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Dominik Zimon[1]
Marcin Jurgilewicz
Mariusz Ruszel

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INFLUENCE OF IMPLEMENTATION OF THE ISO 50001 REQUIREMENTS ON PERFORMANCE OF SSCM

Abstract: *The main purpose of the research was to determine to what extent the standardized energy management system according to ISO 50001 influences the improvement of processes implemented in supply chains operating in Poland and Slovakia. The research was based on a online survey. Survey recipients were representatives of the top management of the surveyed organizations. Based on the research and literature analysis, it can be concluded that the standardized energy management system has a positive impact on the improvement of the SCM. The considerations presented in the article should be helpful for enterprises and supply chains, whose representatives of the top management are considering implementing the requirements of the ISO 50001 standard. It is worth noting that the renowned literature on the subject lacks research and studies on the impact of the implementation of the ISO 50001 standard on the functioning of enterprises and supply chains in Eastern Europe. The obtained research results will therefore contribute to the development of the theory as they provide answers to new research questions and should prove useful for both practitioners and theorists.*

Keywords: *ISO 50001; Energy management system; SSCM.*

1. Introduction

Standardized management systems are very popular with that organizations that aim at improving their internal processes. The most popular of these systems are undoubtedly the quality management system according to ISO 9001 and the environmental management system according to ISO 14001. Both of these standards are universal and allow to improve enterprises and supply chains on many levels, focusing mainly on quality care, errors minimization and improving environmental aspects (Dellana & Kros, 2018; Zimon et al., 2018; Curkovic & Sroufe, 2011) These systems can be supplemented with the ISO 50001 standard, which - in its provisions - focuses on rational energy management and can be relatively easily integrated with the above-mentioned standards (Martínez-Perales et al., 2018; Karcher and Jochem, 2015). The ISO 50001 standard focuses mainly on determining the requirements for an energy management system that will allow the company to systematically strive for continuous improvement of energy efficiency, taking into account legal conditions and other requirements that the company should meet (Zsebik & Novák, 2018). The energy management system is particularly important in the energy-intensive industry or if it is necessary to meet the requirements and regulations regarding greenhouse gas emissions. The standard may function independently or may be integrated with other management systems (Poveda-

[1] Corresponding author: Dominik Zimon
Email: zdomin@prz.edu.pl

Orjuela et al., 2019). Therefore, it seems that nowadays, when the importance of the concept of sustainable development in the management of enterprises and supply chains is increasing, the implementation of the requirements of the ISO 50001 standard will be systematically increasing (Păunescu & Blid, 2016). Meanwhile, the number of implementations of its requirements in comparison with even the ISO 14001 standard is small (Uriarte-Romero et al., 2017). According to ISO Survey, in 2018, this standard was implemented by only 14,549 organizations around the world, including 139 Polish and 53 Slovak.

A relatively small number of implementations of the requirements of the ISO 50001 standard may wonder considering the benefits that an enterprise can obtain by deciding to implement its requirements. In the literature on the subject, the authors indicate that the ISO 50001 standard positively affects such aspects, including: reduction of energy consumption, reduction of the company's operating costs, reduction of the organization's negative impact on the natural environment as well as marketing and image considerations (da Silva Gonçalves et al., 2019; Lira et al., 2019; Chiu and Lo, 2015). In addition, Zsebik and Novák (2018), say that systematic approach to energy management in accordance with the baseline ISO 50001 provides an opportunity for a company to run its business in a way to aim for the most energy efficient operation with continuous improvement. This can lead to better sustainable business development and performance. In turn, Kanneganti et al., (2017) claim that energy management has become crucial for the industrial sector as a structured approach to lowering the cost of production and in reducing the carbon footprint. It is worth mentioning that unused energy is the cleanest method, without negative environmental effects, to improve energy efficiency and at the same time it is the most cost-effective way to reduce energy costs (Tallini & Cedola, 2016; Dzene et al., 2015).

Investments affecting the rationalization of energy consumption can cause positive effects both at the level of an individual organization, guaranteeing its reduction of costs and improvement of the company's image, but also used on a larger scale, may be of significance at the national level, contributing to the increase of competitiveness of entire supply chains (Chrysikopoulos & Chountalas, 2018).

