CORVINUS UNIVERSITY OF BUDAPEST

WHAT MAKES A COMPANY GREEN?

ENVIRONMENTAL PERFORMANCE OF MANUFACTURING COMPANIES

PH.D. DISSERTATION

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Budapest, 2008

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Introduction

How to evaluate corporate environmental performance reliably has been in focus of interest for the author for a long time. Countless different theoretical models and empirical researches exist regarding interpretation and assessment of environmental performance; although when studying the literature a major problem arises: because of very different interpretations, totally different and contradictory conclusions are not uncommon. Some researchers define environmental performance as emissions of companies; others interpret it as level of environmental management, while others again as the combination of these two or even more components.

As Lober ([1996], p.184.) stresses, there are plenty of statements about which companies are the most green; although there is no clear and commonly accepted definition on "green-ness" or (good) environmental performance.

Although some researchers interpret environmental performance comprehensively enough, they usually put less effort on its relationship to corporate success. Other approaches focus on the relationship to corporate performance; they usually simplify the interpretation of environmental performance by picking out a relatively easily measurable component.

In the dissertation the concept of environmental performance is analysed in connection with general corporate performance. In literature there are many motivation factors for environmental performance (legislation, cost saving opportunities, expectations of society, etc.) but finally company decisions are made based on their expected effects on company performance. Aim of the dissertation is to evaluate corporate environmental performance – based on identified performance components – as substantially as possible; there was no intention to make a systematic methodological guidance for environmental performance evaluation.

Thus focus in the dissertation is made on links between company and environmental performance; as well as between different components of environmental performance.

In the first chapter, traditional, financial-focused approaches of corporate performance are compared to complex interpretations considering many different aspects. These latter, strategic approaches enable the integration of environmental performance into evaluation of company performance.

In the second chapter different approaches of environmental performance are introduced and compared. Based on literature research, concept and components of environmental performance are identified according to the author's own model. Four identified elements of company environmental performance are: 1. environmental management, 2. concrete environmental actions and innovations, 3. environmental load and 4. changes in the state of environment as a consequence of company activities. As a next step, several – in practice also widely used – environmental performance evaluation methods are analysed, to what extent they can cover identified performance elements.

Third chapter of the dissertation focuses on potential connections between environmental performance and other fields of company performance. According to one group of approaches, good environmental performance contributes to improvements in competitiveness and financial effectiveness (through cost savings or chance for entering new markets). This group – including the concepts of Michael Porter – is called "optimistic" in the dissertation. Many authors challenge this concept, claiming that there is a necessary trade-off between environmental and financial performance; one can be improved only at the expense of the other. This latter approach is called "sceptic". The "realist" approach may seem to be the most acceptable, stating that there are no general win-win or zero sum models, relationship of environmental and company performance depends mainly on circumstances. On the long run however, good environmental performance most probably contributes to company success.

Fourth chapter includes research hypotheses on different components of environmental performance, as well as on links between environmental performance and other fields of company performance.

Empirical analysis of company environmental performance includes two steps. In the fifth chapter, hypotheses are tested with statistical methods, based on the database of a survey among Hungarian manufacturing companies.

As a next step of empirical analysis, interviews with corporate professionals were made, process and findings of research can be found in chapter six.

Finally, main findings of the dissertation are summarised.

1 A strategic approach to corporate performance

1.1 The concept of corporate performance

To be able to study environmental performance in connection with corporate performance later, there is a need for a deeper analysis of the concept of corporate performance.

The words of the poet Ferenc Kazinczy are still true: „good and well, this is the big secret[1]"; corporate performance is a multidimensional, complex concept, characterised by the duality of *effectiveness* and *efficiency*. Effectiveness means that a company sets itself the right goals and also completes them; while efficiency refers to the fulfilment of the set goals with the optimal use of resources (Carnell [2003], p.61.). Dobák ([2001], p.186.) mentions the example of a Hungarian shoe factory for that. In the seventies the factory followed the practice of mass producing of black and medium quality boots, in that it was very efficient (and also effective by that time, as it had virtually unlimited market potential among the socialist countries). In the nineties, however, it turned out that this strategy would not be successful any more, so the managers of the company had to reshape the aims to be able to maintain effectiveness.

As Wimmer ([2002], p.5.) stresses, in the Hungarian terminology there are more notion-pairs having the same meaning as effectiveness-efficiency[2], so one has to be careful not to get confused. Rolstadas et al. ([1995], p.173.) build in *adaptability* as a third dimension into the concept of corporate performance.

Corporate performance is in close relationship with company aims and strategy. Moll ([1993], p.5ff.) explains corporate performance as achieving corporate goals effectively; and differentiates market, operational, financial and income goals. According to Gruman ([2004], p.49.) performance can be everything that is important for completing company strategy, such as net income, proportion of faulty products, turnover per employee, etc.

Besides the differentiation of effectiveness and efficiency, for the characterising and measuring corporate performance one needs to identify its most important elements and to fill the concept with content. Financial performance is a major component of

[1] "jót s jól, ebben áll a nagy titok"
[2] Such as „eredményesség-gazdaságosság", „hatásosság-hatékonyság", „hatékonyság-gazdaságosság", etc.

corporate performance. Although the importance of financial performance from the point of view of company success is indisputable, it is not sure that one can get a real picture on the performance of a company based only on financial indicators. Kaplan and Norton ([2000], p.38.) divide corporate performance to 1. financial, 2. customer, 3. internal business processes and 4. learning and growth components; stressing the importance of causality between the different components. The authors also point out that corporate performance is too complex to be characterised by past-oriented, mainly financial indicators. Besides the past-oriented *lagging indicators,* there is a strong need for future-oriented *leading indicators*.

Barbosa and Louri ([2005], p.76.) differentiates four components: productivity, profitability, growth and consumer satisfaction. Within corporate performance Wimmer [2001], p.2ff.) regards financial, market and operational performance. During their research project "Corporate competitiveness in the globalising Hungarian economy" Chikán et al [2002], p.195ff.) examined different elements of corporate performance beyond financial performance. These were:

- marketing,
- operational,
- corporate information technology and
- environmental

performance elements.

The strategic approach of corporate performance is more complex than measuring financial performance, it links performance goals to corporate strategy; and other performance dimensions also appear besides the financial one.

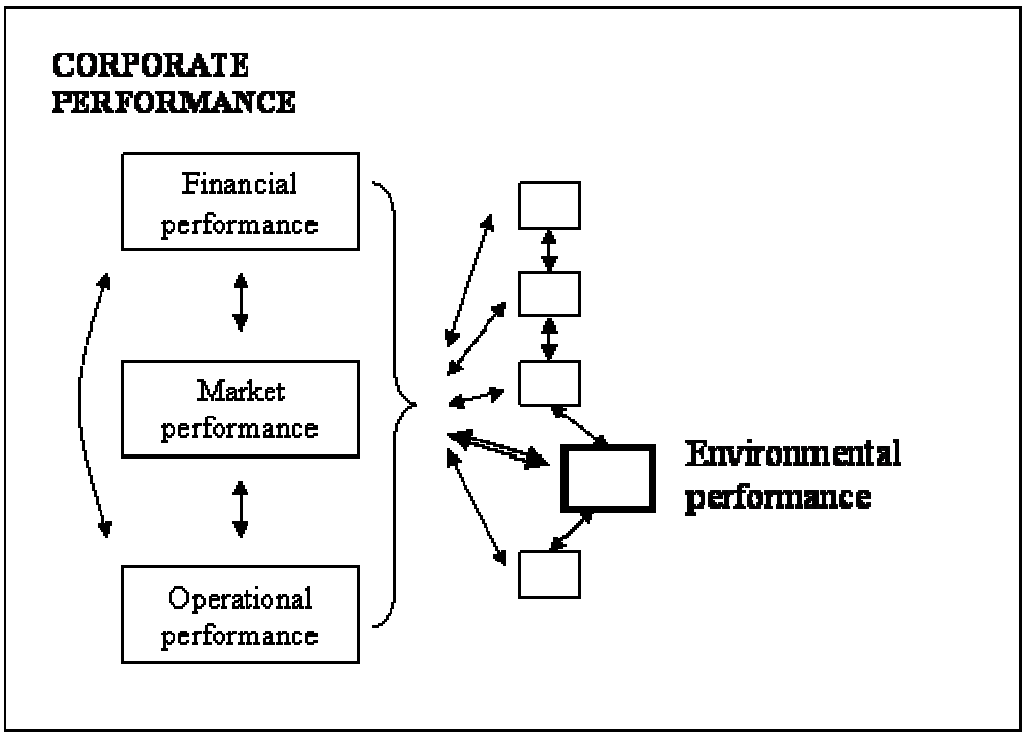
In the literature of corporate performance there is no consensus, whether the concept of performance is value neutral or not[3]. According to one approach performance is a neutral category, it can be good or weak, although according to others the concept of performance has already a positive meaning. An interesting projection of the dispute is the comparison of performance interpretations of different languages and so indirectly of different cultures. An Austrian checklist (BMUJF [1998], p.10.) points to the difference between the meanings of the English „performance" and the German „Leistung" expressions, as the English expression is rather value neutral, although its meaning is much more general, covering not only the results but also the process. Wimmer ([2002], p.6.)

[3] This dilemma appears also later in this dissertation, at the discussion of environmental performance.

puts that also in the French literature performance itself has usually already a positive meaning. Although performance might have a positive interpretation in Hungarian, too, during the analysis of corporate performance it seems to be more useful to use the concept in itself as a value neutral category.

As a summary, *corporate performance is defined by efficiency, long term effectiveness adaptability of a company. It consists of more connecting elements, beyond financial, market and operational performance there are also environmental, information technology, learning, etc. performance components. In this approach corporate performance is a value neutral concept; one can speak about good or bad performance.*

The interpretation of corporate performance in this dissertation can be seen also at 1. Figure:



1. Figure. Interpretation of the concept of corporate performance.

Corporate performance is the total of different fields. In the case of a profit-oriented company, financial, market and operational performance have a stressed position, although other components are also important. One of this latter group is environmental performance[4] – that has a central place in this dissertation –, but one can speak for example

[4] The „black box" of environmental performance will be examined much more closely in a later part of the dissertation.

about IT or learning performance of a company, etc. The unnamed performance components on the figure refer to the incompleteness of the list, it can be supplemented by other elements.

It is important to stress, that there is a supplementary relationship between financial, market, operational and the other performance components. Good environmental performance for example does not only mean some part-results – independent from other elements of the corporate performance – of an isolated environmental department. It also means that environmental protection appears and has an active role at different areas of company operation and contributes to the success of other performance components as well. Of course there is a wide-spread approach in both the literature and the corporate practice that the improvement of environmental performance does not enhance general corporate performance, but because of the resources needed it might even worsen it (see for example Walley and Whitehead [1994], Rappaport [1998]). The discussion of the relationship between environmental and economic performance of companies comes later in the dissertation.

1.2 Performance indicators as tools of corporate performance evaluation

Performance evaluation means quantitative and qualitative description of corporate performance. Corporate performance evaluation is a multi-goal process, these goals can be for example:

- preparing operative decisions,
- following up the fulfilment of strategic goals,
- evaluating individual performance,
- assuring information for external and internal communication,
- making performance improvement possible by revealing inappropriate performance, etc.

Tools of performance evaluation can be the different performance indicators, as they are able to operationalise information regarding corporate performance.

Corporate performance indicators can be grouped many different ways. Heinke ([2001], p. 170f.) differentiates the following possibilities:

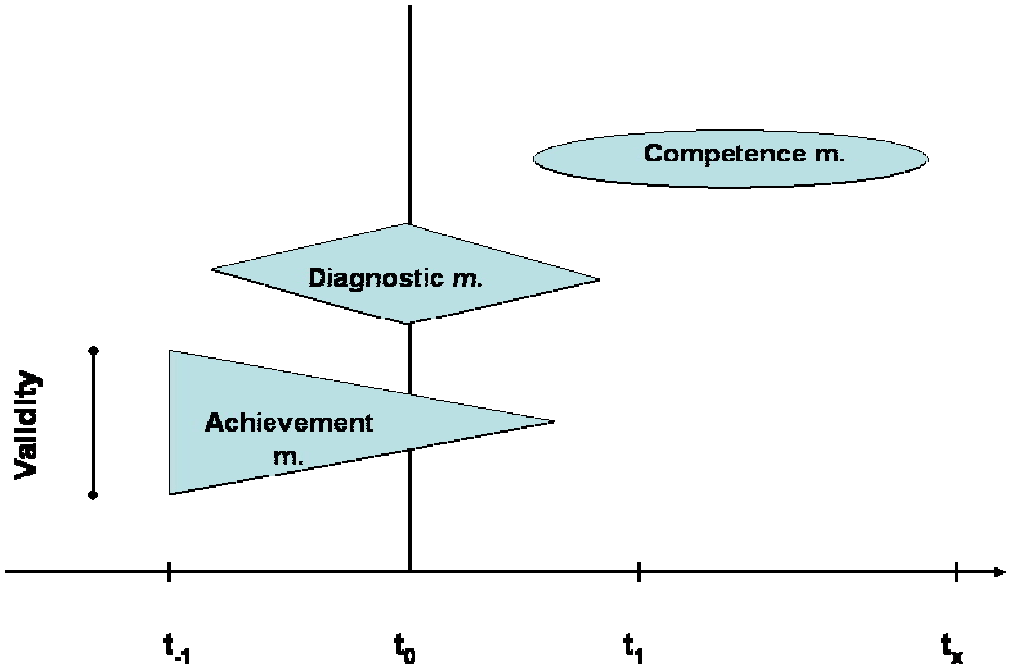
- *Monetary and not monetary (hard and soft) indicators*. Monetary indicators are for instance the traditional performance indicators, such as turnover or net income. However, other areas, such as consumer relations or competitiveness can not be properly described based on only monetary indicators (for example consumer satisfaction or product quality).
- *Strategic and operative indicators.* Besides operative indicators such as fulfilment of orders strategic indicators measuring the achievement of strategic goals are also important. An example for that can be the rate of market leadership in the markets of the most important products of a company. In addition to the following up of the fulfilment of corporate strategy strategic indicators play an important role in evaluating managers and creating corporate rankings.
- *Past-oriented and future-oriented indicators.* Past-oriented indicators characterise already realised results, an example for that can be return on assets (ROA). Future-oriented indicators however, focus on opportunities, potentials in corporate performance, such as indicators concerning the qualification or training of employees.
- *Indicators regarding performance components possible to change in the short or in the long run.* For characterising corporate performance are important both indicators can be changed relatively fast (such as the time demand of a process) and indicators can be improved only on the long run (for example indicators measuring company image).
- *Cost-indicators and performance indicators.* In performance evaluation are important both indicators measuring costs and results (such as turnover) and also indicators measuring the influencing factors of these two.
- *Indicators relating internal and internal processes.* Internal process indicators describe for example production management, while performance indicators regarding external processes measure for instance consumer satisfaction.

Performance evaluation systems are based on different performance indicators. For building a complete and consistent performance evaluation system, Rolstadas et al. ([1995], p.178ff.) suggest the use of three groups of indicators:

- *Achievement metrics*: measuring corporate performance directly, for example net profit, return on investments or market share as indicators.

- *Diagnostic metrics*: measuring corporate performance indirectly, such as product quality or punctuality of shipments.
- *Competence metrics*: giving a projection on the future effectiveness of the company. These can be the level of product development, attitude towards changes or the level of company trainings.

The relations of the three groups can be seen on 2. Figure.



2. Figure. Validity horizon of different indicator groups (Rolstadas et al. [1995], p.181.).

As the figure also shows, the different groups of performance indicators have different goals, time horizon and validity level. If there is a need for a reliable view not only on the past, but also on the present and future performance, all the three indicator groups are needed at the same time[5]. It can be seen, that achievement metrics include information concerning the past, they can be regarded valid mostly for that time period. Their validity decreases rapidly relating present and especially future. Diagnostic metrics give reliable information mainly on present performance; their potential for evaluating past and future performance is limited. Competence metrics are mostly important for measuring future performance, it might be difficult however, detecting an exact point of time, where their validity would be the best.

[5] There is a similar relationship between Balanced Scorecard lagging indicators and leading indicators (Kaplan and Norton [1996], [2000]).

After examining the performance indicators, the focus moves on to introduce a couple of performance evaluation methods; comparing with each other performance measurement based on financial indicators and complex evaluation methods – taking into account also other than financial points of view.

1.3 Methods of corporate performance evaluation

1.3.1 Financial performance evaluation systems

Traditionally corporate performance evaluation systems are based mainly on financial indicators, and concentrate on the short term effects of company activity for example on profitability or liquidity. Assessment of corporate performance happens based on few aggregated financial indicators. The following table summarises the most often used areas of analysis of financial evaluation.

1. Table. Areas of traditional performance evaluation based on finance and accounting (Hahn [1996], p.122.).

Accounting		**Financial analysis**
Internal accounting[6]	**External accounting**	**Liquidity analysis**
Cost and earnings management	**Account management**	**Follow up money flow**
Cost type analysis	Creating balance sheet	Cash flow analyses
Cost centre analysis	Creating profit and loss account	Investment analyses
Short term profit and loss analysis		Financing analyses
	Equity calculations	

[6] Differentiation of internal and external accounting happens based on focus groups. While internal accounting aims mainly informing managers and other corporate professionals, external accounting targets also informing external stakeholders. The terms managerial and financial accounting can be used in the same sense as internal and external accounting.

Based on the table it can be seen that in financial performance measurement systems the most important factors of long term corporate success are financial results, such as profitability and liquidity. Further performance indicators are derived from these latter two groups of indicators, such as indicators concerning cost management, asset management, cash-flow, structure of investments and financing. Based on Klingebiel ([2001], p.43.) a common character of financial performance measurement approaches is that they regard companies as material transformation systems turning in quantity and in value measurable inputs (raw materials) into similarly measurable outputs (products).

Numerous particular indicator systems were developed, one of the most well-known is the Du-Pont-model from the early twentieth century following up financial performance. The Du-Pont-model has more versions, but common in all of them is that profitability indicators are divided into components, enabling a better follow-up of profitability and the different factors behind it[7] (concerning the Du-Pont-model see for instance Klingebiel [2000], Rappaport [2002] or Wimmer [2002]).

Financial based performance measurement has many advantages. Financial indicators can be calculated relatively easily, as raw data needed is usually already available (because of the reporting obligation towards external stakeholders). They are also standardised, making aggregation possible. The latter makes the performance of different organisational units comparable, with the help of money as a common denominator.

The exclusivity of financial performance measurement however, distorts the evaluation of the real corporate performance because of more reasons. Financial indicators focus mainly on past results and do not give enough information on present and future performance. As a result of simplification it is extremely difficult to evaluate and follow many crucial, but non-monetarisable factors concerning the long term performance of a

[7] The following equations show some connections between profitability indicators based on the Du-Pont-model:

ROA = ROS * Asset turnover = (Net Profit/Turnover) * (Turnover/Value of Assets),

or

ROE = ROA * Leverage = ROS * Asset turnover * Leverage =
= (After-tax profit/Turnover) * (Turnover/Asset value) * (Asset value/Equity),

where: ROA: Return On Assets
ROS: Return On Sales
ROE: Return On Equities

Profitability indicators can be divided into further sub-indicators, enabling to include further performance influencing factors into the model.

company, such as environmental performance. In addition, excessive aggregation might lead to the loss of information otherwise important for judging corporate performance.

Klingebiel et al. ([2001], p.6.) group the components of corporate performance based on two dimensions. Firstly, whether they relate to material or immaterial goods and secondly, whether they appear in the accounting system or not. Only one of these four categories plays a role during the financial performance measurement[8].

2. Table shows the strengths and weaknesses of financial indicators.

2. Table. Advantages and disadvantages of using financial indicators for corporate performance measurement based on the systemising of the points of Wimmer ([2002], p. 18-19.).

Advantages	**Disadvantages**
▪ Standardisation ▪ Objectivity ▪ Comparability ▪ Simplicity ▪ Understandability ▪ Availability	▪ Past orientation ▪ Short term focus ▪ Distortions because of methodological differences ▪ Loss of information because of aggregation ▪ Loss of non-quantifiable factors

Finally it can be stated that excessive use of financial performance measurement in spite of its many advantages does not offer appropriate framework for the proper evaluation of corporate performance. Because of that complex performance evaluation systems were developed, to ensure more suitable tools for a finer analysis of corporate performance.

[8] The category concerning immaterial goods appearing in the accounting system might also play a minor role, but this includes only few elements (goodwill for example) made possible by regulation.

1.3.2 Complex performance evaluation systems

Balanced Scorecard

Balanced Scorecard (BSC) is an integrated system that derives corporate goals directly from corporate strategy and mission; and helps to fulfil corporate strategy by a continuous feedback process. BSC is thus a tool aiming to integrate corporate strategy and performance evaluation (Kaplan and Norton [2000]). The authors suggest three more perspectives beyond the financial one regarded corporate performance; altogether the following:

- Learning and growth,
- Internal business processes,
- Customer,
- Financial.

All perspectives include objectives, measures, targets and initiatives to fulfil. As Horváth and Kaufmann ([1999], p.47.) stresses, the method can help managers to find a balance between long term strategy and appropriate short term measures.

In the BSC indicator system we can find both financial and non-financial indicators. Among the indicators there are past oriented *lagging indicators or outcome measures*, such as net income or market share. The other big group of indicators are represented by the future oriented *leading indicators, performance drivers*[9], such as time needed for a process or rate of faulty products. Financial indicators not necessarily, but usually focus on past, customer and internal business process indicators refer to present, while learning and growth indicators give information on future performance.

There is a causal link between the four perspectives, partly because of the different time orientation. Employee knowledge and skills (learning and growth perspective) influence quality of processes (internal business processes perspective); which is crucial for delivery on time and maintenance of customer loyalty (customer perspective). All these have a significant contribution to returns on equities (financial perspective). (Norton, Kaplan [2000], p.38.)

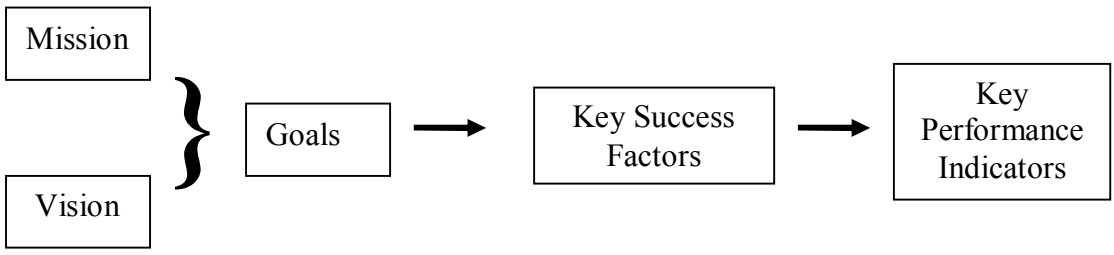
[9] Leading indicators correspond more or less to the earlier quoted diagnostic and competence measures (Rolstadas et al. [1995]).

An advantage of BSC is that goals and indicators are derived directly from corporate strategy and continuous feed-back can support a better fulfilment of the strategy.

Based on this method corporate performance can be evaluated via more dimensions, there is a chance for evaluating also environmental activity of the company and a better follow-up of the link between environmental issues and the corporate strategy. The possibilities of integrating environmental points of view into BSC can be found in a later chapter of this dissertation.

Tableau de Bord

Tableau de Bord (TdB) is a comprehensive indicator system like BSC (for more information see for example: Epstein, Manzoni [1997], Malleret et al. [2001], Klingebiel [2001] and Wimmer [2002]). Although it was developed earlier than BSC, it has been only spread to the French-speaking countries. At TdB corporate goals are derived from corporate mission and vision. For measuring goals there is a need to define key success factors, the quantifying of which is carried out by key performance indicators.



Source: Epstein, Manzoni [1997], p.4.

Non-financial goals and indicators play an important role also in the case of TdB, but the causality between different goals does not appear here, as we could see in the case of BSC perspectives.

Similarly to BSC, TdB also offers an opportunity to integrate strategically important environmental goals and present them in the reporting system. The mission and the vision of a cosmetic company can include for example that the company would operate according to the principles of sustainable development. From this point a corporate goal can be derived, that the company makes efforts to decrease the use of environmentally harmful raw materials. An adequate key success factor might be the use of natural raw materials in the products (which can also serve to achieve other goals such as improving

consumer satisfaction). This can be followed up by different key performance indicators, for example type and quantity of replaced synthetic raw materials.

EFQM-model

An appropriate framework for the evaluation of corporate performance can be also the model developed by the European Foundation for Quality Management (EFQM). The parts of TQM[10]-philosophy also appear in the model: continuous improvement of performance, efforts towards zero-fault rate and self-evaluation (for more see Malorny [1996]).

The model strives for a comprehensive evaluation of corporate performance, not limited to financial performance; the goal is to base the possibility of reaching corporate excellence. Klingebiel ([2001], p.48f.) mentions the analysis of monetary and non-monetary performance components at the same time as a similarity with BSC. He also stresses however, that at BSC the final goal is to increase corporate value, and in the EFQM-model interests of different stakeholders (owners, employees, society, etc.) appear parallel. The basic principles for the evaluation are the followings (EFQM [2003b], p.4ff.):

- results orientation,
- costumer focus,
- leadership and constancy of purpose,
- management by processes and facts,
- people development and involvement,
- continuous learning, innovation and improvement,
- partnership development,
- corporate social responsibility.

EFQM-model evaluates corporate performance based on altogether nine factors logically linked with each other. The first five are performance drivers, the other four are outcome measures. Szintay [2006] describes an application of the method in Hungary.

Based on the model companies have the opportunity for self-assessment and following up development over time. Beyond self-assessment, there is also possibility for external assessment, aiming to compare different companies and to help to improve

[10] Total Quality Management

corporate performance. There are three levels of external assessment (EFQM [2003a], p.10.):

- *European Quality Award - EQA.*. Based on the model there is an opportunity to apply for recognition of the excellence of corporate performance in different categories (for example SMEs, etc.)
- *Recognised for Excellence.* For this level there are less strict conditions prescribed.
- *Committed to Excellence.* Companies applying in this level have to carry out a self-assessment and have to prove having taken measures needed for improving performance.

As an incentive the names of successfully applying companies are published.

The Malcolm Baldridge National Quality Award in the United States can be applied for based on similar criteria to the ones of the European Quality Award.

Graphic performance measurement systems

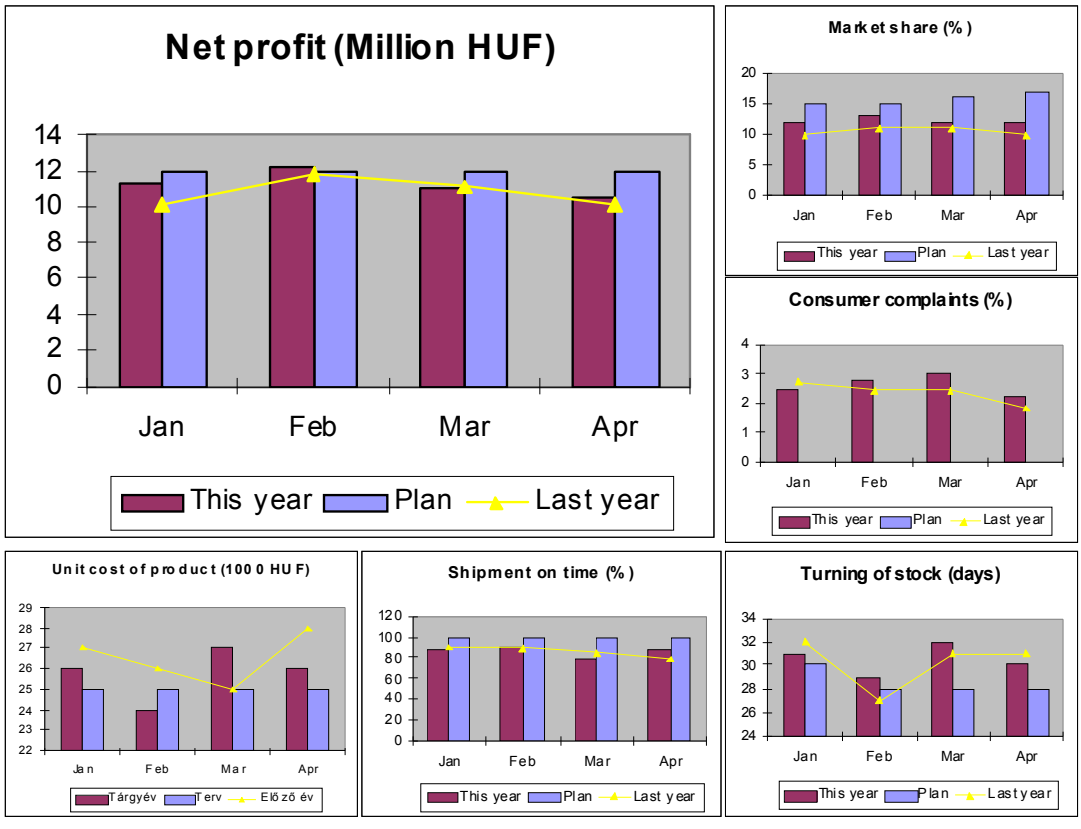
An expectation towards any performance evaluating indicator system is to present results in a way easy to understand and look over. However there are also methods developed particularly for facilitating (a) comprehensive and graphic presentation of corporate performance and (b) reporting. Such methods are for example the use of cockpit-charts[11].

A characteristic of cockpit-charts is that performance indicators based on strategic goals and success factors are presented grouped by the hierarchical levels of corporate structure. Hoffmann, ([2000], p.175ff.) differentiates the following levels:

[11] The name of the method refers to the system of instruments that can be found in the cockpits of aircrafts. Thus cockpit-charts demonstrate corporate performance based on a system of tables hierarchically linked to each other.

- *Level of top management.* The role of – often financial – indicators belonging here is to follow up the fulfilment of strategic goals.
- *Level of corporate units.* In this level much more non-financial indicators appear, making possible a deeper evaluation of the performance of different units.
- *Level of process owners.* Here we can find – mainly non-financial – indicators evaluating the different processes.

As a result of the evaluation we can get a system of logically linked, demonstrative performance graphs, usually summarising corporate performance in a one-page report. The method of cockpit-charts focuses on demonstration; the methodology of indicators is not elaborated in details. Because of that cockpit-charts can be used rather together with other performance evaluation systems (such as the earlier introduced BSC, TdB or EFQM) for the graphic interpretation of their results.



3. Figure. An example for cockpit-charts.

3. Figure gives an example for cockpit-charts. The key performance indicator is now the net profit, but many other additional indicators can be used. The graphs also make

the comparison easier with previous periods and corporate targets. The example shown on the figure can be imagined most probably at the management level, but the system can be certainly further developed. At the level of the controlling department for instance the most reasonable would be the further analysis of the unit cost of major products, examining the main factors behind these costs. It is also possible to use environmental indicators, it would be interesting to analyse for example the contribution of energy and waste management costs to the total costs of production.

The most important strengths and weaknesses of the method are summarised by the following table:

3. Table. Most important strengths and weaknesses of using cockpit-charts (Brunner [1999], p.25.).

Strengths[12]	Weaknesses
▪ Focus on strategic goals; transparency. ▪ Compactness of demonstration. ▪ Decoupling strategic goals into different corporate levels. ▪ Specific indicators at different corporate levels.	▪ Neglecting of effects on management process and culture. ▪ Performance evaluation is limited only to reporting. ▪ The linkage between strategic and operative performance indicators is not enough elaborated. ▪ Neglecting causal relationships. ▪ Value-oriented indicators are surpassed.

As a summary one can state that corporate performance is too complex to be evaluated excessively based on financial indicators.

The complex performance evaluation systems introduced in this chapter offer an appropriate framework to measure the fulfilment of strategic goals, and to follow up the factors behind present and future performance.

After a short overview on the concept of corporate performance and evaluation methods, the focus moves on to the analysis of environmental performance, a component of corporate performance.

[12] Brunner speaks about opportunities and threats, instead of strengths and weaknesses, but based on their contents of the categories it might be better to use the latter expressions.

2 Different approaches to environmental performance

2.1 The concept of environmental performance

A common mistake during environmental performance evaluation is that in many cases easily measurable performance components are regarded as environmental performance, while others are neglected. According to different environmental performance approaches environmental management-like components play a stressed role. This tendency seems to be in positive correlation with the easier measurability of environmental management actions compared to the changes in the state of the environment as a result of company activity. Just consider how easier it is to point out, whether a company has a written environmental policy, or an ISO 14001 system introduced, compared to the follow-up of changes in air quality of neighbouring villages as a consequence of corporate operation. That is the reason why in many cases level of environmental management is regarded equivalent to environmental performance, or at least taken as its most important component. Environmental management is unquestionably a core element of environmental performance, if we go back to the definition of corporate performance; we can see that in addition to outcome measures (air quality in our example) adaptability (such as ISO 14001 environmental management system right now) is also an important factor especially from the point of view of future performance. However, one has to be cautious not to overstress this at the cost of outcome-like components.

4. Table shows different approaches to environmental performance in the literature in chronological order.

4. Table. Different approaches to environmental performance (EP) and methods for evaluation (EPE) – an overview.

Author, year	EP def. (if there is an explicit definition:+/-)	interpretation of EP (in brackets, if there is no explicit definition)	Value of EP (neutral:0 positive:+)	Level of analysis of EP	Methods for EPE	Remarks
Welford, R.; Gouldson, A. [1993]; Young, W. [1996]	+	Dimensions: ▪ characteristics of production process and products, ▪ environmental load and environmental impacts, ▪ environmental infrastructure, ▪ external relations.	0	Company	(Quantitative and qualitative methods for measuring introduced dimensions.)	
Epstein, M. [1996]	-/(+)	(Integration of environmental points of view into corporate culture; environmental impacts.)	0	Company	Level of environmental management.	Goal: improvement of competitiveness and a better realisation of corporate strategy
WBCSD [1996]; WBCSD, UNEP [1996]; Verfaillie, H., A.; Bidwell, R. (WBCSD) [2000]	-	(Level of eco-efficiency, relative concept: ratio of economic performance and environmental impacts.)	0	Company	Measuring eco-efficiency with different general and company-specific indicators.	
ISO 14001 [1996] and ISO 14001 [2004]	+	Measurable results of managing environmental aspects at an organisation. Remark: if EMS is introduced, results can be compared with environmental policy and environmental goals.	0	Company	1. Following up environmental load, with a special focus on environmental aspects relevant to the organisation. 2. Following up correspondence to system requirements.	The EP definition of the 2004 standard can also be expanded to companies with no EMS.

Author, year	EP def. (if there is an explicit definition:+/-)	interpretation of EP (in brackets, if there is no explicit definition)	Value of EP (neutral:0 positive:+)	Level of analysis of EP	Methods for EPE	Remarks
BMU-UBA [1997]	-	(Level of environmental load and its changes over time.)	0	Company	EPE happens mainly based on indicators concerning material and energy flows on the one hand and indicators of infrastructure and transport on the other hand (with more sub-categories within the different categories).	Besides EP indicators the indicator system consists also environmental management and environmental condition indicators.
Ilinitch, A. et al. [1998]	+	Multi-component concept, four components can be differentiated based on two dimensions – internal/external and process/outcome: ▪ ip: environmental management, organisational system, ▪ io: correspondence to law, ▪ ep: stakeholder relations, ▪ eo: environmental impacts.	0	Company	Indicators for the measurement of the four category introduced.	
Caduff, G. [1998]	+	Firstly environmental effects of operation and products, secondly factors behind these issues.	0	Company	Following up environmental impacts caused by operation and products.	Goal: complete measurement of corporate EP.
ISO 14031 [1998]	+	Results of an organisation's management of its environmental aspects		Company	Based on operational (concerning environmental load) and management (concerning management efforts) indicators.	Additionally, use of environmental condition indicators is also suggested.

Author, year	EP def. (if there is an explicit definition:+/-)	interpretation of EP (in brackets, if there is no explicit definition)	Value of EP (neutral:0 positive:+)	Level of analysis of EP	Methods for EPE	Remarks
Edwards, D. [1998]	-	(Mainly environmental impacts.)	0	Company	Mainly based on the number of environmental measures and management tools.	Goal: evaluation of the relationship between financial and env. performance.
Clausen, J. [1998]	-	(Level of environmental load.)	0/(+)	Company	Indicators measuring environmental load.	Prefers the concept of environmental load instead of "euphemistic" EP.
Csutora, M. [1998]	(+)	(Sum of environmental load, technological measures and environmental management tools.)	0	Company	Indicators of the quoted areas.	Stresses the error of regarding equivalent EP and environmental management.
Tyteca, D., Callens, I. [1999]	-	(Environmental efficiency as a precondition of sustainability.)	+	Company and industrial	Relative indicators on the short run rather for environmental load, while on the long run rather for environmental impacts.	Joint evaluation of environmental, social and economic indicators.
Stahlman, V.; Clausen, J. [2000]	+	Direct or indirect decrease of environmental load; revitalising of natural environment taking into account environmental goals and industrial practices.	+	Company	Measuring eco-effectiveness and eco-efficiency in the level of production and products.	According to authors the approach of mainstream economics towards sustainability is unsatisfactory.
OECD [2000] and OECD [2001]	-	(Outcome and measure like components.)	+	National	Indicators for the following areas: ▪ emissions, ▪ condition of the environment, ▪ level of environmental policy, ▪ environmental infrastructure.	Goal: fulfilment of nat. and internat. agreements, improvement of env. management.

