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Environmental Management System According to ISO 14001 as a Source of Eco-Innovations in Enterprises - A Case of Podkarpackie Voivodeship

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***Abstract*—**This paper presents results of empirical studies that were conducted in enterprises from Podkarpackie Voivodeship (Poland). It shows the experiences of those enterprises resulting from implementing and improving the eco-innovativeness management that is formal Environmental Management System (EMS). This study shows the expected and obtained internal benefits which are the effects of a functioning EMS. The aim of this paper is to determine whether the information included in international theoretical studies concerning the benefits of implementing, functioning and improving formal EMS (which is based on the international standard ISO 14001) are confirmed by the effects of the enterprises' activities.

***Keywords*—**Eco-innovations, Environmental Management System (EMS), ISO 14001, Podkarpackie Voivodeship (Poland).

I. Introduction

PODKARPACKIE Voivodeship is one of the 16 voivodeships created in Poland in 1999. State borders are present in this region, from the south with Slovakia and from the east with Ukraine (it is also the border of the European Union). Podkarpackie Voivodeship constitutes 0,4% of the surface area of the EU and 5,7% of Poland. Among 271 regions of the EU it is placed 78th in terms of size (surface area of this voivodeship is 6,87 thousand square miles).

151 563 entities of national economy were registered in the Rzeszów Statistical Office (April 30, 2012). It is worth noting that 94,7% of those entities are micro-enterprises employing up to 9 people [1].

Analyzing the value of the regional GDP, along with the amount of disposable income per inhabitant, it has to be stated that the region is characterized by dynamic, but low (compared both with the country and the EU) level of social development. On a national level the approach to innovation in Podkarpackie Voivodeship is non-standard. In spite of the fact that in general funds for the research and development sphere (R&D) remain rather low (0,37%) still a relatively large part of them come from enterprises (0,25% of GDP, 3rd place in the country). Enterprises from Podkarpackie Voivodeship assign much larger (than on average in Poland) part of their expenditures directly on R&D activity and for acquiring knowledge of the market [2].

Innovative industry, which is connected with the newest technology, is a chief asset of this voivodeship. It is clearly dominant over the service sector which employs only 30% of the workforce. The enterprises in Podkarpackie Voivodeship are characterized by the highest index of industrial enterprises generating innovations (20,7%) in the country [3]. In this case the aviation industry, which activity is greatly supported by the Aviation Valley industrial cluster, plays a very important role. Innovative potential is represented by electric machinery, chemicals and plastics industries [4].

According to the GUS (Central Statistical Office) data from 1.01.2011 the average age in this region is the highest in Poland; respectively 73 for men (Poland 71), 81 for women (Poland 80). According to the researchers, factors such as clean environment, healthy life-style and low level of stress have the decisive influence on the longevity of the inhabitants [5].

Podkarpackie Voivodeship is determined in the vision of the region development as: "an area of balanced development integrating both social, ecological and economical aims that ensures the possibility of realizing the needs of the society and achieving a high standard of life" [6]. Strategic documents concerning operating of the voivodeship treat the issues of environmental management as important – crucial even – for the future development of the region. This attitude results, among others, from the ecological and cultural function that this voivodeship serves now and aims to serve in the future in Europe [7]. In this context it is important to indicate the best available practices in the systemic approach to the functioning of enterprises in the region, since they fulfil a productive function. Pro-ecological management which would include all the enterprises' activities having positive influence on the element of the environment including the following aspects: biological, spatial and social is recommended [8]. Formal environmental management systems, especially those basing on the requirements of the international ISO 140001 standard, fulfil an important role.

The following paper presents selected results of wider, complete studies concerning the diagnoses of the approach of the entrepreneurs towards the issue of eco-innovativeness management that is EMS. By the term *eco-innovativeness* one should understand innovations that are aiming at eliminating

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or minimizing the undesirable effects of human activity on the environment. Eco-innovations have a positive influence on the effectiveness of resources and energy usage that are indispensable in the production process during the whole lifespan of a product (from the moment of its designing till its decomposition). As a specific sort of improvements they contribute to ensuring high quality of the offered goods/services considered in terms of economical, ecological and social benefits not only for people living in the present but also for future generations. Eco-innovations may be effects of deliberate actions, and in such cases they are the results of industrial activity [9], [10]. They can also occur as unplanned effects constituting the elements of changes that take place in an organization.