2. Literature Review

Now more than ever, SSCM is a prerequisite for developing effective business models aligned with long-term goals. However, it should be emphasized that this paradigm is complex and requires a departure from random and reactive activities. Managers need to focus on comprehensive management including social, economic and ecological performance (Zimon et al., 2020; Ansari et al., 2017). Observing global trends, it can be assumed that the implementation of the concept of sustainable development will continue to be one of the main goals of enterprises operating in supply chains. Relevant legal regulations and operational programs adopted by the European Union will increasingly stimulate the interest of enterprises in implementing and certifying environmental management systems and energy management (Foerstl et al., 2015; Straka et al., 2018). There is a fairly large number of studies in the subject literature covering the impact of implementing the ISO 14001 standard on sustainable supply chain management (Tay et al., 2018; Tuczek et al., 2018; Seman et al., 2019; Sroufe, and Curkovic, 2008; Graafland, 2018). There are also several studies addressing the impact of the ISO 50001 standard on business management (Karcher and Jochem, 2015; Poveda-Orjuela et al., 2019). However, there is no research on the impact of the ISO 50001 standard on the functioning of supply chains. In addition, based on an analysis of the literature, we find that reputable journals lack research on energy management systems in

Eastern Europe. Therefore, there is a research gap that is worth filling, because despite the fact that in Eastern Europe still a small percentage of organizations implement energy management systems, there is no doubt that pro-environmental activities are increasingly being implemented in Polish and Slovak enterprises (Zimon et al., 2020; Straka et al., 2019).The business sector is slowly beginning to treat such activities not only as costs resulting from the fashion for "ecological activities", but primarily as investments that can bring measurable benefits in the future, so it can be assumed that in the long run environmental management, including energy management, will be an inseparable element of managing each organization, and energy management systems will become the applicable standard (Malá et al., 2017; Koszarek-Cyra, 2016; Zgodavova et al., 2017; Zimon, 2019). On this basis, it can be assumed that there is a business demand for research on the impact of the ISO 50001 standard on the implementation of key processes in enterprises and supply chains.

Considering the above-mentioned facts, the main purpose of the research was to determine the impact of implementing the requirements of ISO 50001 on improving selected processes in supply chains operating in Eastern Europe. The choice of purpose was dictated by the following premises:

- There is no research in the literature on the effects of implementing the requirements of ISO 50001 (especially in Eastern Europe),
- A small number of system implementations in Eastern Europe,
- Lack of considerations in the literature regarding the legitimacy of implementing the requirements of ISO 50001 in the context of SCM.

3. Research Methodology

The main purpose of the research was to determine to what extent the standardized energy management system according to ISO 50001 influences the improvement of processes implemented in supply chains operating in Poland and Slovakia.

This study was guided by the following exploratory open-ended research questions:

RQ1. To what extent do organizations that have implemented an energy management system according to ISO 50001 determine its impact on improving selected aspects of SSCM?

RQ2. Do organizations that have decided to implement the requirements of ISO 50001 recommend its implementation?

The research process covered 18 companies (operating in Poland and Slovakia) that implemented the ISO 50001 standard. The research process was conducted in December 2019. The research was based on a online survey. Survey recipients were representatives of the top management of the surveyed organizations. An overview of the main characteristics of these variables is given in Table 1.

Table 1. Main characteristics of variables

Question/ Variable	Abbreviation	Answers
Lowering costs	Costs	Scale from 1 (completely disagree) to 7 (completely agree)
Improving the image	Image	
Increase in employees' ecological awareness	Eco_awareness	
Improving the efficiency of distribution processes	Process_eff	
Reducing the negative impact on the environment	Neg_reduction	
Meeting the expectations of external stakeholders	Ext_stakehold_ exp	

The results were processed in two levels. Descriptive and graphical statistics tools were used in the first basic level. In the second

advanced level, the correlation between variables was examined through a bivariate correlation analysis.

