DE GRUYTER OPEN DOI: 10.2478/aslh-2014-0004 *Acta Silv. Lign. Hung., Vol. 10, Nr. 1 (2014) 49–64*

Enhancement of the Corporate Environmental Performance

András POLGÁR* – József PÁJER

Institute of Environmental and Earth Sciences, Faculty of Forestry, University of West Hungary, Sopron, Hungary

Abstract – In the course of the implementation of the environmental management system *(EMS)*, during the planning phase it is of high priority to explore, select and analyse the relevant environmental aspects and impacts. This is the precondition to enhance the real environmental performance *(EP)*. The applied processes are often specific, formal and influenced by the self-interest of a company. The purpose of our work was the uniformly interpretable evaluation of the varied processes, and the creation of an *EMS* enhancement model through which the physical *EP* can be improved. The quantitative empirical research (2010–2011) has been conducted by using questionnaires in 114 domestic and multinational companies applying an *EMS* according to the international standard *ISO 14001*.

In the created database, we have determined the variables which are relevant and adjustable in the process, through a descriptive and multivariable statistical survey. On the basis of the identified performance dimensions, corporate performance indices have been created: the environmental motivation *(MOT)*, environmental performance *(EPI)*, environmental impact evaluation *(EIE)* and environmental management *(EMI)* as well as the aggregative index *(AGG)*. With their help, the evaluation of the surveyed corporate performance can be executed uniformly, in a quantifiable way, without any intervention in the corporate processes. Along the outliers of *EMS* optimization variables, we have identified development points. Their impact was assessed by sensitivity analysis of the indices. The described method offers a model for *EMS* development, based on self-evaluation.

environmental management / impact evaluation / environmental performance indices / development model

Kivonat – A vállalati környezeti teljesítmény fejlesztése. A környezetirányítási rendszer (röviden: *KIR*) mögött rejlő valós környezeti teljesítmény (röviden: *KT*) érdekében a „Tervezési (Plan)” fázisban a környezeti tényezők és –hatások feltárása és elemzése, a releváns környezeti tényezők kiválasztása kiemelt fontosságú a rendszer kiépítése során. A tapasztalatok szerint az alkalmazott eljárások gyakran sajátosak, formálisak, a vállalat egyedi érdekei által meghatározottak. Munkánk során célként tűztük ki a változatos eljárások egységesen értelmezhető értékelését és egy olyan *KIR* fejlesztési modell megalkotását, amely alkalmazásával a fizikai *KT* javítható. A kvantitatív empirikus kutatást (2010–2011) az *ISO 14001* nemzetközi szabvány szerinti *KIR-t* alkalmazó hazai és multinacionális vállalatok között (114 db) végeztük kérdőíves módszerrel.
A létrehozott adatbázisban leíró és többváltozós statisztikai vizsgálatokkal meghatároztuk a releváns és a folyamatban szabályozható, az optimalizálásra ezért potenciálisan alkalmas változókat, a változópárok korrelációit és a témakör főbb teljesítmény dimenzióit jelentő változócsoportokat. Az azonosított teljesítmény dimenziókra alapozottan teljesítmény indexeket (4+1 db) hoztunk létre: környezetvédelmi motivációs *(MOT)*, környezeti teljesítmény *(KTM)*, környezeti hatásértékelési

* Corresponding author: polgar.andras@emk.nyme.hu; H-9400 SOPRON, Bajcsy Zs. u. 4.

(KHÉ) és környezeti menedzsment *(KMR)*, valamint az aggregált index *(AGG)*. Értékeiken keresztül egységesen, relatív, számszerűsíthető módon megadható a vizsgált vállalati teljesítmény adott szintet jellemző értékelése a változatos vállalati folyamatokba történő beavatkozás nélkül. A *KIR* optimalizálási változók szélső értékei mentén az indexek érzékenységvizsgálatával a szignifikáns eltérést okozó változók jelentéstartalma alapján fejlesztési pontokat (36 db) és azok befolyását és területét azonosítottuk. E módszerrel létrehoztuk az önértékelésen alapuló *KIR* fejlesztési modellt.

környezetmenedzsment / hatásértékelés / környezeti teljesítmény index / fejlesztési modell

1 INTRODUCTION

Environmental management system *(EMS)* is part of the management system of an organization with the task to develop and establish, operate and continuously improve the environmental policy of the organization and manage the environmental aspects. The advantage of these systems standardised by international organizations is that they may be certified by specialised certifying systems or authorities (e.g. *ISO 14001*, *EMAS*). Standardized processes providing authoritative (certified) information for competitors and society are being applied worldwide. At the same time it is observable – probably just on the ground of the market competition – that the processes are often specific, formal and influenced by the self-interest of the company.

A number of empirical studies performed in this field have resulted in differing verdicts. Several studies have shown no significant link between measures of environmental performance and profitability (Fogler – Nutt, 1975; Rockness et al., 1986) or between environmental performance and corporate disclosure practices (Freedman – Jaggi, 1982; Wiseman, 1982). But other studies have shown that better pollution performance improved profitability (Bragdon – Marlin, 1972; Spicer, 1978a) and reduced risks (Spicer, 1978b) and that federal compliance liability costs and profitability were negatively related (Holman et al., 1985).

The change in the properties of the environmental elements and systems resulting due to human activity is the *environmental impact*. The *evaluation* of the environmental impact purposes to express the consequence of the change. At the same time, it prepares and establishes measurements and decisions. The evaluation of environmental impacts also provides the basis for the comparison of the different activities according to environmental aspects.

Identification, continuous evaluation and rating of the environmental impacts can be considered as a specific interest for a company. Through the co-operation in environmental protection, it is also of public interest. The environmental management systems (*KÖVET EMS* - Checklist 2007) are playing a key role in managing the domestic corporate environmental impacts (Polgár 2012).

Because of the interrelationships in the complex environmental system, the corporate environmental impacts have to be studied as an integral part of this system. In order to rate the impact on the environment, expert examinations were developed principally in connection to the environmental impact assessments. Beyond that, in the corporate practice, demand emerged for wider systems which measure the necessity of rehabilitation (defining the significant damaging impact). There is a significant need for the indication of positive impacts during performance evaluation (Pájer 2011).