Author, year	EP def. (if there is an explicit definition:+/-)	interpretation of EP (in brackets, if there is no explicit definition)	Value of EP (neutral:0 positive:+)	Level of analysis of EP	Methods for EPE	Remarks
Dyllick, T.; Hamschmidt, J. [2000], SNV [2002] and SAPUZ [2002],	+	Results of measures towards decreasing environmental load at an organisation.	0/(+)	Company	Changes (improvements) in eco-efficiency (relative environmental load) and eco-effectiveness (absolute environmental load).	Importance of system boarders for evaluating EP.
Hamschmidt, J. [2001]	+	Level of environmental load and environmental management tools to influence it.	0	Company	Ecological and economic impacts of EMS, and effects on organisational learning processes and organisational culture.	
Mauser, A. [2001]	+	Level of environmental load, environmental impacts and environmental management.	0	Company	Indicators measuring environmental load, environmental impacts and environmental management.	Stresses that environmental management can not be separated from EPE.
Szabó, L.; Szabó, S. [2001]	-	(Changes of environmental load.)	0	Company	Indicators measuring emissions per unit of output.	
Tóth, G. [2001]	+	Sum of environmental load and efforts to decrease it.	0	Company	Simple and complex methods for measuring environmental load and efforts to manage it.	Goal of EPE is to base a more rational and env. friendly management.
GRI [2002]	-	(Environmental performance as a component of sustainability performance.)	0	Company	Indicators for environmental load of production and products.	Goal: standardisation of company reporting.
Kerekes, S. [2002]	-	(State of environment, formation of environmental load, effectiveness of environmental policy efforts.)	+	National and company	Indicators for environmental condition and emissions, and also qualitative assessment of major tendencies.	Comprehensive interpretation of EP.

Author, year	EP def. (if there is an explicit definition:+/-)	interpretation of EP (in brackets, if there is no explicit definition)	Value of EP (neutral:0 positive:+)	Level of analysis of EP	Methods for EPE	Remarks
Pataki, Gy. [2002]	+	Dimensions: ▪ organisation and communication, ▪ technology, ▪ marketing.	0	Company	Analysis of environmental management and environmental actions.	In other sources regards also environmental load also as a component of EP.
Ammenberg, J. [2003]	+	Environmental management efforts, environmental load concerning operation, environmental impacts.	0	Company	Absolute and relative indicators for measuring the dimensions of EP. Stressing that there is no universal method for EPE.	Goal: analysis of the relationship between introducing EMS and environmental impacts.
BSI [2003]	-	(Conservation of natural capital, effective protection of environment.)	+	Company	Bases on other guidelines (such as ISO 14031 or GRI).	Goal: linking different dimensions of sustainability.
Scruggs, L. [2003]	+	Decreasing the emission of common and toxic pollutants.	+	National	Possibilities: ▪ assessment of the state of the environment, ▪ measuring absolute emissions, ▪ measuring emissions over time. Evaluation based on six indicators.	Goal: evaluation of the effectiveness of public environmental policy and political system from an env. point of view.

When defining environmental performance, most commonly used expressions are quantity and tendency of pollution or environmental load. Also common are concepts like effort, action, management, control or eco-efficiency, while state of environment or natural capital appear less frequently. Most of the presented approaches do not discuss explicitly the meaning of environmental performance, maybe because of complexity of the concept.

4. Table also shows that environmental performance is sometimes handled as a positive category, while most of the approaches regard it as neutral in itself, distinguishing good or bad environmental performance.

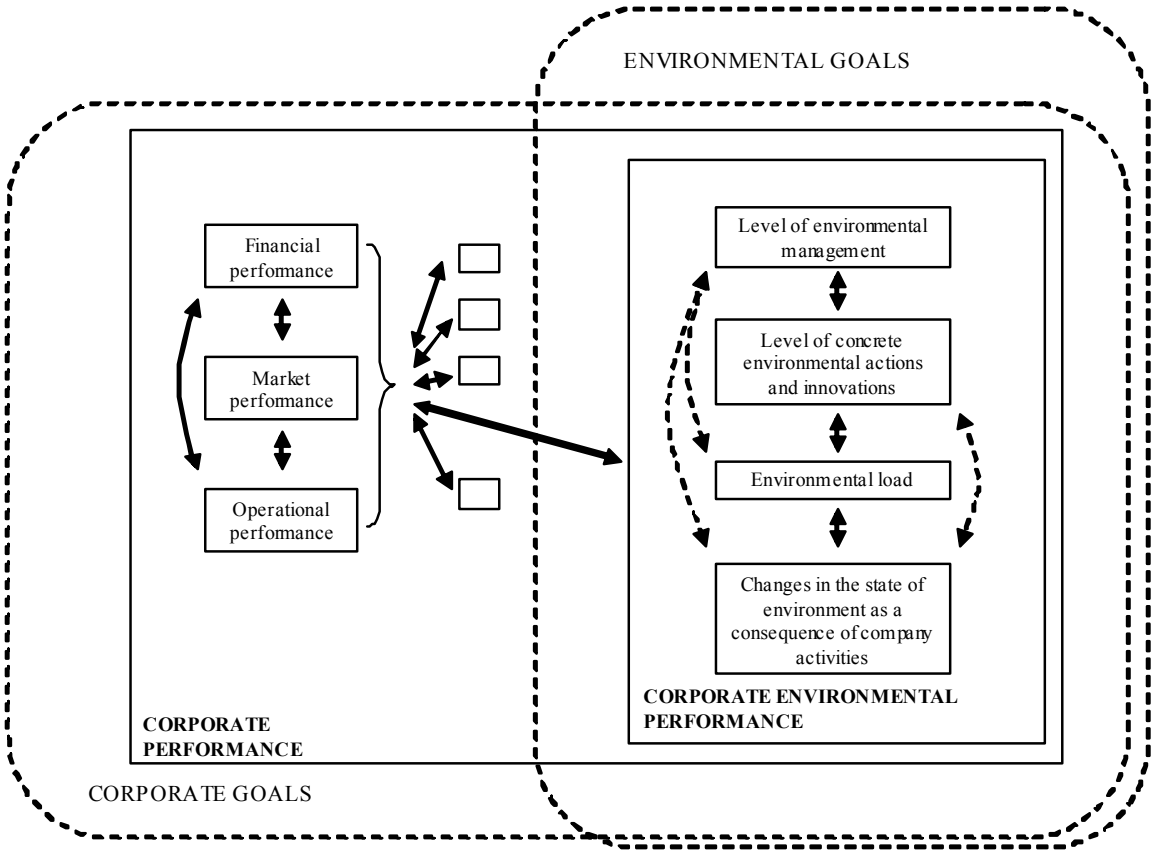
Majority of the sources analyse corporate environmental performance (although most of them can be generalised to almost any other organisation), for the sake of comparability however, the table includes also some industry or national level approaches.

Suppressing partly different approaches into a common table – as almost every systematisation – might lead to loss of information (see Podmaniczky [2006]), but comparability can help to create a framework for analysing corporate "greenness".

Similarly to corporate performance, duality of effectiveness and efficiency can be also considered in case of environmental performance, too (see for example Dyllick and Hamschmidt [2000], Stahlmann and Clausen [2000]). *Environmental efficiency* describes relative (e.g. per unit of production or turnover) environmental load of an activity, while *environmental effectiveness* relates to absolute environmental load of a company[13]. Environmental efficiency of a fast food restaurant – for example packaging material consumption per hamburger – can be really outstanding, while total packaging material need depends also on other factors, such as total sales.

In the followings the author presents a comprehensive framework for the concept of environmental performance; it is summarised by 4. Figure.

[13] According to the author, a common mistake in environmental performance evaluation that environmental performance is identified with environmental (eco-) efficiency. Theory of eco-efficiency and its barriers will be discussed later in this dissertation.



4. Figure. Components of environmental performance and its relationship with corporate performance.

As it can be seen in the figure, environmental performance is interpreted as part of corporate performance, as it can be derived directly or indirectly from activities of a company. At the same time, environmental performance influences different elements of corporate performance (financial, market, operational performance, etc.) So far environmental performance was regarded as a "black box", now four components of it are distinguished, for the sake of operationalising, these are:

- level of environmental management,
- level of concrete environmental actions,
- level of environmental load,
- state of environment as a consequence of company activity.

At a company, *level of environmental management* toolkit is an important element of environmental performance. Examples for that can be different environmental audits, environmental management systems, trainings aiming to increase environmental

consciousness, etc. As it could be seen in 4. Table, environmental management is often not regarded as a component of environmental performance. Mechanical use of environmental management tools certainly does not lead to better environmental performance; whereas their proper use can contribute to the improvement of other components. As an example, just consider two similar companies; one of them with ad hoc environmental management, the other with concrete environmental goals and programmes and a well developed environmental management system supporting it. In case of the latter company, better control and future improvement regarding environmental load is projected, and very likely the probability of environmental accidents is already smaller.

As it is also shown by 4. Figure, environmental management tools can decrease environmental load by supporting concrete environmental actions, such as audits for specifying what sort of technical actions are needed. On the other hand environmental management can have direct effects on environmental load – for example improved environmental consciousness resulted by environmental trainings can lead to better energy efficiency, if employees take special care not to use lighting in empty rooms, etc.

Also an important element of environmental performance is the presence of *concrete environmental actions* or investments. An example for that can be the development of a cooling water recirculation system in a company, leading to a decrease of water consumption. Another example is the shift towards a new production technology with higher material efficiency. In this latter case – beyond more efficient production – material consumption decreases and also less waste occurs. One has to be cautious however, as many environmental actions do not lead automatically to better environmental performance. In some cases end-of-pipe environmental actions (Csutora and Kerekes [2004], p.58.) seem to be convincing for the first sight, even if they have many unfavourable effects. An often mentioned example is catalyst built into motor cars burning toxic emissions (carbon-monoxide, nitrogen-oxides, etc.) resulting carbon-dioxide and nitrogen. On one hand this is useful as quantity of identified emissions decrease, but on the other hand more carbon-dioxide occurs. Air quality of big settlements can improve a bit, but regarding climate change further increase of carbon-dioxide concentration is highly harmful. Moreover, additionally inserted catalysts decrease efficiency of engines leading to higher fuel consumption and thus to further carbon-dioxide emission. Instead of using catalysts, environmental performance of a company could be rather improved by trying to rationalise transport needs, or at least using trucks with lower fuel consumption.

Environmental load plays a central role in the concept of environmental performance. Environmental load means material and energy consumption, wastes and other emissions of a company, as well as environmental effects of products and services (based on life cycle philosophy this can be expanded to all phases of life cycle of a product). Environmental load of companies is often identified with their environmental performance. This seems to be too simplifying and thus incorrect. Although minimizing of environmental load is a really important goal, in itself it does not give a full picture on environmental performance. Imagine a highly polluting company with temporarily turbulent markets, leading not only to decreasing sales, but also to going down of production. Most probably its toxic emissions (environmental load) also decrease, but it can not be stated that its environmental performance would improve.

It has to be stressed that decrease of environmental load can not be regarded as final goal. *Regarding environmental performance not only resources used and emissions are important, but also their impact on the state of environment.* Same level of wastewater load is much more harmful in a vulnerable wetland, as in an already polluted river with stable water supply. Similarly, same air pollution is more dangerous for a highly populated settlement in a smoggy valley, than in the highlands, where emissions are getting diluted causing much lower concentration. Because of that, *effects of company activity on the state of environment* are also regarded as component of environmental performance.

Beyond the identified elements of environmental performance it is also necessary to analyse the relationship between environmental performance and components of corporate performance. Good environmental performance assumes stable company background, while outstanding environmental performance can also contribute to the improvement of general corporate performance.

The presented model summarises the most important components of environmental and corporate performance, highlighting also the links between them. Of course there are many factors behind all these components (such as legal environment, demands of owners and other stakeholders, etc.) but the model does not include them in its present state.

2.2 Aims and tools of environmental performance evaluation

Similarly to corporate performance evaluation, environmental performance evaluation means qualitative and quantitative assessment of environmental performance. In

a broader sense, it refers to all methods, ratings, etc describing environmental performance[14]. These can be for instance:

- ranging among environmental strategy clusters[15],
- environmental audits,
- life cycle assessments,
- other, qualitative methods, expert estimations, etc.

In a narrow sense environmental performance can be measured by quantitative indicator systems. The main aim of applying indicators is to be able to express information in a condensed way, enabling also the comparison between different states. To be able to meet these aims successfully, indicators have to fulfil to different criteria. The most important criteria are (compare with Welford [1996], p.154-159.):

- *Relevance*: indicators applied should be relevant regarding environmental performance.
- *Compactness*: too many indicators make it difficult to survey and evaluate results.
- *Simplicity:* too complex indicators make understanding difficult; simple and easy to understand indicators are better.
- *Comparability*: comparability with former periods and other companies is important; it is not always recommended to use absolute indicators with physical quantities. If possible, it is better to norm indicators, project them to an important characteristic of company operation (production quantity, turnover, number of employees, etc.).
- *Actuality:* Indicators have to be updated frequently, as old data can mislead decision-makers; they can cause more losses than benefits.
- *Meeting demands*: users of indicators and their needs have to be monitored before creating different indicators.

Based on the model of European Green Table [1993], Young [1996] stresses that indicators have to enable comparability between: *1. real and aimed corporate performance, 2. different facilities of a company, 3. different periods, 4.different*

[14] Based on the idea of Maria Csutora
[15] See for example: Pataki, Radácsi [1997], Csutora [1998], Baranyi [2001], Nemcsicsné [2005].

companies, 5. corporate performance and any other well-defined states. It is not always easy to find indicators meeting all these criteria, but it has to be endeavoured.

Environmental performance indicators can be grouped in many different ways (even beyond possibilities mentioned in the section of corporate performance indicators). The guideline of the German Ministry for Environmental Protection, Nature Conservation and Reactor Safety (BMU-UBA [1997], p.8.) interprets environmental indicators along three dimensions, differentiating:

1. absolute (simple) and relative (normed) indicators,
2. indicators in natural units of measurement (kg, t, etc.) or monetary expressed indicators,
3. company, facility or process indicators.

Fiksel [1994] differentiates source and impact indicators. Source indicators are for example data on different emissions. As an advantage, they can be measured directly, but it is very complicated to quantify their impacts on the state of environment. Advantages and disadvantages of impact indicators (such as immission data at a region) are just the counterparts of source indicators.

Wehrmeyer [1993] creates environmental indicators from a general and a special part. Taking sulphur-dioxide emissions as an example, general part is the quotient of present immission and highest acceptable immission at the region analysed. Special part in this case is the quotient of present SO2-emission and highest emission allowed. Environmental performance in this case is measured by the square mean of general and special parts[16]. These indicators have two important disadvantages: concentrating only on environmental load and impact characteristics of environmental performance; and calculation and interpretation of these indicators is not easy.

Main company goals regarding evaluation of environmental performance can be summarised as follows (see also Ashford and Meima [1993], Tóth [2001]):

[16] square root of the sum of squares of general and special parts

- enabling cost saving possibilities (for example with the help of environmental accounting),
- following up compliance with legal requirements and internal goals,
- basing more efficient company management (introduction of ISO 14001 or EMAS),
- supplying reliable data for environmental communication,
- improving company image, goodwill,
- motivating employees,
- improving bargaining power of environmental field within company hierarchy,
- improving environmental performance and state of environment by giving feedback.

Companies might be interested not only in their own environmental performance, but also of their suppliers, as improvements regarding the whole supply chain cannot be achieved without other actors. More and more companies require efforts from their suppliers towards improving their environmental performance; these are in many cases also factors in their selection.

Investors may also be interested in environmental performance of companies, as in some cases positive correlation can be detected between environmental performance and share value (there will be deeper analysis on this issue later in the dissertation). This is not because of the environmental awareness of investors, but the fact that environmentally efficient companies are probably efficient in other fields as well, leading to faster increase in their market values. Another important factor is that environmentally bad companies may have to pay significant fines or compensations; or authorities can even stop their operation, which are against investor interests.

By comparing environmental performance of different companies, they can be motivated to improve, as leaders try to keep their positions, while laggards may try to get out of their shameful situation. Such comparisons however, are rarely made by companies, because it costs a lot of money and might point out weak performance of the company. This kind of rating was created by Fortune among US-companies in 1993 (Young [1996], p.166.); the names of the ten best and worst performing companies were made transparent. Companies were assessed by many different criteria; the most important of them were the followings:

- toxic emissions related to turnover and their tendency,
- comprehensiveness of corporate environmental activities (presence of written environmental policy, etc.),
- compliance with environmental regulation, potential appearance of environmental fines,
- ratings by well-known environmental organisations.

Even governmental agencies or authorities can carry out such a comparison; obligatory assessment of environmental performance can be also part of regulation policy (Afsah and Ratunanda [1999]; cited by Tóth [2001], p.10.). Authors give an example from Indonesia for that, where primary goal of regulatory body was to shame weak performers and reward leaders by transparency. In contrast to the previous Fortune ratings, absolute categories in this case were defined and companies were placed into different categories on the basis of their environmental performance.

Another environmental policy viewpoint of the state can be to evaluate efficiency and effectiveness of different policy tools. After assessing impacts of different norms, taxes and other regulatory practices on environmental performance of companies, the best of them can be selected and kept (Tyteca, [1994]).

Certainly beyond the listed possibilities, many other stakeholder groups can show interest in environmental performance of companies. Such stakeholders can be competitors, consumers, employees, NGOs, etc. Kovács ([2000], p.61.) stresses the importance of environmental reports in communication with stakeholders.

After introducing tools of environmental performance evaluation, a couple of evaluation methods are also analysed. Giving comprehensive guidance on environmental performance evaluation methods is not an aim of this dissertation (see for instance Tóth [2002] in this field). Present focus is on the analysis of several, in practice also widely used methods; how complex they can measure environmental performance (regarding previously identified components[17] and relationships to other fields of corporate performance). Methods analysed are as follows:

[17] Level of environmental management; level of concrete environmental actions and innovations; environmental load and state of environment as a consequence of company operation.

- Evaluation based on the theory of eco-efficiency,
- Indicator systems of ISO 14031 and DBU-UBA,
- Global Reporting Initiative (GRI),
- Financial analyses taking into account also environmental aspects,
- Environmental and sustainability indices,
- Sustainability Balanced Scorecards (SBSC).

2.3 Methods of environmental performance evaluation

2.3.1 The eco-efficiency approach

The theory of eco-efficiency is an effort towards linking environmental and economic efficiency.

Beyond its relative simplicity and easy-understandability, the eco-efficiency approach is popular because it offers a "painless" opportunity for improving their environmental performance. In promoting the concept, World Business Council for Sustainable Development[18] (WBCSD) plays a major role by publishing guidelines on eco-efficiency (for example WBCSD [1996], WBCSD-UNEP [1996], Verfaillie and Bidwell (WBCSD) [2000]).

Based on WBCSD definition *„eco efficiency is reached by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cicle, to a level at least in line with the Earth's estimated carrying capacity"* (WBCSD [1996], p.4.).

To be simpler than complicated definitions, good environmental performance in this approach means creating more products and services with less environmental load. The concept of eco-efficiency seems not to be new at all, as already Taylor has put it in 1911 that *most efficient is the organisation where use of labour, natural resources and capital happens in an optimal combination with minimal spending* (Hukkinen [2003], p. 11-27. or Csutora-Kerekes [2004], p.31.).

[18] Its members are the leading multinational companies of the world, such as Dow Chemical, DuPont, Nestle, Shell or Monsanto.

A WBCSD-UNEP [1996] guideline specifies seven key success factors towards reaching eco-efficiency (p.4.):

- reduce the material intensity[19] of goods and services
- reduce the energy intensity[20] of goods and services
- reduce toxic dispersion
- enhance material recyclability
- maximize sustainable use of renewable resources
- reduce material durability
- increase the service intensity of goods and services

Eco-efficiency usually cannot be measured with only one indicator; a group of different eco-efficiency quotients are needed, where numerators refer to quantity or value of created goods and services, while denominators show environmental load and impacts caused during the lifecycle of those products and services. Regarding both economic (numerator) and environmental (denominator) characteristics, WBCSD specifies generally applicable and business specific indicators (Verfaillie and Bidwell [2000], p.3.). Generally applicable indicators for product/service value are:

- quantity of goods or services produced or provided to customers,
- net sales.

Generally applicable environmental indicators are:

- energy consumption,
- materials consumption,
- water consumption,
- greenhouse gas emissions,
- ozone depleting substance emissions.

Several other indicators that could be generally applicable if global agreement on measurement could be developed:

- additional financial value indicators (such as profit),
- acidification emissions to air,
- total waste.

[19] Material intensity refers to the quantity of material input needed for one unit of product or service; thus it can be interpreted as reciprocal of eco-efficiency. (See for example Csutora-Kerekes [2004], p.30.)
[20] Can be interpreted similarly to material intensity, see previous footnote.

Many scholars and corporate professionals see the solution of environmental problems in radical but still possible improvement of eco-efficiency. In their famous book of Factor 4, Weizsäcker, Lovins and Lovins [1995] state that a four-fold improvement in eco-efficiency could double welfare and halve global environmental load at the same time. To prove their statement they collect lots of examples from different fields, where even bigger improvements could be witnessed (factor 6, 10, 100, etc.).

Reijnders ([1998], p.13-22.) aptly talks about Factor X debate, when looking over many different theories visioning efficiency improvement between 4- and 50-fold.

An indisputable advantage of eco-efficiency approach is that it links environmental and economic performance of companies in a way thet can be attractive also for companies, as better environmental efficiency means better company performance at the same time. It is not only a theoretical model; in practice improvements can be seen in different fields – such as closing the energy-efficiency gap at companies (Zilahy, [2000], p.28.).

At the same time however, the *concept of eco-efficiency shows several insufficiencies or even contradictions.*

1. Perhaps the most common criticism is that eco-efficiency regards environmental load relatively, projected to corporate performance. Linking environmental and corporate performance is advantageous; but doubled eco-efficiency might not lead to absolute decrease in environmental load (if production triples at the same time). Eco-efficiency is necessary but not sufficient towards sustainability; for that eco-effectiveness, thus absolute environmental load should be at least maintained (see also Dyllick and Hamschmidt [2000], Stahlman and Clausen [2000]). It is called "rebound effect" in literature that improvements in (eco-) efficiency may lead to increases in production and consumption; absolute environmental load might even increase at the same time (Hukkinen [2003], p. 11-27., Csutora and Kerekes [2004], p. 32.).

2. An activity can be considered sustainable if it contributes to the common good; beneficial from environmental, social and economic aspects as well[21]. Supporters of eco-efficiency approach however, analyse only the relative environmental load of economic performance created. They neglect characteristics and social utility of company activity;

[21] Sustainability is not only a theoretical category, it has to appear in the daily practices as well (for details see for example Szlávik [2005] or Valkó [2003]).

disregard whether society really needs these products or services[22]. In opposition, based on previous arguments many people do not regard some activities[23] sustainable in any cases (such as manufacturing weapons, tobacco industry, etc.). The contradiction in this case is caused by the issue that eco-efficiency approach disregards values, although it would be important from a sustainability viewpoint. Additionally, Hendrik A. Verfaillie, one of the authors of the previously referred WBCSD-guideline is representative of Monsanto, a company that – as a pioneer in GMO[24]-industry – obtained protest from many governments and NGOs.

3. A barrier against practical applicability of the eco-efficiency approach is that system boundaries are not properly defined between environmental and economic spheres. Thus, it cannot be specified in many cases, what can be considered as harmful environmental impact or recyclable by-product in different lifecycle phases (Hukkinen [2003], p. 11-27., Csutora and Kerekes [2004], p. 32-33.).

A key question is concerning the dissertation, which components of environmental performance are covered by the eco-efficiency approach. Based on previous analysis it can be stated that eco-efficiency relates to the links between environmental load and other elements of company performance, while environmental management, concrete environmental actions and impacts on state of the environment are fairly neglected. In some cases however, the possible contribution of environmental management towards improvement in eco-efficiency appears (WBCSD [1996], p.9.).

2.3.2 Indicator systems of ISO 14031 and DBU-UBA

ISO 14031 is a member of the environmental management standards (14000-series) of ISO – International Standardisation Organisation. ISO 14031 is a guideline for companies on how to evaluate their environmental performance. In contrast to ISO 14001, it can not be certified; it suggests thus a framework for self-evaluation. Based on the definition of ISO 14031 standard, environmental performance refers to the "*results of an organisation's management of its environmental aspects"* (ISO 14031 [1998]). In this

[22] Even if a society raises demand for a product, it does not mean that its production or consumption would automatically be sustainable. A further question can be raised, what are the human needs that should be satisfied (overseas holidays, plasma television etc.) (see also Podmaniczky [2006], p.2-3.).
[23] See also considerations at the chapter of sustainability indices.
[24] Genetically Modified Organism.

approach environmental performance is a complex concept; there are outcome-like components (environmental load, environmental aspects), while a management-like dimension also appears.

A common guideline of the German Ministry for Environmental Protection, Nature Conservation and Reactor Safety (BMU – Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit), and the German Environmental Protection Agency (UBA – Umweltbundesamt) that is very similar to ISO 14031 regarding both content and structure; that is why these two are analysed parallel.

Both guidelines discuss in details: 1. aims and process of environmental performance evaluation, 2. demands for indicators used, 3. finally both guidelines sketch an indicator system that can be used by companies to evaluate their environmental performance – flexibly customised to their own characteristics and needs. As points 1 and 2 were already discussed earlier in the dissertation, current analysis concentrates on the indicator systems suggested (summarised briefly by 5. Table[25]).

Based on 5. Table it can be seen that both guidelines differentiate three main fields for evaluating environmental performance. ISO 14031 identifies operational performance indicators measuring environmental load of the organisation directly (for example absolute amount of wastewaters), or indirectly (relative fuel consumption of transport vehicles). Management performance indicators assess environmental management tools and actions (for instance environmental management systems introduced) and their efficiency (such as environmental savings). In ISO 14031 environmental performance indicators refer to both operational and management performance indicators. Environmental condition indicators try to assess the impacts of company activity on the state of environment (for example on water quality of a stream nearby).

[25] Numeration of different indicator groups follows the ones used by the two guidelines.

5. Table. Brief overview and comparison of ISO 14031 [1998] and BMU-UBA [1997] environmental performance evaluation indicator systems.

ISO 14031 Application fields of environmental performance evaluation (EPE) indicators			**BMU-UBA** Application fields of corporate environmental indicators	
Environmental performance indicators	**Operational performance indicators**	**A.4.3.2.1. Materials** **A.4.3.2.2. Energy** **A.4.3.2.3. Services supporting the organisation's operations** **A.4.3.2.4. Physical facilities and equipment** **A.4.3.2.5. Supply and delivery** **A.4.3.2.6. Products** **A.4.3.2.7. Services provided by the organisation** **A.4.3.2.8. Wastes** **A.4.3.2.9. Emissions**	**1.1. Material and energy indicators** *1.1.1. Input indicators* 1.1.1.1. Material 1.1.1.2. Energy 1.1.1.3. Water *1.1.2. Output indicators* 1.1.2.1. Waste 1.1.2.2. Emissions to air 1.1.2.3. Wastewater 1.1.2.4. Products **1.2. Infrastructure and transport indicators** *1.2.1. Infrastructure* *1.2.2. Transport*	**Environmental performance indicators**
	Management performance indicators	**A.4.2.2.1 Implementation of policies and programmes** **A.4.2.2.2. Conformance** (with legal requirements, internal goals) **A.4.2.2.3. Financial performance** (environmental costs, saving) **A.4.2.2.4. Community relations**	**2.1. System indicators** 2.1.1.System introduction 2.1.2. Legal compliance and handling of complaints 2.1.3. Environmental costs **2.2. Functional indicators** 2.2.1. Training and human resources 2.2.2. Occupational health and safety 2.2.3. Procurement 2.2.4. External communication	**Environmental management indicators**
Environmental condition indicators		**A.4.4.2.1. Regional, national or global indicators** **A.4.4.2.2. Local or regional indicators** a) Air b) Water c) Land d) Flora e) Fauna f) Humans g) Aesthetics, heritage and culture	**3.1. Indicators for condition of water, land, air, flora and fauna**	**Environmental condition indicators**

From 5. Table it can be also seen that environmental performance indicators of BMU-UBA correspond to operational performance indicators of ISO 14031, while naming

and content of management performance and environmental condition indicators are more or less the same in both guidelines.

Both indicator systems are for evaluating *environmental performance*, in a narrow sense ISO 14031 regards only operational and management indicators as environmental performance indicators; while BMU-UBA solely the group called operational performance indicators by ISO 14031. BMU-UBA interprets environmental performance as a value-neutral category, thus both good and weak environmental performance can be identified (p.45.).

Both approaches interpret environmental performance in a complex way; covering all environmental performance components identified earlier. However, one still runs to the problem that environmental condition is very difficult to be operationalised. Even if companies regard their impacts on the state of environment as an element of their own environmental performance, this element will be most probably not enough stressed during performance evaluation.

A disadvantage of using a very detailed system of many different indicators is that chances for comparing environmental performance of different companies are very limited.

2.3.3 Global Reporting Initiative (GRI)

Primary aim of GRI is to enable credible and standardised communication of economic, social and environmental performance of companies. Besides that it can also be regarded as an environmental performance evaluation system, as based on indicators it provides a detailed assessment on different companies.

Different guidelines (for example GRI [2002a], GRI [2002b]) describe in details the basis of credible communication and also give guidance on content of company reports as well as indicators to be used. Company reports based on GRI should include the following chapters:

- Vision and strategy (Shows commitment of company management towards sustainability.)
- Overview of company activities.
- Introduction of management structure and management systems.
- Correspondence between information in the report and structure of the GRI indicator system.
- Economic, social and environmental performance indicators on the company.

The guidelines differentiate core and additional indicators (GRI [2002b], p.7.); and also stress importance of sector-specific information (GRI [2002a], p.10.).

Potential application fields of GRI indicators are summarised by 6. Table. For different indicator groups the guideline gives concrete examples as well (both for core and additional indicators). Based on the table it seems that GRI goes beyond the focus of traditional financial reports: covers relationship with different stakeholders and gives suggestions for taking into account even external effects.

Environmental performance indicators can be placed into the system of ISO 14031, although management performance and environmental condition indicators of ISO 14031 appear very limited in GRI.

Social performance is the most difficult to describe; thus, GRI offers the most indicators in this field. On the other hand it is also true that here are additional indicators in highest proportion, showing the uncertainties in interpreting social performance.

A major strength of GRI is that it regards economic, environmental and social performance of companies in a parallel way. It also interprets economic performance in a much more comprehensive way compared to traditional financial indicator systems.

On the other hand, expressions ‘sustainability’ and ‘sustainability performance’ – commonly used in GRI guidelines– seem to be fairly misleading. Even if a company performs outstanding along different economic, environmental and social indicators, it does not automatically mean that its operation would be sustainable. From an optimistic viewpoint one can talk about contributions to sustainability; but it still cannot be decided based on GRI indicators whether the company operation is sustainable or not.

6. Table. Overview of GRI indicators (table based on GRI [2002a], p.44-59.).

Application fields of GRI corporate performance indicators	
Economic performance indicators	**Direct economic impacts** (measuring the monetary flows between the organisation and its key stakeholders; and indicating how the organisation affects the economic circumstances of those stakeholders): ▪ Customers ▪ Suppliers ▪ Employees ▪ Providers of capital ▪ Public sector **Indirect economic impacts** (external impacts of the organisation on its stakeholders; no concrete indicators suggested by GRI)
Environmental performance indicators	**Materials** **Energy** **Water** **Biodiversity** **Emissions, Effluents, and Waste** **Suppliers** **Products and services** **Compliance** **Transport** **Overall** (e.g. environmental expenditures by type; additional indicators)
Social performance indicators	**Labour Practices and Decent Work** ▪ Employment ▪ Labour/Management relations ▪ Health and Safety ▪ Training and Education ▪ Diversity and Opportunity **Human rights** ▪ Strategy and Management ▪ Non-discrimination ▪ Freedom of Association and Collective Bargaining ▪ Child Labour ▪ Forced and Compulsory Labour ▪ Disciplinary Practices ▪ Security Rights ▪ Indigenous Rights **Society** ▪ Community ▪ Bribery and Corruption ▪ Political Contribution ▪ Competition and Pricing **Product responsibility** ▪ Customer Health and Safety ▪ Products and Services ▪ Advertising ▪ Respect for Privacy

As a result of GRI's distribution, more and more companies publish sustainability reports[26], such as branches of BAT and Denso in Hungary. For the sake of better credibility GRI suggests third party validation of company reports (GRI [2002b], p.8.).

Consequently it can be stated that GRI is an effort for the assessment and standardised communication of environmental, social and economic performance[27] of companies. Mauser ([2001], p.44-45) calls the attention for the issue that possibilities for comparing different companies are still limited, as sector-specific indicators are not yet standardised. One can state that assessment of economic, social and environmental performance at the same time is an indisputable strength of GRI, although parallel focus on the three areas still does not give enough information whether company activities are sustainable or not.

A central question of current analysis is which components of environmental performance are covered by GRI-based evaluation. The indicator system concentrates mainly on environmental load, although environmental management also appears (such as environmental spendings or managing legal compliance). One can also find very limited information about impacts on state of environment (within the indicator group on biodiversity for instance). Even if they are not overweighed, environmental actions and innovations also appear in the beginning chapters of GRI-reports (describing management structure of companies). Although beyond environmental performance GRI also concentrates on economic performance, the analysis does not cover possible links between the two areas.

2.3.4 Financial analyses taking into account also environmental aspects

Methods in this group analyse financial effects of 1. environmental protection activities and 2. environmental impacts as a consequence of company operation. Assessment of these factors can also be regarded as environmental performance evaluation. In the followings two directions of analyses are described: taking into account environmental aspects at investment decisions on one hand and environment oriented cost and earnings management on the other hand.

[26] About the expression sustainability report (meaning a report containing economic, social and environmental performance at the same time) see also previous considerations about sustainability.
[27] called as sustainability performance by GRI

Analysis of environmental aspects at investments can result modified future cash flows influencing also present decisions on investments. This means if environmental impacts of an investment are also quantified, decisions can be different; a lucrative-looking but environmentally harmful project might not be profitable for the company at all, if future environmental fines and recovery costs are significant.

Csutora and Kerekes ([2004], p.96-101.) suggest analysis of the following cost categories before decision making:

- *traditional or usual costs* (for example raw material costs of a product),
- *hidden costs* (for example cost of missing days because of sicknesses related to polluted and unhealthy workplaces),
- *conditional costs* (for example potential future compensations to be paid because of pollution),
- *intangible costs* (for example extra costs raising because of bad relationship with stakeholders),
- *external costs* (for example extra renovation and maintenance costs of buildings raising for local communities related to company pollution).

A common problem is that difficult quantifiable (hidden, conditional, intangible and external) costs and saving opportunities are disregarded by companies, although most of environmental related costs and benefits fall into these categories. Exact quantification of costs and benefits mentioned (increasing fines, potential compensations, etc.) can improve investment calculations; possibilities for quantification however, are very often limited. A further problem related to external costs is if a company can be sure that these costs will remain external, there is no short term interest in decreasing them, as they raise for other stakeholders and not for the company[28,29].

Another problem is time-horizon of investments and parallel also expectations on return of companies. Environment-related investments return usually on a longer period, and are thus often refused by company managers concentrating on short term profits and using too high discount factors for future cash flows.

Environmental pollution can also influence financing opportunities; in many cases banks consider also environmental aspects when rating a potential client.

[28] Of course in the long run local communities might go to the court claiming for compensation, turning external costs into real costs for the company.
[29] For more details on external costs see Kiss and Pál [2006].

Environmental aspects are to be taken into account in liquidity analyses as well. A contaminated piece of land for example can be sold only significantly cheaper if there is demand for that at all.

A main objective of cost and earnings management is to provide information on production costs and profitability of different products, and also on financial results of the company. Beyond a control function it is very important for basing decision-making on product range, by specifying whether different products are profitable for the company or not.