4. Results

4.1. Basic analysis

The first stage of the research process was to determine how respondents perceive the impact of implementing the requirements of the ISO 50001 standard on improving selected aspects of enterprise management and the supply chain. Respondents rated the following aspects:

- Lowering costs: reducing the costs of energy consumption and implementation of logistical processes in supply chains,
- Improving the image: the impact of implementing ISO 50001 on improving the image of the organization in the eyes of clients and colleagues in the supply chain,
- Increase in employees' ecological awareness: increasing employees' awareness of issues related to energy saving and sustainable development,
- Improving the efficiency of distribution processes: increasing the efficiency of distribution processes implementation,
- Reducing the negative impact on the environment: the impact of ISO 50001 on the implementation of environmental solutions in the enterprise and the supply chain,
- Meeting the expectations of external stakeholders: ISO 50001 and better understanding and implementation of solutions expected by external stakeholders.

Fig. 1 and Fig. 2 present the general distribution of answers. Responses were rated on a 7-point scale from 1 no impact to 7 very strong impacts.

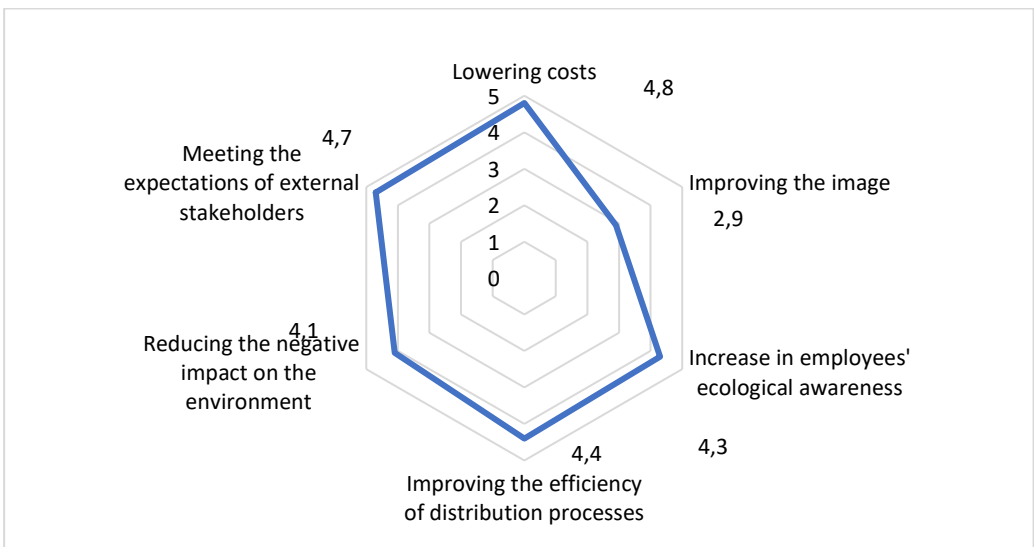

Figure 1. Averaged results of individual aspects

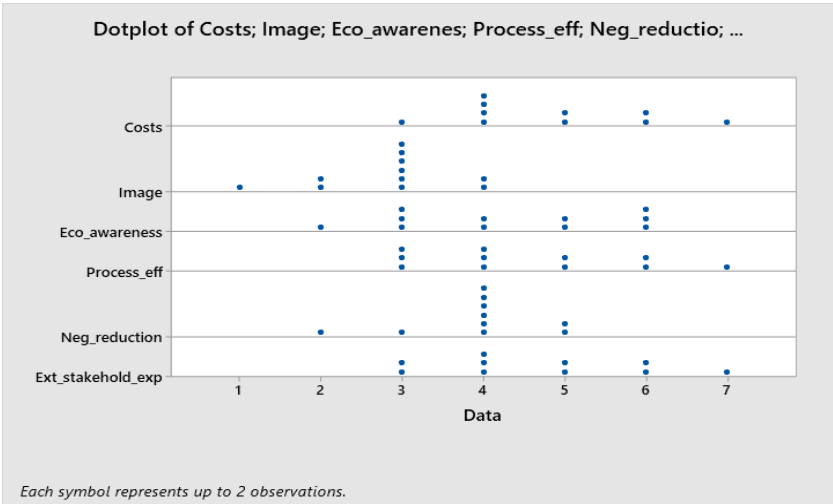

Figure 2. Distribution of the answers received

When analyzing the results presented in Fig. 1 and Fig. 2, it can be concluded that respondents perceive the positive impact of implementing the requirements of the ISO 50001 standard on improving the examined aspects. The average rating of six aspects examined was 4.2 on a seven-point scale, which can be considered a relatively good result. When reviewing the distribution of answers presented in Fig. 2, it can be seen that among the ratings, the dominating groups are 3 and 4. It is also noteworthy that a certain proportion of respondents gave a high rating of 6.