Results of surveys conducted in different countries show that there can be numerous benefits of implementing the requirements of the standard ISO 14001. This fact is confirmed among others by A. Matuszczak-Flejszman [11], S. Summers Raines [12], J. Ejdys [13], R. Hillary [14], L. P. Tan [15], G. Y. Nee, and N. A. Wahid [16]. While analysing, one has to bear in mind that the connection between environment protection (understood as the activity of EMS) and its benefits may vary, among other things it may depend on the legislation of the country, the size, type and characteristics of business, culture, customer behaviour and the duration of operating of EMS in an organization [17].

In the subject literature, the positive effects resulting from implementation of EMS are divided, among others, in two groups. These are internal and external benefits. Internal benefits are directly connected with the positive changes within the company which has implemented EMS. As noted by I. Gavronoski, G. Ferrer, and E. L. Paiva [18] internal benefits influence the shaping of relationships between the internal and competitive business environments.

II. Research Methodology and Description of the Surveyed Enterprises

The on-going discussion concerning the effectiveness of EMS established on the basis of the ISO 14001 standard was a stimulus to seek the answer to the question of how EMS is assessed by enterprises from Podkarpackie Voivodeship. For this purpose, a study of benefits and costs as a tool for assessing the integrated effectiveness of EMS, was used (because of editorial limitations this paper presents only internal benefits). The use of the described tool was justified. In case of 69,8% of those surveyed (i.e. 30 companies) at least one re-certification of an operating and improved EMS was made, whereas 27,9% of respondents were preparing to re-certify (Fig. 1).

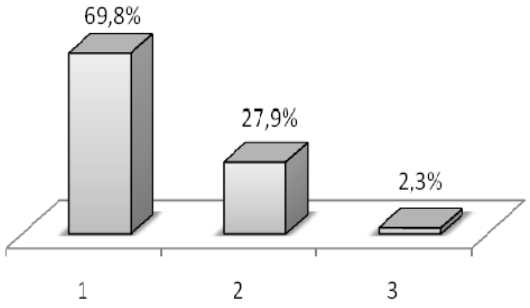

Fig. 1 Planned and made EMS certifications in the surveyed enterprises. Legend: [1] the company is after at least one re-certification; [2] the company is before the first planned recertification; [3] recertification is not planned. Source: Own study based on the results of empirical research

The duration of certified EMS in the surveyed enterprises was on average five and a half years. It can be assumed that most of the Management Representatives representing the discussed enterprises possessed the necessary knowledge to assess at least some part of the effects connected with functioning of EMS (In practice, the time of the operation of non-certified EMS should be - in the opinion of the representatives of the certification bodies - at least three months longer. This means that the EMS in a company should operate for a minimum of three months before it is subjected to certification.).

As it was mentioned before, the surveyed group constituted of Management Representatives for EMS issues, whom the researcher met in person. What is more, the author has studied the system documentation and other source material that were available in the surveyed enterprises in order to confront the gathered data. She has talked to the representatives of insurance companies and with the President of the Polish Forum ISO 14000 Association - INEM Poland.

It was intended to examine all enterprises from Podkarpackie Voivodeship that had implemented EMS. An important selective factor of samples to study was to have a valid certificate (issued by an independent entity) confirming compliance with the requirements of PN-EN ISO 14001:2005 standard. Due to the fact that 14 subjects refused to participate in the study this paper presents results of in-depth interviews conducted in 43 enterprises representing various sections of PKD 2007. The most numerous group were companies engaged in industrial processing (60,47%), construction (13,95%) and those producing and supplying electricity, gas, steam, hot water and air for air-conditioning systems (11,63%). The vast majority of the surveyed enterprises (74,4%) operated (were selling products/services) both in the country and abroad.

The results presented in this paper are an element of broader complete inquiries conducted by the author. The question of why researched entities decided to introduce EMS was answered in the previous publication [19].

III. The Expected and Achieved Internal Benefits in the Light of Personal Research

The conducted primary and secondary researches allowed to establish that correctly introduced and improved EMS is beneficial on several/various levels. These levels should be perceived in terms of environmental, economic and social effectiveness.