After distributing direct costs among different products a significant part of costs still remains undivided. These indirect costs (such as heating costs of headquarters, etc.) are in most cases distributed to products based on traditional units (like working hours, machine hours, etc. needed for the different products).

In practice, indirect costs could be distributed in a much better and more realistic way in many cases taking into account also environmental considerations. (For details on environmentally based cost management see Schaltegger et al. [1996] or Csutora [2001].)

An example for that can be costs of hazardous waste management or environmental fines. Most often these are regarded as indirect costs and distributed by general factors (machine hours used for instance). With a deeper analysis however, one could point out that these costs do not necessarily contribute to product costs in proportion with machine hours in this example. Production of product A might generate much more hazardous waste than product B and environmental fines can also be linked to this issue. Why is that important? Examples of Burritt et al. [2001] show clearly that a so far profitable regarded product causing harmful environmental impacts might in reality create losses for the company, if costs are properly distributed[30]. With other words, products with significant environmental load have usually higher costs than it can be pointed out with traditional cost analysis.

In this case not only society profits from getting rid of a significant pollution source, but also the company, as it can concentrate its resources on producing really profitable products.

As a consequence it seems that taking into account environmental aspects at cost and earnings management is beneficial not only for the environment but also for the companies. Managers can get a more exact view on profitability of different products and

[30] If waste management costs were formerly distributed as indirect costs proportionally to machine hours, analysis could show this product very lucrative.

costs can also be decreased. Environmental aspects are disregarded during analysis in many cases because financial and controlling professionals are not enough familiar with environmental issues (deciding which products and in what proportion a specific environmental fine should be distributed to), while environmental professionals in most cases do not have the expertise to create financial analyses. A solution for that could be a better cooperation of different parties.

From the viewpoint of interpreting the concept of environmental performance one can state that environmentally based financial analyses focus on the relationship between environmental and financial performance, and to some extent also to environmental load of companies. In a very limited way the approach also touches environmental management and concrete environmental actions but the analysis of environmental impacts as a consequence of company operation is missing.

2.3.5 Environmental and sustainability indices

The essence of environmental and sustainability indices[31] and different other complex company ratings is that they evaluate companies with one number or a rating on an ordinal scale (see for example DJSI [no year indicated]). A major advantage of this evaluation is simplicity and comparability (between periods and companies), although standardisation may lead to information losses and thus to distortions.

Examples can be Dow Jones Sustainability Indexes (DJSI), developed by Dow Jones Indexes, STOXX and SAM Group in 1999, or rating of the Swiss ETHOS investment fund (grounded in 1997). Companies are evaluated in both cases in a multi-level, complex procedure. 7. Table summarises briefly these rating criteria.

As it can be seen in 7. Table, evaluation criteria are similar, but weighting of different factors might be different[32]. Sources of information are also fairly similar: company questionnaires, company documents (environmental reports for instance), media, personal contact with companies assessed, etc.

[31] Sustainability indices usually interpreted by their developers as indices containing environmental, economic and social information at the same time. According to the opinion of the author – see also previous considerations – sustainability means more. The expression of sustainability index is used with these background thoughts in this chapter.

[32] The weights applied are only transparent in case of DJSI (http://www.sustainability-index.com/).

Main aim of ratings is in both cases to offer "sustainability portfolios" for investors looking for investing in sustainable operating companies[33]. Ratings can certainly have also other aims (see also model of Tóth [2002], p.126-127.). In case of ETHOS type of activity is also evaluated. Independent from other factors, companies with over 5% of their turnover coming from tobacco, gambling, nuclear energy or weapon industry are automatically excluded, as these sectors are not regarded sustainable at all (see also considerations in chapter on eco-efficiency).

7. Table. Overview of DJSI and ETHOS sustainability ratings. (Source: DJSI – http://www.sustainability-index.com[35], ETHOS Fund – www.ethosfund.ch[36] by suppressing information into a table).

	DJSI	ETHOS-rating
Financial/ economic aspects	▪ Codes of conduct / Compliance / Corruption & Bribery ▪ Corporate governance ▪ Risk & Crisis management ▪ Industry specific criteria	▪ Obviousity of strategy ▪ Profitability and growth ▪ Market state ▪ Risk management
Environmental aspects	▪ Environmental performance (eco-efficiency) ▪ Environmental reporting ▪ Industry specific criteria	▪ Role of environmental protection in corporate strategy ▪ Environmental management tools ▪ Use of raw materials and emissions ▪ Environmental impacts of products
Social aspects	▪ Corporate citizenship/ Philanthropy ▪ Labour practice indicators ▪ Human capital development ▪ Social reporting ▪ Talent attraction & retention ▪ Industry specific criteria	▪ Creating real value to customers ▪ Labour conditions ▪ Meeting requirements of authorities and local communities ▪ Fair information to owners

[33] The question whether these companies are more profitable or not will be discussed later in this dissertation.

[35] Downloaded 2006. 06. 25.
[36] Downloaded 2005. 09. 15. – as a consequence of changes in ownership factors of rating are not transparent any more.

Similarly to the case of Global Reporting Initiative, one should welcome that beyond economic factors also environmental and social aspects are considered when evaluating company performance. It has to be emphasised again however, that economic aspects of sustainable development mean much more than factors like "profitability and growth" or "risk management" (compare with Tóth [2006], p.2.).

Analysing components of environmental performance it seems that in principle environmental and sustainability indices can cover more or less all elements identified earlier. None of the methods described deal with environmental impacts of companies but this can be included among rating criteria. In practice however, environmental management like aspects are often overweighed, as this information is easier to access and inter-company comparison is usually simpler in this field.

2.3.6 Sustainability Balanced Scorecard (SBSC) approaches

Earlier in this dissertation it could be seen that Balanced Scorecard as a complex performance evaluation system can be appropriate to link different areas of corporate performance. In this sense BSC offers a framework for the strategic orientation of corporate environmental activities as well.

A lot of researches have been made on how to integrate the environmental dimension into a corporate BSC (see for example Kaplan and Norton [2000], Schaltegger and Dyllick [2002], Epstein and Wisner [2001], Dias-Sardinha et al. [2002]). Beyond the environmental dimension also the social one can be integrated, this is endeavoured by Sustainability Balanced Scorecards.

Environmental (and sustainability) aspects can be included in corporate BSCs in three different ways:

- *Environmental aspects integrated into the four original BSC perspectives.* Beyond other factors also environmental aims and indicators appear in the original perspectives. In this case only such aspects can be taken into account that improve corporate performance through market mechanisms, thus improving eco-efficiency (for example cost saving possibilities by recycling by-products). As range of indicator system is strictly limited (Kaplan and Norton [2000] suggests altogether 16 to 25 aims, hence 4 to 6 per perspective), even the

most important environmental aspects might not be easy to consider in company or business unit level BSCs.

- *Environmental protection as a further perspective in BSCs.* Number of perspectives in BSC is not strictly regulated; the original four is only a suggestion. A further, environmental perspective makes sense if environmental aspects are of strategic importance for the company, but appear other ways than market mechanisms (protesting of local communities, legal regulation, etc). Protest of locals in case of a polluting firm can lead to severe economic losses but not necessarily through the market. In this case integrating environmental and social issues would be difficult into the original perspectives.

  If an individual perspective is inserted into BSC, range is not so restrictive any more. A new problem emerges however, the further perspective has to be fully integrated into the causal link of the original four perspectives, otherwise environmental aspects can be isolated.
- *Separate additional scorecard, derived from company level scorecard.* In this case a new BSC is developed, including environmental aims and goals along the four original perspectives. This enables managing all strategically important environmental aspects in a common framework, and also their linking to corporate aims (appear in general BSC). Excluding environmental aspects from the "core" BSC might lead to isolation of this field again.

Of course the three options introduced do not preclude each other. The first two methods can be applied optionally or together, while the third one rather additionally, for coordinating corporate environmental protection activities. 8. Table summarises the main aspects about the different options.

Similarly to comments on the concepts on sustainability reports, performance and indices; one has to emphasise that although SBSCs include economic, environmental and social indicators at the same time, they do not measure whether a company is sustainable or not.

8. Table. Opportunities for integrating environmental aspects into BSC (aspects of Schaltegger and Dyllick [2002], p.54-64. suppressed in a table).

	Integrating environmental aspects into the existing four BSC perspectives	Inserting additional, environmental or sustainability perspective into BSC	Deriving additional, environmental or sustainability BSC from general BSC
Advantages	▪ complete integration of environmental aspects ▪ can contribute to improvement in eco-efficiency	▪ many environmental aspects can be handled at the same time	▪ all significant environmental aspects can be handled
Barriers	▪ volume barriers for handling environmental aspects	▪ potential isolation of environmental aspects	▪ potential isolation of environmental aspects
When to use?	▪ environmental aspects are integrated into market mechanisms	▪ Environmental protection is strategic; but can not be integrated into market mechanisms	▪ as an additional method; to coordinate environmental management activity

As a consequence, in environmental and sustainability BSCs focus is put onto links between environmental and corporate performance of companies. In the different BSC-perspectives environmental load, environmental management and concrete environmental actions might be covered, while company impacts on the state of environment are still disregarded.

2.3.7 Comparison of different approaches

It is common in evaluation methods that they describe environmental performance based on an indicator system; however, their structure and logic is significantly different. 9. Table compares environmental performance evaluation methods discussed in this chapter focusing on whether different components of environmental performance are covered by them or not.

9. Table. Interpreting environmental performance by the different evaluation methods.

	Environ-mental load	Environ-mental management	Concrete environ-mental actions	Effects on the state of environ-ment	Relationship with other fields of corporate performance
Eco-efficiency	+	**0**	**0**	**0**	++
Indicator system of ISO 14031 and DBU-UBA	++	++	+	+	+
Global Reporting Initiative	++	++	+	+	+
Environmental financial analyses and environmental accounting	+	**0**	**0**	**0**	++
Environmental and sustainability indices	+/++	+/++	+/++	**0**/+	+/++
Sustainability Balanced Scorecards	+	+	+	**0**	++

0: does not appear
+: appears, but not stressed
++: appears and stressed

It can be seen that indicator systems of ISO 14031, DBU-UBA and GRI offer a properly comprehensive framework for evaluating environmental performance, however, they do not put pressure on the analysis of relationship between environmental and corporate performance. Eco-efficiency and environmental accounting approaches as well as Sustainability Balanced Scorecards analyse environmental performance derived from corporate performance; although giving only limited chances for a detailed analysis on different elements of environmental performance. Environmental and sustainability indices can be used in principle for a proper and comprehensive analysis of corporate environmental performance, but their methodology is not settled enough yet; their application needs caution and experience.

If comparison is made along different components of environmental performance, it can be concluded that relationship with corporate performance and environmental load usually appear. The methods discussed offer different possibilities regarding analysis of environmental management and concrete environmental actions, while following up environmental impacts of companies is in most cases incomplete or inappropriate.

Certainly different methods do not preclude each other; most of them can be applied parallel, giving a more comprehensive view on corporate environmental performance. At a company where an ISO 14031 or GRI indicator system is already in practice, it might be useful to introduce environmental accounting principles as well. For supporting the achievement of aims summarised in a Sustainability Balanced Scorecard, an eco-efficiency attitude can help a lot. Applying more methods at the same time does not necessarily mean disproportionate extra burdens for companies, as experience and expertise gained from one method can be used when introducing others.

A common incompleteness is that endeavour towards sustainability appears often in different methods; in most cases this does not mean more than the presence of environmental and social performance components beyond economic ones. This is an important step forward compared to performance evaluation methods concentrating only on financial indicators, but not necessarily sufficient to measure sustainability. If a company performs exceptionally well according to some indicator systems discussed earlier, one cannot be sure whether its operation would be really sustainable.

In the following chapter focus is put onto analysis of potential relationships between environmental performance and different areas of corporate performance[37] – based on theoretical models and empirical results in literature.

[37] In most cases this means mainly financial performance, but market and operational performance also appear.

3 Potential relationships between environmental performance and other fields of corporate performance

3.1 The optimistic approach

The relevance of an analysis exploring the relationships between environmental performance and other elements of corporate performance (financial, operational, etc.) is undisputable. If an unambiguous positive correlation was established, it would leave no doubt for companies to aim at excellent environmental performance (as well).

Literature offers numerous theoretical and empirical researches proving the correlation between environmental and corporate performance, and the upgrading effect of environmental excellence on the overall corporate performance.

According to the popular, however controversial theory of Porter and van der Linde (eg. [1995a], [1995b]), environmental and corporate competitiveness, that is to say successful business, is compatible. Central point of their argumentation – demonstrated on real-life examples – is that pollution equals to inefficient corporate functioning. Thus improving environmental performance is beneficial also from an economic efficiency point of view. At the same time, strict environmental regulation encourages innovations, and improvement of efficiency, which is favourable to corporate competitiveness (dynamic approach). The authors consider environmental excellence and environmental-conscious corporate behaviour[38] as a possible early mover advantage. It needs to be noted, however, that the theoretical correlation between reducing pollution and improvement of efficiency is only able to bring environmental and economic interest together, if legislation is adequate. Current environmental regulation is only partly able to fulfil this requirement[39]. Even where such correlation exists, only improvement of eco-efficiency should be expected from the improvement of economic efficiency, not necessarily the diminution of total pollution, or improvements in state of the environment.

In their work quoted previously, Weizsäcker, Lovins and Lovins [1995] see such a great potential in the improvement of eco-efficiency that, despite the expansion of economic activity, it is possible to decrease the environmental load in an absolute value.

[38] About the concept of environmental-consciousness, see in more details Nemcsicsné [2005].
[39] This means for instance that environmental friendly raw materials should be cheaper than polluting ones, externalities should be internalised, which latter maximum partly appears in environmental legislation (for more about externalities see Kerekes [1998] and Kerekes, Szlávik [2003]).

Thus environmental and corporate performance is closely correlated; environmental excellence can improve the economic results of companies.

Positive correlation between environmental and corporate performance has been attempted to be proven by several researchers also in an empirical way; usually by comparing indicators of the two categories. Russo and Fouts [1997] compared environmental and corporate performance of 243 American industrial companies. They found a positive correlation, especially in fast-growing industries. Environmental performance was evaluated according the FRDC[40]-ranking, while financial performance according the ROA[41]- indicator in this study.

Feldman et al. [1997] examined the link between environmental load and financial risks in their multifactor regression model. They state that a lower level of polluting emission decreases financial risks, leading to lower costs of capital and higher equity prices. Similar research results are quoted by Pataki ([2002], p.286.).

"Money thrown in the window"[42] publications of Követ[43] (Tóth [ed., 2002-2006]) call the attention to the fact that in many cases environmental investments have faster and larger financial return than expected. Corporate case studies demonstrate the initial investment needs and annual operation costs of different measures at different companies, as well as annual savings realized and also time period of return on investment.

On an example of paper industry, Repetto and Austin [2001] assessed the possible financial burdens that environmental challenge expectedly would bring to companies. In the course of analysis the authors try to sketch probability scenarios regarding the effects of future environmental regulations on corporate expenditures. The moral of this analysis thus is different from the other quoted studies. Its initial hypotheses is that environmental protection is not profitable, but costs money to companies. In the same time good environmental performance can reduce these costs. Thus not a competitive advantage, but "only" decreasing costs are expected from environmental excellence.

Part of studies aiming to explore the link between environmental and financial performance focuses on the question if it is worth investing in companies with excellent environmental performance. The essence of this question is the following: is yield of companies with good environmental performance higher than average? An example for

[40] Franklin Research and Development Corporation
[41] Return on Assets
[42] translated from Hungarian
[43] a major Hungarian NGO with a focus on company level environmental protection

this is the ETHOS-categorization, introduced earlier, or the Dow Jones sustainability indexes. An other tool to compare environmental performance and stock exchange yield of companies is the EcoVALUE ’21 methodology, developed by Innovest Strategic Value Advisors. Whittaker and Kiernan [1999] compared yields of the top 500 companies from the Standard and Poor’s ranking with good and poor environmental performance. Both Dow Jones sustainability indexes and EcoVALUE ’21 methodology proves that share value of companies with better environmental ranking brought a significantly higher yield in the analyzed period. (Tóth [2002]).

A research study of the British Ethical Investment Research Service (EIRIS) had a similar aim (Havemann, Webster – EIRIS, [1999]). Researchers compared yields of companies performing well from an ethical and environmental aspect, with that of the average (FTSE All-Share Index). As the basis of the analysis five different ethical and environmental company ranking criteria of EIRIS, and several other similar indexes have been used. Companies performing well according to these measures were then compared with FTSE-average. As a conclusion, it can be stated that even though yields of “ethical” and “environmental” investments are slightly below average, risk of the yield – based on the beta of the capital asset pricing model (CAPM) – is also slightly lower. This correlation seems to be logical: operations with lower environmental risks will less probably result in environmental scandals. Thus investing in companies or portfolios declared ethical by the EIRIS-index is not only a logical decision for ethical[44], but for any risk avoider investor.

Edwards [1998] made comparative studies also among British companies. He evaluated environmental performance of the London Stock Exchange companies according to the JERU (Jupiter Environmental Research Unit) criteria and compared it to stock yields. As a result of the analysis, he has set a positive correlation between environmental and financial performance.

Another interesting field of analysis is the linkage between environmental management and environmental load. According to the optimistic approach, a high level of environmental management contributes to the improving corporate performance via the reduction of environmental load. This can be especially eye-catching in case of picking „low-hanging fruits”.

[44] Investors who base investment decisions on ethical and sustainability consideration. Their primary goal thus is to support an operation that is reconcilable with their moral values, yield is only secondary.

In their regression model introduced before, Feldman et al. [1997] explored a positive correlation not only between environmental load and financial performance, but also between level of environmental management and reduction of financial costs, just as between level of environmental management and decrease of environmental emissions.

There is a remarkable statement saying that environmental management tools lead to reduction of environmental load particularly at those companies, where it has been the most intensive beforehand. (see also Anton et al. [2004]).

In literature the question is often raised, to what extent do standardized environmental management systems[45] (EMS – e.g. ISO 14001 or EMAS) have an effect on environmental load and economic performance of companies. Although there is not a clear consensus on this issue, many authors argue that introduction of these systems increase the likelihood of improvement of overall corporate performance. (for example Montabon et al. [2000], Hibiki [2004]).

Relationship between environmental and business performance can be analyzed in an indirect manner as well. Approach of Pataki for example ([2002], p.285.) is remarkable, saying if corporate competitiveness can be improved by environmental protection, companies will treat it as a source of competitive advantage, thus it appears in (differences between) their strategies. Thus by analyzing environmental strategy of companies, conclusion can be drawn whether a company regards environmental protection as a factor of competitiveness. Mauser [2001], just as Kolk and Mauser [2002] give an overall review and evaluation of 51 different environmental management and strategic models. Based on applied environmental strategies at least a part of companies seem to believe that good environmental performance improves overall corporate performance, from that a positive link between them can be presumed.

Before sitting back contentedly however, stating that – based on previous arguments –improvement of corporate environmental performance has a green light; it is worthy to see the counter-arguments as well.

[45] For more information on standardised management systems see for example Kósi et al. [1997].

3.2 The sceptical approach

Several objections might be raised against the optimistic approach, explained earlier. Approaching the issue from a logical point of view, it is already hard to understand why not all companies are aiming excellent environmental performance, if it means so much benefit. It was conceivable of course, that some of the managers do not act rationally when disregarding environmental interests, if this group of company leaders was the minority. This assumption is, however, hard to be proven by typical corporate practice.

During the last couple of decades countless academic researchers, pragmatic experts and environmental activists have given voice to their view, that current form of economy and corporate operations are not compatible with sustainability. Accordingly, companies reach a profit by means of destroying natural capital. If this is also accepted concerning weak sustainability appearing in typology of Pearce [1993]; it is clear to see that current corporate practice is destroying a bigger volume of natural capital than economic surplus created.

In his book about shareholder value theory, Rappaport [1998] argues that beyond complying with regulations, companies should not deal with environmental and social questions, as it would reduce created shareholder value, the ultimate measure of social usefulness of companies (p. 5-6.). These ideas coincide with „the business of business is business" approach of Friedman. According to Rappaport, managers neither have the authorization, nor the expertise to make for example environmental decisions. In opinion of the author, the theory in question is only suitable to serve as a scapegoat for unprofitable decisions.[46] (same source, p.7.).

McKinsey consultants Walley and Whitehead [1994] doubt the positive correlation between environmental and financial performance: they state that win-win situations like that are very rare. According to them, role of managers is not trying to link environmental and economic efficiency at all price, but finding the best exchange, with other words reaching economic results with the least possible environmental damage. They argue against the "optimists" that "the current talk of win-win solutions is cheap; environmental

[46] If one thinks this argumentation over – maybe shocking for an environment-conscious reader for the first sight– it becomes clear that in many cases environmental protection does not block shareholder value-creation, but rather facilitates it (compare with related works of Porter, quoted previously). Of course, this is considered not environmental protection, but improvement of efficiency, energy-sparing, etc. by the Rappaport-approach. At the same time it is undisputable that Rappaport clearly rejects the ethical responsibility of company leaders, assuming that it is disadvantageous from a corporate value creation point of view.

initiatives are not" (p.46.). Unlike Rappaport, the authors do not state that managers – as members of the society – should not needlessly deal with environmental protection, yet they have to realize the impact of such activity on the financial performance.

In their article Palmer, Oates and Portney [1995] tackle the theory of Porter and van der Linde introduced earlier, whether environmental protection and business results of companies could be defined by a win-win situation, and strict environmental regulations would improve corporate competitiveness. In their opinion, arguments of Porter, using case studies where correlation between environmental and economic performance is positive, is not convincing. On a probability basis of course, such companies can be found, but Palmer et al. would also easily find companies where growing rigour of environmental regulations would lead to extra costs and losses. Pursuant to this approach, in most cases environmental and business interests are clashing, and – in line with one of the fundamental assumptions of economics – *there is no free lunch, not to mention lunch paid by someone else.* (p. 120.).

In the previous chapter we have overviewed several empirical research findings, exploring positive link between environmental and financial performance of companies. Gerde and Logsdon [2001] are not so optimistic however, when comparing results of 12 different paradigmatic researches, analyzing correlation between environmental and other corporate performance dimensions based on the TRI[47] in the USA. Although a part of researches in question suggest a positive linkage between reduction of pollution and financial performance, most of them do not confirm it at all. However, one of the quoted research statements is interesting: the greatest decrease of environmental pollution has been achieved by companies, whose share prices had plummeted the most in previous periods.

Besides stating a positive link between the environmental and economic performance, "optimists" usually measure environmental performance according to a certain categorization or ranking. These rankings are however, usually based on corporate information that is relatively simple to achieve, and can be compared easily. Thus they risk measuring environmental performance mainly through environmental management type of indicators (e.g.: existence of environmental strategy, politics, environmental prizes, qualifications won by companies, etc.), while little attention is paid to particular environmental emissions. Emissions are only mentioned indirectly in the ranking (e.g.:

[47] Toxic Release Inventory

Edwards [1998]) [48]. It can easily be the case that successful companies, performing well in all fields, build their environmental management better as well, which does not necessarily mean that their level of pollution is lower. From researches mentioned above, only Russo and Fouts [1997] have compared FRDC-ranking – the one they used to characterize environmental performance – with environmental load proportional to turnover[49]. Nevertheless it is true that they have found a significant and negative – better FRDC-ranking meaning less pollution – correlation, that is to say the research is valid to the approach of environmental performance used in this paper as well.

While part of the analyses comparing corporate environmental performance tend to overuse management- and measure-type indicators, based on Johnston and Smith [2001], and Marshall and Brown [2003] one can state that in company level performance evaluation environmental load indicators are more widespread.

It could be seen earlier that a high level of environmental management may support on one hand reduction of environmental load, and on the other hand – by improving competitiveness – may improve financial performance as well. Freimann and Walther [2001] however, do not share this optimism at all, while examining environmental management systems. According to them these systems are often introduced by the most polluting companies, trying to conceal their poor environmental performance this way.

Ammenberg [2003] analysed to what extent does the introduction of standardised environmental management systems (ISO 14001, EMAS) contribute to decrease of negative externalities of companies. The author does not focus on analyses of the average, but the minimal guaranteed results by these systems, stating that EMSs of not too ambitious companies might help in keeping customers for example, but probably will not lead to lower environmental load at all.

It is clear to see that literature does not offer a unified view on the relationship between environmental load and economic efficiency, even if optimistic research results seem to be somewhat more dominant. One should nevertheless not forget that talk is mainly about big corporations, registered on the stock exchange. It is not sure at all, that these research findings were valid as well to smaller companies, who are able to sacrifice much less to environmental and other efficiency-improving investments, even though these would return on long-term. Kerekes ([2002], p. 130.) calls attention to the fact that no reliable data sources are available on environmental performance of small companies. In

[48] Compare to the interpretation of environmental performance examined previously
[49] based on Toxic Release Inventory (TRI)

small businesses, many factors that lead to correlation of environmental and economic performance in case of big corporations, are missing, or have a much weaker effect. Part of environmental regulations (e.g.: IPPC), affects big companies only; or all companies, but only relevant for big ones, as in general only they are reaching the fixed limit level of emission. Media and civil organizations are also keen on dealing with big companies, while small ones rarely get under the magnifying glass.

For a big company it can be pretty expensive to let the sewage into the river without cleaning it, facing serious fines. Besides, it can easily happen that the next day Greenpeace- activists would demonstrate in front of the company headquarters, and local newspapers would also report the case. All these will probably have a negative effect on economic results of the company. At a small company however, the cheapest way of getting rid of unwanted poisonous chemicals is probably to throw them into the garbage, or our them into the sewage system. Even if regulations in this issue do exist, environmental authorities will probably not have the energy and capacity to supervise all the numerous small companies. These cases are less interesting to media as well. Thus in many cases, good environmental performance is not profitable for small companies[50].

3.3 The realistic approach

So then which approach is right? Those who, like Porter, claim that excellent environmental performance leads to improving corporate competitiveness, or those who, similarly as Walley and Whitehead, argue that the majority of corporate environmental projects will never return?

Most probably in most cases there are to some extent eco-efficient ‘win-win” situations resulting improvements in both environmental and financial performance. Besides external factors, the spectrum of these possibilities also depends on the environmental consciousness of company leaders, as it can easily be the case that a less devoted leader does not even consider that environmental excellence might contribute to corporate competitiveness. However, sooner or later even the greenest companies run into walls becoming harder and harder, partly because budget limitations, partly due to

[50] Certainly, there are counter-examples as well, as savings of materials, and energy is beneficial for small companies both environmentally and economically as well. However, we can even find further oppositions to this, as according to the theory of economies of scale it is still not sure, that small companies find these possibilities worth to be used. (Compare to Kerekes [2002]).

decreasing marginal utility. One of the models in environmental economics shows that the higher the abatement of pollution is, the more the marginal abatement cost MAC increases (for more details see Palmer et al. [1995] or Kerekes [1998]).

It can be agreed that excessive optimism is not valid beyond a certain point; however it is probably also not true that win-win type of investments were only the top of the iceberg. The author thinks that logic of Walley and Whitehead is not sound in the respect that it considers only declared environmental projects as a tool of improving environmental performance. Among these type of projects however there are several, that aim to eliminate a backlog of pollution, or other – using the vocabulary of Csutora and Kerekes ([2004], p.92.) – „must" projects, which probably only mean huge costs to the company and will never return.[51]. Improvements in environmental performance however, happens in many cases thanks to more efficient technology or an energy-saving measure, although it might be, that protection of the environment as an aspect has not even been raised.

It could be seen that environmental and economic effects of using environmental management tools are quite controversial. Standardised environmental management systems for example do not guarantee themselves the decrease of environmental load, but offer several opportunities to improve environmental performance (e.g.: Kuisma et al. [2001], who have done comparative studies among Finnish paper industry companies). In his research mentioned before, besides his own study, Ammenberg [2003] compared altogether twenty earlier researches, examining the impact of introducing EMSs on the environment. The results are controversial with respect to the advantages of EMS, nevertheless they make it clear that even though EMSs do not guarantee the improvement of the state of environment, practice shows that environmental load of companies introducing EMS decreases in many cases.

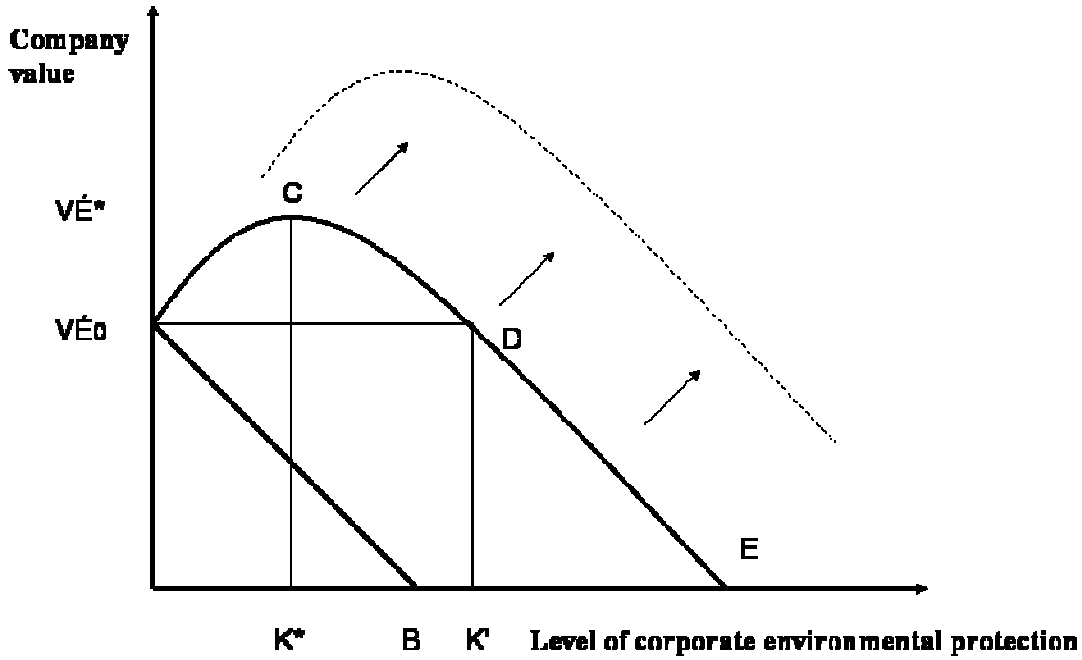
In their research carried out among Swiss companies certified by ISO 14001, Dyllick and Hamschmidt [2000] acknowledge the incertitude about the ecological effects of EMS, at the same time they call attention to trend-type correlations and the future positive effects. Besides ecological effects, they also judge the economic effects of EMS in a positive way (decreasing costs, improving external relations, etc.). Although part of economic benefits could not be quantified, based on data of 158 companies studied, EMSs brought companies an average of 167000 CHF of quantifiable economic profit a year.

[51] If only we do not consider it a return that the company might have been shut down in case of not completing the project.

Taking into account the introduction and maintenance costs of these systems, this means an average 2,2 years of payback period[52]. 67% of the companies concerned considered the thrift of introduction of ISO 14001 specifically good, while a further 13% considered it good. Besides these, Hamschmidt [2001] highlights the positive role of EMSs in ecological learning processes, as long as these help widening corporate ecological knowledge base, ameliorating the acceptance of environmental protection and improving environmental communication.

Bezegh [2006] calls attention to possible benefits coming from the integration of different standardized management systems, such as more efficient company management or cost-savings.

Schaltegger and Figge [2000] studied the relation between environmental and economic performance based on the shareholder-value theory. Their model – considered to very apt by the author – shows possible correlations between corporate environmental protection and value of the company (5. Figure).



5. Figure. Potential relationships between corporate environmental protection and corporate value (Schaltegger and Figge [2000], p. 30.).

[52] Of course, there are significant differences between companies of different sizes, payback period of big companies (above 250employees) was 1,6 years, while that of small ones (1-49 employees) was 10,7 years (Dyllick and Hamschmidt [2000]. p. 79.).

5. Figure basically sets two approaches against each other. One of them represents negative correlation between environmental and corporate performance, supposing that the environmental activity consumes the resources of the company needlessly, thus decreases the value of the company. ($V\acute{E}_0B$ line). This can be identified – of course slightly polarized – with the Rappaport-approach[53] discussed earlier.

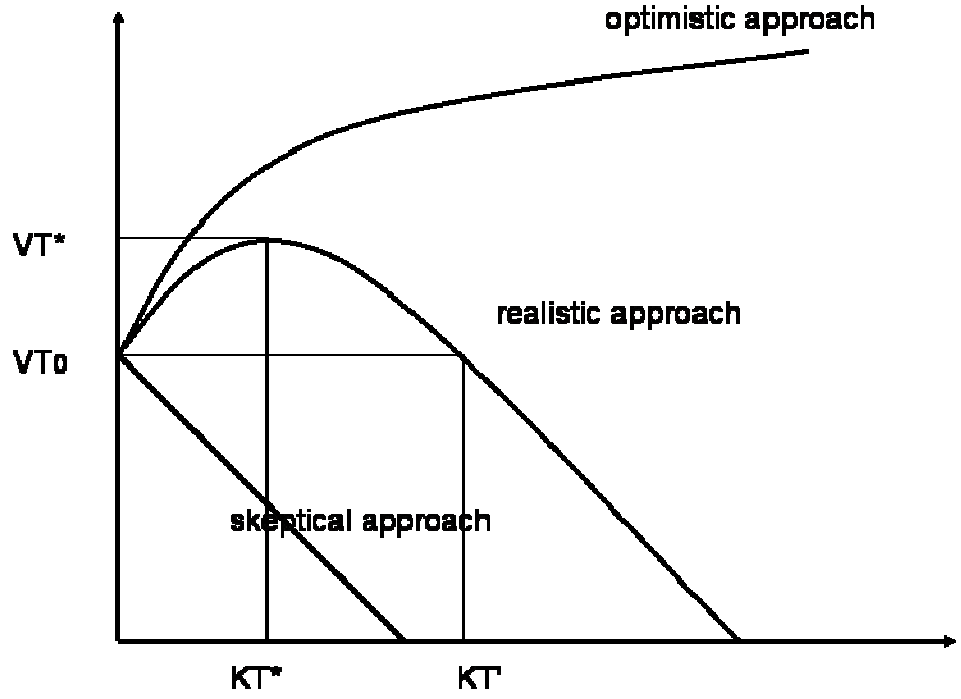
According to another – perhaps more acceptable – possibility, corporate environmental activity may contribute to an increase of value of the company, at least until a certain level ($V\acute{E}_0CDE$ curve). In this case one can see that at K' level of environmental activity, value of the company is the same as if it was doing nothing; while at the optimal K* level of environmental activity, the company value is higher than in all other cases.

Even though the model does not exactly define level of environmental activity, it can be rather understood as a quantitative category (that might be measured for example by the budget spent on environmental activities). At the same time the authors bring attention to the fact that in case of quality improvement in corporate environmental protection (that can be interpreted as establishment of an innovative environmental management system[54], respectively, environmental protection gets incorporated into the strategy), $V\acute{E}_0CDE$ curve might shift, as shown by 5. Figure. According to the model, optimal level of environmental activity will be higher in this case, but as a result, achievable corporate value will be also higher.

Utility of the model for this dissertation is restricted by the fact, that vertical axis is showing *value of the company*, while here focus is made on possible correlation between environmental and *company performance.* At the same time, content of the horizontal axis (level of corporate environmental protection) can be only presumed.

6. Figure is based on further development of the previous figure. The sketched connections show – as a summary of this chapter – possible correlations between environmental and general corporate performance.

[53] Rappaport [1998]
[54] Of course, this is not equivalent for example with the mechanical establishment of an ISO 14001.



6. Figure. Potential relationships between environmental and corporate performance.

The meaning of the axes is corresponding with the interpretation of corporate and environmental performance defined previously. Although the figure is quite simplistic (as both concepts of corporate and environmental performance were considered as multidimensional categories, thus in practice it might be problematic to place specific companies), it helps demonstrating optimistic, sceptical and realistic approaches that have been overviewed.

In line with earlier considerations, in the optimistic approach improving environmental performance leads to improving corporate performance as well (although based on the decreasing marginal utility theory presumably after a certain period of time, corporate performance is growing with a slower pace). According to the sceptical approach, environmental and corporate performances are retrograding, due to expenditures[55]. In the realistic approach, environmental performance has an – from corporate performance point of view – ideal KT* level, where corporate performance is maximal (VT*). At the same time one can see that level of corporate performance (VT_0)

[55] Naturally, it is also a simplification, as even „optimistic" authors do not state that the improvement of environmental performance always, and beyond all measures means the improvement of corporate performance as well; respectively „sceptics" do not say neither that all environmental efforts necessarily deteriorate corporate performance. This is rather about tendencies; outlining of the two extreme contexts. However, they give latitude, in which different standpoints can be placed.

achieved with zero environmental performance can be also maintained in case of high environmental performance signed by KT'.