Basic descriptive statistics are presented in Fig. 3 and in Table 2.

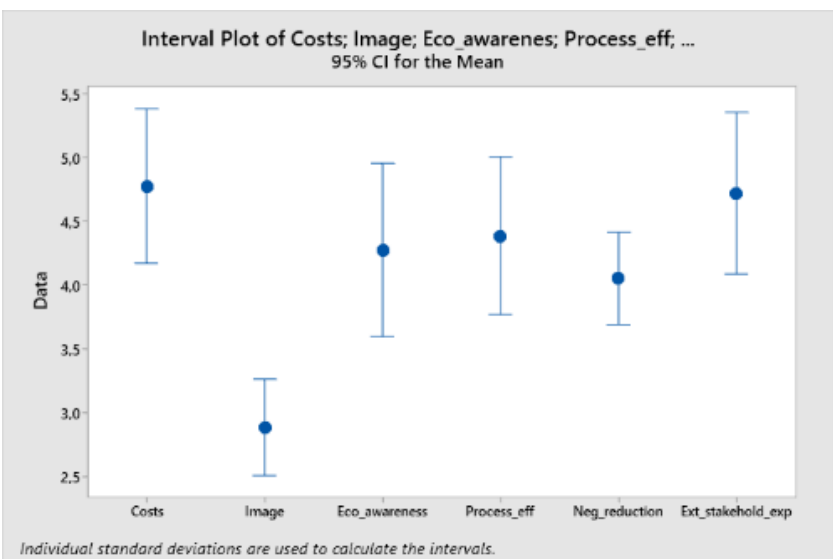

Figure 3. Evaluation of individual aspects

Table 2. Basic descriptive statistics

Variable	Mean	SE Mean	TrMean	StDev	Skewness	Kurtosis
Costs	4,778	0,286	4,750	1,215	0,48	-0,62
Image	2,889	0,179	2,938	0,758	-0,72	1,25
Eco_awareness	4,278	0,321	4,313	1,364	0,06	-1,49
Process_eff	4,389	0,293	4,313	1,243	0,60	-0,60
Neg_reduction	4,056	0,171	4,125	0,725	-1,13	3,13
Ext_stakehold_exp	4,722	0,300	4,688	1,274	0,40	-0,76

When reviewing the above data, it can be concluded that, according to respondents, a standardized energy management system has the greatest impact on:

- Lowering costs (4.8): The purpose of the ISO 50001 standard is to optimize energy consumption while maintaining the continuity and quality of business operations. The implementation of a standardized energy management system necessitates the planning of energy consumption and the establishment of a system for its monitoring and control, which allows conscious and real management of energy consumption (Bernhardt and Böttner, 2017). The requirements of ISO 50001 oblige management representatives to locate devices and processes consuming the largest amounts of energy and to introduce optimization and improvement actions. These measures can therefore effectively reduce energy costs.
- Meeting the expectations of external stakeholders (4.7): Implementation of the requirements of ISO 50001 forces the organization to go beyond its own energy needs and take into account external requirements and threats. Threats and opportunities should be seen as higher-level strategic directions so that energy management principles become an integral part of the organization's structure. Therefore, the requirements and expectations of external stakeholders can be more effectively incorporated into enterprise strategy planning processes.

