

Dominik Zimon¹,
Peter Madzik²

Impact of Implementing ISO 14001 Standard Requirements for Sustainable Supply Chain Management in the Textile Industry

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¹Rzeszow University of Technology,
Department of Management Systems and Logistics,
al. Powstańców Warszawy 12,
35-959, Rzeszow, Poland,
e-mail: zdomin@prz.edu.pl

²Catholic University,
Department of Management,
Ruzomberok, Slovakia,
e-mail: peter.madzik@gmail.com

Abstract

The main objective of the study was to determine the effect of the implementation of the requirements of the ISO 14001 standard on creating sustainable supply chains in the textile industry. The research process was conducted in 2018. It was preceded by an extensive literature review of sustainable development and quality management as well as the supply chain. The research tool was a questionnaire sent to top management representatives of organisations operating in south-eastern Poland and Slovakia who possess a certified system according to ISO 14001. However, analysis of the results does not allow to give clear answers to the research questions. Although the majority of respondents noted a positive impact of the implementation of ISO 14001 on improving environmental actions in the supply chain, its impact on the creation of sustainable supply chains is not so obvious. Based on our research, organisations will be able to more consciously decide on the implementation of the ISO 14001 standard requirements.

Key words: textile industry, SSCM, ISO 14001.

Introduction

The textile industry, due to its specificity, is constantly seeking consumer interest and is under pressure to increase the speed of customer service. However, it is particularly susceptible to irregularities at the various stages of supply chain operation [10]. Unethical attitudes and practices threatening the environment are relatively often observed in the links that co-create the supply chains in the industry discussed [18]. Thus, it can be concluded that the implementation of sustainable solutions is a challenge that companies in the textile industry must face today. The sustainable management of supply chains is expected not only by legislators but more and more often by consumers, who are becoming more and more aware [14] and acquire textiles and clothing based on the analysis of information on production methods and conditions [11]. With this in mind, companies operating in the textile industry while developing supply chain management strategies must consider not only economic issues [15] but also social and environmental ones, emphasising, the following among others:

- cooperation with reliable and certified suppliers,
- transparency of supply chains,
- recycling development,

- using environmentally friendly materials,
- compliance with social and environmental standards by organisations co-creating supply chains,
- respect for human rights and labour rights in the supply chain,
- monitoring environmental behaviour,
- defined environmental policy consistent with the long-term strategy of the supply chain.

Implementation of the solutions above is a complex process and requires the development of a comprehensive supply chain management strategy. According to the authors of this publication, the first stage of creating sustainable solutions in the supply chain may be the implementation of the ISO 14001 standard, which in its area of interest includes managing the side effects of the activities conducted, such as waste, sewage, gas emissions, sustainable and economical use of materials and energy, etc. The ISO 14001 environmental management system can therefore be considered as an integral part of the overall enterprise management system, including the organisational structure, planning, responsibility, rules of conduct, procedures, processes and resources needed to establish, implement, review and improve environmental policy [8, 19]. Therefore, it is stated that the ISO 14001 standard has many features in common with the ISO 9001 standard [1, 13] and that this standard allows to develop a strategy within which environmental issues are gradually in-

troduced into the everyday activities of organisations co-creating supply chains [7, 9]. It should be emphasised that an efficient environmental management system not only has an economical effect on supply chains but also increases their contribution to the implementation of global environmental policy [16]. In the literature on the subject there are studies in which the impact of implementing the requirements of ISO 14001 on the functioning of supply chains in various industries has been studied. They show that the ISO 14001 standard positively affects the implementation of environmental aspects in supply chains [3, 6, 23, 26]; although it is not free of defects [4].

According to the authors, however, there is not enough research regarding the impact of implementing the ISO 14001 standard on creating sustainable solutions in the textile supply chain. In view of this fact and the considerations above, the purpose of the publication is relate research conducted and deliberations made in this area that would fill the existing research gap to some extent.

Research methodology

The aim of this research was to determine the impact of the implementation of the ISO 14001 standard requirements on creating sustainable supply chains in the textile industry. The explanation of such a generally outlined research problem as well as more detailed research issues prompted the authors to formulate the following research questions:

- How is the ISO 14001 standard perceived by organisations that co-create supply chains in the textile industry?
- Is the ISO 14001 standard considered a suitable tool for building pro-ecological strategy in supply chains in the textile industry?
- How do the respondents evaluate the impact of implementing the ISO 14001 standard requirements on the implementation of processes contributing to the sustainable management of supply chains?

