

Improving ISO 14001 Environmental Management Systems

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Abstract

Many developing countries, in particular Poland, are seeking avenues of compliance with ISO 14001 requirements. Polish enterprises should be concerned with its implementation in order to ensure competitiveness. The main objective of this study is to present an improvement procedure of the ISO 14001 environmental management system so that it could generate more benefits for enterprises. This procedure was developed on the basis of primary data collected in Podkarpackie Province enterprises with the use of a questionnaire. The main aim of the procedure was to identify desirable features of the system contributing to the enterprises' better performance. The features of ISO 14001, essential for better performance, were attributed to the following stages of the environmental management system: commitment of all the workers, establishing procedures for achieving objectives and targets, establishing procedures for limiting impurities, conducting periodic internal audits, evaluating environmental performance, management reviews, and minimizing the negative influence on the environment. Positive correlations between the features development and the enterprise results allows for the treatment of the aforementioned determinants as the key features contributing to the economic results of the Podkarpackie Province enterprises. Opinions of the enterprises about ISO 14001 were not accidental, which was supported by Kendall's coefficient of concordance.

Apart from financial result, net receipt and the enterprises' efficiency, the increase in sales after ISO 14001 adoption was treated as a business performance indicator. With the use of χ^2 test of independence it was shown that the period of using the ISO 14001 system influenced the increase in sales.

Keywords: ISO 14001, environmental management system (EMS), performance of enterprises, developing countries

Introduction

Nowadays enterprises seek new ways to improve their economic results. Increased competition and growing customer requirements have forced them to look for new methods to achieve better efficiency. In order to achieve the goal of economic performance improvement, enterprises adopt standardized environmental management systems (EMS), in particular ISO 14001. The core elements of the ISO

14001 standard are: environmental policy, planning, implementation and operation, checking and corrective action, management review, and continuous improvement [1]. They are included in the ISO 14001 environmental management system model, the main aim of which is to minimize the negative influence of economic activity on the natural environment. Therefore, as 'green management' has become a key corporate priority, implying that business cannot survive without taking into consideration the natural environment, [2], the adoption of the ISO 14001 environmental system seems to be fairly attractive.

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The initial reaction to ISO 14001 was skeptical. In 1999, three years after ISO 14001 was introduced, the number of issued certificates worldwide was about 10,000. At the end of 2002 about 46,000 entities were certified, and in 2005 more than 88,000. Up to January 2010, at least 250,972 ISO 14001 certificates were issued in 155 countries [3].

While any organization, including local governments, can decide to adopt ISO 14001, the majority of adoptions are done by companies [4] in both developed and emerging countries. At present, the number of certifications in the latter is growing faster [5, 6]. In 2010 the top 10 countries for growth in ISO 14001 certification were: China (14,468), United Kingdom (3,434), Italy (2,522), Czech Republic (1,945), Republic of Korea (1,838), Spain (1,820), Brazil (1,488), Romania (555), South Korea (468), and Colombia (466) [3].

At present, enterprises that have adopted ISO 14001 or ISO 9001 norm often refuse to do business with non-certified firms. Moreover, the lack of quality or environmental approach at these enterprises, costs them millions of dollars in terms of rejected consignments [7]. This also concerns Polish enterprises. In Poland many companies are trying to find a place for themselves in the new, quickly changing business conditions. These circumstances result in expanding the idea of ISO 14001, which is still lacking in the minds of managers and decision-makers in Poland [8, 9]. This is proved by the number of ISO 14001 certificates in Poland. While in 2000 there were only 150, in August 2006 there were 1,195 green certificates. At the end of May 2010 there were 2,012 certificates and up to 24 January 2012 there were 2,177 ISO 14001 certificates [10].

The literature clearly shows that investment in environmental management leads to better business performance. The involvement of enterprises in environmental management practices can be explained by various reasons, particularly by the factors connected with a potential improvement in the enterprises' economic performance [11, 12]. The issue of environmental management positively effects operational and business performance and remains one of the most important themes in the environmental management research arena [13]. While a lot of studies [14, 15] tend to highlight the positive nature of the impact and the fact that ISO 14001 certification improves the enterprises' performance, nevertheless there is still a limited number of studies determining the relationship between ISO 14001 system development and the enterprises' business performance.