In our survey, we applied the following definition to interpret the concept of the corporate environmental performance *(EP)*: *environmental performance* is the material, energy and information flow which emerges during the normal and abnormal operation state of an organization, impacting the surrounding environmental system in a positive or negative way, coming from the input or output side (i. e. the physical trend of *EP*), furthermore it is the extent of efficiency of the processes developed in order to manage these flows (i. e. the management trend of *EP*), corrected by the quality properties of the specific impacts regarding the condition and sensitivity of the affected environment.

Due to the rapid spreading of *ISO 14001* more and more companies are applying underlying *EMS* evaluation methods (Savage 2000). During the *EMS environmental impact evaluation process*, the main purpose of the evaluation of the environmental factors is to determine the harmful changes caused in the state of the environment. In the course of the evaluation, the occurrence probability and seriousness of the harmful change is required to be taken into account.

Kerekes – Kindler (1997) draws the attention to the fact that companies possessing the *ISO 14001* certificate need not qualify as environmentally friendly. According to the international standard requirements, improvement of *EP* may be measured and accepted by auditors, based purely on the adequacy regarding regulations (i. e. the management *EP*). The physical, environmental aspects can be overshadowed by the management trend (Seifert 1998).

The *survey, consideration and comprehension of environmental aspects and impacts* of the organization is the element of the 'Plan' phase. It is also the *most essential* element of the whole system implementation. It requires particular consideration, during its examination; engineering and technical accuracy is needed and it is of course the step requiring highest creativity (Nagy – Torma – Vagdalt 2006). This is the basis of the formulation of the environmental policy as well as the set-up for environmental objectives, and for the selection of priorities.

We stated that the *EMS* impact evaluation processes usually generate results during the evaluation (application of ordinal scale) by binary ranging of impacts (significant and non-significant impacts). During our survey, we studied mainly the application and the further developed forms of the *ABC* analysis, from among the matrix techniques of impact assessment methods (Pájer 1998, Rédey – Módi – Tamaska 2002, Nagy – Torma – Vagdalt 2006, Polgár 2011). In order to expand the environmental information achieved by an *EMS* impact evaluation process, we recommend further environmentally aware corporate management instruments, by which the efficiency of the 'Plan' phase can be improved (Polgár 2012).

We found that compared to other environmental performance evaluation methods, the *EMS* impact evaluation process showed the minimum complexity of the application and of the aggregation level (on the basis of the classification of Torma, (2007).

Hofstetter (1998, cited by Frischknecht, 2005), distributed the decision support tools by matrixes between methods being interpretable on micro-, meso- and macro-level, and analysing social, environmental and economic properties. We concluded that in this distribution, the *EMS* environmental impact evaluation is applicable on meso-level (within project level). It can be considered as a method describing the environmental dimension. From the point of view of environmental management system on meso-level, on the basis of the classification modifications recommended by Torma (2007), it provides a technique covering social, environmental, economical dimensions.

We organized the main idea of our survey around the concept of Winter (1997). According to it, the result based on the environmental impacts reflecting in the *EP* will rely on whether the companies and advisers implementing the system, attempt to build up a functioning system, or they are satisfied with an accurately documented (and certifiable) system, which may not function.

The purpose of our survey was the uniformly interpretable evaluation of the varied processes. Furthermore the creation of an *EMS* development model concept aimed at the functional utilization of the results and the improvement of the parameters concerning the physical *EP*. We tried to find the answers to the following questions: Which are the main efforts of the organizations applying *EMS* to fulfil the international standard requirements? What is the role of the 'Plan' phase in the improvement of the efficiency of *EMS*? Which parameters do play a role in its optimization? Which are the determinant dimensions of environmental performance in the 'Plan' phase? How and at what level can the *EMS* practice of companies be assessed? How can the efficiency of *EMS* be improved in practice?

2 MATERIAL AND METHOD

We assumed that there are factors along which, from the point of view of the physical *EP*, the optimization process of *EMS* is *biased*. This could be, for example, the low level of management of environmental impacts or the overemphasising of management issues.

The cardinal point of the proper operation is to identify and evaluate the relevant pairs of 'environmental factor-environmental impact' in a more accurate way *based on environmental science*. This will be followed by the *integration of this environmental information* in the process of the determination of the environmental objectives. In the *PDCA* cycle (Plan – Do – Check – Act) operating the *EMS*, this process is covered by the 'Plan' phase ("Planning – Execution – Control – Action" or *PDCA* method).

Specifically in the physical *EP* dimension, the description of the *"partial" performance pertinent to the management of the environmental impacts* was defined on the basis of the detection of the variables and *optimization parameters* of the 'Plan' phase and the *EMS* impact evaluation process *(Figure 1.).*

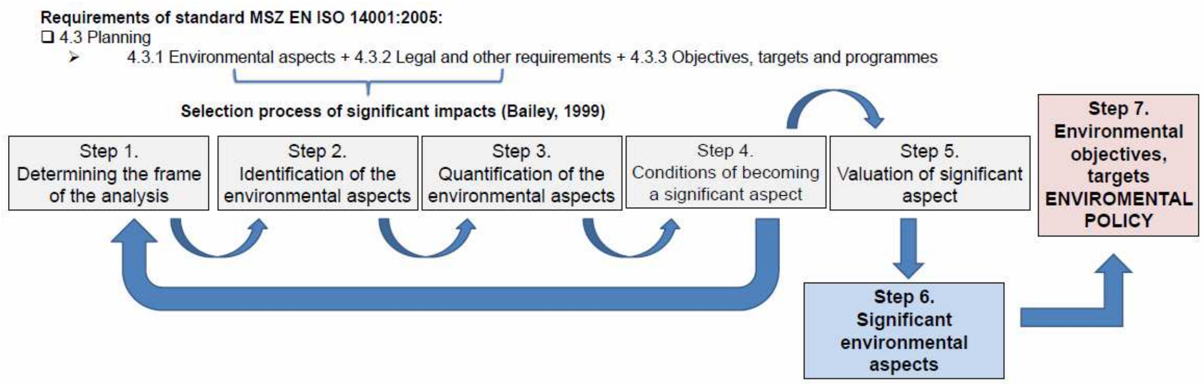

Figure 1. Requirements of the Plan phase and the process of selection of significant impacts in the standard ISO 14001 (Bailey 1999) (own design)

Our quantitative empirical research (2010–2011) has been conducted by using questionnaires in 114 multinational and domestic companies (sampling ratio: 9,89%) applying *EMS* according to the standard *ISO 14001*. The answers were controlled on the basis of the opinion of 10 certification companies (sampling ratio: 62,5%). The sample contained mainly medium-sized companies (55%), but in smaller part, small (13%) and large (18%) as well as micro-enterprises (8%) were represented.