According to the respondents the implementation of the requirements of ISO 50001 also significantly improves aspects such as: improving the efficiency of distribution processes (4,4), increase in employees' ecological awareness (4,3) and reducing the negative impact on the environment (4 1). The ISO 50001 standard is based on continuous improvement of the system, which has a direct impact on improving the company's energy efficiency. In addition, the implementation of the standard may contribute to reducing CO2 emissions. This is not only environmentally friendly, but also allows you to adapt to the legal requirements related to this issue. The principles of the energy management system can also be implemented simultaneously with other systems, which in effect allows for an overall improvement in the functioning of the organization. Supplementing the requirements of the ISO 50001 standard with systems such as ISO 9001 and ISO 14001 allows to obtain an integrated management system based on employee involvement, customer care, the environment and improvement of key processes in the organization and supply chain. It is worth mentioning that the ISO 50001 standard itself also increases the emphasis on continuous improvement of energy efficiency and strengthening the commitment of management and employees. In the opinion of Laskurain et al. (2019), this standard has an

impact on efficiency and minimization of energy costs, thanks to which organizations will limit the impact of their activities on the environment and become more competitive.

Definitely the lowest respondents rated the impact of implementing the requirements of ISO 50001 on marketing considerations. An average rating below 3 suggests that having a standardized energy management system is not a significant marketing asset. This may be due to the fact that, although the ISO 50001 standard is not very popular, standardized management systems according to ISO standards (especially ISO 9001 or 14001) are now common and considered to be a certain binding standard rather than an element distinguishing a given company on the market (Zimon et al., 2020).

4.2. Bivariate correlation

Statistically significant relationships are those in which p-value is less than 0.05. The intensity of particular relationship are quantified via Pearson linear correlation, coefficient r, which can fall into interval <-1 ; 1>.

If we look at Fig. 4 and Table 3 (Appendix) we can identify one significant relationships: Image/Costs (r=0.482; p=0.043). It should be noted, that reliability of results of correlation analysis is affected by sample size. Bigger sample size can produce more reliable results and some borderline relationship, in which p-value is slight above 0.05.

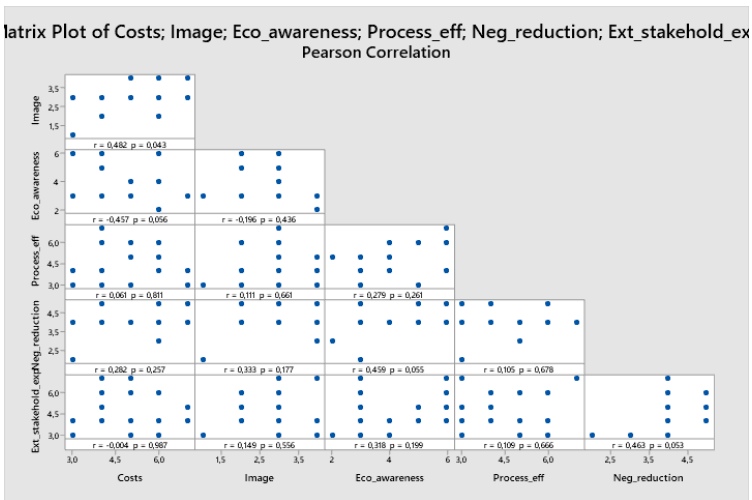

Figure. 4. Matrix Pearson Correlation

4.3. The legitimacy of implementing ISO 50001

Respondents were also asked the question whether the energy management system is effective and effective enough to consider its implementation in the context of improving processes in the organization and supply chain? The answers to this question are presented in Fig. 5.

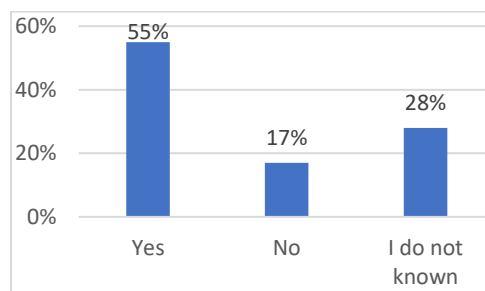

Figure 5. Is the implementation of ISO 50001 in companies needed?