Therefore, new studies are needed in order to fill in this existing research gap. Thus, due to the need for more empirical evidence in the areas of the contribution of environmental management to an enterprises' performance [16-18], which has so far not been extensive, this paper investigates the following research question: Which features of ISO 14001 environmental management development have a positive influence on the enterprises' economic performance? The main results presented in this article identify the key ISO 14001 features whose development may lead to better efficiency and improvement in economic measures of an enterprise's performance, such as financial result and net receipt, which is the main contribution of this paper.

Literature Review

Apart from concrete environmental effects, ISO 14001 gives potential advantages such as: improvement of reputation and relations with the surrounding, area owner and personnel satisfaction, improvement of workers morale, organizational learning, process and product innovation, improvement of product quality, improvement of process efficiency, growth in sales, increase in market share, entering new markets, getting new customers, cost reduction, access to preferential loans and credits, reduction in insurance fees, etc. [19]. In a continuous process, organizations commit themselves to evaluate their environmental impact and to set objectives and targets for improvement [20]. Because the basic environmental management system principle is a commitment to continuous improvement, the standard requirements fulfillment can lead to: better efficiency reflected mainly in cost reduction, decrease in the amount of impurities as a result of better effectiveness, improvement of competitiveness, and the possibility of gaining help from a local government by the enterprises undertaking environmental initiatives [17]. It is, moreover, expected that adherence to this standard and consequently obtaining the registration for it will be perceived as necessary to access the global market.

The literature usually mentions the aforesaid benefits from ISO 14001 adoption, in particular the influence of the system adoption on the enterprises' economic results. For example, Jiménez and Lorente [22] state that environmental management can influence both production performance and business performance. A similar opinion is presented by Darnall et al. [23], who claim that the more proactive the enterprise environmental management, the better the financial performance. The impact of ISO 14001 adoption on environmental performance as well as on operational performance was confirmed by Vachon and Klassen [24]. Operational performance is the measure connected with the efficiency of business activity. The possibility of improvement in efficiency through better operational performance dedicated to ISO 14001 adoption was also confirmed by Wagner [25]. In his opinion integration of environmental management with organizational functions can result in improved marketing performance, an improved image, less risk, and greater efficiency. The importance of ISO 14001 certification for the enterprises doing international business was indicated by Zeng et al. [26]. He states that the environmental management and ISO 14001 certification are relevant to conducting international business.

Market value of firms tends to increase after announcements of ISO 14001 certification. An increase in market value can be one of the determinants of international sales growth observed by the above-mentioned authors. Montabon et al. [27] suggest that ISO 14001 may improve economic efficiency as well as environmental performance. In their opinion the environmental management practices have a positive effect on company performance, in terms of cost reduction and quality, innovations in products and processes, and reduction of environmental accidents, which may improve the enterprises' delivery performance.

Similarly, Sroufe [17] proved a positive relationship between ISO 14001 system and performance in terms of cost, quality, and development of new products. In his opinion the cost criterion can be improved by means of waste reduction. Vachon and Klassen [24] pointed out that an improvement in environmental management may result in operational benefits, mainly those of quality, flexibility and delivery. Nishitani et al. [28] pointed out that reduced pollution emissions can increase the companies' performance through an increase in demand and improvement in productivity.

Methodology

The analysis was carried out on the basis of primary data collected by means of a questionnaire. The questionnaire was sent to the enterprises of Podkarpackie Province that adopted ISO 14001 environmental management system. In September 2008 in Podkarpackie, which is one of 16 Polish provinces, there were 51 organizations with certified ISO 14001 environmental management systems. This standard was most popular among organizations from the provinces of Pomorskie, Śląskie, and Wielkopolskie, where there were almost four certificates per 10,000 enterprises or per 100,000 inhabitants. The smallest interest in ISO 14001 standard adoption was in Zachodnio-Pomorskie, Lubelskie, Warmińsko-Mazurskie, and Podlaskie, where there was less than one certificate per 10,000 enterprises or 100,000 inhabitants [29]. Podkarpackie province was in the middle of the ranking. Podkarpackie voivodeship is one of the least polluted regions in Poland [30], which, combined with the application of environmental management practices, may help with faster development of this region [31].