The research process was conducted in 2018. It was preceded by an extensive literature review of sustainable development and quality management as well as the supply chain. In the research process, the focus was on the analysis of the ISO 14001 standard, which is relatively popular among Polish and Slovak organisations (according to an ISO survey in 2017, this norm was possessed by 2885 organisations in Poland and 1485 in Slovakia). The ISO 14001 standard specifies important pro-ecological processes that should be implemented and described in the system procedures. It is assumed that the development of these procedures and their implementation in supply chains may, to some extent, positively affect the creation of their sustainable development through [24, 25]:

- making identification and assessment of environmental aspects,
- shaping pro-quality habits among employees,
- improvement of forms of communication (external and internal),
- operational control in significant environmental aspects,
- identification of potential threats and failures,
- monitoring of parameters having an impact on the environment,
- assessment of compliance of the activities carried out with the applicable law.

The research tool was a questionnaire sent to top management representatives of organisations operating in south-eastern Poland and Slovakia who operate a certified quality management system according to ISO 14001. Properly completed survey forms were obtained from 28 organizations (19 Polish and 9 Slovak). More than one form (filled in by several members of the board) was obtained from 14 companies. As a result, 43 respondents were involved in the research process.

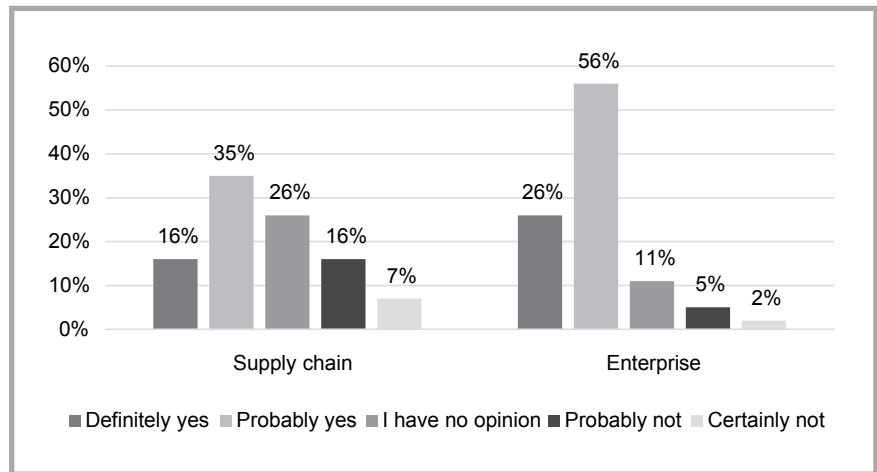


Figure 1. Does the ISO 14001 standard have a positive impact on improving the environmental performance of the company and supply chain? **Source:** own research results.

Table 1. Tests of normality. **Note:** ^a Lilliefors Significance Correction.

Variables and characteristics	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Saving of raw materials and energy	0.279	43	0.000	0.781	43	0.000
Increase in environmental awareness	0.307	43	0.000	0.839	43	0.000
Ethical leadership	0.309	43	0.000	0.733	43	0.000
Rationalisation of reverse logistics	0.219	43	0.000	0.876	43	0.000
Design of products taking into account environmental aspects	0.224	43	0.000	0.876	43	0.000
Corporate green image management	0.235	43	0.000	0.869	43	0.000
Time of functioning of ISO 14001 (years)	0.265	43	0.000	0.788	43	0.000
Impact of ISO 14001 on the improvement of SSCM	0.251	43	0.000	0.869	43	0.000

Presentation and discussion of research results

Variables and characteristics were evaluated by Kolmogorov-Smirnov and Shapiro-Wilk tests. Results of data exploration are shown in **Table 1**.

Both tests show that the distributions of all variable are normal, and therefore the parametric test should be used in further investigations.

The purpose of the first two questions was to determine how the representatives of the organisations surveyed assess the impact of implementation of the ISO 14001 standard requirements on the implementation of sustainable solutions in their enterprise and supply chain (**Figure 1**).