The author believes that in most cases the "realistic" approach is the most appropriate. At the same time however, it seems that ideal level of environmental performance from the corporate performance point of view (KT*) is much higher, than most managers would think, thus standpoint is open towards the "optimists".

Based on approaches reviewed regarding environmental and corporate performance, the following summarizing remarks can be made:

- From a logical point of view it is presumable, that improving environmental performance results in improving economic performance as well on a longer term, respectively, that companies with good business performance have better environmental performance too.
- The correlation between environmental and financial, market and operational performance depends largely on how environmental performance is defined. In a part of theoretical models and empirical researches – in this latter case also because of comparability of different companies – environmental performance is described partly, or in total by management-type variables. In this case however, a tendentiously more optimistic picture arises, as financially well-off companies can probably afford eye-appealing environmental management systems, but this does not necessarily mean that they were cleaner. The correlation between decrease of environmental load and financial indicators is much more contradictory, even though empirical research shows a positive relation as well in many cases.
- Even though there is no deterministic correlation between environmental management tools (such as EMS for example) and decrease of environmental load, practice shows that companies introducing EMS have improving indicators of environmental load as well in many cases.
- Based on all this one can accept that there is a positive correlation between the decrease of environmental load per unit of output or turnover (i.e. improvement of eco-efficiency) and economic results. At the same time however, absolute level of environmental load might still increase (i.e. eco-effectiveness does not improve) parallel to increase of production and consumption.

- Researches overviewed concern mainly bigger companies, it is presumable that in case of smaller ones, correlation between environmental and financial performance is even more contradicting than shown here. On the one hand, smaller companies are much less motivated to improve their environmental performance; on the other hand they cannot even explore their existing business potentials, related to environmental protection.

So far concept of environmental performance has been introduced as part of corporate performance. The author believes this approach facilitates analysis of relationships between environmental performance and other fields of corporate performance. It seems to be important as environmental performance of a corporation can be deducted from its activity, thus it is not practical to analyse it solely from an environment point of view, independently from the logic of the corporate operation.

As a second step, four components of the concept of environmental performance have been identified, which is on the one hand simplifying, on the other hand however, facilitates the operationalisation of the concept. This deeper analysis is also necessary, because it revealed that in many other approaches environmental performance is interpreted in an oversimplified, respectively different manner, which thus leads to contradicting conclusions. Contradictory models and research results introduced in the third chapter can be approached as a proof of this issue.

In the following part of the dissertation, research hypotheses are formulated concerning partly relationships between environmental performance and other fields of corporate performance, and partly relations among the elements of environmental performance. The hypotheses are tested via quantitative and qualitative researches have been carried out among Hungarian manufacturing companies.

4 Research hypotheses

After studying literature on corporate and environmental performance, the following hypotheses have been formulated. Testing of hypotheses has been carried out with the help of two pieces of research among Hungarian manufacturing companies.

H_1: Companies with the most significant environmental load have well-developed environmental management and carry out a lot of environmental actions.

According to expectations, companies with significant environmental load practice high level environmental management, as many circumstances make them to do so (regulation, risk of environmental accidents, etc.). It is almost generally known (see for example Csutora [1998]) that company size and industry strongly influence the level of company environmental management. Big companies and "dirty" – such as chemical – industries develop usually much more advanced environmental management toolkit; although many of them are significant polluters at the same time. As an important step, multicollinearity because of parallel dependence on company size and industry is tried to be filtered out, in order to measure "real" connections between environmental management and environmental load.

H_2: A high level of environmental management is a necessary but not a sufficient condition for a decrease of environmental load.

Companies with high-level environmental management are expected to achieve better improvements regarding environmental load, meaning improvements in eco-efficiency[56]. Certainly, changes in environmental load are not only due to environmental management; in many cases companies with outstanding environmental management have stagnating or even worsening eco-efficiency.

[56] Measured in this case by changes in environmental load per unit of output.

H_3: Those companies where environmental protection is thought to have positive effects on corporate general performance,

a) have better environmental performance concerning all components compared to those, where environmental protection is only regarded as a cost;

b) can usually also point out that good environmental performance directly or indirectly leads also to economic benefits.

The issue, whether environmental protection can also offer direct or indirect economic benefits for companies can be interpreted in many ways. Factors regarding *financial performance* are for example if cost saving opportunities are seen in use of raw materials or waste management; or cost saving is ranked as an important factor for motivating environmental protection. If this field is regarded as important, even environmental accounting may be applied to utilise benefits. Relating *market performance* is important how companies evaluate market potential in different fields of their environmental activities. Potential effects of environmental protection on *operational performance* can be analysed through its effects on controlling environmental risks and accidents. According to expectations, presence of opportunities in these fields is enough motivation for companies to perform above average along different components of environmental performance.

According to assumptions, at companies practicing environmental activities only because of external pressure, environmental protection really takes money. In contrast, where environmental protection is regarded as a factor of corporate competitiveness, it can bring returns also economically at least in some fields.

H_4: Those companies, where environmental management is integrated with other company management tools,

a) usually have a better environmental performance;

b) usually experience an improvement in economic performance.

If environmental protection appears not only as a prescribed, obligatory and from other functional areas independent and isolated activity; one can conclude that it is regarded as a factor for gaining competitive advantage at the company. According to expectations, integration of environmental protection with other company management

practices – such as inventory and materials planning, management accounting, process management, quality management, occupational health and safety, etc. – leads to improved environmental performance.

Similarly, if environmental management is integrated with other fields of company management, as a consequence of better harmonisation of different sub-goals and utilisation of positive synergic effects, operational efficiency and economic effectiveness of the company may increase. If in management accounting analyses – for example – environmentally-related costs are also exactly pointed out and managed[57], cost savings and improvements in profitability can be established. Another example can be if environmental aspects are considered already in product development phase, it can contribute to strengthening current market positions or even entering new markets.

> *H_5: Economically successful companies usually have a high-level of environmental performance; regarding environmental load however, they do not necessarily perform that well.*

Although there is often a positive link between the state of environmental management and changes in environmental load, one should not disregard the different possibilities of different companies about implementing environmental management tools. Economically (also) successful companies can afford more often to implement costly environmental management systems[58], even if these investments can return for the company later. Developing environmental management can also have other goals than reducing environmental load, such as improving company image. As a consequence it is not sure that indicators on environmental load of economically outstanding companies are in harmony with their level of environmental management.

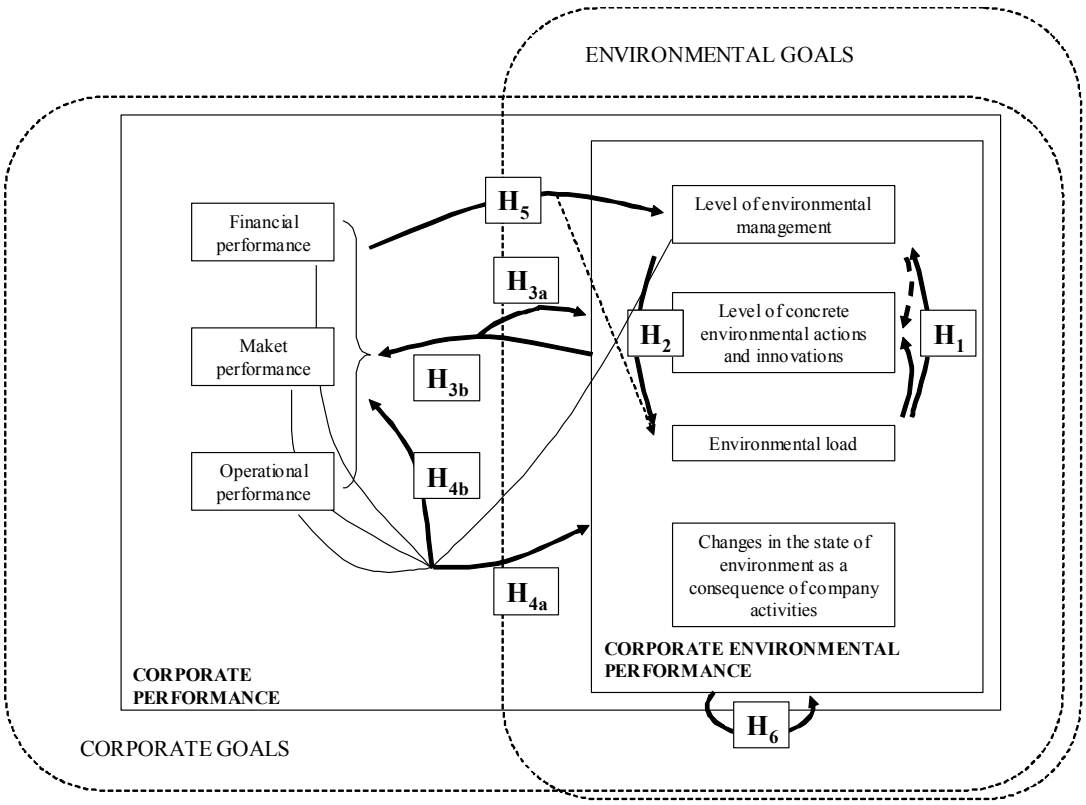
[57] See also earlier in the dissertation possibilities in financial analyses considering also environmental aspects.
[58] For example implementation and operation of ISO 14001-based EMS requires significant resources (see for instance Dyllick and Hamschmidt [2000] or Csutora and Kerekes [2004]).

H_6: Interpretation of the concept of environmental performance by corporate professionals is in relationship with the effective environmental performance of the company.

This hypothesis can seem to be a tautology for the first sight. However, significant differences can be noticed among different companies in how their members interpret environmental performance[59], connecting with actual[60] environmental performance of these companies. A company for instance, where environmental performance is identified only with legal compliance, most probably have weaker environmental performance compared to another, where most of performance-elements appear. Beyond differences between companies, it can be also interesting to analyse how differences between opinions and definitions at one company are connected with actual environmental performance of that company. According to assumptions, significant differences in opinions within a company do not favour to a common company "environment-image", would be an important factor of good environmental performance. Analysis is also made, whether changes in the state of environment as a consequence of company operation appear at all in concept of environmental performance.

Hypotheses of empirical research are summarised in an already used figure (7. Figure). In order to make the figure easier to review and make empirical testing easier, some simplifications have been made compared to previous versions: it includes only financial, market and operational performance components regarding company performance. Instead of all potential relationships, only ones related to specific hypotheses are highlighted by arrows.

[59] Just remember also, how wide range of different definitions and interpretations on environmental performance appears in literature.
[60] Thus interpreted along components identified earlier in the dissertation: environmental management, concrete environmental actions, environmental load and effects on company activities on the state of environment.



7. Figure. Graphical interpretation of research hypotheses.

5 Analysis of the relationship between environmental and corporate performance based on a company survey

5.1 Research background[61]

The largest part of the data for the analysis was taken from a database based on a company survey. The survey was carried out as a part of an OECD-research with other colleagues of the Department of Environmental Economics and Technology at Corvinus University of Budapest[62]. The survey focused on the following areas:

- mapping company environmental protection activity (environmental management tools, environmental actions),
- main motivation factors behind company-level environmental protection,
- gathering information on how companies perceive governmental environmental policy,
- potential relationships between environmental protection and economic effectiveness,
- analysing company environmental practices based on general company characteristics (size, activity, markets, etc.).

Sampling was focused on manufacturing companies with more than 50 employees[63]. Among companies with 50 to 99 employees (totally 1037 at the time of research) a representative sample of 150 companies was created. Companies with more than 100 employees (1380 of them) were all included into the sample.

Questionnaires were sent out in May 2003. Based on responses in the first month, we made some focused phone calls to companies to increase representativity regarding size and industry. From the 1530 questionnaires sent out, 466 were received back, meaning a response rate of 30,5%. Research questionnaire can be found in 1. Appendix.

[61] For a general introduction of the survey, the research report to OECD was also used (Kerekes, Sándor; Harangozó, Gábor; Németh, Patrícia; Nemcsicsné Zsóka, Ágnes [2003]: Environmental Policy Tools and Firm-level Management Practices. OECD National Report: Hungary).

[62] Seven countries took part in the OECD-research in 2003: USA, Canada, Germany, Norway, France, Japan and Hungary. General coordinator of the research project was Nick Johnston from OECD Environmental Directorate. Leader of the Hungarian project was Professor Sándor Kerekes, members of the research group were: Gábor Harangozó, Patrícia Németh, Ágnes Nemcsicsné Zsóka.

[63] Company information for planning the survey was taken from the database of the Hungarian Central Statistical Office.

Except some cases the sample was representative regarding basic activity of companies (for more information see 2. Appendix). In most industries response rate exceeded 20%; sometimes even 40%. There were only three sub-sectors (all in textile industry) with lower response rates of 16-17%. Accordingly, as it can be also seen in the appendices, companies of textile industry are a bit underrepresented, while companies of machine industry are a bit overrepresented.

Data on representativity regarding company size can be seen in 3. Appendix. It can be seen that representativity was challenged mainly because of sampling methodology. As focus was put on companies with over 100 employees, companies with 50 to 99 employees are underrepresented, while ones below 50 do not appear at all.

Descriptive statistics of the survey can be found in Kerekes, Harangozó, Nemcsicsné, Németh [2003], some summarising figures also in 4. Appendix. This dissertation focuses on the previously identified components of environmental performance and the links between them.

As a next step, variables might be appropriate for assessing environmental performance were identified and grouped. These groups were the following:

- environmental management,
- concrete environmental actions,
- environmental load,
- role of environmental protection in the improvement of corporate performance,
- economic performance,
- other background characteristics.

Further characteristics of different variable groups can be found in 5. Appendix[64].

It was only possible to collect categorical information regarding environmental load, although exact numbers would have been much more useful. That is why the author also used additional supplementary data sources in this dissertation regarding company level environmental load. For that purpose, the European Union EPER-PRTR database[65]

[64] Not all variables identified appeared in the original questionnaire, many recoded and computed variables were also created and applied.
[65] http://eper-prtr.kvvm.hu or www.emla.hu

seemed to be most appropriate. This freely accessible database contains environmental load data of companies under IPPC[66,67].

Changes in the state of environment due to company activities – as a further component of environmental performance – were unfortunately not able to be measured based on the questionnaire. Because of its importance however, it seems to be justified to regard it as an element of environmental performance. Accordingly, during the qualitative interviews supplementing quantitative research, it was also analysed how important companies consider changes in the state of environment regarding their environmental and corporate performance.

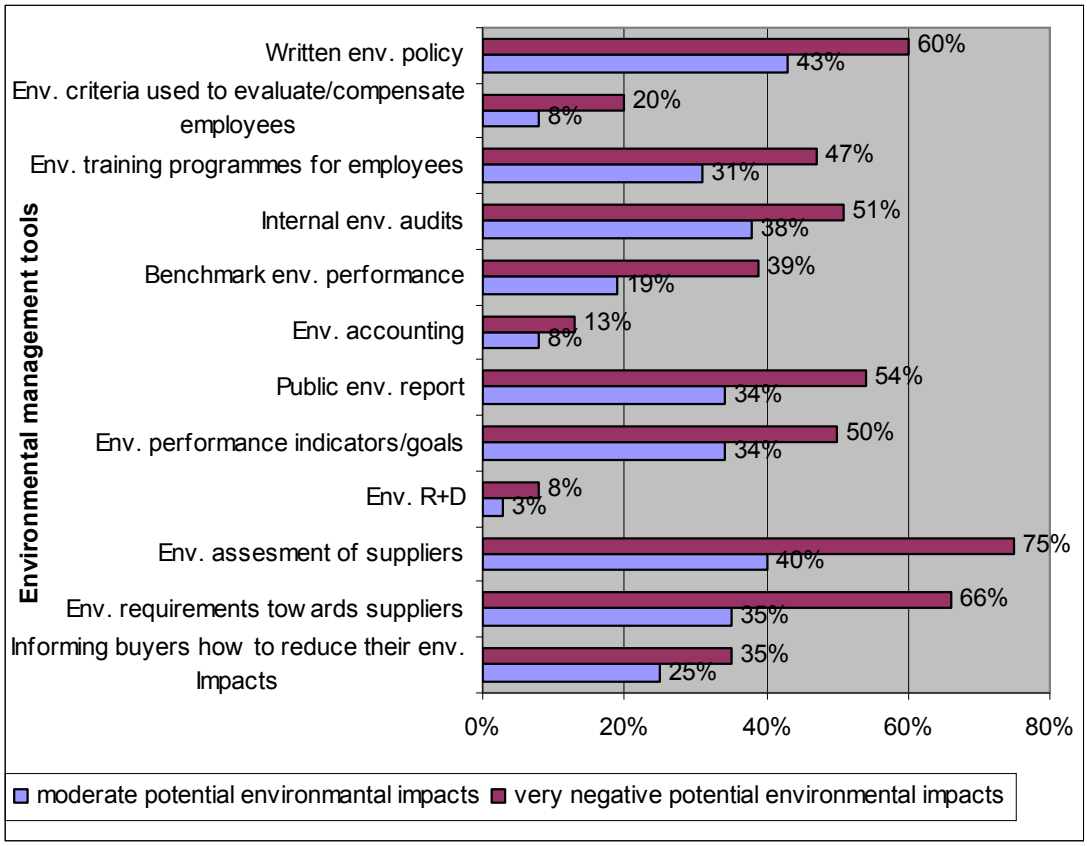
To test the hypotheses, statistical methods were used in this phase of research to analyse the database of the survey. Beyond simple descriptive statistics the following, other methods were applied: relationship analysis based on crosstabulation, analysis of variance, factor analysis and cluster analysis based on its results. Because of the characteristics of variables, the database was not appropriate for regression analysis. To filter out multicollinearity, partial correlation analysis and multiway analysis of variance proved to be very useful.

5.2 Findings of the research

5.2.1 Links between different components of environmental performance

It became visible in the previous chapters that there are many different explanations for the links between components of environmental performance. Nevertheless, it seems that environmental load regarding company activity influences significantly environmental management practices applied by the company. Links between level of potential environmental impacts[68] and application of different environmental management tools can be seen in 8. Figure.

[66] based on 2000/479/EC and 96/61/EC.
[67] Companies have to report in every three years, and they can be publicly accessed three years delayed. Consequently, data for years 2001 and 2004 could be used in this research.
[68] This variable is called as environmental impact following the questionnaire, but meaning environmental load in this case (see also the questionnaire). It is an aggregated variable, created as a summary of



8. Figure. Application of different environmental management tools in case of different potential environmental impacts.

Based on the figure one can state that companies considering their potential impacts very negative have much more often introduced different environmental management practices.

Difference is significant by applying a written environmental policy, environmental training programmes for employees or publishing environmental reports. This suggests that internal and external environmental communication can be interpreted as an answer to the environmental challenge.

Companies considering their potential impacts as significant, also put much more effort on the follow-up of their environmental performance. They have more often environmental goals, indicators and carry out environmental benchmarking more frequently.

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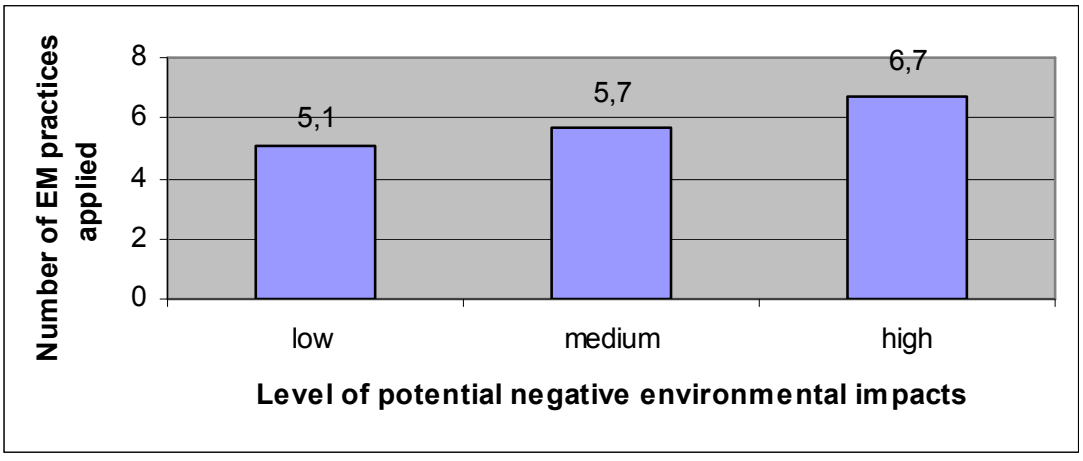
environmental load regarding different fields (emissions to air, wastewater, natural resources, etc.). See also 4. Appendix.

Environmental management seems to go beyond the company gates. Companies with significant potential impacts set requirements for their suppliers to be able to manage environmental performance regarding the total supply chain. These companies may also inform their customers on how customers could decrease their environmental impacts. Beyond environmental protection this latter issue is also in the interest of the company, as their buyers (for whom the company is a supplier) might regard them as an environmentally conscious company, can be an important factor when selecting suppliers.

Use of some environmental management tools (such as presence of a person responsible for environmental matters, presence of an environmental department) did not show any relationship with potential environmental impacts. Application of these tools seems to be linked to other factors like regulation, industry or size of the company. In fact, it is almost generally known, that application of most of the environmental management tools is closely connected with size and industry (activity), see for instance Kerekes et al. [2003].

6. Appendix shows some similar relationships between environmental risks of company activities and application of different environmental management practices.

Consequently it seems that companies with higher potential negative environmental impacts develop a higher level environmental management tool kit, as it is also shown by 9. Figure.

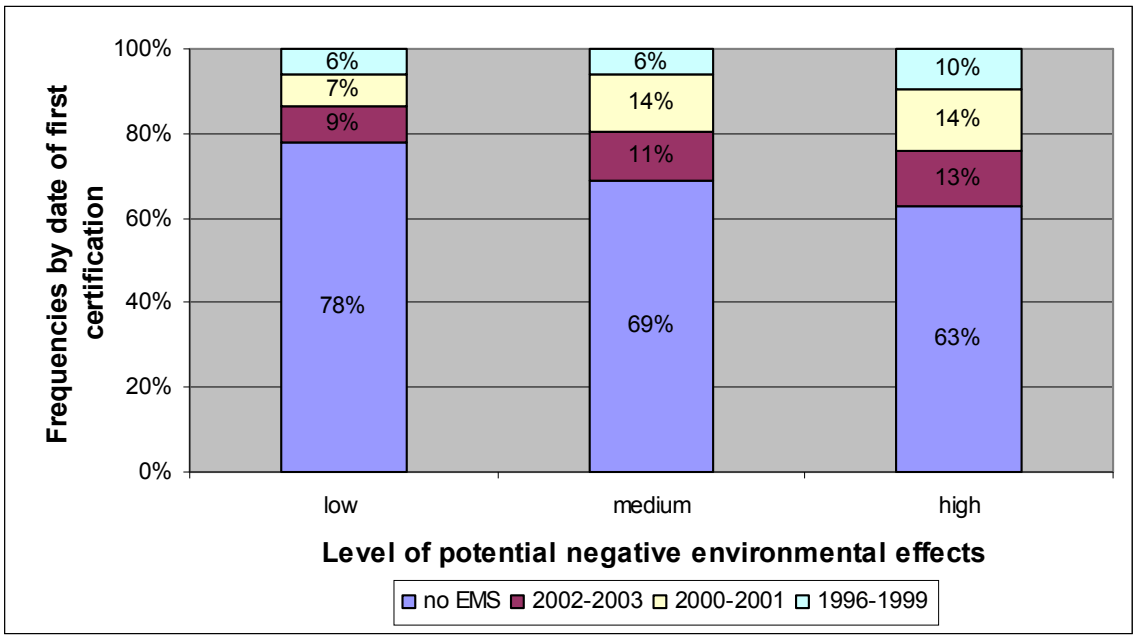


9. Figure. Number of environmental management practices based on potential negative environmental impacts of company activity.

It could be seen that presence of a person responsible for environmental matters and environmental department did not show significant relationship with potential negative

environmental impacts. However, it seemed to be interesting to analyse whether position of environmental responsibility in organisational hierarchy shows any relationship with potential negative environmental impacts at all (see 7. Appendix). Frequencies show that in case of high negative impacts usually an environmental department[69] is in charge of environmental matters; while in case of lower impacts environmental issues in mostly belong directly to top management. *This statement might be a bit surprising for the first sight; but it is mainly because smaller companies judged tendentiously smaller their impacts, while in these companies most responsibilities concentrate in hands of senior management (as they are relatively small).*

4. Appendix shows that 27% of companies in the sample introduced a standardised EMS (in most cases ISO 14001). Based on 10. Figure one can analyse, whether severeness of environmental impacts plays a role in introducing an EMS.



10. Figure. Application of EMSs according to severeness of environmental effects.

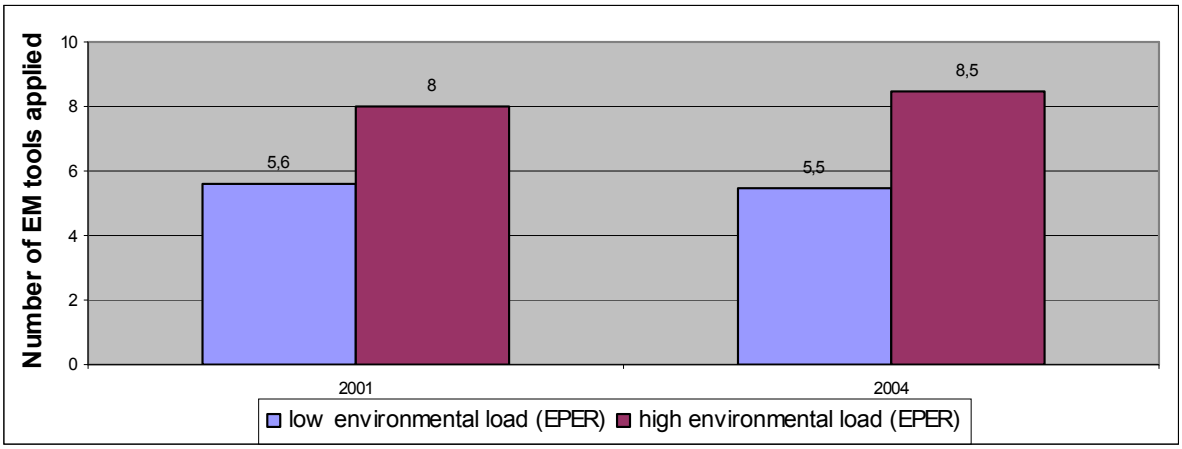
This assumption seems to be true; data show that 37% of companies with severe environmental effects have introduced EMS, while this proportion is only 22% among companies with insignificant effects.

[69] or equivalent, such as EHS (environment, health and safety) or quality management, etc.

There were no significant difference regarding date of EMS-introduction, frequencies does not show for instance that companies with higher environmental effects would have introduced ISO 14001 proportionally earlier than others.

It was mentioned earlier that information gained from the survey is based on responses from companies; and especially data on environmental load would be useful to be supplemented from other sources, as well. In the followings, analysis is made on whether companies with significant environmental load (based on the previously introduced EPER-PRTR-database) have better environmental management than others. The database contains data on different emissions of companies, and also an aggregated "total-emission" indicator (http://eper-prtr.kvvm.hu). As also because of different company activities and sizes total-emissions varied in a more hundred-fold range, comparison of concrete numerical data did not seem to be reasonable. As an alternative method, grouping was chosen: companies in the EPER-database were regarded as "significant polluters" and they were compared to others taking part in the OECD-survey[70].

11. Figure shows that most significant polluters (based on EPER-databases in both 2001 and 2004) applied much more different environmental management practices on average than other companies; in harmony with previous statements.

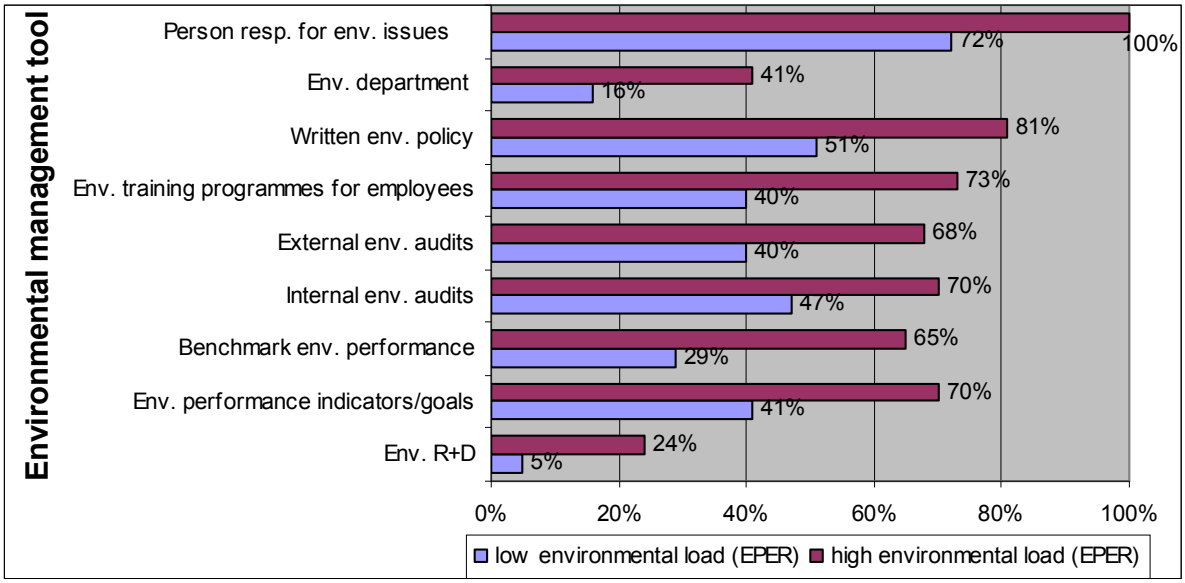


11. Figure. Relationship between the number of environmental management tools applied and significance of environmental load (based on EPER database).

[70] EPER 2001 database contains altogether 86 firms, 25 of them is included in the OECD-sample (responders); EPER 2004 includes 96 firms, 37 of them responded the OECD-questionnaire. As EPER-database refers to firms and not companies, some of the 25 and 37 companies are represented with more than one firm, delivering a bit better "covering ratio" for the OECD-sample. Between 2001, 2003 (time of the survey) and 2004 some companies were reorganised, went bankrupt or changed names, thus identification was not always simple.

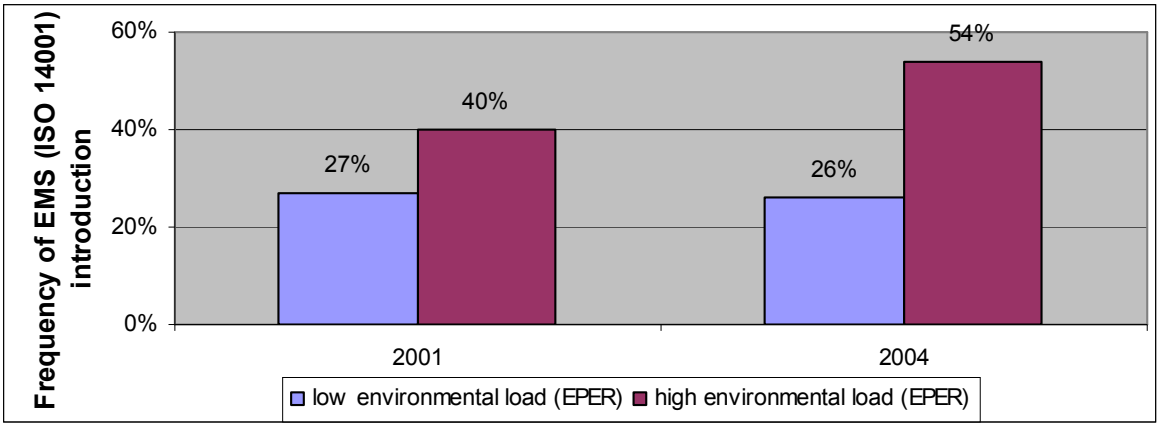
Certainly, the question can arise, whether these relationships are not influenced by multicollinearity; as both number of applied environmental management tools and EPER-reporting obligation seem to be in positive correlation with company size. For this purpose multiway analysis of variance has been carried out, where also size of company (number of employees) was included as independent variable. Most important data on ANOVA can be found in 8. Appendix. Indeed, relationship for 2001 is only due to the influence of company size (multicollinearity). However, regarding the more comprehensive EPER 2004 database, environmental load significantly influences application of environmental management tools, also after exclusion of effects of company size. One can conclude that level of environmental management is positively influenced by level of environmental load, although relatively low value of deterministic coefficient suggests cautiousness. In the followings, only EPER 2004 database will be further analysed.

12. Figure includes different environmental management tools that were applied in significantly higher proportion by companies with high environmental load.



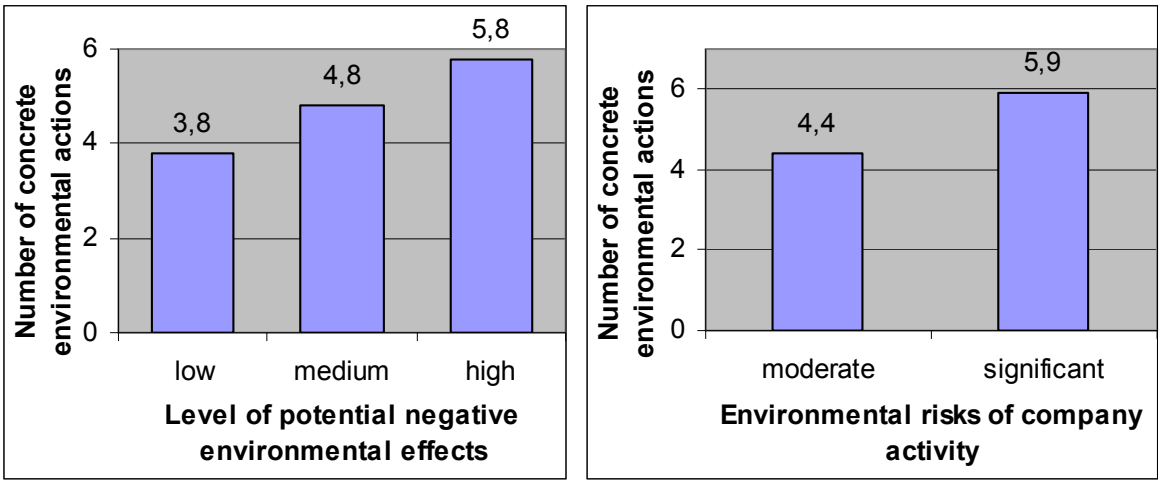
12. Figure. Relationship between the application of different environmental management tools and significance of environmental load (based on EPER database in 2004).

In agreement with previous findings, significant polluters (EPER-database) introduced ISO 14001 much more often than others (see 13. Figure). After running the multiway analysis of variance also in this case, real relationship (thus also after excluding multicollinearity caused by company size) could be detected again only for EPER 2004.



13. Figure. Relationship between introduction of EMS and significance of environmental load (based on EPER database).

Analysis was also carried out to decide, whether companies with significant environmental effects realise more concrete environmental actions than others. While environmental management plays an important role to signpost environmental goals and organise environmental activities; a decrease of environmental load can be mostly expected from concrete actions, such as construction of a water recirculation system or a wastewater treatment facility.