In order to identify the subjects with ISO 14001 certificate, the database created by the Center for Environmental Studies of Gdańsk University of Technology (CENVIG) was used. CENVIG is a pioneer in the area of environmental management systems in Poland. The research was conducted from January to June 2009. The complete list included 51 enterprises. The proper research was preceded by pilot research, i.e. five interviews with the enterprises' representatives being in charge of environmental and/or quality management. This was the first step of the research, which helped to adjust the questionnaire. The revised questionnaire was sent to the whole group of 51 selected enterprises. In order to collect the highest amount of responses, the supervisors' proxies responsible for environmental management in the examined enterprises were contacted. In the effect, 36 enterprises (70.1%) responded to the questionnaire. The remaining 15 firms did not fill in the questionnaire despite receiving it twice. In most cases a possible reason for the refusal could be the organizations' reluctance to share any information. This result can be related to the fact that the sample consisted of companies with an already certified ISO 14001 system and, therefore, were used to disclosing their environmental data to the public. Refusal might also be the sign of the possibility of non-conformity to ISO 14001 requirements [32].

Nevertheless, it seems that the collected data represent environmental management development in Podkarpackie quite sufficiently. Moreover, because of the small sample, the case study analysis carried out in four enterprises supplemented the questionnaire analysis. The analysis was conducted in the companies from the industrial sector. Industrial enterprises were chosen on the basis of their higher probability of environmental impact rather than the service companies. It was, moreover, assumed that they were the subjects chosen properly to show the relationship between the ISO 14001 system development and their performance. Experts who were responsible for the environmental management were interviewed. The investigated companies are presented as follows:

- Company A is a large company that produces durable goods and has been certified under ISO14001 since 2002.
- Company B is a medium size company that produces durable goods and has been certified under ISO 14001 since 2004.
- Company C is a large company that produces durable goods and has been certified under ISO14001 since 2000.
- Company D is a large company that produces durable goods and has been certified under ISO 14001 since 2005.

As the research was based on subjective opinions of the enterprises, the conformity of the opinions was expressed using tau-Kendall's coefficient of concordance [33]. The concept of concordance refers to at least three different contexts: voting and decision-making, attitude assessment, and statistics [34]. Statistical significance of tau-Kendall's coefficient of concordance was measured with the use of Friedman's test, which is a nonparametric analogue of two-way analysis of variance [35].

The questionnaire was filled in by the environmental managers or people from the top management in charge of environmental management. Because of the fact that they filled in the questionnaire independently, their answers were treated as independent experts' opinions. Moreover, the value of the coefficient of concordance and its statistical significance allowed treating the group of experts as credible and continuing the procedure of improvement, built with the application of tau-Kendall's correlation [36]. The analysis mentioned above was used in order to examine the correlation between the level of advancement of ISO 14001 [37, 38] and the variables measuring the results of enterprises, such as net receipts, financial results, and the enterprises' opinion about the changes in their efficiency after ISO 14001 adoption. In order to examine the level of the system's adoption, the organizations were asked to assess the features of the system development. Their answers were presented on a scale with values from 0 to 5. Zero meant that the system's feature wasn't applied at all, and five meant that the characteristic was fully introduced.

Among ISO 14001 environmental management system features, the key ones were pointed out on the basis of tau-Kendall's analysis of correlation. The statistical significance of the correlations was examined using Z test [39].

Appendix 1. Questionnaire.

Part 1. Enterprise characteristics.

Variable	Category	Answer (tick)
Year of establishment	Up to 1945	
	From 1946 to 1988	
	After 1989	
Size	Small and medium (to 250 workers)	
	Large (above 250 workers)	
Legal form	Joint-stock companies	
	Limited liability companies	
	Other	
Type of capital	Private	
	Public	
Share of foreign capital	Yes	
	No	
Area of business activity	Local and regional markets	
	National market	
	International market	
Polish Classification of Activities	Industrial section	
	Construction	
	Production of and providing electric energy, gas, steam, hot water and air to air conditioning arrangements	
	Mining and extraction	
	Transportation and warehouse economy	
Export sales	Yes	
	No	
Period of using ISO 14001	1-3 years	
	4-6 years	
	7-9 years	
	10-12 years	

Part 2. ISO 14001 system determinants adoption.