Assessment of the economic effectiveness is based on the confrontation of effects (benefits) of the EMS functioning with expenditures incurred on this activity. Eco-efficiency is evaluated on the basis of the degree of achieving environmental objectives listed in the company's environmental policy. The social efficiency assessment refers to the degree of executing aims as well as the social functions of the company. It should be noted that environmental performance can have a measurable financial nature (e.g. illustrated by reducing costs) or an immeasurable nature (e.g. expressed by the degree of customer satisfaction) [20].

As noted before, benefits have been divided into internal (having direct impact on the company activity) and external benefits, which influence not only the company but also its environment.

The most important internal benefit according to 95.4% of representatives of companies from Podkarpackie Voivodeship is reasonable waste management (table 1). In comparison, according to the findings of a research done by S. Bukowiecka [21] (one of the members of KPF ISO 14000 in the country) this particular benefit appeared on the third place in the ranking.

Justifying the choice of the benefit connected with maintaining reasonable waste management the representatives of the surveyed enterprises pointed out that ISO 14001 in much greater degree solves the problems of management of various waste that would be safe and financially anticipated than ISO 9001 standard. Properly functioning EMS 'enters the life cycle of waste' and, for example, closely monitors their rise, circulation, segregation, storage and transport.

In the surveyed subjects the recyclable wastes were:

- sold – (creating an additional source of income);
- recycled which made it possible to re-use them in the production process, allowing savings from, among others, reducing the amount of funds needed to purchase new materials, energy etc. necessary for the production process;
- re-used to create new goods, other than those primarily created in the production process.

It was established during the in-depth interviews that the surveyed companies were showing the greatest initiative towards searching and introducing eco-innovations just in the field of eliminating and the consequent dealing with waste. It was noted that one of the surveyed companies had an environmental patent developed in the scope of waste management by its employees.

A paradox was also noticed. Only 34,9% of those surveyed stated that functioning of the certified EMS contributes to increasing the innovativeness (7% of those surveyed achieved increase of innovativeness although they did not expect to achieve this benefit when implementing the EMS).

TABLE I
Expected and Achieved Internal Benefits of Functioning an EMS Based On ISO 14001 Standard in The Companies from Podkarpackie Voivodeship

Internal benefit	[1] Not expected and not achieved	[2] Expected but not achieved	[3] Achieved although not expected	[4] Expected and achieved	[5] = [3]+[4] Achieved
Ensuring compliance with environmental regulations	7%	2%	19%	72%	91%
Improving the quality and effectiveness of training in the field of environmental protection	30%	2%	7%	61%	68%
Conducting a reasonable waste management	2%	2%	7%	88%	95%
Reduction of insurance rates	58%	35%	5%	2%	7%
The increase in environmental awareness on all organizational levels	7%	7%	12%	74%	86%
Reducing the environmental staff	95%	5%	0%	0%	0%
Saving resources, raw materials and energy	19%	23%	9%	49%	58%
Increasing safety at the workplace	35%	5%	7%	54%	61%
Reduction of environmental liabilities: fees, damages, others	47%	26%	0%	28%	28%
Conducting rational resource management	21%	12%	9%	58%	67%
Conducting rational water and sewage management	19%	5%	9%	67%	77%
Reduction of the risk of environmental incidents and preventing them from occurring	16%	5%	7%	72%	79%
Increase of effectiveness	65%	12%	2%	21%	23%
The increase in self-control and responsibility of employees	19%	14%	9%	58%	67%
Proper dealing with a case of arising of an environmental incident	12%	12%	14%	63%	77%
General enhancement of effectiveness of the company management	56%	16%	7%	21%	28%
Reduction of production costs	67%	12%	2%	19%	21%
Relieving the burden resulting from environmental legislation	58%	23%	0%	19%	19%
Increase in the innovativeness of the company	54%	12%	7%	28%	35%

Note: Responses do not sum up 100% because respondents could indicate multiple answers.
Source: Own study based on the findings of empirical studies.

This paradox probably resulted from low awareness in both the types of innovations and the fact that improving the EMS based on the series ISO 14000 standards may be the source of both products' and processes' innovations. One should be aware that in the light of the subject literature the implementation of formal EMS made on the basis of both the international ISO 14001 standard and the Regulation of the European Parliament and the Council on the voluntary participation by organizations in a Community Eco-management and Audit Scheme (EMAS) are considered as eco-innovation management [22]. Other potential causes of the absence of benefits resulting from eco-innovations among surveyed companies could be: lack of understanding of the essence of the EMS and the lack of a process approach.