When reviewing the distribution of responses presented in Fig. 5, it is noted that more than half of the respondents recommend implementing the requirements of the ISO 50001 standard. Only 17% of respondents do not consider the implementation of a standardized energy management system to be necessary. A fairly large group of respondents (28%) could not determine whether this system is recommendable. It certainly has some advantages, which were discussed in the previous part of the article, but like any formalized management system, it has disadvantages, which overcoming at the stage of implementation and improvement of the system determines its subsequent effectiveness and efficiency (Prashar, 2017). The labor and time consuming required for proper implementation and development of the system may affect the fact that some respondents are not willing to clearly assess whether it is worth implementing such a system.

5. Discussion

According to Mengha and co-authors (2019) and Böttcher and Müller (2016), the need to mitigate the negative impact of production and logistics processes on the environment nowadays makes energy efficiency one of the key factors of sustainable management. Enterprises and supply chains must therefore seek solutions to optimize energy consumption (Benedetti et al., 2017; Fonseca et al., 2018; Javied et al., 2015). It should be emphasized that rational energy management in enterprises cannot be incidental, one-off, but should be a systemic process. Only then can enterprises and supply chains implement the adopted strategy and implement systematic improvement and repair actions. According to many researchers (Chrysikopoulos and Chountalas, 2016; Gueorguiev, 2016, Majernik et al., 2014) the ISO 50001 standard can be a good tool to stimulate the implementation of best practices in energy management. The research results presented in this article seem to confirm this thesis. The conducted research process allowed to state that the implementation of the requirements of the ISO 5001 standard leads, among others to reduce the cost of implementing key processes, stimulates the implementation of environmentally friendly solutions and helps meet the requirements of external stakeholders. Zsebik and Novák (2018) speak in a similar tone, recognizing that the systematic approach to energy management in accordance with the baseline ISO 50001 provides an opportunity for a company to run its business in a way to aim for the most energy efficient operation with continuous improvement . This can lead to better sustainable business development and performance. In turn, Meshcheryakova et al. (2018) emphasizes that the savings resulting from the introduction of the ISO 50001 energy management system also allow for increased competitiveness on the market. Energy costs are usually a significant element of the budget and have a significant impact on the price of the final product.

Ochoa et al., (2019) found that most of the characterized industries have measurement deficiencies, lack of company policies that prioritize energy efficiency, and continuous improvement of energy performance concerning the production process. They also recognize that the implementation of the ISO 50001 standard allows achieving significant savings in production and distribution processes without having to invest in new technologies. These suggestions are confirmed by the research carried out in this article.

Despite a number of advantages, the ISO 50001 standard is still relatively rarely implemented in enterprises operating in Eastern Europe. The research shows that slightly more than half of the surveyed organizations decided to recommend the implementation of the requirements of the ISO 50001 standard. It is worth mentioning that there are also studies in the literature which negate the positive impact of implementing the requirements of the ISO 50001 standard on improving even financial

results (Pham, 2015). The difference of opinions in the literature and the different assessment of the effectiveness of systems may result from mistakes made at the stage of their implementation and improvement. As Cooper (2016) rightly notes, standardized management systems must be properly designed, implemented and improved, without continuous work and a comprehensive approach to improvement, the management system according to ISO 50001 will not function properly. Enterprises implementing the requirements of ISO 50001 may encounter a number of difficulties such as: lack of properly trained staff, problems in developing documentation or lack of commitment from management (Rampasso, et al., 2019). These are not the problems assigned only to the ISO 50001 standard but to most standardized management systems (Zimon & Dellana, 2020, Fonseca & Domingues, 2018). Therefore, it seems that the requirements of the ISO 50001 standard in the coming years will be implemented in organizations that successfully use more popular standardized systems (such as ISO 9001 and 14001) and are looking for solutions enabling the development of an integrated management system towards improving energy efficiency (Hernandez-Vivanco et al., 2019). This is a good way because, according to Laskurain et al., (2017) these systems support each other and their implementation can cause synergistic effects without generating significant additional costs.