Please tick the right box according to the degree of ISO 14001 system determinant adoption (an example).

Determinant	0	1	2	3	4	5
Defining objectives and targets						

Part 3. The enterprise's economic results.

- Did ISO 14001 adoption influence your company's efficiency improvement?
definitely don't agree don't agree hard to say agree definitely agree
- What changes in your company's sales connected with ISO 14001 adoption were observed?
significant decrease decrease slight decrease no changes slight increase significant increase
- What was the level of net receipt in 2008 (in PLN) in your company?
up to 25 mln 25.1-50 mln 50.1-75 mln 75.1-100 mln 100.1-125 mln more
- What was the level of financial result in 2008 (in PLN) in your company?
up to 5 mln 5.1-10 mln 10.1-15 mln 15.1-20 mln 20.1-25 mln more

The system features that were positively correlated with the three distinguished variables, and statistically significant correlations with at least one variable, were treated as the key features contributing to the subject's performance. All the examined features were divided according to ISO 14001 EMS model [40] with respect to their role. In a procedure of improvement the following symbols for the variables were used: I for net receipts, R for financial result and E for enterprise efficiency. The procedure of improvement highlighted the features contributing to the enterprises' performance.

In order to examine the relationship between the ISO 14001 development and the enterprises' results, chi² test of independence [41] was applied. It was conducted for the variable: period of using ISO 14001 and variables like: efficiency improvement and sales increase. Because of a small sample for the variable – the period of using ISO 14001, only two categories were distinguished – up to 6 years and more than 6 years. Similarly for the variables – efficiency improvement and sales increase, only two categories were determined: agree/do not agree.

Results and Discussion

Sample Profile

The characteristics of the studied enterprises was based on their profiles: year of establishment, size, legal form, capital, share of foreign capital, area and range of business activity, export activity and ISO 14001 period of use. The majority of the examined enterprises were private. Most of the surveyed subjects worked in the industrial section, a few in construction, some in production and provision of electric energy and the rest in other sections. About 75% of them were exporters and almost 70% worked on international markets. Most of the examined enterprises were only with Polish capital, about 1/3 had a share of foreign capital. Legally, they mostly functioned as joint-stock companies and limited liability companies. The ISO 14001 system was more popular in large enterprises than in SMEs. More than half of the subjects were established in a market economy, i.e. after 1989. As for 2009, 47.22% of the enterprises have used ISO 14001 for a period of 4 to 6 years. 16.67% of the subjects used ISO 14001 for 1 to 3 years, 25% for 7 to 9 years and 11.1% for 10 to 12 years. Many of them passed recertification audit and decided to extend the expiry date of the system, which proves the usefulness of ISO 14001 certification. Detailed enterprise characteristics are presented in Table 1.

Case Study Results

The case studies were conducted in four enterprises with at least two renewal certification audits positively completed. A long-enough period of using ISO 14001 was assumed to be a guarantee that the implementation of the system was consolidated and that some environmental and business targets had presumably already been achieved.

Table 1. Characteristics of the examined enterprises.

Variable	Category	Percentage (%)
Year of establishment	Up to 1945	22.2
	From 1946 to 1988	22.2
	After 1989	55.6
Size	Small and medium (to 250 workers)	41.7
	Large (above 250 workers)	58.3
Legal form	Joint-stock companies	50.0
	Limited liability companies	44.4
	Other	5.6
Type of capital	Private	77.8
	Public	22.2
Share of foreign capital	Yes	33.3
	No	66.7
Area of business activity	Local and regional markets	13.9
	National market	16.7
	International market	69.4
Polish Classification of Activities	Industrial section	72.2
	Construction	11.1
	Production and provision of electric energy, gas, steam, hot water and air to air conditioning systems	11.1
	Mining and extraction	2.8
	Transportation and warehouse economy	2.8
Export sales	Yes	66.7
	No	33.3
Period of using ISO 14001	1-3 years	16.7
	4-6 years	47.2
	7-9 years	25.0
	10-12 years	11.1

By including in the case study the analysis of performance achieved over a period of six years after obtaining the certificate, its results would not overestimate initial improvements. The selected enterprises were operating in the industrial section, as the manufacturing companies have a higher probability of environmental impact [42]. All of them were exporters. The case study results were presented in Table 2.