The distribution of responses shows that according to the majority of respondents, the implementation of the ISO 14001 standard has a positive impact on the implementation of pro-ecological solutions in the enterprise (82% of respondents). Enterprises in which no positive results have been noticed are

in an extreme minority (only 7% of respondents). However, the respondents were not so unanimous in assessing the impact of the implementation of the standard discussed on the creation of sustainable supply chains. Slightly more than half of respondents (51%) consider the ISO 14001 standard to be helpful in sustainable supply chain management, while 23% of respondents did not notice a positive impact in this aspect. The results obtained are confirmed in the work of authors dealing with research on the functionality of the ISO 14001 standard [4]. The research and analysis of the literature presented show that enterprises have problems with the implementation of the pro-ecological strategy in the entire supply chain. It is therefore necessary to develop models that will support the integration process and make it easier for business representatives to transfer the patterns developed in their own organisation to the entire supply chain. Summing up, it can be stated that the ISO 14001 standard works well in individual organisations, but translating its guidelines to other links co-creating supply chains is a problem for half of the respondents

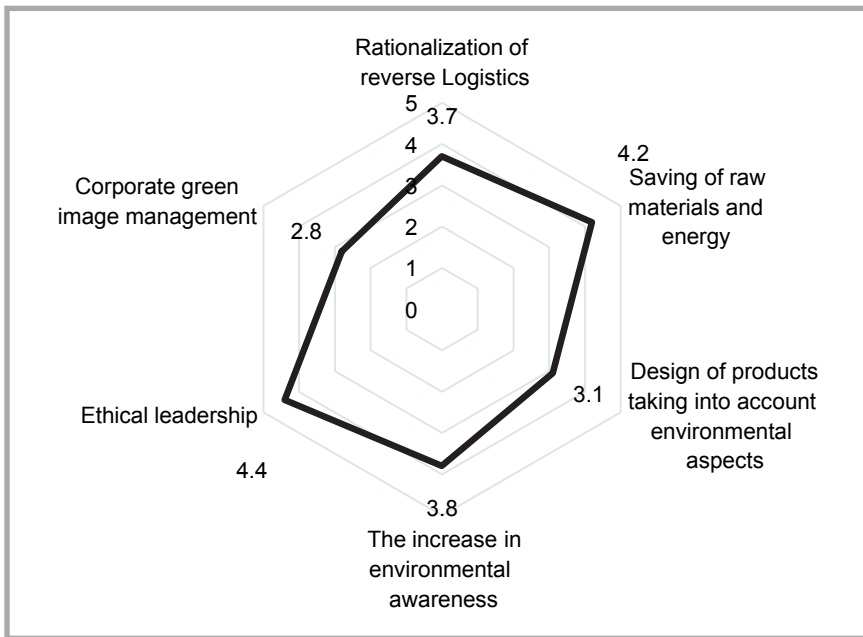


Figure 2. Impact of the ISO 14001 standard on the improvement of selected processes in SSCM. Source: own research results.

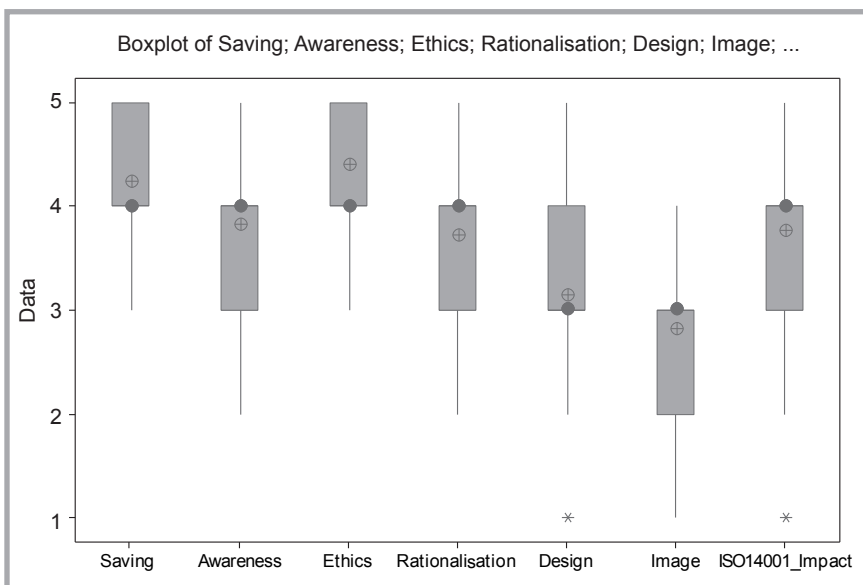


Figure 3. Evaluation of individual aspects.

and requires the development of comprehensive solutions in this respect. This problem may result from the specificity of the textile industry, which consists of a: strong dispersion of individual links in the supply chain resulting from efforts to minimise labour and production costs, the widespread adoption of the outsourcing of finished products far away from sales markets, problems with managing the return of post-seasonal clothing items, and implementation of the Fast Fashion strategy, which is based on maximum shortening of the product flow time in supply chains [27].

