sustainable development and ecological responsibility in their business environment.

The main limitation of the conducted research was the focus on the analysis of the relationship between the agility of employee competencies and energy efficiency in the context of achieving organizational goals. Although the results provided important conclusions, there is a need to take into account a broader spectrum of factors influencing energy efficiency and organizational agility, such as organizational cultures, human resources management strategies, or technologies used in companies.

Future research directions may include extending the analysis to other industries and economic sectors to better understand the specifics of organizational agility and the challenges associated with the rational use of green energy in various contexts. Furthermore, research could focus on identifying specific management practices that support energy

efficiency gains and examining the impact of different business models on the adoption of sustainable strategies.

5. Conclusions

This study is based on data collected from Polish companies, which may limit the generalizability of the findings to other regions and cultural contexts. However, there are several reasons to suggest that the results could also be relevant in a broader, international context.

Firstly, the principles and practices related to developing agile employee competencies and the sustainable use of green energy have a universal character. Modern organizations around the world face similar challenges, such as the increasing environmental protection requirements, the need to improve energy efficiency, and the necessity to adapt to dynamically changing market conditions.

Secondly, the concept of organizational agility and the development of employee competencies in the context of efficient resource use are critical regardless of the specific cultural context. However, this requires the consideration of local factors, such as the differences in legal regulations, the availability of technology, and the level of environmental awareness among employees.

While the findings of this study are rooted in the Polish context, they could potentially be applied in other countries, especially in Central and Eastern Europe, where organizations face similar challenges related to sustainable development. Further research, taking regional diversity into account, could help adapt these findings to the specific needs and operational conditions of organizations in different parts of the world.

Focusing on employee competencies in the context of effectively utilizing green energy provides a valuable contribution to the literature. However, there is a need to expand the analysis to include other organizational factors, such as leadership styles and organizational culture, which may also significantly influence the successful implementation of green technologies. Including these additional variables could provide a more comprehensive view of how different aspects of organizational functioning impact the effective use of green energy.

Moreover, the cross-sectional nature of this study captures only a snapshot of reality at a specific point in time, which may not reflect the long-term impact of agile competencies on energy efficiency and sustainable development. Conducting longitudinal studies would be advisable to provide more robust conclusions regarding the sustainability and long-term effects of implementing agile practices in energy management.

This article could benefit from a more detailed discussion of its limitations, particularly concerning potential biases in survey responses and the challenges associated with measuring "agility" in a meaningful and consistent way across different organizations. It should be noted that variations in organizational structures, corporate cultures, and management approaches may lead to differences in the perception and evaluation of agility, which in turn could affect this study's results. Additionally, there is a risk that respondents may tend to provide answers that align with social or corporate expectations, which could distort the true picture of competencies and practices within organizations. Therefore, addressing and discussing these limitations could contribute to a better understanding and interpretation of the findings.

The research results on agile employee competencies and their impact on energy efficiency can be compared with the publications of other authors who also considered similar topics. For example, a study by Ebirim, Montero and Ani [55] highlights that teams equipped with the right skills and tools necessary to work in an agile environment can significantly contribute to innovations in energy efficiency. This coincides with research results that also indicate the benefits of developing agile competencies. In turn, the study by Kettunen and Laanti [56] highlights how agile transformation in organizations can improve resource management and increase their efficiency, which is consistent with the results regarding energy resources management. Both of these works provide valuable context

and confirm the importance of developing agile employee competencies in the context of energy efficiency.

A comparison of the research findings contained in this article with the work of Schuetze [57] could make a significant contribution to the discussion on the impact of political and economic factors on sustainable energy development.

In the article *The Use of Green Energy as a Determinant of the Sustainable Development of an Agile Organization*, the authors analyze how the development of employee competencies in agile organizations influences energy efficiency and sustainable development. This research shows that developing these competencies, such as time management, budget management, and the ability to implement multiple projects simultaneously, has a positive impact on the energy efficiency of an organization.

In the context of Schuetze's work, which focuses on the geopolitical and economic aspects of energy transition in Jordan, certain similarities can be observed. Schuetze emphasizes that decisions regarding energy transition are not made solely based on the availability of technology or resources but are strongly shaped by local and international political and economic conditions. In both cases, there is a common theme of integrating energy strategies with broader socio-economic factors.

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