Regarding the industrial classification provided, the following branches were represented mainly equally: metal industry, automobile industry, mining industry, health care, furniture industry, packaging industry, telecommunications, food industry, energy industry, forestry, manufacturing industry, service and trade, machine industry, chemical industry, waste management, waterworks, environmental protection, research and development, agriculture, plastics industry, printing industry, heavy industry, building industry, traffic, transport, glass industry.

In the sample of companies, energy and construction were represented in larger proportion; the organizations of waste management and chemical industry were present in moderate proportion.

Table 1 shows the regional distribution of the examined sample from the company universe, i.e. of the 1153 organizations certified by the international standard *ISO 14001* (*KÖVET EMS* -Checklist 2007).

Table 1. Geographical distribution and proportion of the company universe and of the sample

Region	**Company universe** (number)	**Proportion (universe)** (%)	**Company sample** (number)	**Proportion (sample)** (%)	**Sample ratio** (%)
Foreign countries	3	0,26	9	7,89	300,00
Budapest	315	27,32	27	23,68	8,57
Middle-Hungary	113	9,80	12	10,53	10,62
West-Transdanubia	123	10,67	15	13,16	12,20
Middle-Transdanubia	143	12,40	15	13,16	10,49
South-Transdanubia	135	11,71	7	6,14	5,19
North-Hungary	90	7,81	8	7,02	8,89
North-Alföld	137	11,88	7	6,14	5,11
South-Alföld	94	8,15	6	5,26	6,38
ND	0	0,00	8	7,02	0,00
Total	**1153**	**100,00**	**114**	**100,00**	***9,89***

We analysed the general level and motivations of the environmental management of companies; the characteristics of the methodologies applied in environmental impact evaluation; questions relating *EMS* application and environmental objectives (integrated management, conflicts); the role of *EMS* in influencing the state of environmental elements; the specific environmental arrangements; and the main company efforts in operating of *EMS*.

In case of the main differential factors (customized solutions and purposefulness of *EMS*, application of *EMS* in the future, attitude of the senior management, year of initiation etc.) the 'best practices' could be filtered out by the processes accommodated to other parameters by strong organizations.

We counted the relevant *optimization parameters* detected in the course of the questionnaire survey for *indicators*. These indices indicated the *manner* of the application of the standard requirements, on the basis of which we *qualified* the efforts. By the *numerical qualification of the specific indices* we *envisaged evaluable developments*.

Besides the descriptive statistics (frequency analysis), we executed multivariable statistical evaluation of the data base of the questionnaire survey (correlation analysis, factor analysis by: varimax rotation and cluster analysis, by hierarchical average linkage clustering and K-means method).

For quantification we constructed performance indices by merging the connectable parameters. We aggregated the information accordant to the meaning of the indices. With the aim of detecting the correspondent variable groups, i. e. the dimensions of performance we applied principal component analysis *(PCA)*.

On the base of the parameters influencing corporate *EP*, we created 4 corporate performance indices: environmental motivation *(MOT)*, environmental performance *(EPI)*, impact evaluation *(EIE)* and management *(EMI)* (applying the method of Pataki – Tóth, 1999).
For the indices we used the quantifiable variables. The structure of the created system and the point values were covered in 'index background tables' *(Table 3)*. We accomplished

the description of the merged performance of respondents by defining a fifth, aggregative index *(AGG)*.

By the created quantified index values, the post-development, relative evaluation of the corporate performance is uniformly executable, without intervention in the varied corporate processes.

In case of the created indices (answers: *'A'* – unfavourable and *'B'* – favourable group), we examined the performance of respondent organizations by sensitivity survey and histogram analysis depending on the main parameters. In the course of the sensitivity analysis of the indices, we interpreted the variables causing significant differences as development suggestions. The detected effects of parameters and the arrangements made for their improvement give the opportunity to estimate the fields of corporate development for the sake of improvement of *EP* in the course of implementation and operation of *EMS*. Some of the summary of the influences of the identified 36 development opportunities can be found in the'Auxiliary Table' of *Table 4*.

The application of the background and auxiliary tables of indices opens up the opportunity for the expedient development of the performance and efficiency of the *EMS* 'Plan' phase. In order to support this, we elaborated a self-evaluation based *EMS* development model for the determination of most appropriate developments by organizations *(Figure 4)*. With the help of indices, the efforts can be expressed in a quantitative way. The evaluation method identifies the weak and strong points, and determines the appropriate and effective developments, providing a decision support.

3 RESULTS

3.1 The main results of frequency analysis

We detected the efforts of the respondents according to the *EMS* operation. The efforts, examined by the function of the certain phases of *PDCA* cycle and the time, occurred at maximum frequency significantly in the 'Plan' phase (in 68% of the organizations). Increased activity occurred mainly regarding the environmental factors and environmental goals (32%), within the first three years from the implementation of *EMS*. The users were encouraged to significant and permanent efforts by the renewing objective system (18%) and the legal and other requirements (15%).

We have proved the importance of the environmental motivation (attitude) in the environmental impact based optimisation of *EMS*, as one of the determinants of the frame of impact evaluation.

Quantifiable benefits from the application of the *EMS* accrued at more than the half of the organizations (53%). The emergence of benefits had a favourable effect on the motivation of the organizations. It plays an indirect role in the environmental impact based optimisation of *EMS*.

We have concluded that the appropriate customization of *EMS* favourably developed the handling of environmental aspects/impacts.