The system of quality management underlines the minimization of wastes. EMS concentrates not only on the wastes minimization but also on the further dealing with them in an optimal way, both for the environment and the company. So it was not surprising that as the important assets of EMS:

- 76,7% of those surveyed found the conducting of reasonable water and sewage management
- 67,4% of the respondents pointed on running a rational resources management
- 58,1% of the respondents noticed saving of materials, raw materials and energy.

It is worth noting that 9,3% of the surveyed companies declared conducting rational water and sewage management, as well as conducting reasonable management of raw materials and saving resources, raw materials and energy as a result of EMS operation, although those benefits of implementing the EMS were not expected.

Ensuring that environmental regulations are obeyed was the second in the hierarchy of internal benefits of functioning of EMS. 90,7% of the representatives declared achieving it. This is interesting because according to the obligatory legislative solutions each entity (regardless whether it introduced formal EMS or not) should obey the rules of the binding law. Probably, in instance of some surveyed companies, the implementation of the requirements of the standard contributed to distinguish and eliminating those areas of its business in which it did not realize that its actions were against the law.

Achieving increase in environment awareness was mentioned by 86% of those surveyed. According to them, EMS facilitates creating management culture based on the cooperation of the whole staff aware of its responsibility for the on-going activities, for their own and the others' health perceived in the long term.

The results of earlier studies conducted by J. Ejdys on a sample of 35 companies indicated that raising environmental awareness as a result of implementing EMS was declared by 62,5% of surveyed companies [23].

In the case of 67,4% of the respondents, a certified EMS influenced the improvement of the quality and the effectiveness of training connected with issues concerning environmental protection. This resulted is specific behaviour. Some of the Management Representatives who represent companies with EMS functioning for several years noticed that the increase of the staff competence was followed by a gradual process of decrease in the details of the procedures. Some of them resigned from documenting them in the form of text in favour of posters, drawings and recordings which 'reached the addressees' in a greater extent. It can be admitted that implementing the EMS had positive impact on organizational learning of the staff.

According to what was pointed out by 79,1% of respondents, the implementation of EMS contributed to the reduction of the risk of environmental incidents and also to the effective preventing of them from occurring. As an effect of EMS functioning, 76,8% of those interviewed indicated the development of appropriate procedures in the case of environmental incidents. 14% of those surveyed achieved the discussed benefit, despite the lack of basic expectations in this area. EMS impacts the employee's satisfaction and morale.

The increase of employees' self-control and responsibility as a result of EMS implementation was mentioned by 67,4% of the Management Representatives (9,3% of the responders declared observation of the growth of self-control and responsibility of employees, even though this was not expected basing on the reluctance of the staff when implementing the EMS).

Additionally 60,5% of the respondents noticed the increase in workplace safety. According to the Management Representatives, it was and still is important to make all the employees (both from the production department and the office) aware that all their actions bring similar effects as a drop which 'hollows the rock not by its strength but because of its rate of falling down'. Everyone should be aware that a valve left not closed contributes to the fact that not only the life-giving substance, which is costly, is wasted but also the energy that is required for its extraction and purification. In order to produce energy it is necessary to burn e.g. coal which carries emission of large amount of pollutants. Similarly, one of the consequences of irresponsible paper usage is the process of cutting down trees and so on [24]. Improper handling of some substances may be a result of dangerous, chronic diseases, which effects may be visible immediately or after some time (e.g. genetic defects). Hence some solutions have to be applied despite the fact that they tend to be laborious and time-consuming. Those factors also support EMS implementation in companies.

In the context of sociological effects, it was noted that improved EMS in a company allows building and consolidating the ecological knowledge that additionally can be transferred into the area of family life. It is a slow and laborious process (due to the Polish mentality) but it is supported by the media, educational units and other organizations that have a good chance to shape the desirable attitudes/behaviour, as it is the case e.g. in our neighbouring country – Germany. It is worth noting that the increase in ecological awareness and the gradual change of attitude was facilitated, among other things, by frequent business trips

made by employees from the surveyed companies to UE countries.