In three of the enterprises, ISO 14001 system adoption influenced the increase in sales, one enterprise observed no changes in sales. The enterprises' answers allow for the conclusion that ISO 14001 helped them to achieve the

Table 2. The case study results.

Enterprise	Polish Classification of Activities	Period of using ISO 14001 in years	Export sales	Efficiency improvement after ISO 14001 adoption	Changes in sales after ISO 14001 adoption
A	Industrial section	10	Yes	Don't agree	Slight increase
B	Industrial section	8	Yes	Definitely agree	No changes
C	Industrial section	12	Yes	Hard to say	Increase
D	Industrial section	7	Yes	Agree	Increase

Table 3. Statistics of Friedman's test and the value of Kendall's coefficient of concordance.

Chi ² statistic	N	df	p-value	W
801.8756	17	35	0.0000	0.5455
Opinion 1 (example)	Mean rang	Sum of rangs	Mean	Standard deviation
	24.6667	1036.00	4.6429	0.6177

increase in sales. It is important to stress that the chosen companies operated in international markets, where ISO 14001 compliance can be treated as an important tool for doing global business. In the opinion of the surveyed subjects, the environmental management system adoption influenced the improvement of their efficiency. One enterprise stated that ISO 14001 adoption definitely improved the company's efficiency, while another agreed that such a relationship was observed. For one enterprise it was hard to determine whether ISO 14001 adoption improved its input/output ratio. The results of the case study can't be extended to 51 selected enterprises. Therefore, in order to examine the influence of ISO 14001 system adoption on the performance of the Podkarpackie Province enterprises, a more detailed analysis is needed.

Kendall's Coefficient of Concordance

The value of the coefficient of concordance (0.55) proves that the experts agreed in their average opinions about the examined environmental management system features. Moreover, the result of Friedman's test confirms that the compliance of the experts was not accidental (Table 3). It allowed recognizing the selected expert team as a competent body.

Tau-Kendall's Correlation Analysis Outcomes

In spite of the fact that the examined enterprises adopted ISO 14001, the degree of the system development was varied. Table 4 presents the average level of the adoption of the system features as well as the values of tau-Kendall's coefficient defined between the levels and the following variables: net receipts, financial result and enterprise efficiency. The table contains only the features that were statistically significantly correlated with the enterprises' results. The remaining are presented in Fig. 1.

Key Factors of the Procedure of ISO 14001 System Improvement

Organizations of Podkarpackie adopted ISO 14001 mainly from the formal side, i.e. internal audits were conducted regularly and the results were carefully analyzed. The companies successfully implemented the right procedures to meet their objectives and targets as well as conducted management reviews. The other features were mostly connected with the procedures aimed at the reduction of the negative effects of business activity. The areas of the system that require further improvements are the following: evaluation of environmental performance, ensuring personnel competence, defining and accomplishing training needs, fulfilling operational criteria, updating environmental policy, and providing means for meeting objectives and targets.

The values of tau-Kendall's coefficient of correlation between net receipts and the system determinants, such as procedures for objectives and targets, compliance with the system foundation, conducting periodic internal audits, minimizing the negative influence on the environment, establishing procedures for limiting impurities, and management review were: 0.50, 0.30, 0.27, 0.23, 0.21, and 0.23, respectively. These positive values proved that the level of the enterprises' net receipts increased together with an increase in the implementation of the aforementioned features.

However, the analysis of correlation between the system determinants (such as updating the environmental policy and evaluating environmental performance) and enterprises' financial results indicated two statistically significant dependencies. In the first case, the value of tau-Kendall's coefficient was less than zero (-0.23), which meant that the enterprises achieving higher financial results were not concerned too much with updating the environmental policy. Nevertheless, the other correlation had a positive value (0.24).

Table 4. The development of ISO 14001 EMS adoption and the enterprises' performance.