We evaluated the application frequency of the additional corporate environmental management means playing a role in customization *(Figure 2.)*.

We have stated that techniques requiring profound environmental survey, considerable resources and efforts is still at low level in the *EMS* impact evaluation processes. We have demonstrated that concerning the methods applied in environmental impact assessment, mostly own company methodology (82%) was adopted. In case of the majority (70%) of the organizations the review of factors was required. We have found that certain corporate methods provide environmental information at low level.

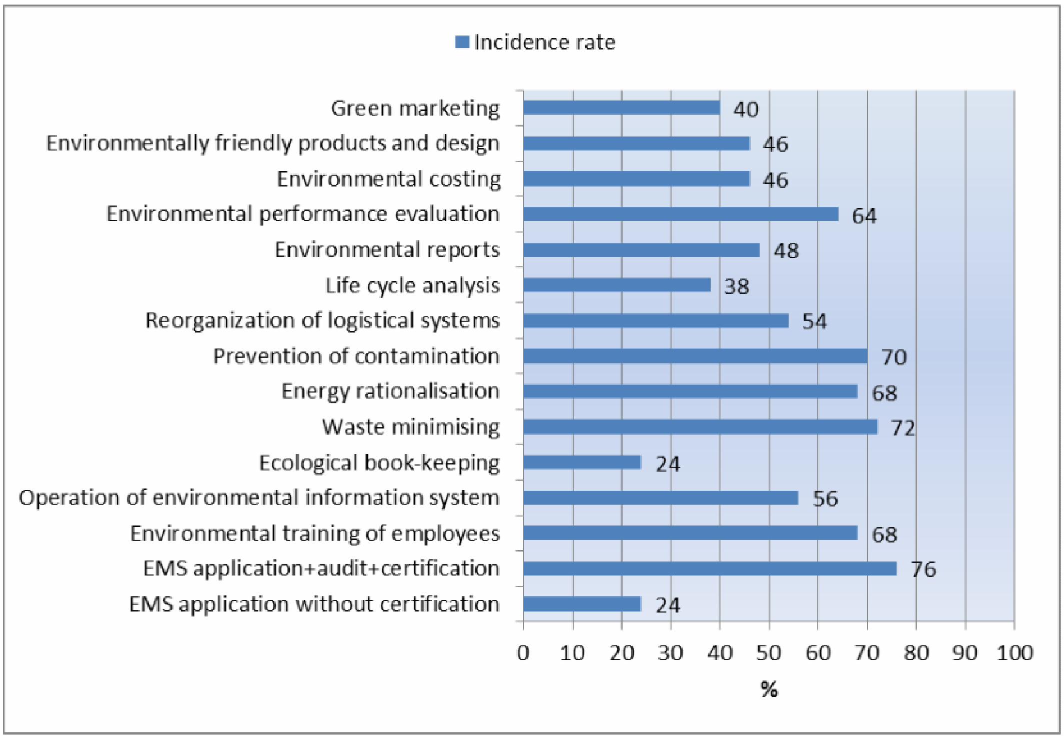

Figure 2. Application frequency of environmental management means in organizations (%)

Among the conditions of becoming significant factor, we identified the data, derived from the technological knowledge, as strong environmental information with regard to the detection and evaluation of the impact factors in the company practice. By this also the important criterions of legal and environmental science become strong aspects in the decision process. We mainly had available data related to the environmental impacts of technology, which we had found well covered in the corporate material and energy balances.

Realization effectiveness of objectives, compared to the envisaged ones, has brought slightly better results in the long-term (87%) than after the first *EMS* certification (79%).

We examined the progress of the facilitating/aggravating factors of the operation of *EMS* in the first three years, presented in *Figure 3*.

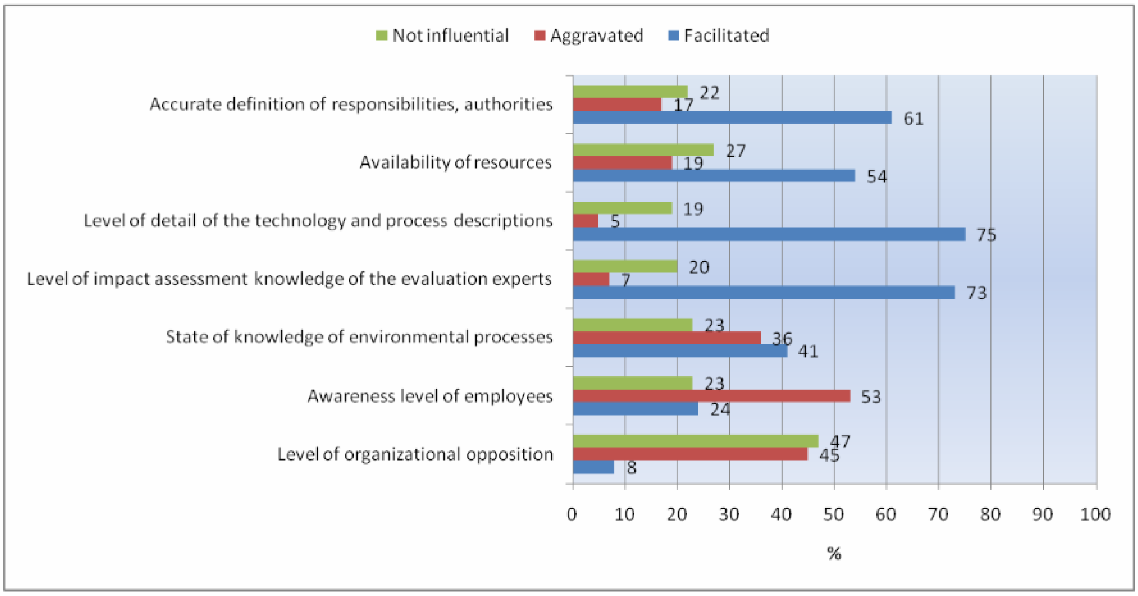

Figure 3. Influencing factors of the operation of EMS in the first three years

Regarding the role of *EMS* in influencing the condition of environmental components, a definitely strong positive influence (average value: 4,10; range: 1,00–5,00) can be noticed among those companies applying *EMS*.