Another benefit that was achieved by 27,9% of the surveyed companies was a general enhancement of management effectiveness and also the decrease in environmental commitments including: environmental fees, compensations and others (inter alia concession fees and service charges). They were reduced by: successive reduction of ecological nuisances of the enterprise and its products, minimizing the environmental risk, reduction of the cost of environmental repairs and failures (so called costs of non-compliance). In the long term, benefits connected with the reduction of environmental fees are expected by every fourth of those surveyed companies. It is worth adding that in the case of three companies the environmental (exploitation) fees have increased after implementing the EMS. It resulted from identification of legal and other regulations that the companies were subjects to but which they did not follow, due to previous lack of awareness of them being in force.

Among other internal benefits the surveyed companies identified:

- efficient allocation of resources and increased productivity – achieved respectively by 27,7% and 23,3% of the surveyed,
- reduction of production costs, declared by 20,9% of the Management Representatives,
- mitigation of the burden of environmental legislation – reached by 18,6% of the respondents.

By creating a specific triad of items, it was found that every fifth enterprise achieved benefits resulting from eco-efficiency. Eco-efficiency was available by means of supplying the market with competitively priced goods and services. They met the needs of recipients along with decreasing the resources consumption and reducing the negative impact on the environment at every stage of the production process [25].

The representatives of the surveyed companies expect that thanks to the certification of the EMS in the future they will gain easier access to preferential subsidies and loans for environmental investments, especially from EU funds.

Only 7% of the surveyed (i.e. 3 companies: 2 categorised as large, 1 as medium) obtained improved conditions of insurance, in particular reducing the insurance rates. Those companies represented completely different production-service profiles. In the long term this benefit is expected by 34,9% (i.e. 15 companies) of the surveyed subjects. The results of previous researches conducted in the last quarter of 2005 by M. Hajduk, L. Woźniak [26] and also of the studies conducted more than ten years ago by A. Matuszak-Flejszman indicated that none of the companies achieved reduction of insurance rates [27].

This situation was the result of a too short period of the EMS functioning in the surveyed companies (often it was a period of only a few months). Therefore, the companies were not yet able to negotiate the reduction of insurance rates. The results of the tests carried out in enterprises operating in Podkarpackie Voivodeship suggest that the low level of expectations in terms of reducing insurance rates is a consequence of the fact that insurance companies generally do not offer any preferences to those who have implemented EMS, and so the expectations in this regard are as yet an utopia, especially for small and medium businesses. This is a surprising phenomenon since companies with ISO 14001 certificate should be considered as more reliable (less burdened with the unacceptable risk level) partners for the insurance companies, among other things because they aim to be less dangerous for the local environment, especially for the local society.

On the other hand, the Management Representatives of the insurance companies, when asked to comment on this issue, stated that there is strong competition between the certification units. This is a specific problem resulting from the fact that companies pay the certification unit for its 'favour' – hence the lack of creditability, because a unit which is too meticulous may lose its client to a competitor. The effect of the miss-understood, unfair competitive rivalry is that in the most extreme cases there may be a practice of 'performing the audit without the presence of representatives of the certification body in the company'. Because of this, for many banks and insurance companies the fact that a company has a certificate confirming the implementation of EMS based on ISO 14001 is not a sufficient argument for offering this company privileges. It happens that this document does not constitute a proof that the company has reduced the risk. In the context of EMS evaluation it should be noted that some of the surveyed companies lacked a comprehensive and strategic approach to EMS. Therefore banks and insurers send additional verifiers who check the company at this angle - in this context, EMS certificate compliant with ISO 14001 does not actually provide any advantage over its competitors.

The conclusion arises that it is necessary to pay more attention to the quality of the certified EMSs. The solution for the discussed problem is to introduce greater responsibility of the certification units for issuing a certificate – similarly as it takes place in registration with EMAS. Representing the Polish Forum ISO 14000 – INEM Poland R. Pochyluk paid attention to the fact that if a verifier signs an environmental statement in EMAS scheme, and subsequently it turns out that he missed non-compliance with some requirements (because e.g. VIEP – Voivodeship Inspector for Environmental Protection discovered 'something unsettling') then the company may claim damages from the verifier.

Understanding the essence of process management and the systemic approach to pro-ecological management is the key to generate benefits from the functioning and improving of EMS. The certification is not a sufficient condition to gain profits from implementation of EMS. It should be remembered that the benefits are varied and they should be considered in both short and long terms. Implementation, functioning and continuous improvement of EMS based on ISO 14001 requirements involves diverse resources. The effects of EMS functioning should be monitored in order to check what the costs and benefits resulting from the adopted strategy for

action are and will be in the future.

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