ISO 14001 environmental management system determinants	Mean	Tau Kendall's coefficient of correlation					
		Net receipts (I)	p-value	Financial result (R)	p-value	Efficiency (E)	p-value
Analyzing the results from audits	4.5588	0.0539	0.6645	-0.1487	0.2400	-0.2185c	0.0692
Commitment of all the workers	3.7353	0.0189	0.8794	0.1525	0.2281	0.2244c	0.0621
Compliance with the system foundation	4.5000	0.2937 ^b	0.0182	0.1402	0.2679	-0.0261	0.8284
Conducting periodic internal audits	4.6471	0.2723 ^b	0.0285	0.0745	0.5560	0.0064	0.9575
Defining objectives and targets	4.2353	0.0483	0.6975	0.0431	0.7337	-0.2110c	0.0793
Establishing procedures for limiting impurities	4.0000	0.2058 ^c	0.0285	0.1780	0.1594	0.1058	0.3788
Establishing procedures for objectives and targets	4.3529	0.4919 ^a	0.0001	0.1723	0.1734	0.1082	0.3682
Evaluation of environmental performance	3.8824	0.1919	0.1228	0.2422 ^c	0.0555	0.0434	0.7182
Improvement in minimizing the negative influence on the environment	4.0882	0.2280 ^c	0.0666	0.1322	0.2962	0.1982c	0.0993
Management review	4.2647	0.2278 ^c	0.0678	0.0399	0.7524	0.0726	0.5460
Monitoring the equipment	4.1471	0.0234	0.8510	-0.0221	0.8616	-0.3555b	0.0031
Non-conformance assessment	4.2353	0.1469	0.2373	0.0215	0.8649	-0.2163c	0.0720
Providing the means for meeting the objectives and targets	3.4118	0.1776	0.1532	-0.0423	0.7379	0.2280c	0.0579
Updating environmental policy	3.7647	-0.0054	0.9652	-0.2349 ^c	0.0633	-0.2030c	0.0914

^a0.001, ^b0.05, ^c0.1.