3.2 Factor and cluster analysis

The reduced database of questionnaire survey was subjected to principal component analysis. The result of factor analysis indicated that the *EP* of the industrial companies performing in the survey and the effectiveness of *EMSs* can be explained and separated characteristically along six dimensions:

- factors of proactivity, verification of environmental impacts, adequate objectives and *EMS* procedure proved to be common principal components, while
- factors of exterior motivation (business partners) and interior audit occurred as specific indices.

As an auxiliary step of the survey, we executed the rotation recommended for validation. The Varimax rotation confirmed the above interpretation of the factor matrix.

By simplifying the dimensions of performance we have created a manageable structure eligible for further examinations. The dimensions are as follows:

- motivation for environmental protection
- environmental performance
- environmental impact evaluation
- environmental management.

On the basis of the results of the factor analysis, we have grouped the companies with cluster analysis. Firstly, we run a hierarchical cluster analysis, measuring the distance by average linkage clustering. The analysis has demonstrated 2 separated cluster structures. Following that, we carried out the K-means cluster analysis, where again 2 clusters appeared:

- 41 elements in the first cluster ('Formalists')
- the second cluster contained 73 companies ('Environmental performance oriented')

The result confirmed the opinion of Winter (1997), according to which the companies belong to distinct groups, the *formal* and the *EP-oriented* group. Thus, the optimisation of the application of *EMS* has the potential for the development of physical *EP* and a beneficial influence on the environment.

3.3 Summary of developments

3.3.1 Construction of performance indices

We have demonstrated that the improvement of physical *EP* can be executed through the development of the 'Plan' phase and through evaluation of the *EMS*. Our research has detected the factors and the characteristics of best practice which influences the result of the 'Plan' phase process directly and the whole *EMS* indirectly.

We have demonstrated that the relevant *EMS* optimisation variables affect the level of the 'Plan' phase and the *EMS* impact evaluation process. According to the meaning of the variables we executed their grouping (partial performance dimensions).

In order to characterise variable groups as dimensions, we constructed the following indices: environmental motivation *(MOT)*, environmental performance *(EPI)*, environmental impact evaluation *(EIE)* and environmental management *(EMI)*. We have summarised the performance indices and the values of the company sample in *Table 2*.

Table 2. Data of constructed EMS performance indices

EMS performance index	**Abbreviation**	**Number of variables**	**Index value (1,00–5,00)**	**Deviation**
1. Environmental motivation index	MOT	15	3,14	0,74
2. Environmental performance index	EPI	6	3,49	0,66
3. Environmental impact evaluation index	EIE	16	3,09	0,61
4. Environmental management index	EMI	26	3,05	0,50
5. Aggregative index	AGG	–	3,20	0,20

The structure of each index is found in a background table *(Table 3)*, which provides detailed, quantifiable information about the partial performance peculiar to the corporation.

Table 3. Example. Construction of the environmental motivation index (MOT)

Motivation topic	**Variable**	**Evaluation**
Motivation of environmental actions	External motivations ***Strict regulatory system*** ***Expectations of banks and insurers*** ***Requirements of business partners*** Expectations of competitors Market and customer demands ***Strong influence of local population*** *Civil organizations* Internal motivations ***Expectations of the owners*** Nature of product/service Expectations of the employees	yes = 5 points no = 1 point
Motivation implied by the quantifiable benefits	Quantifiable benefit	yes = 5 points no = 1 point
Motivation for the future application of *EMS*	***Future application of* EMS**	essential = 5 points neutral = 3 points unnecessary = 1 point
Environmental awareness of the senior management in the determination of environmental objectives	Determination of the environmental objectives ***Environmental awareness of the senior management*** ***Environmental strategy of the organization***	yes = 5 points no = 1 point
Motivation for the environmental purpose orders (in the last 3 years)	Order for environmental purpose	yes = 5 points no = 1 point

Variables in italics: parameter identified by correlation analysis; **variable marked in bold:** parameter with large principal component weight; non-marked variable: variable built in with process-oriented approach.
The index represents the following environmental motivations: extent of the environmental external-internal motivation, occurrence of the quantifiable benefits, approach for the future application of the *EMS*, environmental awareness of the senior management, environmental strategy of the organization and the orders for environmental purpose.

In order to weigh the variables, we could have used either the relevant variables of the correlation analysis on the basis of the equivalency ratios (classification factors) or the direct application of factor weights. The calculation of independent variables with smaller weight would not have been accurate, because by this we would have ignored the individual importance of the information content of the variables. We dispensed with these techniques the opinion of Miakisz (1999).

We chose the average of the variables as the appropriate method to calculate the values of the indices, in which we calculated the variables with equal weight.

We created the aggregative index *(AGG)* by averaging the values of the *EMS* indices, in order to express the result of the survey in one single number without dimension. The different sensitivity of the indices influences the *AGG* value. This effect is largely originating from the higher sensitivity of the *EPI* index. The more robust sensitivity of the *EMI* index results from the fact that the included variables are almost the twice of the variables of the other indices. *MOT* and *EIE* indices have normal sensitivity. The value of the aggregative index *(AGG)* was 3,20, i. e. average (range: 1,00–5,00; deviation: 0,20).

We developed an evaluation method to apply the indices, by which we have the possibility to rate the performance per dimension and the aggregate partial performance of the participants. Furthermore, the method enables intra-corporate self-assessment under certain conditions, additionally inter-corporate comparison concerning the survey period. We achieved this without modification of the processes identified in the organizations.

Performance indices were established per organization. In order to quantify environmental information we used the evaluation of each variable as a base (range of values: 1–5). By quantifying the information we gave the organizations the opportunity for self-evaluation. The results were usable for status review concerning each index and their variables. In the variable groups (in partial performance dimensions) we calculated the typical performance characterized by the index averages. This provided information about the efficiency of the 'Plan' phase development in the given period.