5.1. Implication and limitations

The considerations presented in the article should be helpful for enterprises and supply chains, whose representatives of the top management are considering implementing the requirements of the ISO 50001 standard. It is worth noting that the renowned literature on the subject lacks research and studies on the impact of the implementation of the ISO 50001 standard on the functioning of enterprises and supply chains in Eastern Europe. The obtained research results will therefore contribute to the development of the theory as they provide answers to new research questions and should prove useful for both practitioners and theorists. The authors hope that the considerations made in the article will at least partly fill the gap that exists in the area of research on the impact of implementing the requirements of ISO 50001 on the energy efficiency of enterprises and supply chains.

The main limitations of the conducted tests are the small sample size (resulting from a small number of implementations of the ISO 50001 standard) and the narrowing of the tests to two countries. For these reasons, the research results cannot be generalized and should be treated as preliminary and pilot studies. Therefore, there is a need to conduct further research in this area on a larger research group and a wider geographical coverage. It seems reasonable to conduct research in Western and Central Europe and compare the results with those obtained in this publication. Despite this, the research can be considered as an important contribution to fill the gap that undoubtedly exists in the area of research on the impact of the implementation of the ISO 50001 standard on the functioning of enterprises and supply chains in Eastern Europe.

6. Conclusions

Based on the research and literature analysis, it can be concluded that the standardized energy management system:

- has a positive impact on the improvement of the aspects examined (the average rating of the six aspects examined was 4.2 on a seven-point scale),
- contributes to the greatest reduction of costs and meeting the requirements of external stakeholders,
- in the opinion of most respondents, there is no noticeable marketing effect,

- requires a lot of work related to its proper implementation and improvement,
- is recommended by 55% of surveyed organizations,
- can be support for more popular management systems such as ISO 9001 or ISO 14001.

Considering the above information and the fact that external consumers and stakeholders are increasingly taking into account the issue of sustainable development when making purchasing decisions, it may be assumed that standardized energy management systems will gain popularity over time. At present, in Eastern Europe, considerations on the efficiency and effectiveness of energy management systems according to ISO 50001 (perhaps due to the relatively small number of implementations) are not very often the topic of scientific articles. Perhaps the considerations undertaken in this article will stimulate a wider discussion on the legitimacy of the implementation and the impact of ISO 50001 on the implementation of key processes in enterprises and supply chains. The authors intend to continue research on a larger scale and popularize the subject of standardized energy management systems.

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Domnik Zimon
Rzeszow University of Technology,
Rzeszow,
Poland
zdomin@prz.edu.pl

Marcin Jurgilewicz
Rzeszow University of Technology,
Rzeszow,
Poland
m.jurgilewicz@prz.edu.pl

Mariusz Ruszel
Rzeszow University of Technology,
Rzeszow,
Poland
mruszel@prz.edu.pl

Appendix

Table. 3 Pairwise Pearson Correlations

Sample 1	Sample 2	N	Correlation	95% CI for ?	P-Value
Image	Costs	18	0,482	(0,020; 0,775)	0,043
Eco_awareness	Costs	18	-0,457	(-0,762; 0,012)	0,056
Process_eff	Costs	18	0,061	(-0,418; 0,513)	0,811
Neg_reduction	Costs	18	0,282	(-0,213; 0,662)	0,257
Ext_stakehold_exp	Costs	18	-0,004	(-0,470; 0,464)	0,987
Eco_awareness	Image	18	-0,196	(-0,607; 0,298)	0,436
Process_eff	Image	18	0,111	(-0,375; 0,549)	0,661
Neg_reduction	Image	18	0,333	(-0,159; 0,692)	0,177
Ext_stakehold_exp	Image	18	0,149	(-0,342; 0,576)	0,556
Process_eff	Eco_awareness	18	0,279	(-0,215; 0,660)	0,261
Neg_reduction	Eco_awareness	18	0,459	(-0,010; 0,763)	0,055
Ext_stakehold_exp	Eco_awareness	18	0,318	(-0,175; 0,683)	0,199
Neg_reduction	Process_eff	18	0,105	(-0,380; 0,545)	0,678
Ext_stakehold_exp	Process_eff	18	0,109	(-0,377; 0,548)	0,666
Ext_stakehold_exp	Neg_reduction	18	0,463	(-0,005; 0,765)	0,053