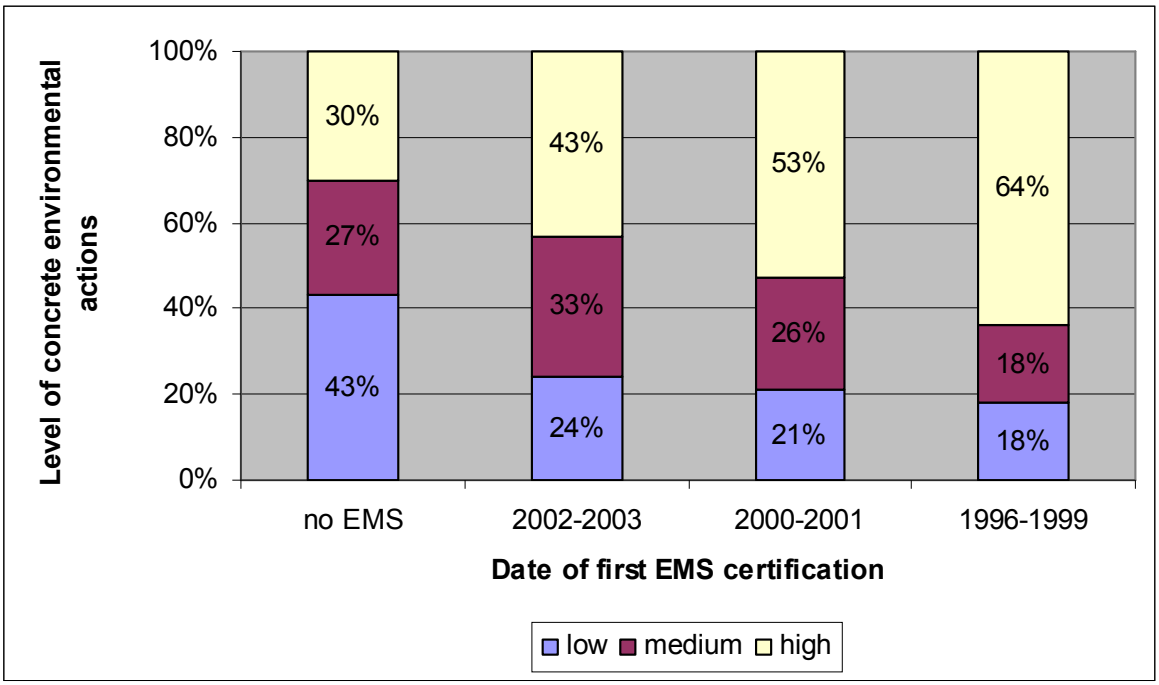


14-15. Figure. Concrete environmental actions based on potential negative environmental effects and environmental risks.

14-15. Figures show in how many fields companies have taken concrete environmental actions[71] on average based on their negative environmental effects and environmental risks regarding company activity. Based on the figures a positive relationship can be detected: companies with more significant environmental effects and risks carried out more environmental actions at the same time. Although it was expected that in fields (for example soil contamination), where the company judges its risks significant, concrete action comes with a higher proportion. However, there were many cross-correlations detected between different fields; suggesting that deciding on environmental actions is influenced by the perceived environmental impacts from other fields as well. Certainly, this does not mean that decision on a wastewater treatment facility with a budget over one million euros will be taken based on air pollution or aesthetic effects of a company; but in specific cases, especially regarding smaller-scale investments, general picture can also play an important role. Stakeholders (customers, local communities, etc.) do not judge company environmental performance by different fields but rather on their general impressions on environmental actions taken by the company.

Based on expectations, development of environmental management also plays an important role in what sort of concrete environmental actions are taken by companies. Well operating EMSs, environmental performance evaluation systems and environmental audits can help a lot to find out areas, where urgent action is needed or recommended. Environmental training programmes can increase environmental consciousness of employees, resulting in preparation of more environmental actions.

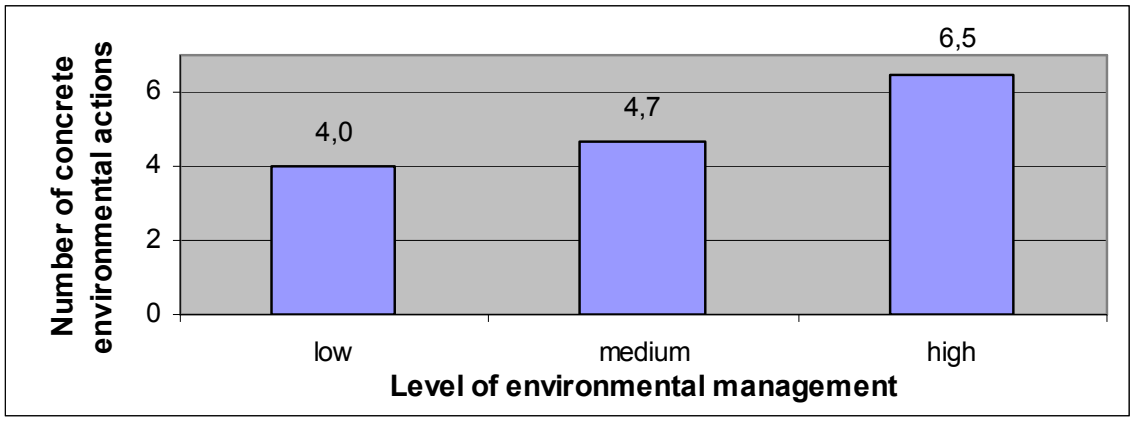
[71] Aggregated from eight areas of environmental actions (1. Appendix):
- use of natural resources (energy, water, etc.),
- solid waste generation,
- wastewater generation
- emissions to air causing local and regional pollution,
- emissions to air causing global pollution (such as green house gases),
- aesthetic effects (noise, odour, landscape),
- soil contamination,
- risk of severe accidents (for more see explination of different variables at 5. Appendix).



16. Figure. Environmental actions according to introduction of EMS.

16. Figure show that companies introducing EMS have realised significantly more environmental actions in different fields than others. Date of EMS introduction was also an influencing factors, as early movers carried out more concrete actions than late-introducers. Previous analysis showed that companies with significant negative environmental impacts introduced EMS more frequently, although regarding ISO 14001 introducers these companies were not overrepresented among early-introducers (see also 10. Figure).

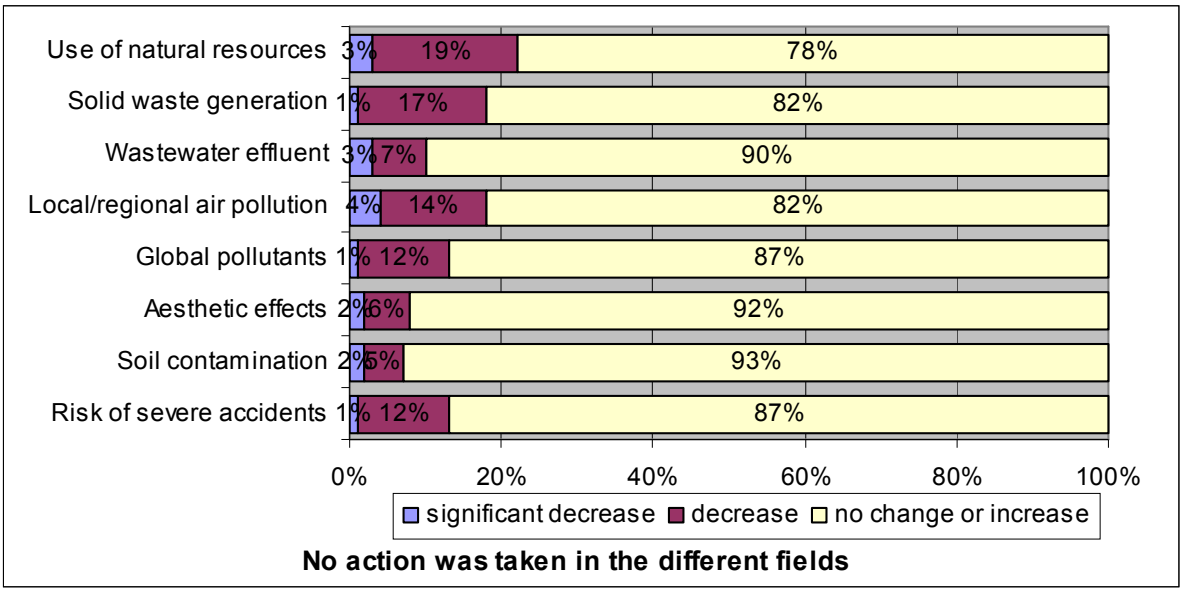
This tendency suggests that time is needed to reach a well-operating EMS. Logic of EMSs includes continuous improvement, meaning that environmental actions have to cover more and more fields, even if some of them were not among priorities at the time of EMS implementation. Just consider a chemical company, introducing previously an EMS in order to manage toxic raw materials and hazardous wastes. After a while, when the system turned out to be efficient and received acceptance among employees, environmental actions can also cover fields like decreasing aesthetic effects or recycling non-hazardous wastes as well.



17. Figure. Link between environmental actions and environmental management.

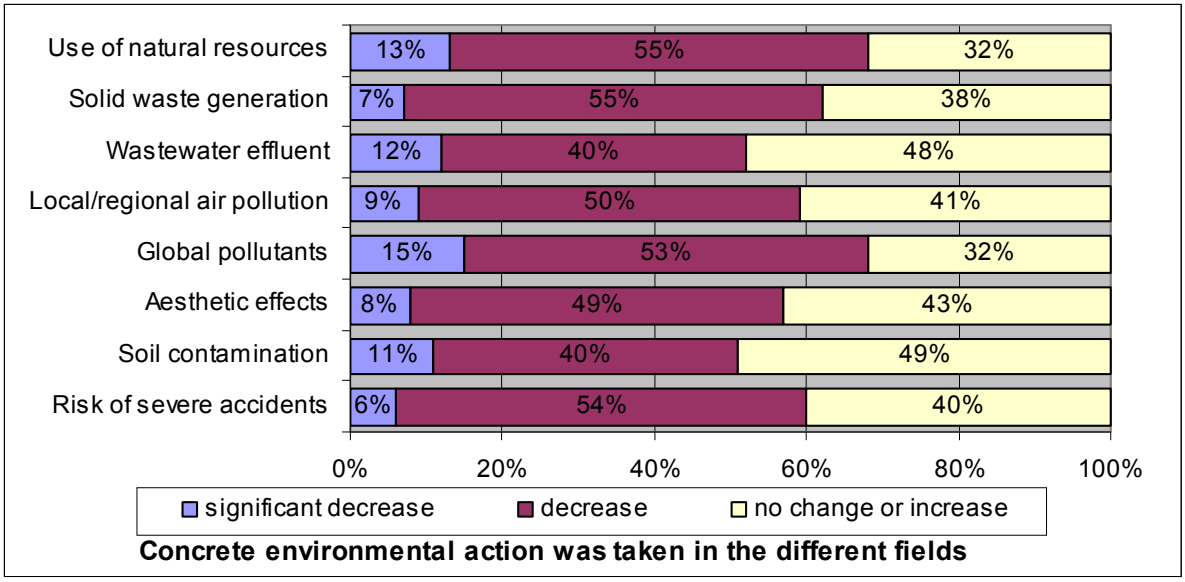
Similar consequences can be made based on 17. Figure, companies with better developed environmental management practice carry out concrete environmental actions in different fields more often than others.

The following 18. Figure and 19. Figure summarise effectiveness of concrete environmental actions taken. In cases when no actions were taken, environmental load decreased only very rarely. Of course, improvements regarding environmental load can also happen because of other factors: changes in product range or technology development (not considered as environmental action). Actions for improving material and energy efficiency are in many cases not regarded as environmental actions either; this might interpret why relatively high proportion of companies achieved improvement in the field of natural resources (18. Figure).



18. Figure. Changes in environmental load per unit of production in case of no concrete action in the respecting fields.

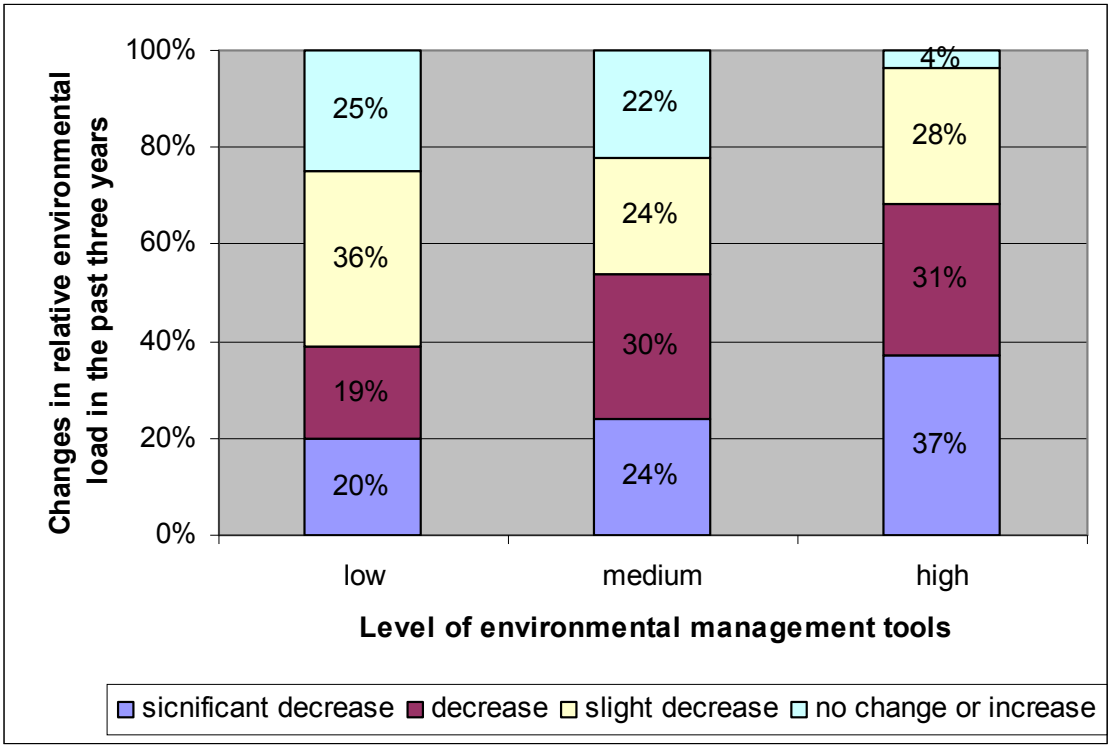
19. Figure shows that a significant part of environmental actions was effective, in most cases environmental load per unit of output has decreased. However, this relationship seems to be not deterministic at all, in many cases no change or even increase was detected. One reason behind this can be that responses did not give any data on quality of different environmental actions. This might be the case regarding wastewater generation and soil contamination; here hardly more than 50% of environmental actions resulted decrease in environmental load. A severe case of soil contamination or wastewater problem might need serious investments (for example soil cleaning or building a wastewater treating facility). Minor actions can be useful, however, they do not lead to significant improvement regarding environmental load in this field.



19. Figure. Changes in environmental load per unit of production if concrete environmental action was taken in the respective fields.

It was also important to analyse, whether application of environmental management tools has a significant contribution to improvements concerning environmental load. In addition to expectations of the author, a positive linkage is suggested by a part of the previously overlooked analysis from literature as well (see for example Dyllick and Hamschmidt [2000]). However, many authors warn that well developed environmental management or the introduction of an EMS can be important for keeping customers, but do not guarantee at all that the company would pollute less (for instance Ammenberg [2003]).

Previous analysis showed that companies with better environmental management seem to carry out more concrete environmental actions, having a positive effect on improving environmental load per unit of output. General conclusions can be drawn, but this is not enough to judge effectiveness of specific environmental management tools.



20. Figure. Changes in environmental load per unit of output related to level of environmental management.

Analysis shows that companies implementing more of the different environmental management practices, achieved usually better results regarding their relative environmental load than others (20. Figure). Similar conclusions are suggested by 9. Appendix, as there is positive correlation between level of environmental management and decrease in relative environmental load. Although correlation coefficient refers to a maximum medium-level linkage, partial correlation analysis (to company size and profitability) shows that this is a real relationship, not an effect of multicollinearity.

As both variables are aggregated from different others, a closer relationship could not be expected. Stronger correlations appeared in case of concrete cases. 10. Table summarises links between presence of different environmental management tools and changes in relative environmental load in different fields.

10. Table. Link between application of different environmental management tools and changes in relative environmental load.

	Natural resources	Solid waste	Wastewater	Local air pollution	Global air pollution	Aesthetic effects	Soil contamination	Risk of severe accidents
Person responsible for env. matters	++	0	++	0	++	0	+	0
Environmental department	0	0	0	0	+	0	++	0
Written env. policy	++	+	++	0	++	+	++	0
Env. criteria for evaluating employees	++	+	0	0	0	0	0	+
Env. trainings	++	++	+	0	+	0	+	+
External audits	+	++	0	0	+	0	++	+
Internal audits	++	+	0	0	0	0	+	0
Environmental benchmarking	++	0	++	0	++	0	+	0
Env. accounting	++	0	++	0	++	0	+	0
Env. reporting	0	++	0	0	0	0	0	++
Env. perf. goals	++	++	+	+	++	0	++	++
Env. R+D	0	0	0	0	0	0	++	0
Assessment of suppliers	++	++	0	0	++	0	++	0
Requirements towards suppliers	+	0	0	0	++	0	+	0
Information of customers	0	0	0	0	0	0	+	0

++: relationship significant at 99%
+: relationship significant at 95%
0. no relationship

Beyond specific links it is also interesting to consider, which are 1. those environmental management tools correlating with improvements in environmental load in many cases and 2. those environmental fields where improvement could be detected in case of many different environmental management tools. These environmental management tools and fields of environmental load are highlighted with grey colour.

It can be seen that *presence of a person responsible for environmental matters* contributes in many cases to improvements in environmental load. Of course this relationship can be also indirect in many cases; the presence of this position can help a lot for the company to prepare and make the right decisions on environmental actions.

To some extent it is similar to the *presence of written environmental policy* and *environmental training programmes for employees*. Environmental policy of course does not lead automatically to a decrease in pollution; showing the commitment of company management is an important condition for environmental protection to become a part of organisational culture. Environmental trainings can also serve this goal. Furthermore, deepening the environmental knowledge of company people enables them to consider environmental aspects during their work, leading finally to a decrease in pollution.

Environmental benchmarking, environmental accounting, and *environmental performance goals/indicators* are methods for helping companies to continuously monitor their environmental performance. This probably leads to a better detection and correction of improper processes, improving relative environmental load on the long run.

Beyond own performance, more and more companies *evaluate environmental performance of* their *suppliers*, as environmental practices of suppliers have important impacts on performance of the companies as well. All endeavours of a company for environmental excellence in producing environmentally sound products fails if its supplier uses toxic raw materials for producing a special part for that product. Same happens if toxic emissions of the suppliers questionmark good environmental performance of the total supply chain. Indeed, if a company requires environmental measures from its suppliers, indirectly it also improves its own environmental performance.

If regarding columns of the table, different environmental fields can be detected, showing correlation with the use of many environmental management tools. Perhaps not too surprisingly*, use of natural resources* belongs to these areas. Companies are not legally forced to improve their material and energy efficiency; however, it is their economic interest. Practice shows that in many cases improvement can not only be reached by significant technological changes, but at least to a certain level also by better management

of processes, thus by better use of management practices (see for example Dyllick and Hamschmidt [2000]). Similar arguments can be followed in case of emission of *global pollutants* as well, as majority of greenhouse emissions is proportional to energy use: improvements in the field of energy efficiency will result a relative decrease regarding greenhouse gases, too.

Proper treatment of *solid wastes* is usually a significant cost for companies. Good management, however, can decrease these costs to a limit efficiently. Examples for that can be energy efficiency mentioned also earlier, or recycling emerging wastes. Environmental management practices play a major role in preparing this.

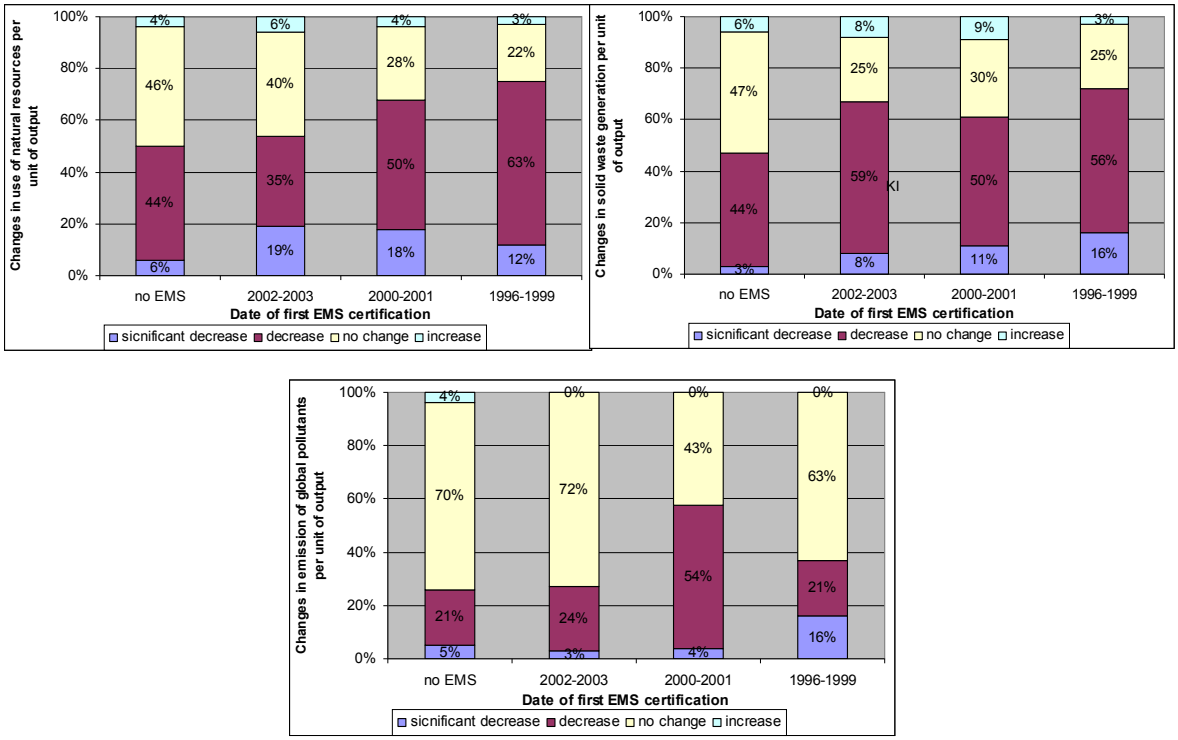
10. Table also shows that emissions of wastewater and local air pollutants do not show that close relationship with presence of different environmental management tools. For improvements in these fields in most cases significant investments are needed, mainly supported by legal pressure. With other words, companies do not fulfil these actions because they can point out with their environmental management toolkits the return of these investments, but because otherwise they could not operate any more. Similar results have been expected also in case of *soil contamination*, as getting rid of existing contamination is a highly resource intensive and not very efficient task. However, management tools analysed seem to play an important role in prevention.

Beyond efficiency of different management tools, many researches have been made on the effects of standardised EMSs on changes in environmental load. According to Kuisma et al. [2001] EMSs do not automatically lead to decrease in pollution, although many companies provide better data on environmental load as a consequence of introducing the system.

According to expectations, positive effects of EMS can be pointed out at least regarding some fields of environmental load.

10. Appendix shows that no general relationship exists: one cannot state that presence of EMS would mean *in general* better performance regarding environmental load. Reasons of this might be found in motivation factors behind introducing EMS. Many companies implement EMS mainly because of marketing purposes for keeping customers; they put less pressure on improving processes from an environmental aspect.

The absence of a general relationship in this field however does not mean its absence in some fields of environmental load. 21-22-23. Figures show some evidence on that:



21-22-23. Figure. Changes in relative natural resource consumption, solid waste generation and global pollutants emission based on introduction of EMS.

It can be seen that companies implementing EMS achieved improvements regarding *use of natural resources* more often than others. Similarly, the earlier EMS was introduced, the more significant these improvements were. Among companies achieving *significant* improvements, companies with EMS were overrepresented, but in this case older EMSs mean on average less significant decrease in the use of natural resources[72].

This result seems to be surprising at the first sight, but it can be explained as recent EMS-implementations still offer the possibility for picking "low hanging fruits" in different fields, usually also utilised by companies. Later on – as material and energy efficiency improves continuously –, these opportunities are getting more difficult to find, even the best companies can improve much slower in this field.

Very similar connections can be detected regarding *solid waste generation*, although in this case companies achieving *significant* improvements are overrepresented also among early EMS implementers. The reason behind this issue can be that time, experience and organisational support is needed to prevent or recycle wastes.

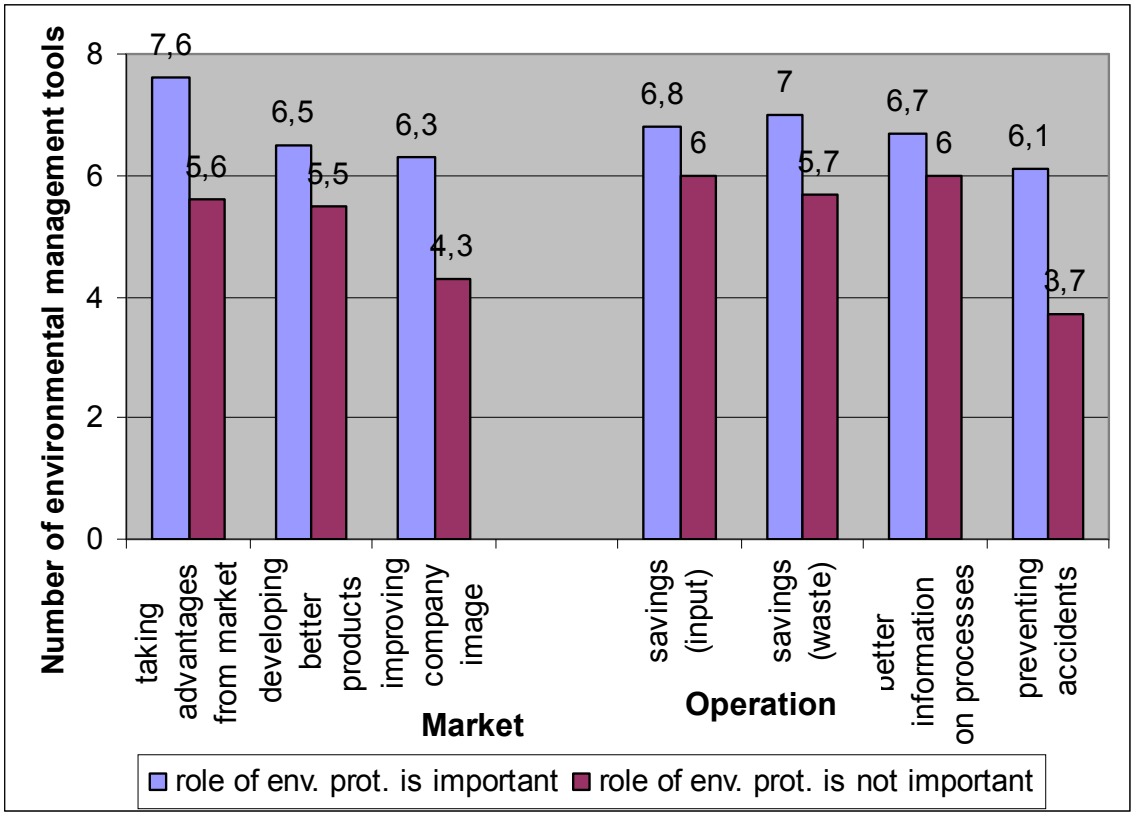
[72] per unit of output and in the last three years

There is also positive link between EMS-implementation and improvements in *emission of global pollutants*; and here also older EMSs seem to be more efficient.

As a consequence it can be stated that EMS-implementation is accompanied by relative improvements in different fields of environmental load, with other words the improvement of eco-efficiency. However, the sample did not offer opportunity to measure absolute changes in environmental load (eco-effectiveness). Most probably, regarding eco-effectiveness much lower impacts of EMSs could have been detected.

5.2.2 Links between environmental performance and other fields of corporate performance

According to previous assumptions, analysis was also made on whether companies where environmental protection activities are thought to be positively contributing to the general performance of the company, have actually better performance along components of environmental performance.



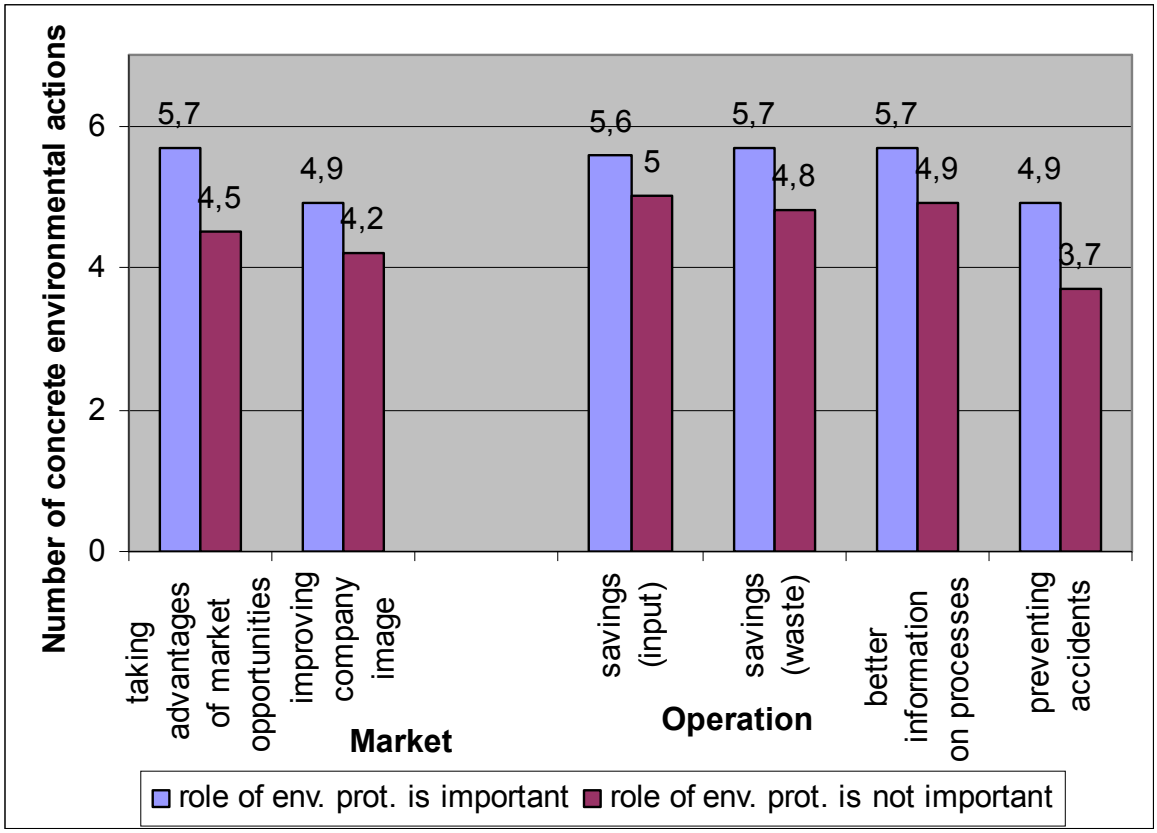
24. Figure. Application of environmental management tools depending on the presumed relationship between environmental protection and corporate performance.

24. Figure shows that companies considering environmental protection as an important factor in corporate competitiveness apply significantly more environmental management tools than others.

Interpreting the figure from an other aspect, one can analyse which links between environmental protection and company performance do really influence, whether the company implements well or less developed environmental management[73].

Variables showing significant relationship with level of environmental management tools were divided into two groups. One includes variables taking environmental protection as a tool for improving *market performance*, the other relates to *operational performance*.

Companies seeing *market potential in environmental protection* (as a consequence of better products or less polluting production processes) applied above average environmental management tools. Same is true for companies considering environmental protection as a factor of *improving company image*.



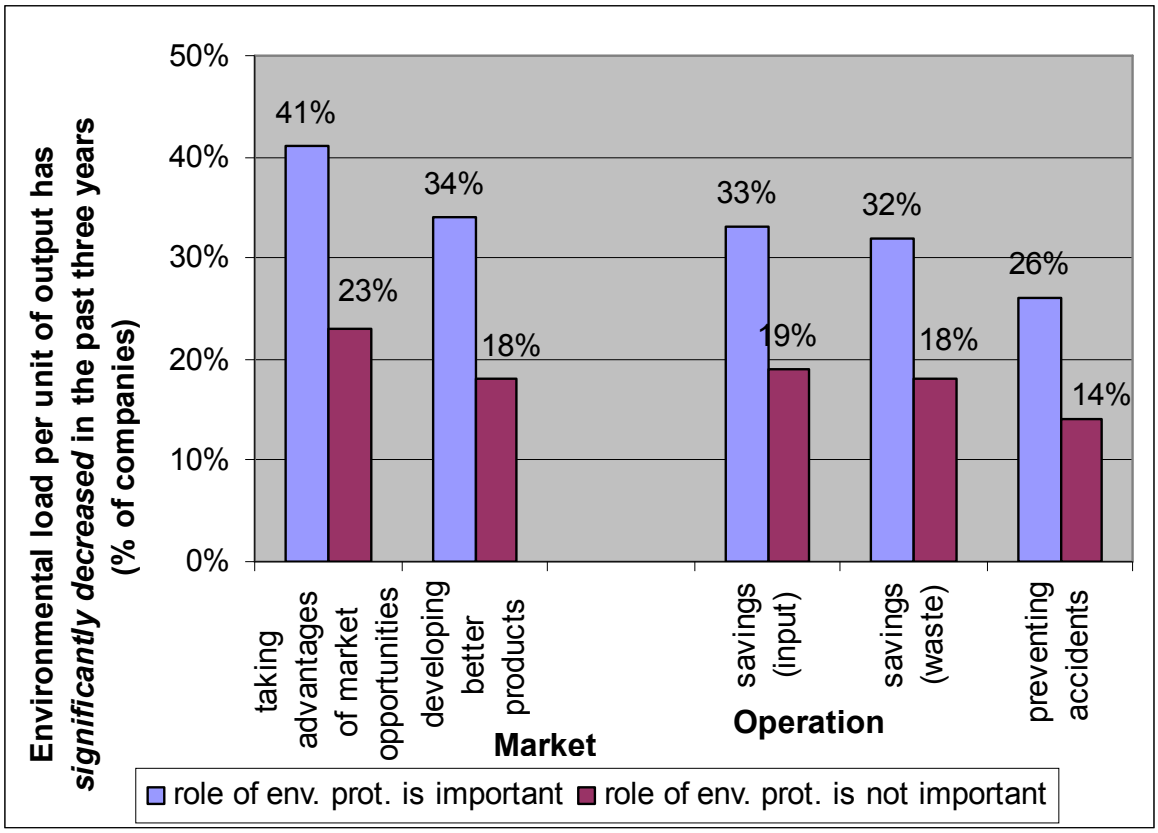
25. Figure. Concrete environmental actions depending on the presumed relationship between environmental protection and corporate performance.

[73] The figure shows only areas where significant relationship could be detected.

Contribution of environmental protection to operational performance showed also significant relationship with the level of environmental management in some cases. These cases were: *cost savings in use of raw materials or waste management, better information on processes* and *prevention of accidents*.

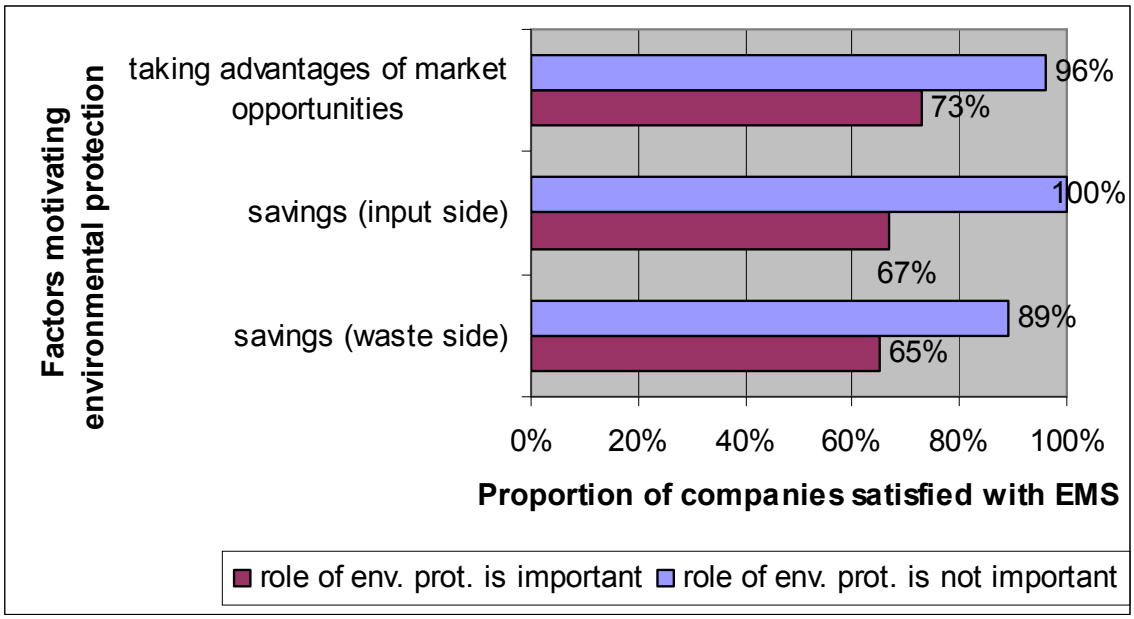
Considerations on the link between environmental protection and company performance and number of concrete environmental actions seemed to be also connected in some cases, summarised by 25. Figure. As a tendency, companies thinking environmental protection was positively contributing to competitiveness, carried out more concrete actions. Areas of relationships were similar to the case of environmental management before.