The assumption of the next question was an attempt to identify the impact of the ISO 14001 standard on the improvement of 6 selected aspects of sustainable supply chain management. The mutual relationships between these 6 aspect were examined by factor analysis with the principal component extraction method and Varimax rotation. The Keiser-Meier-Olking measure only reaches the value -0.496 . From these statistics we can deduce that the 6 aspects (variables) selected are relatively independent. The average levels of these aspects are shown in *Figure 2*, and the variability can be seen in *Figure 3*.

According to the respondents, the ISO 14001 standard has the greatest impact on the following:

- **Ethical leadership (4,4):** the high price of this aspect may be due to the fact that management standards require top management to be fully committed to the implementation of environmental policy and objectives. In addition, management representatives are required to take responsibility for the processes carried out in enterprises. Compliance with the guidelines of the ISO 14001 norm affects not only the implementation of environmental activities within its own enterprise, but may also have an impact on the establishment of behaviour patterns and desirable pro-social and pro-environmental attitudes in the supply chain [22].
- **Saving of raw materials and energy (4,2):** The ISO 14001 standard in this aspect introduces the scope of its regulation, including streamlining activities leading to the minimisation of material and energy consumption and the maximum use of recycling. Moreover, it recommends developing an environmental policy that is consistent with the company's long-term strategy and identifying programs to minimise environmental risks for specific activities of enterprises co-created by the supply chain. This standard also obliges management to define a control concept of risk response. In the opinion of respondents, these activities significantly contribute to the implementation of pro-ecological activities.

Implementation of the ISO 14001 standard also has a noticeable effect on:

- **The increase in environmental awareness (3,8):** organisations that apply this standard in their strategy take into account the need to consider environmental issues throughout the product life cycle. These practices should be implemented jointly with suppliers [5, 21] and promote pro-ecological solutions among customers and the co-creating chains of supply chains.
- **Rationalisation of reverse logistics (3,7):** the relatively high impact of the implementation of ISO 14001 requirements on the improvement of reverse logistics is extremely important as waste reduction has become one of the main areas of interest for science in industrialised countries [2].

Table 2. Correlation matrix of selected variables. *Source:* own research results.

		Saving of raw materials and energy	The increase in environmental awareness	Ethical leadership	Rationalisation of reverse Logistics	Design of products taking into account environmental aspects	Corporate green image management	Time of functioning of ISO 14001 (years)	Impact of ISO 14001 on the improvement of SSCM
Saving of raw materials and energy	Pearson Correlation	1	0.281	0.055	0.343	-0.051	0.064	-0.161	0.044
	p-value		0.068	0.728	0.025	0.745	0.682	0.302	0.78
The increase in environmental awareness	Pearson Correlation	0.281	1	0.056	0.576	0.071	0.27	-0.156	0.065
	p-value	0.068		0.723	0	0.651	0.08	0.317	0.679
Ethical leadership	Pearson Correlation	0.055	0.056	1	0.117	-0.165	0.24	0.182	0.131
	p-value	0.728	0.723		0.456	0.29	0.122	0.243	0.403
Rationalization of reverse Logistics	Pearson Correlation	0.343	0.576	0.117	1	0.139	0.05	-0.112	0.033
	p-value	0.025	0	0.456		0.373	0.751	0.475	0.836
Design of products taking into account environmental aspects	Pearson Correlation	-0.051	0.071	-0.165	0.139	1	0.134	-0.12	-0.174
	p-value	0.745	0.651	0.29	0.373		0.393	0.442	0.265
Corporate green image management	Pearson Correlation	0.064	0.27	0.24	0.05	0.134	1	0.059	-0.055
	p-value	0.682	0.08	0.122	0.751	0.393		0.709	0.728
Time of functioning of ISO 14001 (years)	Pearson Correlation	-0.161	-0.156	0.182	-0.112	-0.12	0.059	1	0.604
	p-value	0.302	0.317	0.243	0.475	0.442	0.709		0
Impact of ISO 14001 on the improvement of SSCM	Pearson Correlation	0.044	0.065	0.131	0.033	-0.174	-0.055	0.604	1
	p-value	0.78	0.679	0.403	0.836	0.265	0.728	0	