3.3.2 EMS development model based on self-evaluation

In the course of the sensitivity analysis of the indices, we interpreted the variables causing significant differences as development suggestions. We identified the potential result of the improvements from index averages. Targeted developments can be assigned to certain performance dimensions. To support the assignment process, we elaborated detailed auxiliary tables *(Table 4)*. In case of the certain indices, we ranked the significance of the impact of *EMS* variable from 1 to 4. Finally we interpreted the differences observed in the aggregative index, as the complete, partial, specific or neutral speciality of the impact related to index dimensions. The ranking of the *EMS* variables was based on the differences of the average values experienced in the aggregative index.

To put our research achievements into practice, we evolved the self-evaluation based *EMS* development model *(Figure 4)*.

Table 4. Example. Auxiliary table: Identified impact of EMS variables upon the indices

EMS variable	**Impact of EMS variable**					**Ranking: difference experienced in aggregative index (B-A)**
	MOT	**EPI**	**EIE**	**EMI**	**AGG**	
Application of environmental performance evaluation system	2	(1)	3	4	complete	0,7
Articulation of environmental objectives to the local significant aspects	2	3	(1)	4	complete	0,47
Importance of the future application of *EMS*	(1)	3	4	2	complete	0,46
Targetedness of *EMS*	2	(1)	3	4	complete	0,45
Extension of the data in the material and energy balance of the organization to the factors on which the organization has an expectable influence	1	3	4	(2)	complete	0,44
Environmental awareness of senior management in setting environmental objectives	(1)	3	4	2	complete	0,43
Application of impact register	4	(1)	3	2	complete	0,41
Customization of *EMS*	3	2	4	(1)	complete	0,4
Preventive approach in the documented environmental processes of the organization regarding the material/ energy consumption and emissions	2	3	4	(1)	complete	0,35
Careful treatment in the documented environmental processes of the organization regarding the material/ energy consumption and emissions	2	3	0	(1)	complete	0,51
Adequacy for legal requirement in the selection of significant environmental factors	2	0	(1)	0	partial	0,44
Environmental strategy of the organization in setting the environmental objectives	(1)	3	2	0	partial	0,43
Expectation of the owners	(1)	0	0	0	specific	0,43
Certification of the suppliers	0	(1)	0	0	specific	0,37
Recycling in the documented environmental processes of the organization regarding the material/ energy consumption and emissions	1	0	0	(2)	partial	0,34
Application of LCA	3	(1)	2	0	partial	0,34

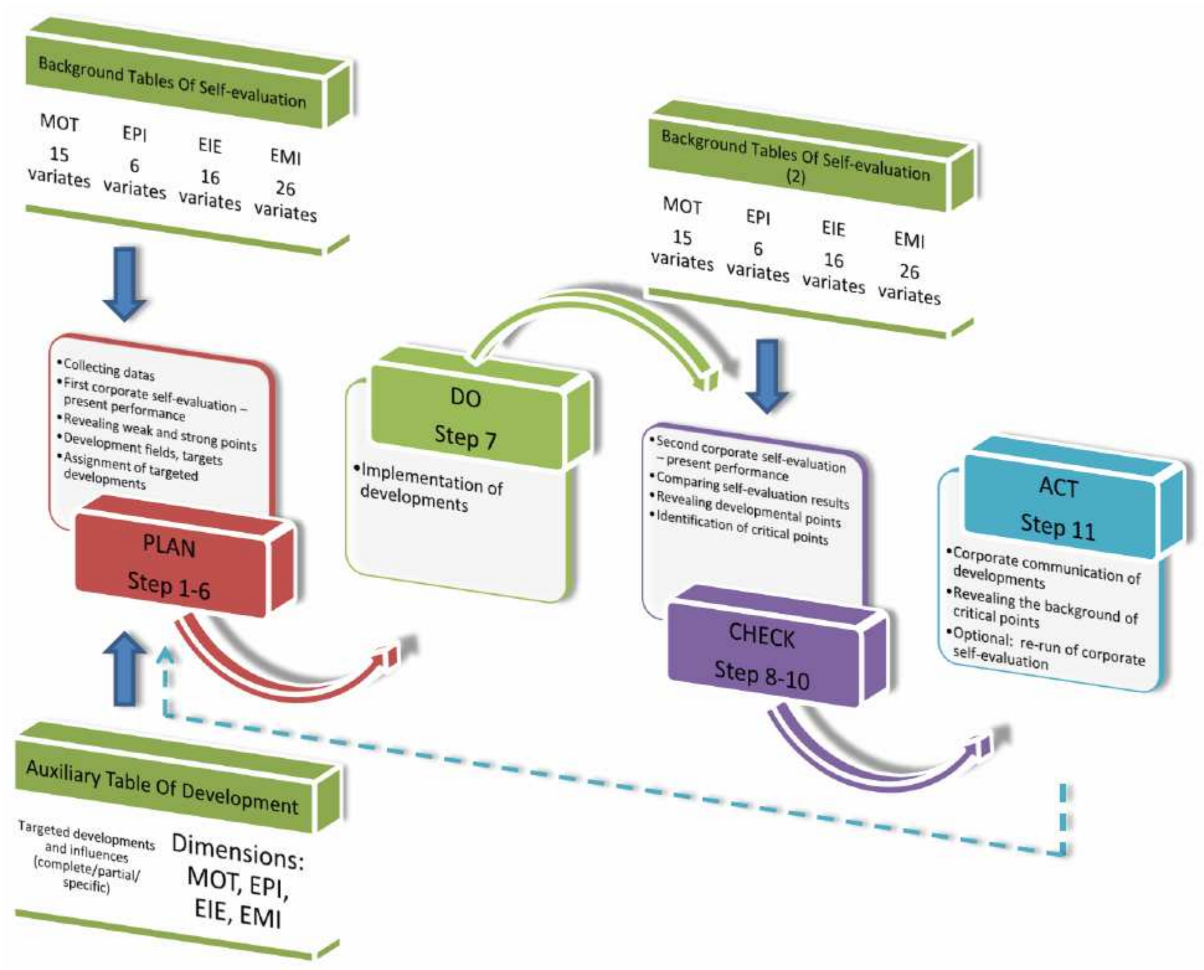

Figure 4. Model flowchart: the EMS development model based on self-evaluation for the ’Plan’ phase of EMS according to the principle PDCA

Through the model, we created a system of correlations and formulated technical recommendations for defining and programming the targeted development tasks. This is a decision support tool *(Step 1-11)* for the continuous improvement of *EMS*, in the surveyed partial performance dimension according to the principle *PDCA*.