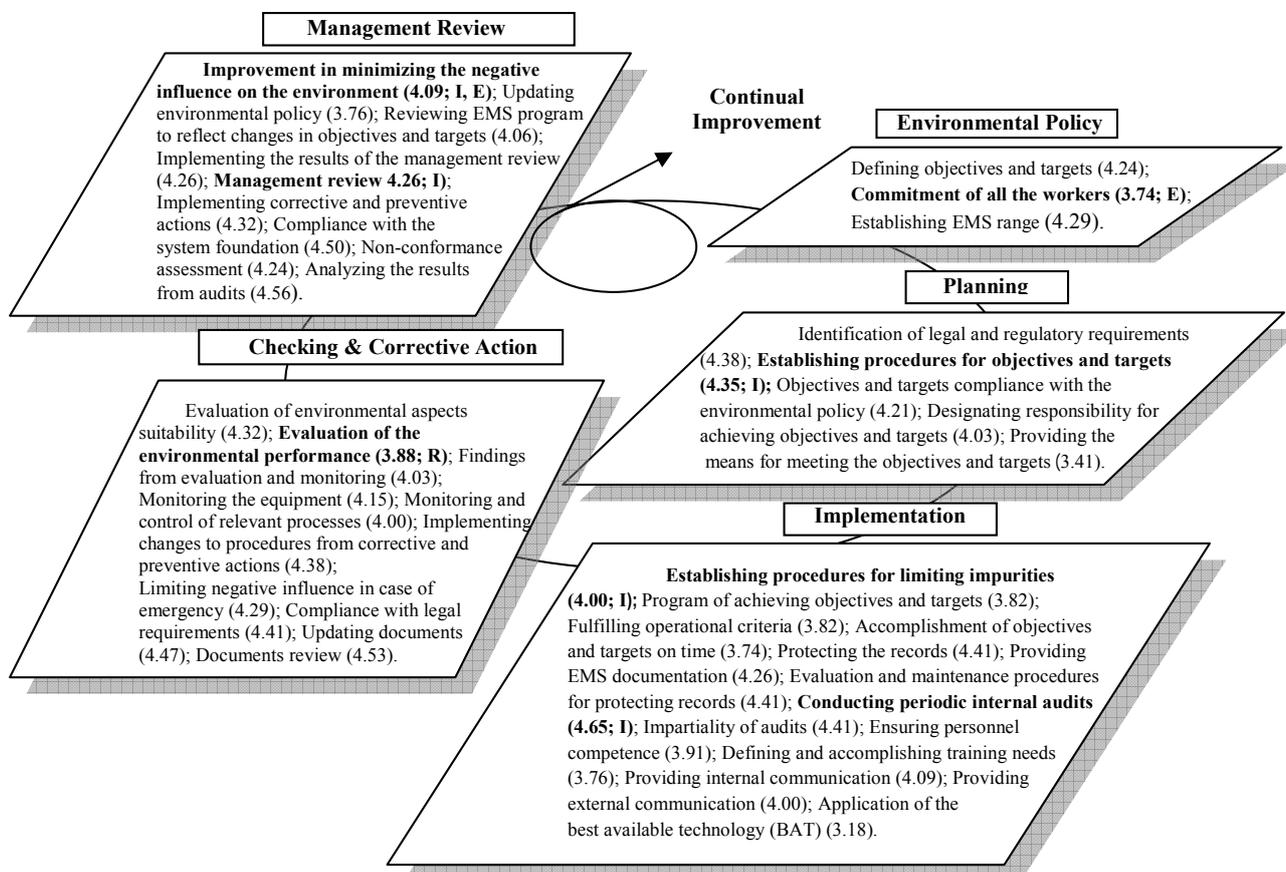


Fig. 1. A procedure of continuous improvement of the ISO 14001 environmental management system.

Table 5. Chi² test of independence between the variable: period of using ISO 14001 system and the variables: efficiency improvement and increase in sales.

Independent variable	$\chi^2_{emp.}$	χ^2_{α}	p-value	V-Cramer's coefficient	Significance
Efficiency improvement	0.0241	3.8415	0.8767	–	No
Increase in sales	3.8824	3.8415	0.0488 ^a	0.3244	Yes

^a 0.05

Correlation analysis also was used in order to examine the relationship between the enterprises' efficiency and the level of development of the determinants. The analysis pointed out three statistically significant dependencies related to the following system features: commitment of all the workers, improvement in minimizing the negative influence on the environment, and providing the means for fulfilling objectives and targets. The values of tau-Kendall's coefficient were, respectively: 0.22, 0.20, and 0.23, which prove that the effect of a higher commitment of the workers in adopting the ISO 14001 environmental management system (as well as continuous environmental improvement and better availability of resources) resulted in the improvement of the enterprises' economic efficiency.

The correlation analysis allows for settling ISO 14001 system features, indicating the relevance of their introduction and development. However, because of the fact that the majority of them have to be initiated simultaneously, it is better to highlight the key determinants contributing to enterprise performance. These determinants were attributed to the EMS model [43-45], i.e. the model similar to the PDCA continual improvement cycle [46-50].

Establishing the environmental policy, the key determinant for the enterprises' economic results, was the commitment of all the workers in the system's adoption. The assessment of this determinant adoption was comparatively low (3.74). Insufficient commitment of the workers while introducing the system indicates the direction of the environmental management system improvement for the Podkarpackie province enterprises.

The level of adoption of another key feature, establishing procedures for fulfilling objectives and targets (assigned to the *Planning* stage), was higher (4.35). This probably resulted from the necessity of direct ISO 14001 requirements.

In the next stage of EMS model related to the practical system's adoption named *Implementation*, the key factors contributing to enterprise performance were: establishing procedures for limiting impurities (4.00) and conducting periodic internal audits (4.65). The scores reached by them show that the continual improvement in minimizing the negative influence on the environment is reached by establishing and then applying the right procedures. Any variances from the plan are to be indicated through providing internal audits. During *Checking and Corrective Action*, what should be taken into account is the basic aim of the EMS, namely a continuous minimization of the negative influence on the natural environment during any economic activity. Environmental performance influenced the financial results of the enterprises, while a comparatively low

level of its implementation (3.88) suggests the need for further improvement in this area.

As to the last stage of the EMS model, *Management Review*, Podkarpackie enterprises should pay more attention to the improvement in minimizing the negative influence on the environment (4.09) and to the procedure of conducting the management review (4.26). The average levels of these determinants showed that the examined enterprises were aware of their significance.

Fig. 1 presents the above-mentioned EMS model constituting the basis for the procedure of improvement suggested for implementation by Podkarpackie enterprises.