The question is still open, whether considering environmental protection as an important tool in increasing competitiveness leads to improvements in relative environmental load or not. Some tendencies in this field are shown by 26. Figure; there are positive connections regarding both contributions to market and operational performance.



26. Figure. Tendencies in relative environmental load depending on the presumed relationship between environmental protection and corporate performance.

Comparing components of environmental performance based on the last three figures it shows clearly: *although companies putting pressure on environmental protection in order to improve company image have good environmental management, they do not perform exceptionally well regarding decrease in environmental load. Those companies in contrast, seeing also opportunities in environmental protection in input- or waste-side cost saving, not only have above-average environmental management, but also achieved better results in decreasing environmental load per unit of output.*



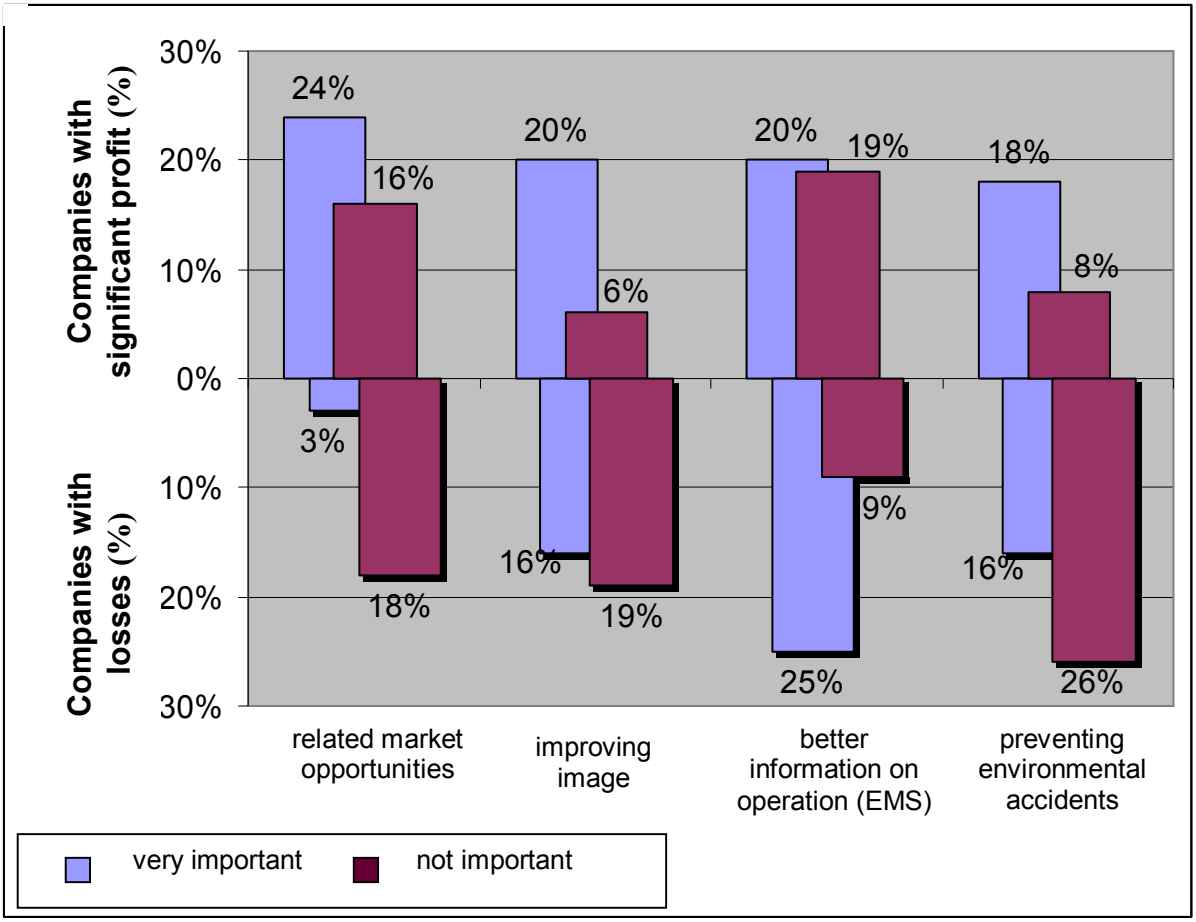
27. Figure. Satisfaction with EMS based on motivating factors behind environmental protection.

Analysis was also made on which fields EMSs can contribute to company performance. 27. Figure shows that companies considering environmental protection as an important opportunity for cost-saving (input and wastes) and utilising market potential were much more often satisfied with their EMSs implemented.

These connections also show that benefits of EMSs do not emerge automatically. They appear primarily at companies thinking better environmental performance is necessary for improving company performance, and implementing a well-operating EMS as well.

A further key issue is whether *actual* improvements in company performance can be really detected in case of companies considering environmental protection for increasing competitiveness. For that purpose however, the questionnaire offered only very limited possibilities.

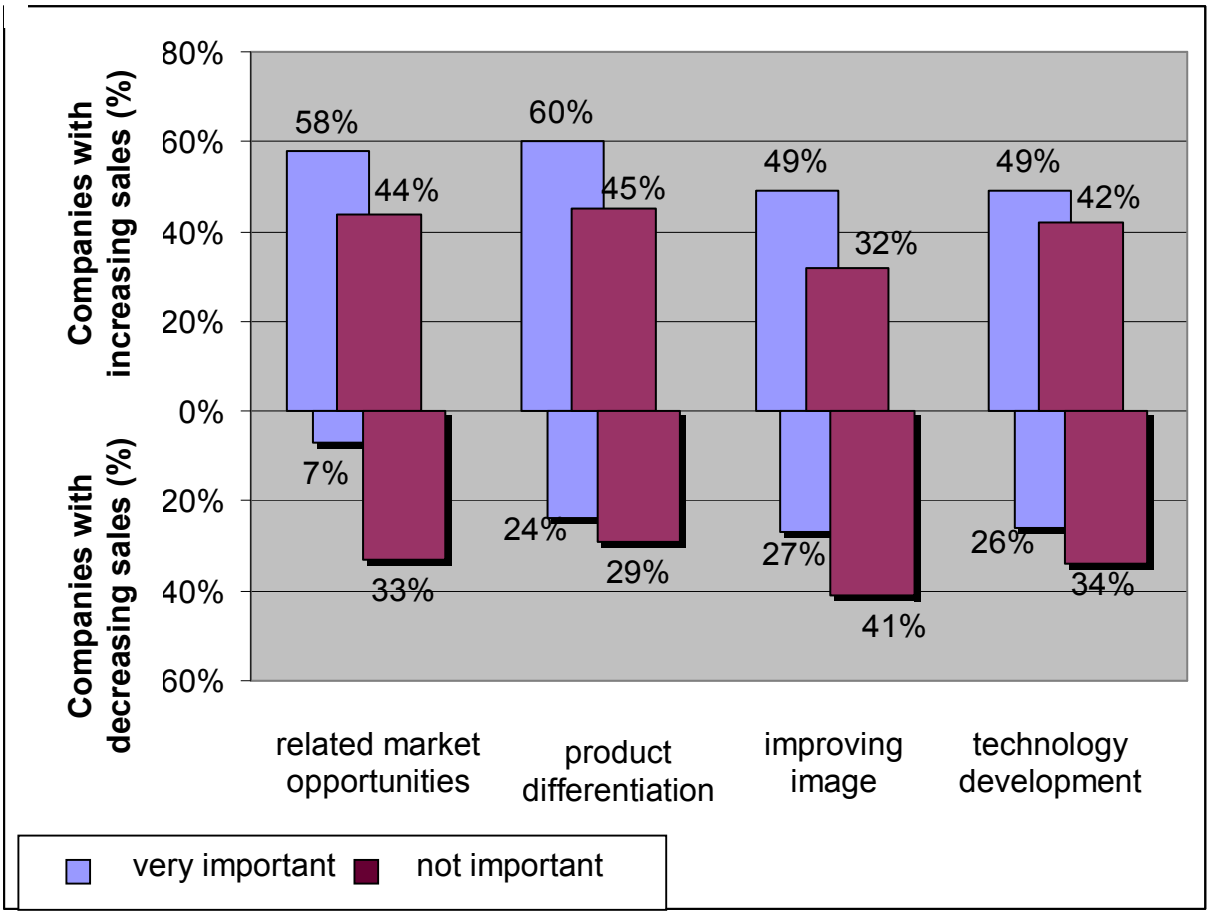
Even if net added value generated by environmental protection to the companies cannot be reconstructed; it can make sense to analyse changes in profitability and turnover of companies seeing business potential in environmental protection (28. Figure - 29. Figure).



28. Figure. Links between profitability and motivations behind environmental protection.

28. Figure shows that among companies seeing performance improvement potential in environmental protection, significantly profitable companies are overrepresented. At the same time, proportion of companies with losses is much lower than average. An exception is assessment of EMS-contribution to better information on processes; in this field also companies with losses appear in high proportion.

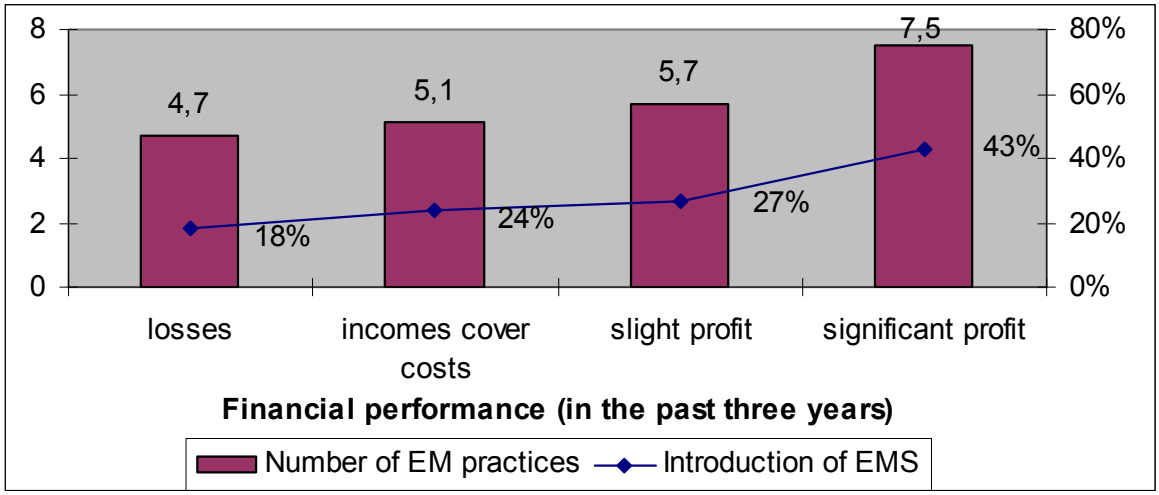
Based on the figure, of course, direction of the linkage cannot be decided. It can also be interpreted that profitable companies see potential in environmental protection (as well as in many other fields), perhaps (also) because of that they have better results.



29. Figure. Links between tendencies of sales and motivations behind environmental protection.

Similarly, 29. Figure suggests that growing companies regard positive link between environmental protection and corporate performance in much more cases than companies with declining sales in the last period.

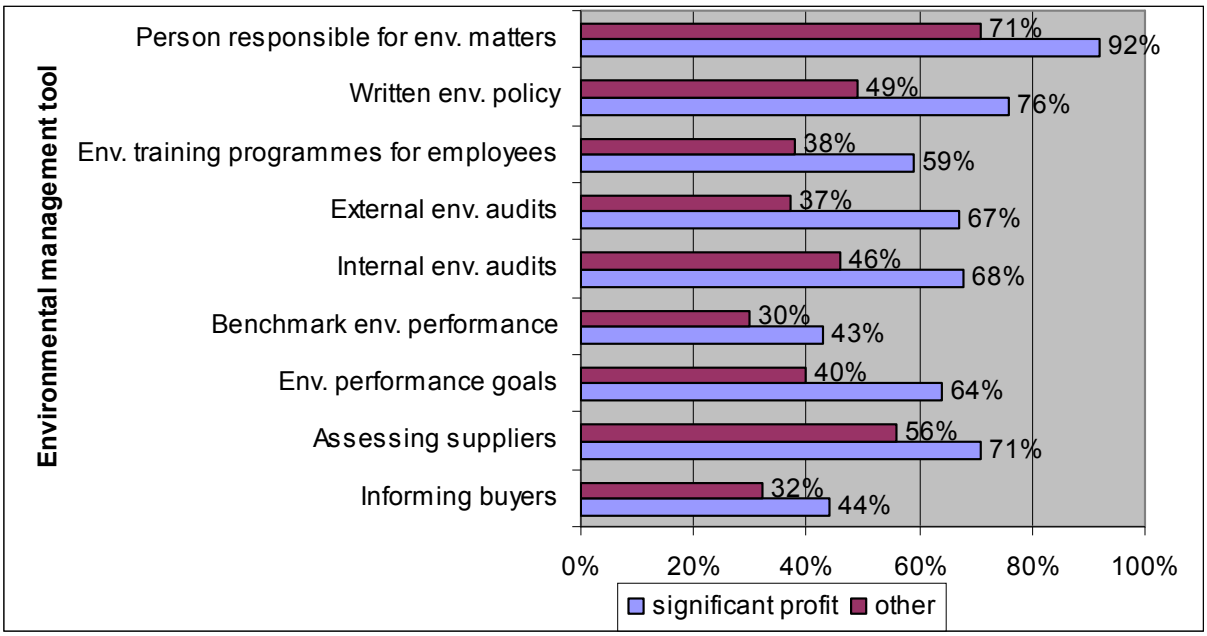
Based on previous analysis one might raise the question whether economically successful companies – performing well in almost all areas – would also have tendentiously better environmental performance.



30. Figure. Level of environmental management based on profitability.

It can be seen from 30. Figure that corporate profitability is in a positive relation with number of environmental management tools applied (on the left axis). Similarly, companies with significant profits have implemented EMSs twice more often than companies with losses (right axis). Furthermore, if different categories of profitability are compared, it seems that companies with significant profit perform outstandingly in the field of environmental management.

Beyond level of environmental management, implementation of different specific management tools were also analysed in relation to company profitability (31. Figure).



31. Figure. Application of different environmental management practices depending on the level of financial performance.

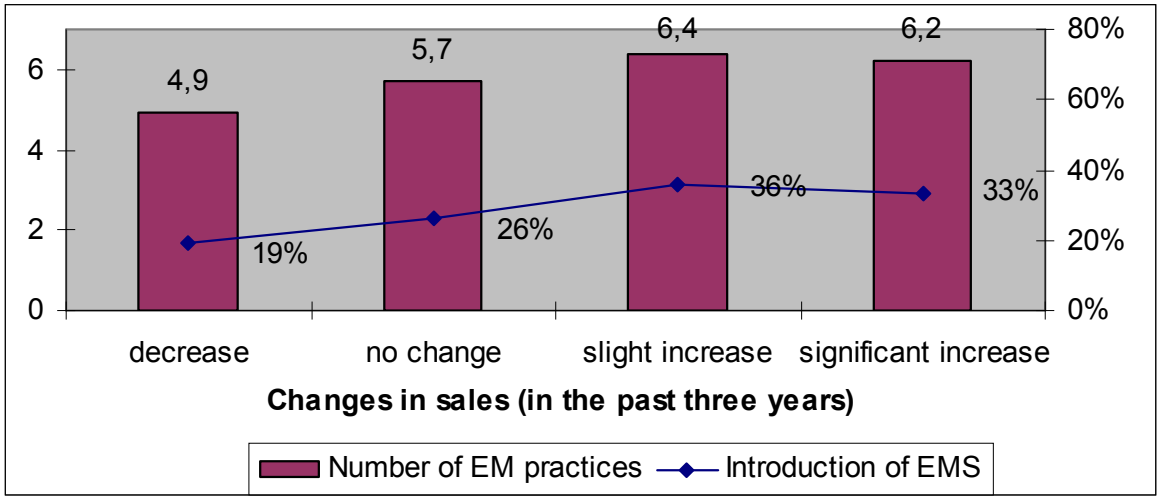
Nine of the fifteen environmental management tools analysed were significantly more often applied by companies with solid profits compared to others.

For a better interpretation of results, potential multicollinearity behind profitability (for company size) was also checked. Analysis showed however, that there was no link between profitability and company size, so relationships on 31. Figure can be accepted.

Thus data from the figure can be interpreted that profitable companies can afford in higher proportion to employ someone responsible (only) for environmental matters or organise environmental training programmes for employees. Presence of an environmental department however – depending rather on company size and industrial activity – was not overproportional in this group.

Although environmental audits and other environmental performance evaluation methods can contribute to the improvement of company performance; application of these tools need financial and human resources, available mainly at profitable companies.

Data on environmental assessment of suppliers can be interpreted as companies with losses may focus mainly on price, while profitable companies can afford also to think on the long run, considering also other aspects than procurement price. Weak environmental performance of suppliers may also harm company image.



32. Figure. Level of environmental management based on changes in sales.

32. Figure shows that growing enterprises apply usually more environmental management tools and implement EMS more often than other companies. In contrast to analysis of profitability, in this case fast growing companies do not perform *exceptionally* well, maybe because concentrating on growth absorbs most resources of these companies.

Based on the last figures the question may arise, whether *good environmental performance would be a luxury affordable only for economically well performing companies.* If it is true, companies representing a major part of economy with not exceptionally good profitability do not offer too much. Before accepting this – from an environmental aspect not very motivating – assumption, analysis on other components of environmental performance is also recommended.

Accordingly, many comparisons were carried out between variables on concrete environmental actions, changes in environmental load and variables on economic performance, but no significant relationship at all was detected.

This means that economically successful companies – maybe because they can afford it better – practice more developed environmental management activities; but this does mean at all that they would carry out more concrete environmental actions or their relative environmental load would be lower.

As a next step, analysis has been made, whether companies integrating environmental activities with other fields of company management[74] experience better environmental or corporate performance.

Logically it can be assumed that such an integration of environmental aspects in company decisions can be beneficial from both environmental and economic points of view. Examples for that can be:

- **Environmental objectives can be achieved more efficiently.** Environmental aspects appear in different fields of company operation (production, procurement, marketing, training of employees, etc.). Because of that, environmentally related tasks and responsibilities are good to be linked also to the different functional fields; instead of isolating these totally as a sub-function of one specific area (production for example). This latter and unfavourable issue however, can be detected in practice in many cases. A better practice is if different functional areas are responsible for environmental aspects relating to them (such as environmental assessment of suppliers regarding procurements or substituting hazardous raw materials regarding production). In this case environmental aspects can be directly integrated into decisions and corrections are also easier to be made. When following this model, specified environmental department (or alike, if exists at all) 1. can coordinate environmental activities of the different functional areas and 2. can take part in strategic decisions (in order to include environmental aspects in company strategy as well).
- **Organisational acceptance of the field of environmental protection can improve.** Partly in connection with the previous passage, if different environmental tasks belong to the responsibility of different functional units, otherwise common conflicts between environmental and other areas can be smoothened. Conflicts may not disappear totally, but environmental objectives can be realised with less organisational resistance. If environmental aspects are included in the annual training programme of a specific department instead of separate environmental trainings, resistance of already overtasked employees may decrease.
- **Economic benefits can be achieved as well**. If different special management systems have been implemented by a company, it can be reasonable to utilise synergy between similar systems. This can lead to resource efficiency especially in case of standardised, auditable systems with significant administrative needs, such as EMSs, quality and

[74] and do not practice environmental protection as a field isolated from other company functions

occupational health and safety management systems. There are similarities in structure and philosophy of the ISO 14001 EMS and the earlier developed ISO 9001 quality management systems. If a company already has an ISO 9001, and in order to systematise its environmental management practices ISO 14001 is decided to be implemented as well, it may be reasonable to link the systems to some extent. In such a way experiences gained from the earlier system can be utilised and also significant savings can be achieved. Many authors point (for example Csutora and Kerekes [2004], p.120.) that high cost of implementation and maintenance of different management systems mean competitive disadvantage especially for smaller companies. In this aspect, integration of systems can be beneficial (also) for these companies. Dyllick and Hamschmidt ([2000], p.106.) stress however, that in spite of advantages mentioned, integration of environmental and quality management systems leads only to suboptimal solution, and that is why it is not recommended. Although these management systems are similar in structure, there is a threat that environmental protection will be equal to keeping formal rules written in the standards.

As it could be seen so far, environmental protection can be integrated with other fields of company management in many different ways, in order to improve company and environmental performance:

- Integrating environmental management and other special management systems (mainly quality and health and safety).
- Considering environmental aspects in financial analyses and evaluation.
- Integrating environmental aspects into core company processes (production, procurements, etc.).

In the company survey integration of environmental protection could be analysed in the field of six different management practices. These were:

- quality management,
- occupational health and safety,
- full-cost or activity-based accounting,
- management accounting,
- process or job control,
- inventory and materials requirement planning.

Furthermore, integration of environmental protection and company management was also assessed by institutionalisation of environmental protection. It was measured by two variables:

- level of environmental management tools and
- implementation of EMS.

A question arises, whether these eight variables are appropriate for evaluating links between environmental protection and other fields of company management, or they should be reduced into fewer variables, still including the same information.

As identified variables correlated with each other in many cases, creating fewer variables with the method of factor analysis seemed to be the reasonable choice.

Steps of factor analysis can followed in 11. Appendix. As mentioned before, correlation matrix shows many correlations between the eight original variables. Accordingly, the KMO-value of 0,707 and positive outcome of the Bartlett-test suggest that factor analysis can be fulfilled.

Principal component analysis was chosen to create factors. When deciding on number of factors, many aspects have been considered, for example the Kaiser-rule relating to Eigenvalues and the Scree-test (for more information see 11. Appendix and compare with Sajtos and Mitev [2007]). Final decision has been made based on how good factors can explain original variables and how easily factors can be interpreted. As a consequence, three factors emerged from the eight original variables. In order to make interpretation easier, Varimax rotation was also used (see 11. Appendix).

Factors emerging from the analysis can be seen in 11. Table. Factor weights belonging to original variables show that factors created interpret them relatively well.

11. Table. Factors created from variables on the relationship between environmental protection and company management.

Factor	Original variables	Factor weights
Factor 1: Integration of environmental protection and basic processes	Environmental activities integrated with full-cost/activity-based accounting	0,844
	Environmental activities integrated with inventory and material requirement planning	0,807
	Environmental activities integrated with management accounting system	0,805
	Environmental activities integrated with process or job control system	0,707
Factor 2: System focus	Application of environmental management system	0,894
	Level of environmental management tools	0,874
	Integrating environmental and quality management activities	0,727
Factor 3: EHS[75]-focus	Integrating environmental with occupational health and safety management activities	0,978

Based on newly created factor-variables the author has tried to classify units of the sample (with other words the different companies) into homogeneous and well separated clusters, and to characterise these clusters.

Considering methodological suggestions on cluster analysis (for example Füstös et al. [1986], Sajtos and Mitev [2007]), the Ward method (a method of hierarchical classification methods) has been selected. Among different possibilities finally a four-cluster classification seemed to be the most appropriate.

Clusters emerging were characterised first of all by variables behind factor analysis, then by variables measuring environmental and economic performance, and finally by other background variables. Findings of the cluster analysis are summarised by 12. Table.

Most important characteristics of different clusters can be interpreted as follows:

Committed to Environmental Excellence: Cluster members are companies applying many different environmental management tools and implementing EMS in a significant proportion. Environmental management is closely integrated with quality management (management systems of similar structure, similar management tools).

[75] EHS – Environment, Health and Safety

Among environmental actions distinguished pressure is put on waste management, leading to significant results in decrease of solid waste generation per unit of output. These companies perform above average also in the field of raw material use and soil contamination. Their financial results are usually above average, with increasing tendency in turnover. There are many bigger companies in this cluster; chemical and manufacturing sectors are overrepresented. For companies belonging to this group company image and well-established relationships with costumers are exceptionally important.

Committed to Survival: Companies in this group have usually lower level environmental management; integrating environmental protection with other fields of company management happens very rarely. They perform average or below average in the field of concrete environmental actions and environmental load. Financial performance of these companies is weaker than average, stagnating or declining companies are overrepresented in this group. They are usually medium-sized enterprises; companies from textile industry are overrepresented. Corporate image and customer relations seem to be less important in this cluster.

Cautiously Movers: Companies perform average along most variables analysed in this group. However, they consider environmental aspects relatively often in planning and evaluating company processes. Medium-sized companies are common in this cluster; enterprises in metal processing are overrepresented.

EHS-focused: Companies belonging to this cluster have above average environmental management; relatively many companies implement EMS. Their environmental protection activities are however, strongly influenced by occupational health and safety: they put significant pressure on decreasing risks of accidents and negative aesthetic effects. They perform above average in the field of wastewater emissions and soil contamination per unit of output. Their profitability is average, bigger and food processing companies are overrepresented. Company image has above average importance in this group.

12. Table. Clusters based on the relationships between environmental protection and company management.

Name of cluster		Committed to Environmental Excellence	Committed to Survival	Cautiously Movers	EHS-focused
Variables included into (factor and) cluster analysis	Level of environmental management	high	low	average	above average
	Introduction of EMS	84%	2%	19%	36%
	Integrating environmental and quality management activities	often	uncommon	average	average
	Integrating environmental with occupational health and safety management activities	uncommon	uncommon	uncommon	often
	Considering environmental aspects in the following fields: ▪ inventory/material requirement planning, ▪ process/job control, ▪ management accounting, ▪ activity-based accounting	uncommon	uncommon	above average	slightly above average
Other variables concerning environmental performance	Concrete environmental actions; above average performance in the following fields:	waste management			decreasing risk of accidents and aesthetic effects
	Environmental load per unit of output; above average performance in the following fields:	waste generation, use of natural resources, soil contamination			wastewater, soil contamination
Variables concerning corporate performance	Profitability	above average	below average	average	average
	Growth in sales	above average	below average	average	average
Other background variables	Company size (number of employees)	big companies over-represented	rather medium-sized companies	rather medium-sized companies	big companies over-represented
	Industry (which were over-represented)	chemical and machine industry	textile industry	metal processing	food industry
	Role of company image in the competition	above average	below average	average	above average
	Role of well-established customer relationship in the competition	above average	below average	average	average

6 Analysis of the relationship between environmental and corporate performance based on interviews with company professionals

6.1 Research background

The large-sample, quantitative company analysis plays an important role in giving a general view on different areas of corporate environmental performance; although it is almost impossible not to run against its boundaries. Standardisation is important to base the comparability among different companies; on the other hand it leads to information losses on the company level. For example information whether the company has carried out environmental actions in order to prevent or decrease soil contamination is not enough to judge the quality of this action.

A further limit of questionnaire-based surveys, that usually closed questions are used with ready answers to make answering and processing questionnaires easier. In this "good" answers might be suggested. Furthermore, respondents tend to give a better view on their companies than reality; this can be only partly filtered out with control questions.

Because of these issues, it seemed to be justified in addition to the quantitative research to carry out a deeper analysis in smaller sample. Based on the methodological guidance (for example Yin [1994], Miles, Huberman [1994]) qualitative techniques seemed to be the most appropriate for the further analysis of corporate environmental performance.

In this phase of research, most important aims were the followings:

- to understand, how corporate professionals interpret the concept of environmental performance in general and also projected to their own companies;
- to better understand, what relationships corporate professionals see between environmental and general performance of their companies.

In addition, comparison of experiences with results of the quantitative research proved to be also very useful.

From the qualitative tool set offered by Miles and Huberman [1994] interviews were chosen as primary method for the deeper analysis of corporate environmental performance. During this phase of the research, semi-structured interviews were carried

out. The author intended to get answers from the interviewees for a couple of questions (such as "how do you interpret the environmental performance of the Company?" or "What role environmental protection can play regarding success of the Company?") without suggesting possible or proper answers. The aim of the interviews was to get know the personal views of the interviewees as detailed as possible.

Main aspects of selecting companies were as follows:

- The company has responded the questionnaire mentioned earlier.
- Companies with good and weaker environmental performance should be also included into the sample (based on the questionnaires and other background information).
- The sample should contain not only bigger companies and companies from industries regarded traditionally as heavy polluter (such as chemical industry). Companies from less "dirty" industries and smaller companies should be included, too.
- As honest answers play a major role in research, primarily possibly cooperating companies were contacted.

Altogether five companies were selected. Most selection criteria could be achieved, but finally big enterprises were overrepresented also in this sample. A reason behind was also that company members of contacted smaller enterprises seemed to be busier and also less interested, resulting a higher refusal rate. Activity of companies in the sample covered the following industries:

- food and tobacco industry: 2 companies,
- chemical industry: 1 company,
- metal processing: 1 company,
- machine industry: 1 company.

At a company more interviews were planned to be made. A main intention was to be able to get know the opinions from different professions and hierarchical levels. Potential interviewees were the following persons (of course overlaps between different positions could happen):

- one member of top management,
- one professional in charge for environmental matters (possible at the level of middle management),
- one professional in charge for production matters (possible at the level of middle management),
- one professional in charge for financial (or accounting) matters (possible at the level of middle management),
- one non-professional employee.

Altogether thirteen interviews have been made at the companies in the sample. Companies were contacted firstly by phone, and parallel a letter of invitation was also send. In this letter aim and structure of the research was outlined and also role of company professionals in present phase of the research (see 12. Appendix).

Sketches for interviews have been made in advance, 13. Appendix gives an example for that. Of course they were used only as guidance, weights were put in most cases to one area or another.

The interviews at different companies followed each other, so the experience gathered from the earlier conversations – as well as the results of the quantitative research – could partly modify the focus of the latter interviews.

In general, length of a conversation was 45 to 60 minutes, although the shortest was only 30 minutes long, while the longest lasted two and a half hours.

In order to increase validity and reliability, additionally also document analysis was carried out. The most important corporate documents analysed were the followings:

- environmental policies,
- environmental and sustainability reports,
- annual reports,
- internal communication materials (wall newspapers, presentations, etc.),
- company websites.

6.2 Findings of the research

6.2.1 Factors behind the improvement of environmental performance

The factors behind the environmental activity have been already mentioned in earlier chapters and a detailed analysis on the effects of stakeholder groups based on the presented corporate sample was also prepared (Kerekes et al. [2003]). In the following section focus is made on presenting the most important aspects – the ones pointed out in the interviews with corporate professionals – along the dimensions of '*why*' and '*how*' rather than the dimension of how strong their influence is.

Legal compliance is without doubt the most important motive for environmental protection for the majority of companies. A few hundred – occasionally also often altering – regulations may apply to some bigger manufacturing companies, giving them a serious task even by keeping the relating records. Extremely simplifying, the following formula can be drawn up: the role of environmental regulations is to keep companies' activity within barriers so that state of the environment improves or at least keeps its actual level. To reach this goal many tools are applicable, for instance protocols on the measure of environmental load or on the quality of environmental management, motivation, etc.

Corporate professionals did not argue about the justification and importance of environmental legislation, whereas suggested several critical points in actual practice, most of all they *missed transparency and dialogue in legislation process*. This does not necessarily refer to the difficulties occurring in the course of lobbying against the aggravation of regulations[76]; it was raised many times that objectives drawn in the regulations would be attainable in a less „painful" way for companies if they were involved in preparation process.

> *"feedbacks from the industry and technical rationality are not considered, although cooperation would be much better that way"*

This mostly occurred in case of authority regulations like the issuance or prolongation of operating permissions. Generally corporate professionals argued that it is them who are most familiar with their own processes, therefore their involvement in

[76] Obviously this point cannot be entirely excluded especially in the case of corporate enterprises, nevertheless most of the companies have not got the possibility to substantially influence legislation. From their point of view the most important thing is to assure that it's possible to comply with the regulations.

preparation of regulations would be the best choice from the environmental aspect also. Although it is a common remark from the environmentalists' side that companies keep on adducing technical rationality in order to explain to those not so well up in technical issues why some things *cannot* be done; in particular cases it can be useful to have company professionals' opinion.

The contrary also occurred, one of the companies regularly receives drafts of the regulations that affect them from the local authorities, and in this case representatives of the company have at least the right to express their opinion.

It can be stated that the resolutions produced by mutual accord are much more probably to be observed and thus costs of control and enforcement are reduced; the good relationship among companies and the authorities is in both parties' interest.

It also occurred in several cases that frequent changes in environmental legislation renders significantly more difficulties to execution of environmental protection measures requiring large investments.

> *"we had calculated that construction costs of the wastewater treatment plant would return in four years, but then regulations changed… this way it is impossible to make plans"*

Apart from law, *shareholders' expectations* are a motivating factor often mentioned. But why is good or at least acceptable environmental performance important for shareholders? Beyond avoiding the drawbacks of non-compliance with law, several other considerations were suggested.

> *"shares of the parent company are traded on the stock market of xy, so it is important to us to measure up to social expectations… in the end the standard is judgement of public opinion in xy country rather than in Hungary"*

For companies of foreign (Western European, American or Japanese) ownership expectations of the home country's public opinion are also important. Where the parent company was quoted on the stock exchange the good reputation was even more important compared to average (also regarding environmental protection). One of the corporate representatives reported proudly that their company is included in the Dow Jones

Sustainability Index, while their main competitors are not, and that has evoked their shareholders' appreciation.

In this connection several companies have directions of their environmental activities set by *environmental objectives and standards drawn up by the company's headquarters*.

> *"sometimes it is difficult to convince the management to approve certain arrangements, but if we manage to demonstrate that they do it like this in the headquarters as well, they nod approval right away"*

Costumer expectations can also be definitive. This consideration arose principally at companies delivering for other companies.

> *"if we did not lay emphasis on environmental protection, we would be crowded out of the market bit by bit"*

In many places it was a recurrent idea that other companies' suppliers face significantly stricter environmental expectations than those producing for end-consumers.

> *"we are in the FMCG*[77] *sector, for our consumers environmental protection is irrelevant,...obviously in B2B*78 *relations it may play a much more important role"*

Improving environmental performance can be significantly promoted by *personal motivations of corporate environmental (and other) professionals*. As a result of personal innovations, one of the companies' 'zero-emissions' objectives that involved several environmental elements was adopted by the parent company and obligated the rest of their subsidiaries to do so.

> *"in the beginning this was not a central expectation at all, ... then seeing the success of the initiative it was included in the directives of the (parent) company, ... I think, we can be proud of that"*

[77] FMCG : Fast Moving Consumer Goods
[78] business to business, that is, other companies' supplier

Certainly for the success of such initiatives environmental protection needs to be sufficiently accepted in the organizational culture, to this point we shall return later on.

6.2.2 Environmental protection in the organizational culture

With respect to environmental performance of companies it is extremely important whether or not environmental protection as a value infiltrates the organizational culture, and if yes, what position does it take. Obviously it would not be realistic to expect environmental protection to be the principal decision-making criterion, whereas it is a great leap forward if environmental protection is a part of the organizational mentality and the environmental aspects are automatically considered in the course of decisions (e.g. investments, product development, etc).

In this respect *attitude* and commitment of *corporate management* is a key factor. As far as the management treats environmental protection as an obligation or annoyance, it will not provide sufficient motivation for members of the organization to take environmental aspects into consideration in daily work. Environmental protection measures – even ones not implying serious investment – often fail due to organizational resistance; for decision-makers this is often another problem to deal with. Good examples to this question are the following:

"I did not feel good at my previous workplace ... to most of our ideas we only got the feedback of 'oh well, environmental protection…'"

"...we are in a lucky situation, our management can be generally described with 'positive lack of interest'... if we demonstrate that something is good for the environment and does not imply economic disadvantages, then it is usually approved"

Environmental trainings and events play an important role in environmentally conscious thinking. At most of the companies analysed environmental protection is in some form part of employees' training programme. There were examples where – for example – proper management of wastes and rejects was mentioned only in the fire and accident prevention training of newcomers at the production unit.

In several places, however, environmental trainings are organized with more or less regularity, which means that presentations are delivered (generally every six or twelve months) on the environmental objectives, programmes of the company, with emphasis on what areas the co-workers can influence during their daily work.

In earlier sections one could see that introducing an EMS itself does not guarantee good environmental performance, but it gives opportunity to improvement in many fields. The interviews showed that *EMS plays a significant role in organization of internal environmental communication and thus in the establishment of environmental aspects in organizational culture.*

> *"environmental protection at our company was earlier characterised by 'fire-fighting'... since we introduced ISO 14001 our environmental activity has become much more organized,... I think this is because people understand better why we do what we do, while earlier they had the feeling that we were picking at them"*

> *"in the beginning training participants' attitude was to let themselves to be 'trained' so that they get rid of us the earlier possible, but now they see what it is all about and are much more cooperative"*

In case of companies with a well-functioning environmental management system non-productive employees were generally also well informed about environmental issues concerning their company and in most cases agreed on the importance of environmental protection objectives.