From Step 1 to Step 11:

I. ‘Plan’ phase of the model:

Step 1, START:

- *Function:* Study of the *EMS* performance indices (4+1 pcs) and their variables applied in the model in regard of the values definable by the organization. Collection of data.
- *Result:* Criterion: All of the *EMS* variables are evaluable concerning the organization: MOT (15 variables), EPI (6 variables), EIE (16 variables), EMI (26 variables), AGG.

  Preparation of evaluation: background tables of the indices and their variables, development auxiliary tables. Collected environmental data of company.

Step 2:

- *Function: First corporate self-evaluation* by the indices meaning the performance dimensions and their valuable variables. Status review. Completion background tables.
- *Result:* First completed self-evaluation. Quantifiable values by variables and indices, as well as in case of aggregated index. Completed background tables. Registration of the certain environmental performance of *EMS*. (1,00–5,00).

Step 3:

- *Function:* Examination of the results of self-evaluation by variables and indices.
- *Result:* Detection of weak and strong points. Interpretation of the first self-evaluation of organization.

Step 4:

- *Function:* Analysing the manageability of the weak points.
- *Result:* Establishment of order of priority for the development of weak points.

Step 5:

- *Function:* Determination of development fields on the level of evaluated variables and indices (by priorities), application of background tables.
- *Result:* Development objectives set out concerning the certain variables and indices (by priorities).

Step 6:

- *Function:* Assignment of the relevant *EMS* variables relating to the selected development objective(s), forecast of their expected impact by using the auxiliary tables 1 and 2.
- *Result:* Development program: *EMS* variables assigned to the targeted development(s). Identified targeted development field(s) and expected impact(s).

II. 'Do' phase of the model:

Step 7:

- *Function:* Realising the development objective(s) according to the meaning of the *EMS* variable and in view of the expected impact.
- *Result:* Execution of development(s).

III. 'Check' phase of the model:

Step 8:

- *Function: Second corporate self-evaluation* by the indices meaning the performance dimensions and their valuable variables for the assessment of achievement(s). Completion background tables.
- *Result:* Second corporate self-evaluation. Quantifiable values by variables and indices, as well as in case of aggregated index. Completed background tables. Registration of the environmental performance of *EMS*. (1,00–5,00).

Step 9:

- *Function:* Comparison of the achievements of the targeted and realized development field(s). Controlling of the field and extent of development by variables and indices.
- *Result:* Interpretation of the second self-evaluation of organization. Comparison with the results of the first self-evaluation by variables and indices.

Step 10:

- *Function:* Detection and identification of development point(s). Determination of critical point(s).
- *Result:* Detected development and critical point(s).

IV. 'Act' phase of the model:

Step 11, STOP:

- *Function:* Inter-corporate communication of the realised development(s). Detection of the background of critical points. *Optional:* Re-run of the corporate self-evaluation after the carry out of the priorities based on the first self-evaluation.
- *Result:* Feedback to the 'Plan' phase *(Step 1.)*.

4 CONCLUSIONS

The *EMS* impact evaluation process is one of the uppermost means of environmentally aware corporate management at the disposal of the organizations for developing their *EP*.

In certain cases, corporate methods are below the minimal requirements of the *ISO 14001* international standard. They only provide environmental information at low level. The development of this situation and improvement of environmentally aware corporate management are key points in the course of improvement of physical *EP* of the *EMS*.

In the course of our methodical research, we have achieved a potential indirect development of the physical *EP*. The identified, potential development efforts affected the planning parameters pertinent to the treatment of the environmental aspects and impacts. We ensured the uniform evaluation of different organizations. It does not require the modification of the varied corporate processes, and provides the opportunity for comparison. The developed model is a development and decision support tool. Through applying the model, the organizations will be able to improve the efficiency of the 'Plan' phase and their environmental management system.

Acknowledgement: We express our sincere thanks to ass. prof. Dr. Botond Héjj CSc., Dr. László Tamaska, director, Dr. Olivér Bogdán, director and János Nagy, head auditor, who all assisted us with useful advice. Without the cooperation of the companies and certification authorities this work could not have been achieved.

REFERENCES

BAILEY, A. (1999): Környezeti auditálás [Environmental audit]. In: BAILEY, A. – BEZEGH A. – FRIGYER A. – BÁNDI GY. – GALLI M. – KEREKES S. – TÓTH G. (1999): Környezeti vezető és auditor képzés. [Training of Environmental Managers and Auditors] Magyar Szabványügyi Testület (MSZT), Budapest : 79–88. (in Hungarian)

BRAGDON, J. H., MARLIN, J. A. T. (1972): Is pollution profitable? Risk Management, 19(4): 9–18.

FOGLER, H. R., & NUTT, F. (1975): A note on social responsibility and stock valuation. Academy of Management Journal, 18: 155–160.

FREEDMAN, M., – JAGGI, B. (1982): The SEC's pollution disclosure requirements – Are they meaningful? California Management Review, 24(2): 60–67.

FRISCHKNECHT (2005): Methoden der Umweltbewertung technischer Systeme, Teil 1: Ökobilanzen (Life cycle assessment, LCA), ETH Zürich, Studiengang Umweltnaturwissenschaften, Sommersemester, Zürich

HERCZEG, M. (2005): Környezetmenedzsment. [Environmental Management] Budapesti Műszaki és Gazdaságtudományi Egyetem Környezetgazdaságtan Tanszék. Budapest (in Hungarian)

HOFSTETTER, P. (1998): Perspectives in Life Cycle Impact Assessment. A Structured Approach to Combine Models of the Technosphere, Ecosphere and Valuesphere. Kluwers Academic Publishers

HOLMAN, W. R., NEW, J. R., & SINGER, D. (1985): The impact of corporate social responsiveness on shareholder wealth. In L. Preston (Ed.), Research in corporate social performance and policy, vol. 7: 137–152. Greenwich, CT: JAI Press.