Chi² Test of Independence Results

Chi² test of independency was conducted between the variables: the period of using ISO 14001 and the variables, efficiency improvement, and increase in sales. Its results allowed drawing a conclusion about a statistically significant relationship between the period of using ISO 14001 and the increase in sales. The strength of the pointed out dependency was measured by using V-Cramer's coefficient. Its value (0.32) indicates the dependency on a small/average level. No relationship was shown between the first variable and efficiency improvement (Table 5).

Conclusions

Among 42 distinguished environmental management system features, essential for the improvement of the results and the efficiency of the enterprises, were: establishing procedures for achieving objectives and targets, commitment of all the workers in the adoption of the system, establishing procedures for limiting impurities, conducting periodic internal audits, evaluating environmental performance, improvement in minimizing the negative influence on the environment, and management review. In order for ISO 14001 to protect the natural environment and be a source of economic advantages, the Podkarpackie enterprises should concentrate on the above-mentioned determinants. The positive sign of statistically significant correlations between the aforementioned features and the enterprises' performance indicates that their development in the Podkarpackie province enterprises can result in the companies' better economic performance. The results of this study demonstrating a significant and positive relationship between environmental management practices and measures of performance concur with arguments from the literature [51, 52]. Moreover, the results show that the examined organizations

use a wide range of environmental management practices and that these practices (system determinants) are positively correlated with multiple performance measurements of the companies. This concurs with Molina-Azorin et al. [53], who showed a significant relationship between the degree of environmental proactivity and firm performance from the hotel industry. They proved that the values of performance increased with the degree of hotel proactivity toward environmental management. Also, López-Gamero et al. [54] found a significant two-way relationship between proactive environmental management and financial performance.

The longer the companies used ISO 14001, the higher the increase in sales. The fact that 66.7% of the examined subjects were exporters allows for a conclusion that ISO 14001 certification helped the Podkarpackie Province enterprises to extend access to global markets. The influence of ISO 14001 adoption on sales increases has already been confirmed in the literature [55].

No dependency between the period of using ISO 14001 and the improvement in the enterprises' efficiency was shown. This fact may concur with the results of the researchers who evaluated the time it takes for reduction in emissions to take effect once certification has been achieved. Russo [56] states that being an early user of the standard and having the greater experience are the factors that work together to reduce emissions.

The results were obtained from analyzing the organizations from Podkarpackie, but subjects from other Polish provinces and organizations from other countries can also use some of the ideas to try to improve their performance. It can be implemented at each stage of ISO 14001 system development. The application of the procedure should be accepted by the top management. The staff responsible for its application are the people in charge of environmental management in the organizations. They should be aware of the areas of the environmental management system, the development of which may help to achieve better performance. It seems that the cooperation between the top management, environmental representatives and the other staff is essential.

The results found are, moreover, potentially useful for scholars and practitioners. For scholars, this research adds new perspective to the debate about the relationship between environmental management and enterprises' economic performance. For practitioners, especially those in Poland, the results suggest that there is still a lot to be done in the adoption of environmental management practices. In this light, environmental management may be considered a competitive priority of the organizations. On the other hand, these results should be considered within the limitations of the study. It was focused only on Podkarpackie Province. The research sample is statistically satisfactory, but, even so, it is relatively small. Therefore, the conclusions must be considered with caution for companies not located in Poland. In this respect, the Polish context for environmental issues may be remarkably different from industrialized, and even other emerging economies. These limitations create opportunities for the development of new

studies in this topic. One suggestion would be to develop a similar type of analysis for companies from other Polish provinces and other countries. Another suggestion would be to indicate the need for broader analyses, with larger cross-country or international samples.

The main objective of the study was achieved by examining the relationship between ISO 14001 adoption and improvement of enterprises performance. That dependency was observed for the enterprises in the Podkarpackie province in Poland, but the proposed framework of ISO 14001 improvement may be useful for other less developed regions. From the perspective of their organizations, ISO 14001 adoption can be seen as a way to improve competitiveness not only on micro but also on macro levels. It can help to improve the operational efficiency of the enterprises and thus their economic results. The development of environmental management can make doing business in Poland more relevant to global environmental requirements and to be more competitive. The environmental concern may serve those organizations as a way of distinction from their competitors. In order to show the enterprises how to use ISO 14001 standard more efficiently, the areas of its contribution to their performance were indicated.

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