Apart from trainings *various environmental protection-related events organized for employees* also play an important role. Such actions were the collection of piles and batteries from homes or motivation to do voluntary work in groups for local NGOs. Such activities – besides enhancing employees' environmental consciousness – can also be useful by strengthening organizational culture or by team-building.

Other means of environmental communication are different *notice boards on environmental protection*. In case of several companies these give place to present the main environmental objectives and achievements and also to give employees specific advice, useful hints that they can use in their work as well as at home.

Communication may work the other way round as well, an example to this was a company using a box where employees could leave their ideas and suggestions on how the firm's environmental performance, their eco-efficiency could be improved. The proposers of ideas realized were rewarded.

A possibility to get feedback from the employees was the „environmental weather report" applied by one of the companies, which meant that the respondents could express their opinion on the company's environmental practice through filling out a simple and understandable questionnaire[79] (the questionnaire is attached in 14. Appendix). Besides helping in selection of the areas that need further development, the employees' involvement in the process can contribute to the strengthening of their environmental awareness.

In case of appropriate organizational culture the team-spirit or the majority's pressure can promote the better performance of the less motivated colleagues as well.

> *"the advantage of EMS is the process itself,... that it is infiltrating corporate mentality,.. thus after a while employees give nasty looks to colleagues who do not do their tasks properly"*

6.2.3 Role of environmental protection in the improvement of corporate performance

Theoretically environmental protection can contribute to the improvement of corporate performance through the reduction of costs and the promotion of sales (consolidation of market position, entering new markets).

Many times the growing importance of environmental aspects opens new dimensions to already existing objectives. Goals of material and energy saving production, or reduction of reject proportion are aims that appear in most companies irrespective of environmental protection.

It leaves no doubt though that in these fields set of environmental and economic objectives largely overlap.

[79]The questionnaire includes various fields of the environmental activity, it is easy to fill out, the respondent has to choose from four symbols, which are from best to worst: sun – clouded sun – dark cloud – lightning. After answering the questions possibility is given to put down other comments and suggestions. .

"In the past years we have significantly reduced our per unit use of raw material in several fields which has resulted in significant cost reduction,... of course we would like to keep on improving, but after a while it gets more and more difficult"

However, there are some activities where production is regulated by technological specifications and quality assurance to such an extent that leaves environmental protection only bounded opportunities.

"our industry is very special, our hands are tied by the technology,... of course if everybody would turn the lights off after leaving the room it would reduce our use of energy, its effect would show in, say, the 150th decimal place..."

„our opportunities to reduce are minimal... if we had any, we would already have exploited them"

Several interviewees underlined that like the input side, waste management costs can be significantly reduced by prevention and creation of salvage possibilities. In many places selective waste collection was introduced which makes possible recycling of the waste produced.

"we collect our waste selectively, certain materials are to be recycled, others go to the landfill,... this means a significant cost reduction or rather income to us,... the waste disposal containers in the factory bear inscriptions that also tell the amount of money that every kilogram of that particular waste yields or the sum we have to pay for its disposal,... this is a way to make our workers aware of that a lot of money is at stake here"

"we think it is important to collect our waste selectively and accomplishment of related objectives is part of the evaluation of our foremen's work"

During the interviews *selective collection of waste* was mentioned so often that it can be regarded as *a 'flagship' of environmental activity*. *If employees understand its importance and it becomes a prevalent habit, then environmental protection in general*

becomes more accepted and other initiatives in the future will have to cope with a much weaker resistance (see also the section of the connection between environmental protection and organizational culture).

The companies analysed had liability insurance or other type of insurance. In pursuance of calculation of fees, insurance companies evaluate the firms' operation and activities from various aspects. Most probably in case of environmental accidents insurance fees will be significantly higher.

Interviewees' judgements on the opportunities of environmental protection to increase sales were quite contradictory.

> *"the quality of our products* (machine parts) *is also affected by their energy consumption through their life-span,... thus environmental protection is a quality requirement, contributes to the competitiveness of our products*

> *"we are in an industry of limited possibilities for advertisement,... the product must look tip-top, so for example recycled packings are not suitable"*

> *"our consumers are not interested in environmental protection at all, the most important thing for them is what the bottle or can that they pick from the shelf costs"*

> *"in the short run environmental protection does not increase our sales at all, but I hope that in the long run it may improve our industry's image to the society, which is important for the consumers' side but also because of the changing of the regulations concerning our industry"*

In cases when more environmentally sound products demonstrably return during their life-cycle (e.g. lower energy consumption, lower maintenance costs), environmental protection may lead to competitive advantage, however, in other cases this is not so. Generally the interviewees judged the Hungarian (end-) consumers' environmental consciousness to be of considerably low level; they thought that this is not a typical choice criterion. A somewhat different situation can be observed in case of firms that sell to other

productive companies which evaluate their suppliers also from the aspects of environmental protection.

> *"the connection between environmental protection and competitiveness was described aptly by our former technical executive, I think many of us still agree with that,... our objective is to turn the product into marketable merchandise, or rather, profits,... to achieve this, environmental protection is essential, for without it after a while no-one will buy from us, but that does not raise our sales at all"*

Similar thoughts appeared in several firms. Environmental protection thus appears as some basic condition to stay on the market; however, performing above the basic level of requirements does not mean a competitive advantage (at least not regarding increase in sales). The following statement exemplifies this:

> *"introducing ISO 14001 is enough for most of our costumers,... but we know that by itself it is not enough for the improvement of our performance"*

6.2.4 The effects of integrating environmental and other corporate activities

In earlier sections one could see that environmental and other corporate management practices can be integrated in many ways. One of them was where the companies intend to achieve mostly cost-reduction, but also efficiency improvements through the exploitation of overlaps and synergies between similarly constructed management systems.

At companies examined this possibility emerged in most cases in relation to environmental protection and quality management (in some cases occupational health and safety management). The interconnection took place in several cases in course of implementation and operation of standardized management systems (ISO 14001, ISO 9001 and OHSAS 18001[80]), but also happened that it was the internal management practices that were coordinated in the fields mentioned rather than the standardized systems.

Integration of management systems mostly refers to the structure of the system: documentation needs are significantly decreased; several companies used one common

[80] Occupational Health and Safety System

manual instead of several overlapping ones. In practice this meant revision of the usually already existing quality management manual, complementing it with environmental protocols relating to processes.

> *"this way we pay greater attention to environmental protection,… otherwise it would only be a pain in the neck for everyone"*

There was a firm where regular internal and external audits were carried out in an integrated way. This requires less time from the internal auditors, which is a significant saving in resources – although obtaining expertise for integrated audits needed extra trainings. In places where external system audits were carried out together, significant cost reduction was reported.

> *"in our company the external audit is carried out by XY, this means saving millions every year"*

Interviewees mentioned several times that another advantage of integrating management systems is that members of the organization accept environmental protection more as it means less extra work for them. So we can see that *integration of environmental and other management systems can yield savings in resources (financial and human) for the companies and systems may operate more efficiently. However, it has not been explicitly proven that environmental performance also improves as a result of the systems integration*. Main advantage from this aspect is that in some cases the integration of different systems fosters organizational acceptance of environmental protection, which is – according to earlier sections – an important condition for the improvement of environmental performance.

Of course standardized management systems are not the only way environmental protection may be connected to other means of corporate management. One could see earlier that for example environmental aspects may be included in the employees' general training programme. Due to usual overtasking of employees, additional trainings often would not be possible, but this way environmental protection may receive a place in „regular" ones.

In some companies *in case of investments* environmental aspects are also considered. In many cases however this means considering relevant legal regulations in advance in order to avoid extra costs later on. In many specific cases however, material and energy saving played an important role.

In most cases specific environmental investments are also to comply with the general corporate return requirements ranging from two to seven years.

It was mentioned earlier that there are several opportunities to consider environmental aspects in financial and accounting analyses. In one company attempts were made to demonstrate environment-related costs and benefits generated through investments and production, though not within the frameworks of the existing accounting system.

> *"our accounting system comes from the centre, X country, and is relatively inflexible,… we are working on a database that can demonstrate the detailed environmental costs and benefits, it is expected to be ready in 2008"*

Objectives of this company include the introduction of an environmental accounting system.

Standardization also constitutes a problem to the extension of existing accounting systems with an environmental aspect. The structure of financial statements is mostly an external factor for the companies. Besides, most companies follow an existing formula in controlling statements, modification faces significant organizational resistance.

In *product design* and *material requirements management* environmental aspects have gained importance. In many cases companies try to substitute dangerous materials with non-dangerous ones. This is a requirement to stay on the market, and decreases environmental load as well.

> *"we continually inspect the raw materials that we buy, we have high requirements on the permitted level of chemical residues,… if a supplier cannot meet these, we stop buying from them"*

> *"during product development phase we carry out life-cycle-analysis, …we are trying to substitute dangerous materials with non-dangerous ones, so for example after 2007 we will not use any lead in our basic materials"*

6.2.5 Environmental performance in the perception of corporate professionals

It may seem trivial for the first sight, but it was interesting to analyse whether the way how corporate professionals interpret the concept of environmental performance correlates with the company's actual environmental performance[81] According to expectations of the author, environmental knowledge and willingness to act (which also define interpretation of environmental performance) play an important role in the promotion of a particular action and efficiency[82].

At the beginning of the interviews[83] interviewees were asked to explain what good environmental performance[84] and environmental excellence mean to them and their company.

In almost every case interviewees mentioned importance of reducing environmental load.

"environmental performance means that our chimney does not fumigate"

"the reduction of the toxic emissions related to our activity"

In most cases however, reduction of environmental load is considered per unit of output, meaning the improvement of eco-efficiency.

"environmental performance means decrease of pollution per unit of output, ... we are always thinking in that, since we are interested in increase of sales and profits"

[81] based on the approach of this dissertation
[82] For further thoughts on gaps between environmental knowledge and effective action see Nemcsicsné [2005].
[83] This was needed to avoid the influence of the whole interview and of the further questions on the response. Certainly when a respondent did not emphasise a topic (e.g. environmental load), but later on spoke all the time about it (how important their reduction is for him), it was considered later in the analysis.
[84] In course of the first interviews it became clear that „good environmental performance" was much easier to understand and much more tangible for the interviewees than environmental performance in general. Certainly the definitions and approaches obtained this way can also be interpreted omitting the „good" attribute.

"by environmental excellence I mean a relative improvement,... the least pollution per production unit occurs, the better it is,... our company in the past few years has grown quickly: comparing absolute numbers just would not make sense"

In relation to that in many places appeared the combination of environmental and business aspects also.

"we are not greens,... our aim is to reduce emissions in an economical way"

"of course, reducing environmental load is also important for us, but our activity is very peculiar, our products contain only a very low proportion of raw materials used, ... the thing that the environmentalists talk about, that reduction of emissions increases profits, is simply hogwash"

„to reach an optimal equilibrium between business objectives and the reduction of environmental pollution"

Many respondents emphasized the importance of (often technological) actions for the reduction of environmental load.

"applying green technologies, as far as it is possible"

"to spend money regularly on environmental investments, developments"

"to collect waste selectively"

Importance of selective collection of waste was mentioned in the majority of the interviews. It is true that waste management generally is an area where costs can be reduced by recycling, and these measures were made in some form in a significant part of the companies studied. Whereas opinion of the author is that in some specific cases emphasis of this issue is partly a result of the mind-shaping effect of the media, often identifying environmental protection with selective collection of waste.

The notion of good environmental performance included environmental management as well.

"to control emissions, to make them transparent, to ensure stability,… and certainly the prevention of accidents as well"

"introducing ISO 14001, applying other voluntary measures, ... certainly these should mean more to us than just the seal and signature, ... they give us the opportunity of constant improvement"

Apart from these, many interpreted environmental awareness of employees as an element of environmental performance.

"adopting the ISO 14001 system, I think this is important because this way all the workers can have something to do with environmental protection"

"to what extent is environmental way of thinking present among managers and employees, how much environmental protection appears among tasks of an organizational unit or a specific person"

Not very surprisingly, from the earlier presented elements of environmental performance state of the environment did not appear at all during the interviews.

Many interviewees extended the notion of corporate environmental performance beyond the gates of their company.

"and for me it is environmental performance as well if we take part in the town's environmental programme and support environmental NGOs"

In accordance with the expectations several times the compliance with external expectations appeared.

"we respect the law, the threshold limits, we do not pay any fines"

"environmental protection should not cause disarray"

Although obviously legal compliance is important for all the companies, this aspect was often absent, or if it was mentioned, it was not at the first place.

An interesting observation was that in cases where the environmental performance of that particular company was not excellent, their responses were often defensive or tried to shift off responsibility.

"there is no sense in talking about environmental excellence till things go on like this in this country, now I principally think of the importation of foreign garbage"

"well, good environmental performance can be for example selective collection of waste, but till people see that the collectors mix the whole thing, it is not very motivating"

In companies with regular environmental trainings usually all respondents were aware of the company's main environmental impacts and objectives. Most probably this was fostered by well-functioning EMSs, as some interviewees suggested.

Those who regularly experience the importance of environmental protection are more likely to try to consider environmental aspects as much as possible in their own field of responsibility. A first sign of this can be their awareness of 'wrong' practices and 'expected' terminology, for example when they correct the word 'garbage' to 'waste' instantly.

6.2.6 Problems, conflicts hampering the improvement of environmental performance

In most companies several factors hamper the improvement of environmental performance: the most common is *lack of financial resources*.

"if we really have to, we take part in this survey, but I do not think we could say much,... our firm faces serious difficulties, environmental protection consists of trying to observe the regulations in the cheapest possible way"

This citation is from the representative of a company that finally did not participate in the research. Most probably this attitude stands for many companies with financial difficulties.

The resource gap was a problem in many companies.

"it has happened that there was not enough money for some, otherwise necessary environmental investments, ... we had to make a cost-benefit analysis to find out whether the fine is cheaper"

"usually there is a serious competition among organizational units for development resources, ...but sometimes we could join with some of them, ... we demonstrated that a particular development is environmentally beneficial as well"

Organizational resistance towards change was a problem in many firms. In many places environmental activity was not considered to be a partner, but a setback to development. In bigger companies appropriate communication, information exchange can face difficulties.

"earlier many people looked at environmental officers suspiciously,... they did not like that when we saw any problem, we tried to solve it right away,... sometimes the colleagues hid the inauspicious data from me,... fortunately this is over now"

"since our company is getting bigger, communication gets harder: properly transferring a message through the organisation might even take a year, ...right now for example we are working on the selective collection of communal waste, but it took a very long time to convince the management and the representatives of the organizational units, although in the end it is a profitable activity,... the information is constantly distorted, it is not the same as when you tell it in person,...

it is not enough for example to tell the tasks to the cleaners' boss, you have to tell it to the cleaners directly"

Many respondents mentioned the problem that opportunities to improve eco-efficiency and to pick "low-hanging fruits" run out very soon and from that point there is hardly any real chance for the improvement of environmental performance.

"our technology is very strictly regulated, the GMP[85] principles many times hinder environmental aspects from prevailing,... the strict quality regulations for example do not permit the recycling of dissolvents"

During the preparation of interviews I visited several companies that – according to the corporate questionnaire and other background information – had an expansive environmental management practice, but it seemed to serve only marketing purposes. One of them turned out to have merged the environmental function with other subsidiary companies in other countries.

"in our firm the environmental protection officer is from abroad, he comes to Hungary once a month, but then he is very busy"

In this case it seemed that environmental protection is probably only needed for the image, the good fame of the company. This assumption can be confirmed by the fact that environmental protection officer is at the same time the communications executive of the company.

Apart from factors listed above, improvement of environmental performance can also be set back by individual lack of interest. This may occur in cases when the tasks related to environmental issues are consigned to an already overloaded person.

"look, I am an architect,... they dumped environmental protection on me as well, but to tell the truth I do not know why we need this at all"

[85] Good Manufacturing Practice

7 Assessment of the hypotheses

Based on the empirical results presented, previously formulated hypotheses can be assessed as follows.

H_1: Companies with the most significant environmental load have well-developed environmental management and carry out a lot of environmental actions.

As a result of analysis of the survey database, it turned out that companies with significant environmental load introduced much more environmental management tools compared to other companies. The most commonly applied environmental management tools were the followings:

- environmental audits carried out by company professionals;
- follow-up of environmental performance by using performance indicators; evaluation and comparison of results (environmental benchmarking);
- formulating a written environmental policy;
- publishing environmental report,
- organising environmental training programmes for employees;
- environmental assessment of suppliers, and requiring environmental measures from them.

Tendencies in introduction of standardised environmental management systems (EMSs) were similar: companies with higher environmental load introduced ISO 14001 much more often than the others. At the same time, there seemed to be no correlation between intensity of negative environmental effects and year of EMS introduction.

In order to increase reliability of results, it seemed to be reasonable to apply also external information on environmental load of companies. For that purpose, the earlier introduced EPER-database was taken into account.

Emerging results support previous statements; companies with significant environmental load (based on the EPER-database) applied the different environmental management tools and also EMS much more often than other companies.

Analyses carried out also showed that companies with higher environmental load have taken significantly more concrete environmental actions; although it was also influenced by their higher-level environmental management practices.

Interviews with corporate professionals demonstrated that companies with high environmental load had usually well-developed environmental organisation; in most cases more than one full-time professionals worked on environmental matters. Institutionalisation of environmental management was high and many different environmental management tools were applied. There were concrete environmental actions taken in many different fields, and further investments are planned.

Based on empirical experience this hypothesis seems to be acceptable; one can state that c*ompanies with the most significant environmental load have well-developed environmental management and carry out a lot of environmental actions.*

> *H_2: A high level of environmental management is a necessary but not a sufficient condition for a decrease of environmental load.*

Statistical analysis showed that majority of companies applying many different environmental management tools experienced more or less decrease in their environmental load per unit of output. At the same time a considerable part of these companies achieved *significant* improvements in this field.

Effects of environmental management tools were most obvious in the following areas: *use of natural resources, solid waste generation, emission of global pollutants and soil contamination.*

Most efficient environmental management tools facilitating improvements in environmental load were: *presence of a person responsible for environmental matters, environmental training programmes for employees, formulation of written environmental policy, continuous follow up, assessment and benchmark of environmental performance, environmental requirements towards suppliers.*

Results showed that introduction of ISO 14001 did not automatically lead to decrease in environmental load. According to expectations it seemed however, that in some fields introduction of EMSs was followed by decrease in environmental load per unit of output, with other words improvements in eco-efficiency. These areas were: *use of natural resources, solid waste generation and emission of global pollutants.*

Corporate interviews also highlighted that companies having a leading position in the field of environmental management achieved significant improvements regarding eco-efficiency as well.

Statements so far referred to improvements in eco-efficiency, thus relative decrease in environmental load. After investigating data available on concrete emissions (such as corporate environmental reports, other company information) it seems that absolute decreases in environmental load (improvements in eco-effectiveness) happened only very rarely. Even these decreases emerged in most cases as a consequence of legislation – for example after ban on different raw materials, use of toxic materials and generation of hazardous wastes went down. *Relative improvements in most cases were overcompensated by increases in production; working against progress of eco-efficiency both in level of a company and the whole economy*.

Altogether also this hypothesis can be accepted, hence *a high level of environmental management is a necessary but not a sufficient condition for a decrease of environmental load*. Environmental management plays a major role in improving eco-efficiency, but it cannot guarantee in itself that absolute level of environmental load would not increase. To achieve this latter, global political agreement and basic changes regarding production and consumption would be needed, but this goes beyond the frameworks of the dissertation.

H_3: Those companies where environmental protection is thought to have positive effects on corporate general performance,

a) have better environmental performance concerning all components compared to those where environmental protection is only regarded as a cost;

b) can usually also point out that good environmental performance directly or indirectly leads also to economic benefits.

Statistical analysis showed that judgements of companies on potential in environmental protection correlated in many cases with their actual environmental performance.

From a *market performance* aspect – such variables were developing better products, improving company image, or market potential in environmental protection in

general – companies assessed opportunities of environmental protection very differently. Those companies regarding this aspect important, performed usually above average in the field of environmental management, concrete environmental actions and environmental load.

Role of environmental protection in improving *operational performance* of companies – variables like saving potential in input or waste side, better information on company processes, preventing accidents, etc. – was also evaluated in many different ways. At the same time, companies considering these aspects important performed well with much higher probability also in the field of environmental management, concrete environmental actions and environmental load.

Analysing the identified components of environmental performance it became distinct that *those companies regarding environmental aspects important only because of corporate image, most probably have well-developed environmental management, but not necessarily perform above average in the field of environmental load. Those companies in contrast, seeing significant potential in environmental protection concerning savings in input or waste side as well, have not only good environmental management, but achieve also better results in decreasing environmental load per unit of output*.

One could also see that satisfaction with EMSs introduced was significantly higher among companies that considered higher market and saving (input and waste) potential in relation with environmental protection than other companies. From this issue it can be indirectly concluded that a well operating EMS can offer an appropriate framework for environmental protection to improve corporate performance; mechanic introduction of an EMS however, is not enough for that.

Company interviews have also shown that importance of environmental performance in corporate thinking – meaning not only keeping law but also in order to improve company performance – was in positive correlation with the actual environmental performance of companies. At the same time, this was true again only for relative improvements in environmental load, absolute changes correlated much more with production quantities of companies examined.

Analysis has been also made, whether companies realising opportunities in environmental protection benefit also in economic sense. As range of variables measuring economic performance of companies was very narrow, statistical analysis offered only limited chances in this field. It could be concluded that profitable and fast growing

companies considered market and saving opportunities in environmental protection much more important compared to other companies.

Interviews showed that many companies carried out concrete environmental actions and investments – with no direct external pressure or obligation – bringing profits for the companies[86]. Most of these investments happened in the field of resource efficiency and waste management; usually by improving recycling rate. Companies seeing business opportunities in environmental protection fulfilled many different projects turning out to be profitable. In case of those companies on the other hand, where environmental protection was important in order not to loose present markets and get better information on processes, returns of environmental activity could not be pointed out.

It seems to be true that potential profitability of environmental protection is not (only) a question of attitude; most economically successful projects could have been fulfilled also at other companies analysed. Of course there are industries, where operation is strictly regulated by technological or quality management rules; in most cases at least few areas exist where environmental protection has some economic potential as well.

Based on previous arguments, this hypothesis can be accepted with some modification and supplementary remarks. *Those companies where environmental protection is thought to have positive effects on corporate general performance,*

> *a) perform better in the field of environmental management, concrete environmental actions and eco-efficiency; although their eco-effectiveness is not necessarily better compared to those, where environmental protection is only regarded as costs;*
>
> *b) usually carry out more environmental actions beneficial also from an economic aspect, such as in the field of waste management and resource efficiency.*

[86] Of course most actions in order to comply with legislation also "return" in a sense that otherwise the company would have to pay severe fines or simply close its operation. These projects however, do not show that environmental protection would "bring the money".

H_4: Those companies, where environmental management is integrated with other company management tools,

a) usually have a better environmental performance;

b) usually experience an improvement in economic performance.

Based on results of the survey it could be seen that companies integrating environmental activities with other management practices had usually better developed environmental management tool kit, and introduced EMS more often. These companies performed also above average regarding concrete environmental actions and environmental load per unit of output, such as in fields of waste management, raw materials and energy efficiency.

Environmental protection was most often integrated with quality management. On one hand, this is because of similarities in structures of ISO 9001 quality management and ISO 14001 environmental management systems; at many companies ISO 14001 is introduced based on experiences gained from the already existing ISO 9001. On the other hand, objectives of environmental protection and quality management overlap in many cases (for example resource efficiency, decreasing ratio of wastes and by-products, etc.), and overlaps between the two fields regarding organisational structure is also not uncommon. Tight integration however, has also threats, as environmental protection can become subordinate to quality management, although former is more general in many cases than the latter. Focus groups of quality management are mainly customers, while environmental protection plays a major role in fulfilling requirements of almost any company stakeholder groups.

Environmental protection was also often integrated with occupational health and safety management; less frequently with inventory and materials planning or process management; in some cases also with financial analyses.

Interviews with company professionals showed that in cases when environmental protection became a part of corporate culture as a consequence of attitude of the management or environmental trainings, environmental aspects appeared much more often in different company decisions. In addition, environmental actions or programmes met less organisational resistance at these companies. Where environmental aspects were better accepted by employees, at least corporate environmental goals could be achieved easier.

On the level of different standardised management systems it can be concluded that integration of for example environmental, quality and occupational health and safety management systems made operation simpler. This also resulted in better organisational acceptance in most cases.

Statistical analysis showed that economically successful companies were overrepresented within companies integrating environmental and other company management practices. Unfortunately the questionnaire was inappropriate to examine whether and to what extent integration has contributed to improvement of economic performance.

Interviews have pointed out that integration of management systems mentioned also earlier[87] can lead to cost savings. These savings emerge partly during introduction (similar processes, common handbook), partly during operation (resources needed for external and internal audits as well as certification costs decrease etc.).

Companies where environmental aspects were regularly considered at financial analyses could usually point out, whether different environmental actions return or not; and if yes, in what time. At other companies in most cases only estimations could have been given; or environmental protection was simply regarded as something only taking money.

There were cases, where environment-related product parameters (such as energy efficiency) were of high priority; having great influence on competitiveness and sales of the products. These opportunities depend of course highly on characteristics of activity, in some cases no environmental aspects at all emerge from consumer side. Market characteristics are also important in this field: in B2B relations good environmental performance is usually required, FMCG companies do not have such experiences in most cases.

Consequently, first part of the hypotheses can be accepted, while second part needs some modification. It can be thus stated that *those companies, where environmental management is integrated with other company management tools,*

a) usually have a better environmental performance;

b) can realise savings more often, and their sales can also increase in some cases.

[87] environmental, quality, occupational health and safety

H_5: Economically successful companies have usually a high-level of environmental performance; regarding environmental load however, they do not necessarily perform that well.

Analysis based on the questionnaire showed that companies realising significant profits in recent years had developed much more comprehensive environmental management tool kit than others. It can be also stated that use of EMS and other different environmental management tools was also more common among these companies.

Not that sharply, but it also became distinct that fast growing companies also perform above average in the field of environmental management.

However, frequency of concrete environmental actions and changes in environmental load per unit of output did not show any relationship with economic performance of companies. This means, *economically successful companies – maybe because they can afford it better – operate better-developed environmental management, but this does not mean at all that they would carry out more concrete environmental actions or they would reach better improvements regarding environmental load.*

In the sample for corporate interviews economically successful companies were overrepresented. Similarly to previous findings, their environmental management was in most cases above average, while they performed very diversely regarding other components of environmental performance. When contacting potential companies for the first time, in order to include them into the sample, many of them refused it because of economic difficulties, claiming that they had no resources to properly *manage* environmental matters at that time.

As a consequence, the hypothesis can be accepted: *economically successful companies have usually high-level environmental performance, regarding environmental load however, they do not necessarily perform that well.*

H_6: Interpretation of the concept of environmental performance by corporate professionals is in relationship with the effective environmental performance of the company.

Interview partners interpreted the (good) environmental performance in many different ways. They listed and stressed different components within the concept.

Possibly not too high level of environmental load appeared in almost every interview. However, it was interesting to experience that the way towards it was considered differently. Some professionals focused on following legislation, while others also highlighted the importance of managing[88] and controlling environmental aspects, as well as the importance of environmental innovations[89] and investments.

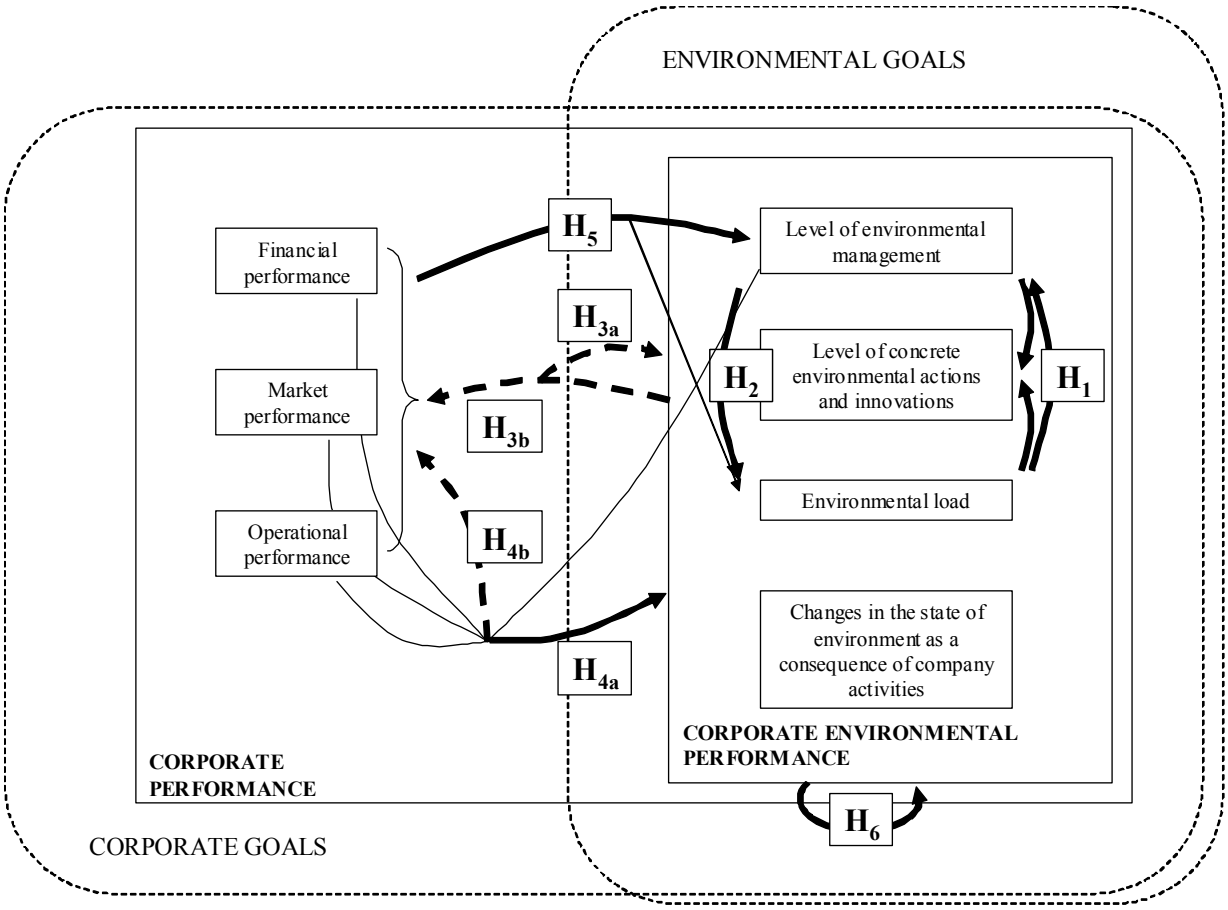
It could be seen that in companies, where more interviewees mentioned the importance of environmental management and environmental actions, the company had actually better environmental management and fulfilled more environmental actions[90].

It also seemed to be in a positive relationship with actual performance of companies, how broadly the concept of good environmental performance was interpreted by professionals not from the environmental field. This is thought to be linked also with the fact, whether there are also voluntary initiatives at the company to manage environmental aspects or it happens rather as a consequence of regulatory pressure. Where good environmental performance meant usually legal compliance to corporate professionals, a common view was that in case of their activities, industries, etc. opportunities of environmental protection are very limited.

For testing this hypothesis mainly the interviews resulted to be useful. As a consequence it can be stated that *interpretation of the concept of environmental performance by corporate professionals is in relationship with the effective environmental performance of the company.*

33. Figure shows hypotheses accepted in their original forms (with continuous arrow) and with modifications (dotted arrow).

[88] environmental management component
[89] environmental action component
[90] based on experience of statistical analysis and interviews



33. Figure. Graphical interpretation of research hypotheses.

When describing process and findings of a research, one has to cover also the issues of reliability and validity. *Reliability* refers to how "stable" results are, whether same research repeated would deliver same findings. In addition, *validity* means whether one has measured what he intended to; and whether there were any factors that may distort findings significantly.

In order to increase *reliability,* the author made efforts to use many different information sources. Research based on statistical analysis and interviews supplement each other on one hand, but interviews also enable checking most findings gained by the survey on the other hand. Beyond these two sources, other, from respondents independent data was also endeavoured to be used. Examples for that can be EPER-database supplementing the survey with company level information on environmental load, or corporate environmental reports and other documents related to interview topics. To increase

transparency of research process, efforts were made to document different steps and considerations.

An important question related to *validity* is whether research samples represent well the ground population, the Hungarian manufacturing companies. Samples were representative regarding activity, although bigger companies were a bit overrepresented in both the survey and the interviews. This is interesting, as because of better access to resources, bigger companies have usually better developed environmental management than smaller ones. The survey was carried out in a framework of an international research, so opportunities in sampling were very limited. The sample was however, supplemented by a group of smaller companies; as well as smaller companies were motivated to reply in additional channels, too (phone calls, repeated sending of questionnaire).

As it happens often in case of research projects with voluntary participation, participants might have above average environmental performance (because laggards refused taking part with higher probability). This issue was tried to be taken into account when formulating general findings. In additions, companies with not particularly good environmental performance were also tried to be included into the sample when making interviews. This effort was only partly successful, because these companies refused participation in a higher ratio. However, preparatory phone calls delivered also valuable information on them.

Consequently, findings seem to be reliable, while valid rather for bigger companies; statements on smaller companies should be handled cautiously.

8 Summary

Main aim of the dissertation was to substantially analyse the concept of environmental performance; and based on this to evaluate environmental performance of manufacturing companies.

In the dissertation environmental performance is derived from company performance. After scanning literature, four components of environmental performance have been identified: *1. environmental management, 2. concrete environmental actions, 3. environmental load and 4. effects of company activity on the state of environment.* A substantial interpretation for the dissertation was needed, as many different definitions exist, leading to contradictory findings in practice. Several practically used environmental performance evaluation methods were assessed, whether they offer an appropriate framework to cover identified fields of environmental performance.

As a next step, potential links between corporate and environmental performance were identified. A grouping of different approaches in literature suggests also the possible directions of these relationships.

Research hypotheses formulated later were tested among Hungarian manufacturing companies. For this purpose, two pieces of research were carried out: 1. a survey based on a questionnaire on a big sample and 2. interviews with company professionals, focusing on a smaller-scale sample. In order to increase reliability, additional information sources were used in both cases (other databases, company documents, etc.).

The main findings of the dissertation are the following:

1. **Environmental information is also needed to get an exact and reliable view on the performance of a company.**

Based on the overview of corporate performance literature it can be seen that in recent complex performance evaluation systems not (always) monetarisable, in some cases even not quantifiable, although from the viewpoint of environmental performance very important information – such as environmental information – plays an increasing role.

2. **The most widely-used environmental performance evaluation methods are in principal suitable for assessing the identified components of environmental performance; in practice, however, not all these components are stressed enough.**

Based on the analysis of environmental performance evaluation methods it can be stated that some of the in practice widely-used methods offer a chance for comprehensive and detailed assessment of environmental performance. In most of these, however – such as indicator systems of ISO 14031, DBU-UBA or GRI – analysis of the relationship with other elements of corporate performance (for example financial or market performance) is not stressed enough. Although the approaches of eco-efficiency, environmental accounting or sustainability balanced scorecards analyse environmental performance from a corporate performance viewpoint, they offer only very limited possibilities for the assessment of different components of environmental performance. In principle, environmental and sustainability indices can be appropriate for a proper assessment of environmental performance, but in practice their methodology is not well- established; their application demands caution and experience.

3. **The often contradictory judgements on the relationship between environmental and corporate performance are in many cases due to the different interpretations of the concept of environmental performance.**

In a part of theoretical models and empirical research – in the latter case also demand for comparability among companies takes second place – environmental performance is described by environmental management variables only. In this case however, a tendentiously more optimistic picture occurs, as most probably financially well-performing companies can afford to introduce fancy environmental management systems (although this does not mean they are inevitably cleaner). The relationship between a decrease of environmental load and financial indicators is much more contradictory, although empirical results show a positive relationship in many cases also in this field.

Contradictory conclusions are caused also in many cases, as environmental load can be regarded relatively (projected to product unit or unit of turnover) or as an absolute category. It can be seen from the dissertation that *improvement in eco-efficiency* (decrease of relative environmental load) can go very well with improvement of business

performance. Better *eco-effectiveness* (decrease in the absolute level of environmental load) however, does not necessarily mean better economic performance; in fact, in many cases they move to opposite directions. In general, both environmental load and economic effectiveness have a positive relationship with production quantity; practice shows that such an improvement in eco-efficiency that would overcompensate for the effect of an increase in production quantity on the level of environmental load is fairly uncommon.