Due to legal, economic and technical limitations, enterprises are looking for new solutions that would enable reuse of already used products and regain their value [20, 25]. According to the respondents, compliance with the requirements of environmental standards limits the amount of waste and selectively storing it and reduces the costs associated with the recovery and management of waste.

According to the respondents, the impact of the ISO 14001 standard is small on the other two aspects examined. Hence, it can be concluded that implementation of the ISO 14001 standard requirements has a relatively significant impact on the improvement of the aspects examined (the average score was 3.7 on the 5-point scale). However, the scale of assessments is quite diverse (which can be seen in *Figure 3*), and thus the requirements of the ISO 14001 standard can be considered as complementary to the strategy implemented, and for the purpose of comprehensive development they should be supported by instruments, systems and methods used to improve technological, marketing and social processes.

The next stage of the research process was to determine the relationship that occurs between the aspects studied (*Table 2*). The mutual relationship was examined by bivariate correlation analysis (linear Pearson correlation).

Analysis of data contained in *Table 1* allows to state that there exist three statistically significant relationships, which are stated in bullet form:

- Saving of raw materials/energy and rationalization of reverse logistics.

As already indicated in this publication, the implementation of ISO 14001 requirements supports organisations and supply chains in terms of emissions of pollutants and waste, as it places particular emphasis on the principles of supervision over activities that have an impact on the environment. The advantage of implementing the ISO 14001 system is the promotion of environmental awareness among company employees, as well as building a positive image of the organization among business partners and the public. These activities can significantly affect the improvement of reverse logistics, the proper functioning of which is so important in the textile industry.

- Time of functioning of ISO 14001 (years) and impact of ISO 14001 on the improvement of SSCM.

Thus, it can be assumed that ISO 14001 over time has a more positive impact on the improvement of the supply chain. In order to deepen the research process, ANOVA was performed. The enterprises surveyed were divided into three groups according to the time that had passed since the implementation of the requirements of ISO 14001: with low

experience (1 to 3 years), with medium experience (4 to 6 years) and with a high level of experience (7 to 10 years). Each organisation assessed the impact of the ISO 14001 standard on the improvement of SSCM (on a 5-point scale – the more points, the higher the score). The results obtained are presented in *Figure 4*.

Analysis of the data contained in *Figure 4* shows that enterprises in which the environmental management system operates longer positively assess its impact on the improvement of sustainable supply chain management. Therefore, it can be concluded that the implementation and continuous improvement of environmental management systems over a longer time span noticeably supports the functioning of supply chains in the textile industry.

The last question was formulated as follows: In your opinion, is the ISO 14001 standard an appropriate tool for creating a sustainable supply chain? The distribution of responses is contained in *Figure 5*.

Analysis of the distribution of responses does not allow to answer the question formulated in this way. Although the majority of respondents (46%) considered that implementing the requirements of ISO 14001 to a very large or large extent affects the creation of a sustainable supply chain, the number of indications is not convincing. The quite large group