ISO 14001: Environmental management systems. Specification with guidance for use (ISO 14001:2004), Hungarian Standards Institution, Budapest, 2005

ISO 14031: Environmental management. Environmental performance evaluation. Guidelines (ISO 14031:1999). Hungarian Standards Institution, Budapest, 2001.

KEKEKES, S. – KINDLER, J. (eds.) (1997): Vállalati környezetmenedzsment. [Corporate Environmental Management] Budapesti Közgazdaságtudományi Egyetem, Budapest. (in Hungarian)

KÓSI, K. – VALKÓ, L. (1999): Környezetgazdaságtan és –menedzsment. [Environmental Economy and –Management] Eötvös József Főiskola Műszaki Fakultás, Baja (in Hungarian)

KÖVET Egyesület a Fenntartható Gazdálkodásért, KIR – lista [KÖVET Association for Sustainable Economies, EMS Check-list]. 2007 (On-line: http://www.kovet.hu/ISO14001/Linkek/KIRnyilvantartas.htm) (in Hungarian)

KUN-SZABÓ, T. (1999): A Környezetvédelem minőségmenedzsmentje. [The Quality Management of Environmental Care.] Műszaki Könyvkiadó, Magyar Minőség Társaság, Budapest (in Hungarian)

MIAKISZ, J. (1999): Measuring and Benchmarking Environmental Performance in the Electric Utility Sector: The Experience of Niagara Mohawk. In: BENNETT, M. – JAMES, P. (eds.): Sustainable Measures, Greenleaf Publishing, Sheffield, p. 221–245.

NAGY, G. – TORMA, A. – VAGDALT, L. (2006): A környezeti teljesítmény javítása és értékelése [The Development and Evaluation of Environmental Performance]. Universitas-Győr Nonprofit Kft., Győr, (in Hungarian)

PÁJER, J. (2011): A környezeti terhelés minősítése. [The Qualification of the Environmental Loads.] In: LAKATOS F., SZABÓ Z. (eds.): Nyugat-magyarországi Egyetem Erdőmérnöki Kar Kari Tudományos Konferencia Kiadvány. [Proceedings of the Scientific Conference of the University of West Hungary Faculty of Forestry] NyME Kiadó, Sopron, p. 14. (in Hungarian)

PATAKI, GY. – TÓTH, G. (1999): Vállalati környezettudatosság, GEMS-HU jelentés [Corporates' Environmental Awareness, Global Environmental Management Survey in Hungary (GEMS-HU) Report], KÖVET , Környezettudatos Vállalatirányítási Egyesület, Budapest (in Hungarian)

POLGÁR, A. (2011): Környezetirányítási rendszerek hatáselemzésének vizsgálata. Analysis of Impact Assesment of Environmental Management Systems.] In: A Nyugat-magyarországi Egyetem Savaria Egyetemi Központ Tudományos Közleményei XVIII. Természettudományok 13. Supplementum – VI. Euroregionális Természettudományi Konferencia Konferencia Kiadványa. NymE Kiadó. NymE-SEK-TTK: 163–168., Szombathely. ISSN 0864-7127, HU ISSN 2061-8336 (in Hungarian)

POLGÁR, A. (2012): Környezeti hatásértékelés a környezetirányítási rendszerekben. [Environmental Impact Evaluation in the Environmental Management Systems]. Doctoral (PhD) Dissertation. Sopron, 380 p. (Online: http://ilex.efe.hu/PhD/emk/polgarandras/disszertacio.pdf) (in Hungarian)

RÉDEY, Á. – MÓDI, M. – TAMASKA, L. (2002): Környezetállapot-értékelés. [Environmental State Evaluation] Veszprémi Egyetemi Kiadó. Veszprém, p. 8., 50. (in Hungarian)

RÉDEY, Á. (2008): Környezetmenedzsment rendszerek. A felsőoktatás szerkezeti és tartalmi fejlesztése. [Environmental Management Systems. Structural and Material Development of the Higher Education] HEFOP 3.3.1-P.-2004-0900152/1.0. Veszprém, p. 24., 27., pp: 81–82. (in Hungarian)

ROCKNESS, J., SCHLACHTER, P., & ROCKNESS, H. O. (1986): Hazardous waste disposal, corporate disclosure, and financial performance in the chemical industry. In M. Neimark (Ed.), Advances in public interest accounting, vol. 1: 167–191. Greenwich, CT: JAI Press.

SAVAGE, E. (2000): MSV and public disclosure of performance goals are key agenda issues, Chemical Market Reporter, May 22, 2000, Vol. 257, Iss. 21, New York, p. 25.

SEIFERT, E. K. (1998): Kennzahlen zur Umweltleistungsbewertung – Der internationale ISO 14031-Standard im Kontext einer zukunftsfähigen Umweltberichterstattung. In: SEIDEL, E. – CLAUSEN, J. – SEIFERT, E. K.: Umweltkennzahlen, Verlag Vahlen, München, p. 71–120.

SPICER, B. H. (1978a): Investors corporate social performance and information disclosure: An empirical study. Accounting Review, 53: 94–111.

SPICER, B. H. (1978b): Market risk, accounting data, and companies' pollution control records. Journal of Business, Finance, and Accounting, 5: 67–83.

TORMA, A. (2007): A környezeti teljesítményértékelés aggregáló módszerei és az anyagáram-elemzés kapcsolatrendszere – Egy integrált vállalati modell megalapozása. Doktori értekezés [The Relationship Between the Aggregation Methods of Environmental Performance Evaluation and Material Flow Analysis. Establishment of an Integrated Corporate Method.] Doctoral (PhD) Dissertation. BMGE-GTK, Budapest. (in Hungarian)
(On-line: http://www.omikk.bme.hu/collections/phd/Gazdasag_es_Tarsadalomtudomanyi_Kar/2008/Torma_Andras/ertekezes.pdf)

WINTER, G. (1997): Zölden és nyereségesen. [Green and Profitable.] Műszaki Könyvkiadó Budapest, (in Hungarian)

WISEMAN, J. (1982): An evaluation of environmental disclosures made in corporate annual reports. Accounting, Organizations, and Society, 7: 53–63.