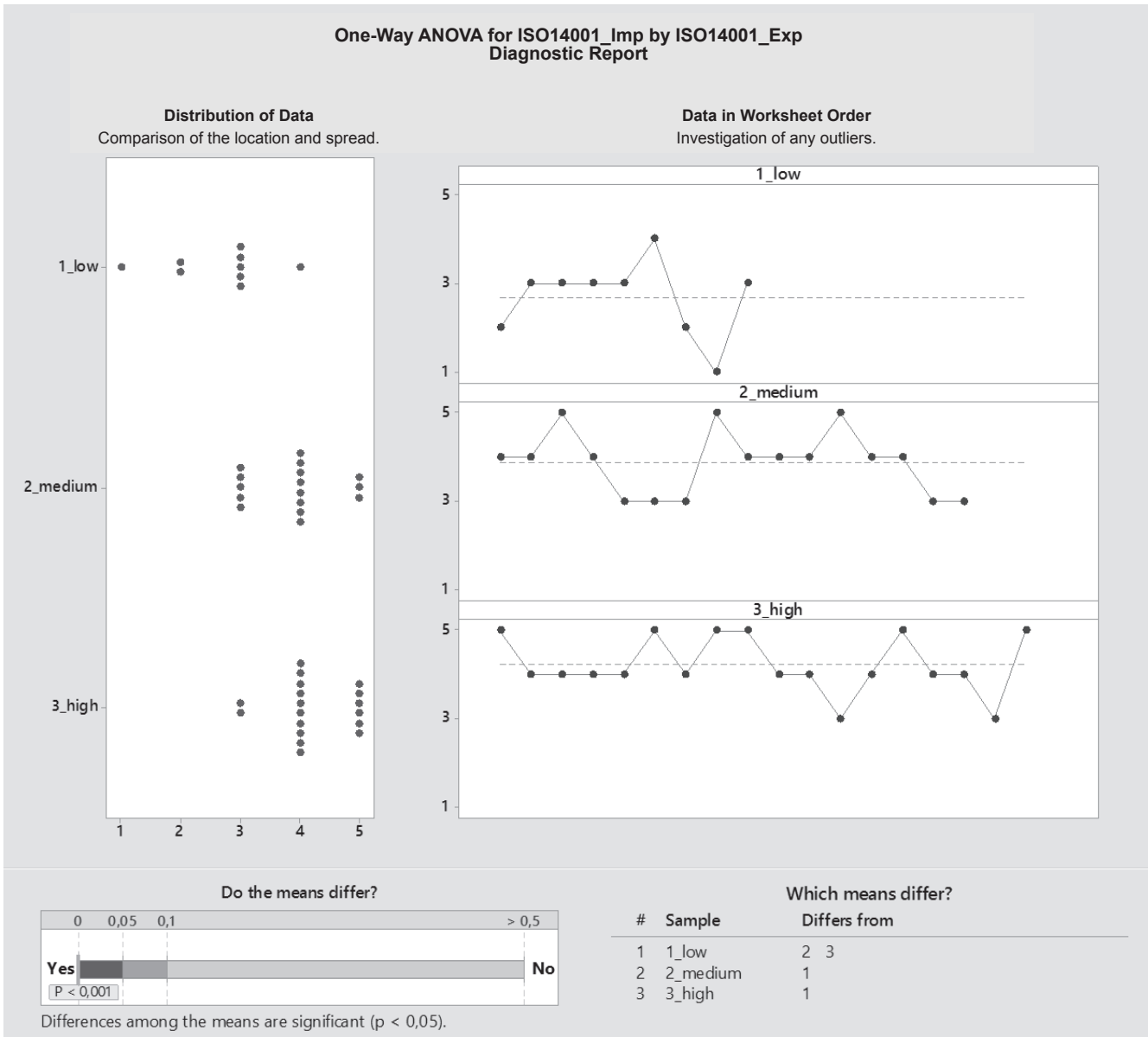


Figure 4. Results of ANOVA test. **Source:** own research results.

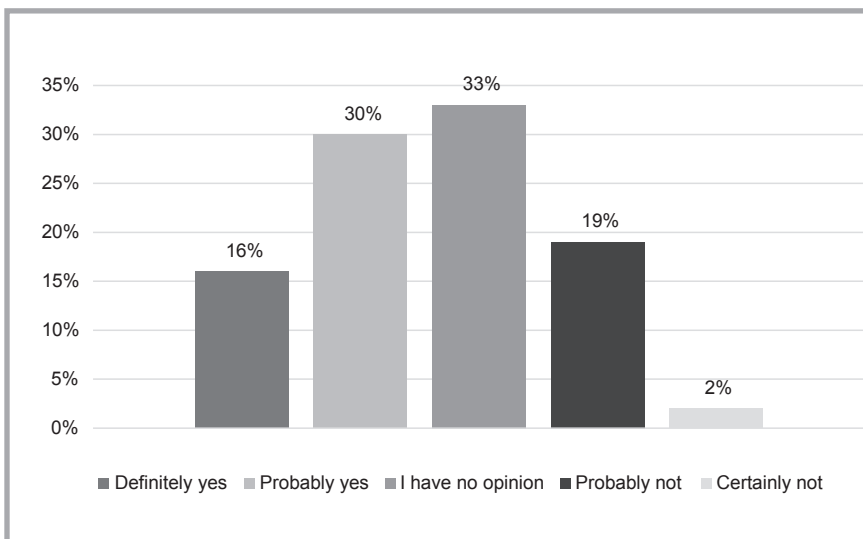


Figure 5. Is the ISO 14001 standard an appropriate tool for creating a sustainable supply chain in the textile industry? **Source:** own research results.

of respondents who could not clearly answer this question (33%) may be due to the complexity of the concept, which is sustainable development. Such concepts can be considered on many levels, and various models of managing a sustainable supply chain can be implemented with different degrees of complexity and sophistication. In addition, developing a generic model of sustainable supply chain management based on the implementation of management standards is a complicated and extremely time-consuming process. According to the authors, due to the large number of undecided respondents (33%), it can be assumed that there is some doubt whether the activities resulting from the implementation of the ISO 14001 standard can cover cells of different specifics and work

out a common compromise [12]. Therefore, it is worth repeating the research in a few years – perhaps, with the passage of time, respondents will be able to give a more precise answer to such a question. Finally, it is worth emphasising that only 5% of respondents strongly believe that the ISO 14001 standard is not useful in the context of the implementation of a strategy of sustainable supply chain management in the textile industry. Bearing in mind this fact and previous considerations, it can be concluded that the implementation of the ISO 14001 standard is a good solution that supports the implementation of pro-ecological projects in the textile supply chain. However, its implementation should be preceded by a close analysis of needs, costs and expected effects.

■ Limitations and implications

This research offers valuable information for both science and business representatives. The surveys conducted are the only ones in which the opinions of organisations conducting operations in Eastern Europe are given on the impact of the ISO 14001 standard on the functioning of SSCM in the textile industry. Based on our research, organisations will be able to more consciously decide on the implementation of the ISO 14001 standard requirements. The main research limitations include the relatively low sample of organisations under study. Therefore, the results obtained should be considered only as preliminary, and the process should be replicated in the future including a larger number of organisations. In addition, it should be noted that the implementation of the ISO 14001 standard is just one of many aspects that can affect SSCM. However, the implementation of this standard is part of the cooperative SSCM model, in which organisations co-creating supply chains try to actively implement pro-ecological and prospective concepts.

■ Conclusions

The main objective of the work was to determine the impact of implementation of the ISO 14001 standard requirements on creating sustainable supply chains in the textile industry. The research process conducted allowed to respond to research questions and state that:

- Respondents highly assess the impact of implementation of the ISO 14001

standard requirements on the improvement of selected processes supporting sustainable supply chain management (ethical leadership, saving of raw materials and energy, increase in environmental awareness).

- Rated the lowest was the impact of Standard ISO 14001 on corporate green image management and the design of products taking into account environmental aspects.
- Standard ISO 14001 significantly improves proecological activities in individual organisations, but translating its guidelines into other links co-creating supply chains is a problem for a large part of respondents.
- Less than half of the respondents (46%) considered that the ISO 14001 standard can be regarded as a tool useful for creating sustainable supply chain management in the textile industry.
- The issue of sustainable development in the supply chain is so complex and multifaceted that a significant number of respondents had difficulties in providing unambiguous answers to the research questions posed.
- Although the majority of organisations surveyed positively assess the ISO 14001 standard in the context of implementation of the concept of sustainable supply chain management, the insufficient number of answers gives no grounds to state that this standard is necessary for the improvement of SSCM in the textile industry.

Summing up, it can be concluded that the assumption of the ISO 14001 standard is to provide organisations co-creating a supply chain with guidelines for the development of an effective system that will facilitate the implementation of environmental objectives. Implementation of the ISO 14001 standard will, to a certain extent, help to move away from random and uncoordinated activities and to look at environmental management in full, facilitating the same processes of monitoring and improving the concept of sustainable development in the supply chain. However, it should be emphasised that in order for the ISO 14001 standard to significantly support sustainable supply chain management, it must become part of an integrated supply chain management system, which will increase its impact and effectiveness. In a similar tone speak Maletic and co-authors [17],

who recognise that ISO 14001 can be an effective tool for pursuing sustainable development; however, organisations should move a step beyond ISO 14001's environmental focus and adopt a multidimensional perspective by simultaneously addressing environmental, quality and social responsibility issues. □

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