4. **Companies with the most significant environmental load have well-developed environmental management and carry out a lot of environmental actions.**

Research carried out shows that broad environmental management – such as introduction of EMS, environmental audits, environmental performance evaluation, environmental benchmarking, written environmental policy, publishing of environmental report, environmental trainings for employees and environmental evaluation of suppliers, etc. – is much more typical among companies with significant environmental load compared to the average. These companies fulfilled also over average concrete environmental actions to avoid or control negative environmental impacts.

It can be seen that, although different elements of environmental performance are related to each other, it does not mean that well or badly performing companies - regarding one element – necessarily perform the same way regarding another one. The environmental performance of a significant polluter company can be classified at first sight as indisputably bad; the picture can be slightly tinged if the same company makes serious efforts at managing its environmental load and carries out programmes to decrease it. Consequently, for an exact view of the environmental performance of a company, parallel analysis of different performance elements is needed.

5. **High level of environmental management is a necessary - but not a sufficient condition for the decrease of environmental load.**

Based on empirical analysis it can be stated that companies with high-level environmental management usually achieve better results in improving their eco-efficiency compared to the average.

The effects of environmental management tools emerge especially in the field of use of natural resources, solid waste generation, emission of global pollutants and soil contamination.

Considering the absolute level of environmental load it seems that, as a consequence of environmental management activities, a real decrease (improvement in eco-effectiveness) is fairly rare. This happens in practice rather because of legal control, such as decrease in use of toxic materials and toxic waste emissions as a consequence of bans on different raw materials. Relative improvements are usually overcompensated for by increases in production; which is in opposition to the improvement of eco-efficiency, both at a company level and at the level of the wider economy. As a consequence, it can be seen that good environmental management and parallel improvement of eco-efficiency are important steps toward decreasing environmental load; although practice shows that in spite of these improvements in eco-efficiency, there is no guarantee even for keeping absolute emissions at the same level.

6. **At those companies where environmental protection is thought to have also economic benefits, environmental protection effectively contributes to the improvement of corporate performance in different fields.**

Companies which consider environmental protection important with regard to improvement of their market performance usually establish well-developed environmental management, carry out more concrete environmental actions and achieve better results in the field of eco-efficiency compared to the average.

Good environmental control and eco-efficiency can also improve the operational performance of companies – especially because of saving potential on raw materials or the waste side, improving transparency of processes or better control of accidents etc.

Despite those companies where environmental protection is important principally because of expected improvement in company image having usually high-level environmental management, they in most cases do not perform above average concerning decrease of environmental load. In contradiction, at companies where opportunities are seen also in the field of savings on both raw-material and waste sides, not only environmental management is better developed, but relative environmental load can decrease also to a greater extent compared to other companies.

Most – potentially economically returnable – environmental investments focus on waste management and raw material saving; aiming in most cases at an increase of recycling rate.

It is indisputable that the positive economic potential of environmental protection is not (only) question of attitude, but it is also true that most of the most frequently implemented, economically successful actions could be carried out at a much higher rate at companies. Certainly there are industries where activity is strictly regulated, and because of technological or quality management reasons opportunities in environmental protection are very limited. In most cases however, at least some areas exist where environmental protection activity could provide economic benefit.

7. **Those companies where environmental viewpoints are integrated into different fields of corporate management usually have better environmental performance, more often realise cost savings, and have potential for increased sales.**

Companies integrating environmental protection with other corporate activities – such as quality management, corporate health and safety management, inventory or materials requirement planning, process control, financial analyses etc. –usually have a better-developed environmental management toolkit, and implement EMS more frequently. Probably, these companies also perform above average in the field of concrete environmental actions and eco-efficiency.

Considering integration of different special management systems – for example environmental, quality management and health and safety systems – they can simplify their operation significantly. This can lead to better organisational acceptance, as employees might not regard environmental protection activities as obligatory extra work. Mechanical integration of environmental management with other management systems however, may increase the risk of simply "ticking off" an environmental concern checklist during company operation.

By the integration of different management systems, cost and resource savings can also be achieved. These can emerge during both implementation (similar processes, common handbook) and operation (less human resources are needed for external and internal audits, decreasing costs of system certification, etc.)

At those companies where environmental viewpoints are also considered in financial analyses, it is usually exactly known whether different environmental actions have positive returns or not, and if yes, when. Otherwise, corporate professionals can in best cases only give estimations, or simply assume that environmental protection inevitably entails costs.

It can easily occur that environmental parameters of products (such as energy efficiency) can increase competitiveness of these products significantly. This opportunity does not exist for every industry; in the case of different products environmental points of view do not influence the customer side at all. It seems to be also true that in B2B relations good environmental performance is usually much more important and expected as regards final consumer sales.

8. **Economically successful companies usually have high-level environmental performance; regarding environmental load, however, they do not necessarily perform that well.**

Empirical results show that profitable and growing companies develop much more comprehensive environmental management practices than the others and also introduce EMS more often.

In contradiction, good economic performance in itself is not a guarantee at all for more environmental actions and development, and for greater eco-efficiency.

Consequently, the often heard assumption – that environmental protection is a "luxury" of wealthy companies – is not true at all, as it is not even true that such companies have above-average environmental performance.

9. **Interpretation of the concept of environmental performance by corporate professionals is in relation to the effective environmental performance of the company.**

The concept of good environmental performance is interpreted by corporate professionals in many different ways; at least emphasis is put onto different components. Usually the thought of the company's lower environmental load emerges, although there is no consensus among corporate professionals about how to reach it. Some of them concentrate on regulation and regard keeping the rules as good environmental performance, while other approaches also include management and control of

environmental protection as well as consideration of the importance of environmental investments and developments.

In these latter cases a much more active attitude can be expected from companies towards environmental issues; results show that in practice these companies usually have better-developed environmental management, and carry out more environmental actions.

How comprehensively corporate professionals (from outside the environmental field) interpret the concept of good environmental performance also shows positive correlation with corporate environmental performance. To what extent company initiatives emerge for managing environmental load, even without legal pressure additionally seems to be in connection with the issue.

Findings of the dissertation may be useful primarily for *corporate professionals*. If the analyses and results showed are used as benchmarks, environmental performance of different companies can be compared to the average regarding different performance components. The dissertation may also help them to think over the links between environmental and corporate performance at their own companies.

Findings about efficiency and effectiveness of voluntary environmental management tools can be considerable for *professionals from regulating authorities*, too. Although their main intention is, for example, decreasing environmental load caused as a consequence of economic activities, they also put increasing pressure on monitoring the impacts of voluntary environmental management tools, and sometimes also on motivating companies to use these tools. Considering the links between environmental and corporate performance can help them to a better understanding of the driving forces behind corporate decisions; this can positively influence the effectiveness of environmental regulation.

Finally, the dissertation may also include new thoughts for *researchers,* and may contribute with new viewpoints to the literature on the relationship between environmental protection and corporate competitiveness.

There are more directions for future research. On one hand, a deeper and more comprehensive analysis would be interesting – the topic being what tools and methods are used by companies to track their own environmental performance, and how they use this information to supporting corporate decisions.

On the other hand, if later on more comprehensive data on environmental load – enabling comparison – became available (e.g. such as information from sources like the presented EPER-PRTR database) more exact evaluation of effectiveness of environmental management tools would be possible.

Indeed, one has also to see that in spite of the large potential for eco-efficiency gains in the case of most companies, solving global environmental challenges is not possible *only* by improving the environmental performance of companies. For a real solution which goes beyond the greening of production, the greening of consumption is essential; a transformation in which we, consumers are also key players.

9 Appendices

1. Appendix. Questionnaire used for the corporate survey

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Environmental Policy Tools and Firm-Level Management and Practices:

An International Survey

National Policies Division
OECD Environment Directorate

SECTION 1: MANAGEMENT SYSTEMS AND TOOLS IN YOUR FACILITY

*This section contains questions related to your **facility**'s general management systems and tools, as well as those which relate to the environment. If your firm has many production facilities, please answer with reference to the facility at which you are located or with which you are most familiar. This is true of all subsequent sections, except the final section which is related to the firm as a whole.*

1.1. Does your facility have at least one person with **explicit responsibility** for environmental concerns?

Yes ❑ 1
No ❑ 0

If no, please proceed to question 1.3.

1.2. Which of the following **best describes the location** of this individual within your facility? (*Please tick only one box.*)

Senior management	❑ 1
Production/operations	❑ 2
Finance/accounting	❑ 3
Specialised environmental department (or equivalent)	❑ 4
External/media relations	❑ 5
Marketing/Sales	❑ 6
Purchasing	❑ 7
Human resources	❑ 8
Product development	❑ 9
Other department (please specify)_____	❑ 10

1.3. While **purchasing and/or marketing goods and services**, does your facility regularly consider the following measures? *(Please tick one box for each row.)*

	Yes 1	No 0
Assessing the environmental performance of our suppliers	❑	❑
Requiring suppliers to undertake environmental measures	❑	❑
Informing buyers of ways to reduce their environmental impacts	❑	❑

1.4. Which **practices** have been established in your facility in order to implement environmental management? *(Please tick one box for each row.)*

	Yes 1	No 0
Written environmental policy	❑	❑
Environmental criteria used in the evaluation and/or compensation of employees	❑	❑
Environmental training program in place for employees	❑	❑
Carry out external environmental audits	❑	❑
Carry out internal environmental audits	❑	❑
Benchmark environmental performance	❑	❑
Environmental accounting	❑	❑
Public environmental report	❑	❑
Environmental performance indicators / goals	❑	❑
Other practice (please specify) _____		

1.5. Has your facility **considered introducing** an environmental management system?

Yes	❑	1
No	❑	0

If yes, please assess the importance of the following motivations. *(Please tick one box for each row.)*

	Not Important 1	Moderately Important 2	Very Important 3
It may help us to prevent or control our pollution	❑	❑	❑
It may improve our efforts to achieve regulatory compliance	❑	❑	❑
It may reduce the applicability of some regulations	❑	❑	❑
It may better identify future environmental liabilities	❑	❑	❑
It may improve our relations with regulatory authorities	❑	❑	❑
Regulators' incentives made it attractive	❑	❑	❑
It may allow for differentiation of our products	❑	❑	❑
It may improve our facility's profile/image	❑	❑	❑
It may create cost savings in terms of use of inputs	❑	❑	❑
It may create cost savings in terms of waste management	❑	❑	❑
It may improve information about our facility's operations	❑	❑	❑
Other facilities like ours are adopting similar systems	❑	❑	❑
Other reasons (please specify)_____	❑	❑	❑

1.6. Has your facility actually **implemented** an **environmental management system**?

Yes	❑	1	Year _ _ _ _
In progress	❑	2	
No	❑	0	

If no or in progress, please proceed to Question 1.8.

If yes: Has your facility acquired any of the following **certifications in environmental management**?

	Yes 1	No 0	Year
EMAS	❑	❑	_ _ _ _
ISO 14001	❑	❑	_ _ _ _

1.7. Were the expected **benefits** of adopting an environmental management system as great as had been anticipated?

Yes	❑	1
No	❑	0

1.8. Has your facility implemented any of the following **other management practices**? *(Please tick one box for each row.)*

	Yes 1	No 0
Quality management system (e.g. ISO 9000)	❑	❑
Health and safety management system	❑	❑
Full-cost or activity-based accounting	❑	❑
Management accounting system	❑	❑
Process or job control system	❑	❑
Inventory or materials requirement planning	❑	❑
Other (please specify)_____		

1.9. To what extent are the **environmental activities** of your facility **integrated** with the following management practices? *(Please tick one box for each row.)*

	Not at all 1	Partially 2	Fully 3	Not applicable 4
Quality management system (e.g. ISO 9000)	❑	❑	❑	❑
Health and safety management system	❑	❑	❑	❑
Full-cost or activity-based accounting	❑	❑	❑	❑
Management accounting system	❑	❑	❑	❑
Process or job control system	❑	❑	❑	❑
Inventory or materials requirement planning	❑	❑	❑	❑
Other (please specify)_____	❑	❑	❑	❑

SECTION 2: ENVIRONMENTAL MEASURES, INNOVATION AND PERFORMANCE

*In this section, you are asked to provide an overall picture of how your **facility** has sought to address the environmental impacts of its production activities through technical measures and innovations.*

2.1. How important do you consider each of the following potential **negative environmental impacts** from your facility's products and production processes? *(Please tick one box for each row.)*

	No Negative Impacts 1	Moderately Negative Impacts 2	Very Negative Impacts 3	Not Applicable 4
Use of natural resources (energy, water, etc.)	❑	❑	❑	❑
Solid waste generation	❑	❑	❑	❑
Wastewater effluent	❑	❑	❑	❑
Local or regional air pollution	❑	❑	❑	❑
Global pollutants (e.g. greenhouse gases)	❑	❑	❑	❑
Aesthetic effects (noise, smell, landscape)	❑	❑	❑	❑
Soil contamination	❑	❑	❑	❑
Risk of severe accidents	❑	❑	❑	❑
Other negative environmental impact (please specify)_____	❑	❑	❑	❑

2.2. Taking into consideration the negative environmental impacts stated above, which of the following **environmental performance measures** does your facility **regularly monitor**? *(Please tick one box for each row.)*

	Yes 1	No 0	Not Applicable 2
Use of natural resources (energy, water, etc.)	❑	❑	❑
Solid waste generation	❑	❑	❑
Wastewater effluent	❑	❑	❑
Local or regional air pollution	❑	❑	❑
Global pollutants (e.g. greenhouse gases)	❑	❑	❑
Aesthetic effects (noise, smell, landscape)	❑	❑	❑
Soil contamination	❑	❑	❑
Risk of severe accidents	❑	❑	❑
Other environmental performance measure (please specify)_____	❑	❑	❑

2.3. Has your facility undertaken **concrete actions to reduce environmental impacts** associated with the following? *(Please tick one box for each row.)*

	Yes 1	No 0	Not Applicable 2
Use of natural resources (energy, water, etc.)	❑	❑	❑
Solid waste generation	❑	❑	❑
Wastewater effluent	❑	❑	❑
Local or regional air pollution	❑	❑	❑
Global pollutants (e.g. greenhouse gases)	❑	❑	❑
Aesthetic effects (noise, smell, landscape)	❑	❑	❑
Soil contamination	❑	❑	❑
Risk of severe accidents	❑	❑	❑
Other negative environmental impacts (please specify)_____	❑	❑	❑

2.4. If your facility has undertaken significant **measures** specifically related to its **production technologies**, which of the following most closely characterises the nature of such measures? *(Please tick only one box.)*

Changes in production processes which reduce pollution emissions and/or resource use ❑ 1
End-of-pipe technologies which reduce pollution emissions or allow for resource recovery ❑ 0

2.5. If your facility has undertaken significant **technical measures** which reduce the environmental impacts associated with its activities, which of the following most closely characterises the nature of such measures? *(Please tick only one box.)*

Changes in production technologies ❑ 1
Changes in product characteristics ❑ 0

2.6. Has your facility experienced a **change in the environmental impacts per unit of output** of its products or production processes in the last three years with respect to the following? *(Please tick one box for each row.)*

	Significant Decrease 1	Decrease 2	No Change 3	Increase 4	Significant Increase 5	Not Applicable 6
Use of natural resources (energy, water, etc.)	❑	❑	❑	❑	❑	❑
Solid waste generation	❑	❑	❑	❑	❑	❑
Wastewater effluent	❑	❑	❑	❑	❑	❑
Local or regional air pollution	❑	❑	❑	❑	❑	❑
Global pollutants (e.g. greenhouse gases)	❑	❑	❑	❑	❑	❑
Aesthetic effects (noise, smell, landscape)	❑	❑	❑	❑	❑	❑
Soil contamination	❑	❑	❑	❑	❑	❑
Risk of severe accidents	❑	❑	❑	❑	❑	❑
Other negative environmental impact (please specify)_____	❑	❑	❑	❑	❑	❑

SECTION 3: THE INFLUENCE OF STAKEHOLDERS AND MOTIVATIONS ON ENVIRONMENTAL PRACTICES

*In this section, you are asked to provide information on the relative importance of different stakeholder groups and motivations on decisions regarding your **facility's** environmental practices.*

3.1. How important do you consider the **influence** of the following **groups or organisations** on the environmental practices of your facility? *(Please tick one box for each row.)*

	Not Important 1	Moderately Important 2	Very Important 3	Not Applicable 4
Public authorities (government, state, municipal)	❑	❑	❑	❑
Corporate headquarters	❑	❑	❑	❑
Household consumers	❑	❑	❑	❑
Commercial buyers	❑	❑	❑	❑
Suppliers of goods and services	❑	❑	❑	❑
Shareholders and investment funds	❑	❑	❑	❑
Banks and other lenders	❑	❑	❑	❑
Management employees	❑	❑	❑	❑
Non-management employees	❑	❑	❑	❑
Labour unions	❑	❑	❑	❑
Industry or trade associations	❑	❑	❑	❑
Environmental groups or organisations	❑	❑	❑	❑
Neighbourhood/community groups & organisations	❑	❑	❑	❑
Other groups or organisations (please specify)_____	❑	❑	❑	❑

3.2. How **important** do you consider the following **motivations** to have been with respect to the environmental practices of your facility? *(Please tick one box for each row.)*

	Not Important 1	Moderately Important 2	Very Important 3	Not Applicable 4
Prevent or control environmental incidents	❑	❑	❑	❑
Regulatory compliance	❑	❑	❑	❑
Corporate profile/image	❑	❑	❑	❑
Cost savings	❑	❑	❑	❑
New technology development	❑	❑	❑	❑
New product development	❑	❑	❑	❑
Facilities similar to ours are adopting similar practices	❑	❑	❑	❑
Other reasons (please specify)_____	❑	❑	❑	❑

SECTION 4: PUBLIC ENVIRONMENTAL POLICY

*In this section you will be asked about the nature of public environmental policy, and how it affects your **facility**. Responses should reflect the role of all relevant public authorities (municipal, state, etc…).*

4.1. Please assess the following **environmental policy instruments** in terms of their impacts on your facility's production activities. *(Please tick one box for each row.)*

	Not Important 1	Moderately Important 2	Very Important 3	Not Applicable 4
Input bans	❑	❑	❑	❑
Technology-based standards (e.g. abatement equipment)	❑	❑	❑	❑
Performance-based standards (e.g. emission levels)	❑	❑	❑	❑
Input taxes (including energy)	❑	❑	❑	❑
Emission or effluent taxes or charges	❑	❑	❑	❑
Tradable emission permits or credits	❑	❑	❑	❑
Liability for environmental damages	❑	❑	❑	❑
Demand information measures (e.g. eco-labels)	❑	❑	❑	❑
Supply information measures (e.g. recognition programs)	❑	❑	❑	❑
Voluntary / negotiated agreements	❑	❑	❑	❑
Subsidies / tax preferences	❑	❑	❑	❑
Technical assistance programmes	❑	❑	❑	❑
Other policy instrument (please specify)_____	❑	❑	❑	❑

4.2. Do the **regulatory authorities** have programmes and policies in place to encourage your facility to use an environmental management system?

Yes ❑ 1
No ❑ 0

If yes, please indicate programmes which regulatory authorities have in place to encourage your facility to use an environmental management system. *(Please tick one box for each row.)*

	Yes 1	No 0
Reducing the frequency of their regulatory inspections	❑	❑
Expediting environmental permits	❑	❑
Consolidating environmental permits	❑	❑
Waiving environmental regulations	❑	❑
Reducing stringency of regulatory thresholds	❑	❑
Providing technical assistance	❑	❑
Providing financial support	❑	❑
Providing special recognition or award	❑	❑
Providing preferences for public procurement	❑	❑
Providing information about the value of such systems	❑	❑
Other incentive (please specify)_____	❑	❑

4.3. How would you describe the **environmental policy regime** to which your facility is subject? *(Please tick only one box.)*

Not particularly stringent, obligations can be met with relative ease	❑	1
Moderate stringency, requires some managerial and technological responses	❑	2
Very stringent, has a great deal of influence on decision-making within the facility	❑	3

4.4. How many times has your **facility** been **inspected** by public environmental authorities (central, state/province and municipal governments) in the last three years? _____

SECTION 5: FACILITY CHARACTERISTICS

*This section is intended to help us obtain a general picture of your **facility**'s market, ownership structure, size and sale, as well as the nature of its commercial market.*

5.1. How would you, in general, classify the **primary customers** for your facility's products? *(Please tick only one box.)*

Other manufacturing firms	❑	1
Wholesalers or retailers	❑	2
Households	❑	3
Other facilities within your firm	❑	4

5.2. What **best characterises the scope** of your facility's market? *(Please tick only one box.)*

Local	❑	1
National	❑	2
Regional (neighbouring countries)	❑	3
Global	❑	4

5.3. With how many other firms did your facility **compete on the market** for its most commercially important product within the past three years? *(Please tick only one box.)*

Less than 5	❑	1
5-10	❑	2
Greater than 10	❑	3

5.4. Please assess the following factors in your facility's **ability to compete** on the market for its most important product within the past three years. *(Please tick one box for each row.)*

	Not Important 1	Moderately Important 2	Very Important 3
Product price	❑	❑	❑
Product quality	❑	❑	❑
Firm image	❑	❑	❑
Established relationships with buyers	❑	❑	❑

5.5. What is the approximate **age of your facility** (in years)?_____

5.6. How many **people** were **employed full-time** by your facility on average over the last three years? _____

5.7. Please estimate your facility's average **annual expenditures on research and development** over the last three years? _____

5.8. Does your facility have a budget for **research and development** specifically related to **environmental matters**?

Yes ❑ 1
No ❑ 2

If yes, what percentage of your total budget for research and development has been allocated to environmental matters in the last three years? _____

5.9. Please estimate your facility's **average annual value of shipments** over the last three years._____

5.10. How has the value of shipments from your facility **changed** in the last three years? *(Please tick only one box.)*

They have significantly decreased ❑ 1
They have decreased ❑ 2
They have stayed about the same ❑ 3
They have increased ❑ 4
They have significantly increased ❑ 5

If you are able to do so, please estimate your facility's **change in average annual value of shipments** over the last three years (in percentage per year)? _____

5.11. How would you assess your facility's **overall business performance** over the past three years? *(Please tick only one box.)*

Revenue has been so low as to produce large losses ❑ 1
Revenue has been insufficient to cover costs ❑ 2
Revenue has allowed us to break even ❑ 3
Revenue has been sufficient to make a small profit ❑ 4
Revenue has been well in excess of costs ❑ 5

5.12. Please indicate the industrial sector in which you would place the **main production activity** of your facility. *(Please tick only one box.)*

Manufacture of food products and beverages	❑ 15
Manufacture of tobacco products	❑ 16
Manufacture of textiles	❑ 17
Manufacture of wearing apparel, dressing and dyeing of fur	❑ 18
Tanning and dressing of leather; manufacture of luggage, handbags, footwear, etc.	❑ 19
Manufacture of wood and products of wood and cork, except furniture	❑ 20
Manufacture of paper and paper products	❑ 21
Publishing, printing and reproduction of recorded media	❑ 22
Manufacture of coke, refined petroleum products and nuclear fuel	❑ 23
Manufacture of chemicals and chemical products	❑ 24
Manufacture of rubber and plastics products	❑ 25
Manufacture of other non-metallic mineral products	❑ 26
Manufacture of basic metals	❑ 27
Manufacture of fabricated metal products, except machinery and equipment	❑ 28
Manufacture of other machinery and equipment	❑ 29
Manufacture of office, accounting and computing machinery	❑ 30
Manufacture of electrical machinery and apparatus	❑ 31
Manufacture of radio, television and communication equipment	❑ 32
Manufacture of medical, precision, and optical instruments, watches and clocks	❑ 33
Manufacture of motor vehicles, trailers and semi-trailers	❑ 34
Manufacture of other transport equipment	❑ 35
Manufacture of furniture	❑ 36
Recycling	❑ 37
Other (please specify) _____	❑ 99

Statistical Code:

TEAOR: _ _ _ _

SIC: _ _ _ _

SECTION 6: ENVIRONMENTAL RISKS

This section helps us to get a picture about the environmental risks of your facility, and the market potential in environment protection.

6.1. Assess the **environmental risks of your facility based on its activity** (risks based on the applied technology, education level of the employees, input materials etc.).

Insignificant	❑ 1
Considerable	❑ 2
I do not know	❑ 0

6.2. Assess the **threats** concerning your **facility** based on **external conditions** (for example location of the facility, NGOs, media, ecological conditions etc.).

Insignificant	❑	1
Considerable	❑	2
I do not know	❑	0

6.3. Assess the **market potential of your facility connected to the environment protection** (for example selling eco-products or –technologies, offering services or consultancy in the field of environment protection etc.).

Insignificant	❑	1
Considerable	❑	2
I do not know	❑	0

SECTION 7: FIRM CHARACTERISTICS

*This section is intended to help us obtain a general picture of your **firm** of which your facility is a part. The first four questions should be completed by all respondents. The last four should be completed by firms with more than one facility.*

7.1. Is your firm listed on a **stock exchange**?

Yes	❑	1
No	❑	0

7.2. Is your firm's **head office** located in a **foreign country**?

Yes	❑	1
No	❑	0

If yes, in which country? _____

7.3. Does your firm have **an environmental department** (or equivalent such as environmental, health and safety department)?

Yes	❑	1
No	❑	0

7.4. How many **different production facilities** does your firm have? _____

*Please answer the following questions if your firm has **more than one facility**.*

7.5. Please estimate your firm's average **annual expenditures on research and development** over the last three years? _____

7.6. Does your firm have a budget for **research and development** specifically related to **environmental matters**?

Yes	❑	1
No	❑	0

If yes, what percentage of your total budget for research and development has been allocated to environmental matters in the last three years? _____

7.7. How many **people** are presently **employed full-time** by your firm?_____

7.8. Please estimate your **firm's average annual value of shipments** over the last three years. _____

Thank you for taking the time to complete this questionnaire!

This concludes our survey. Thank you for helping us to learn about facility-level and firm-level environmental activities. More information about OECD's work in related areas can be found at www.oecd.org. The main results and reports obtained from this survey will be posted at this web address beginning in early 2004. Thank you again for your assistance.

Please complete the details below:

Name and title --

Facility name --

Firm name --

Address --

Postcode --

Email --

Please characterise your responsibilities. *(Please tick only one box.)*

Senior management	❑	1
Production/operations	❑	2
Finance/accounting	❑	3
Specialised environmental department (or equivalent)	❑	4
External/media relations	❑	5
Marketing/Sales	❑	6
Purchasing	❑	7
Human Resources	❑	8
Product Development	❑	9
Other (please specify)_____	❑	10

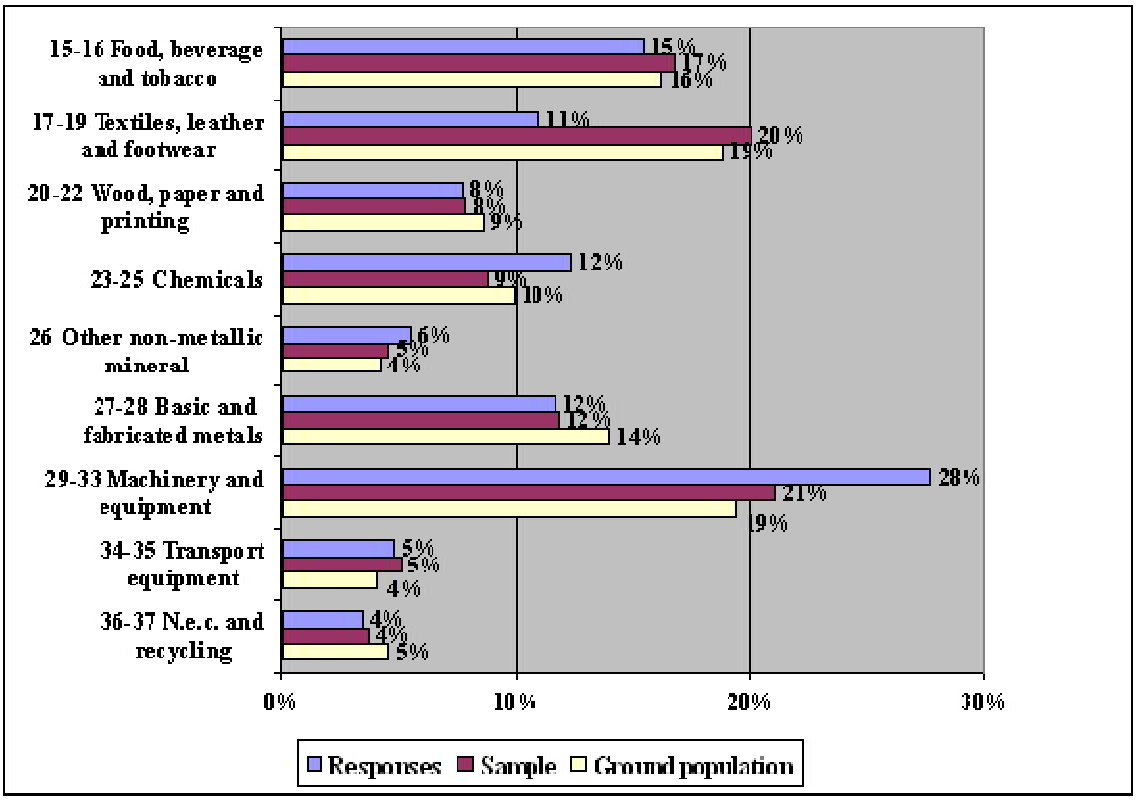
If you have any comments concerning the issues addressed in this questionnaire, feel free to state them below:

PLEASE RETURN THE COMPLETED QUESTIONNAIRE IN THE ENCLOSED PRE-PAID ENVELOPE. THANK YOU AGAIN FOR YOUR ASSISTANCE.

2. Appendix. Distribution of the sample by activity

Represented sectors, frequencies and rates of respondents

Statistical-code	Manufacturing sector	Ground population	Total sample	Responses	Response rates
15	Food and beverages	388	252	69	27,4%
16	Tobacco	5	4	1	25,0%
17	Textile	122	80	13	16,3%
18	Wearing	236	162	26	16,0%
19	Leather	97	65	11	16,9%
20	Wood	80	42	15	35,7%
21	Paper	45	30	8	26,7%
22	Printing	83	48	12	25,0%
23	Fuel	2	2	2	100,0%
24	Chemicals	80	53	21	39,6%
25	Rubber and plastics	157	80	33	41,3%
26	Non-metallic mineral	104	70	25	35,7%
27	Basic metals	56	36	12	33,3%
28	Fabricated metal	283	146	41	28,1%
29	Other machinery	214	134	51	38,1%
30	Office machinery	13	9	2	22,2%
31	Electrical machinery	114	84	37	44,0%
32	Radio, television	79	63	21	33,3%
33	Medical instruments	49	33	14	42,4%
34	Motor vehicles	74	61	14	23,0%
35	Other transport equipment	25	18	8	44,4%
36	Manufacturing n.e.c.	104	54	13	24,1%
37	Recycling	7	4	3	75,0%
	Other or missing			14	
All manufacturing sectors		**2417**	**1530**	**466**	**30,5%**



3. Appendix. Distribution of companies by size (number of employees).

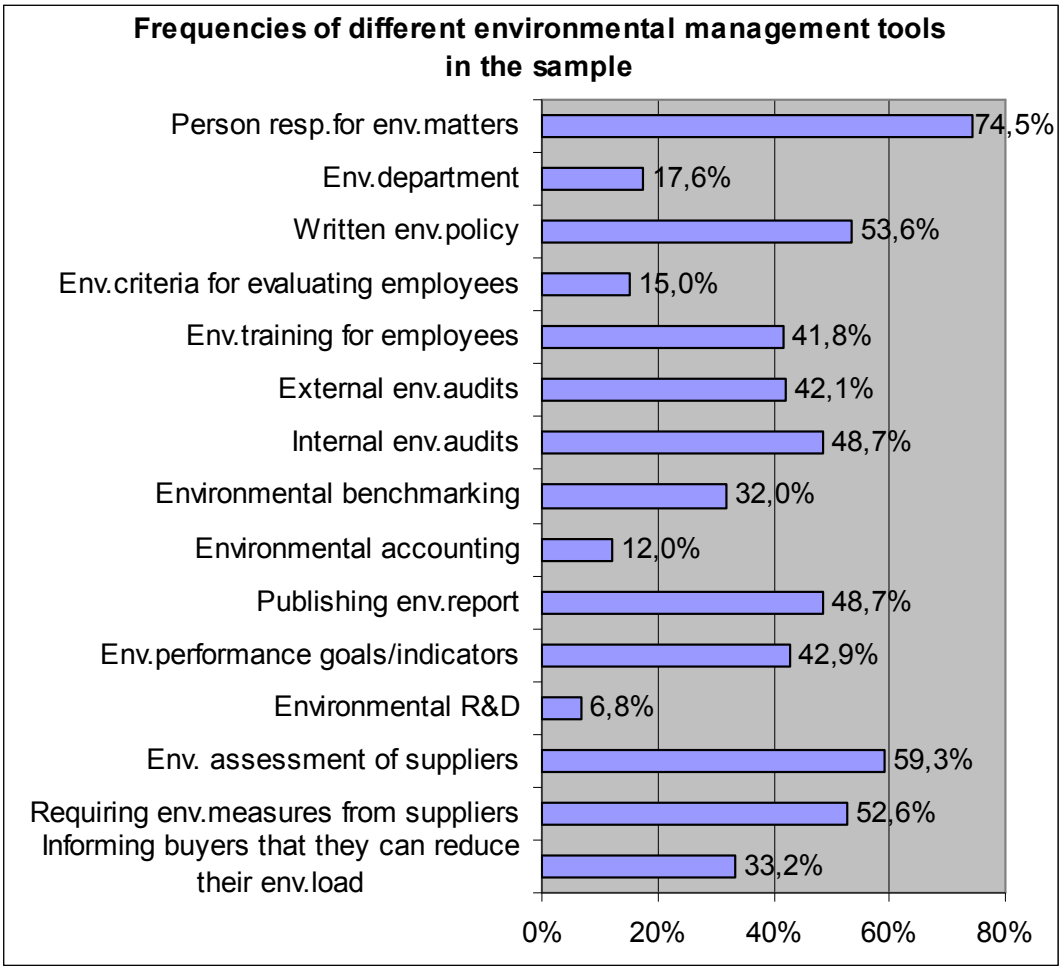
No. of employees	Ground population (X_i)	Total sample (N_i)	Res-ponses (n_i)	Response rates (n_i/N_i)	Ground population (X_i/X)	Total sample (N_i/N)	Responses $(n_i/n)^{a)}$	R – TS $(N_i/N - n_i/n)^{b)}$
50-99	1037	150	31	20,7%	42,9%	9,8%	7,0%	-35,9
100-249	805	805	200	24,8%	33,3%	52,6%	44,8%	+11,5
250-999	497	497	186	37,4%	20,6%	32,5%	41,7%	+21,1
>1000	78	78	29	37,2%	3,2%	5,1%	6,5%	+3,3
Missing			20					
Total	**2417**	**1530**	**466**	**30,5%**	**100,0%**	**100,0%**	**100,0%**	

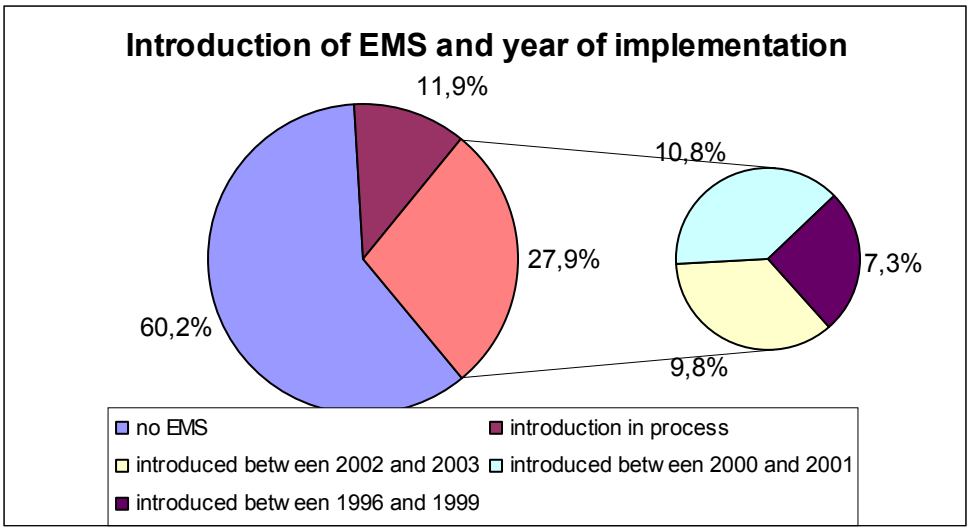
a) Units with known employee number are taken as 100%.
b) in percentage points

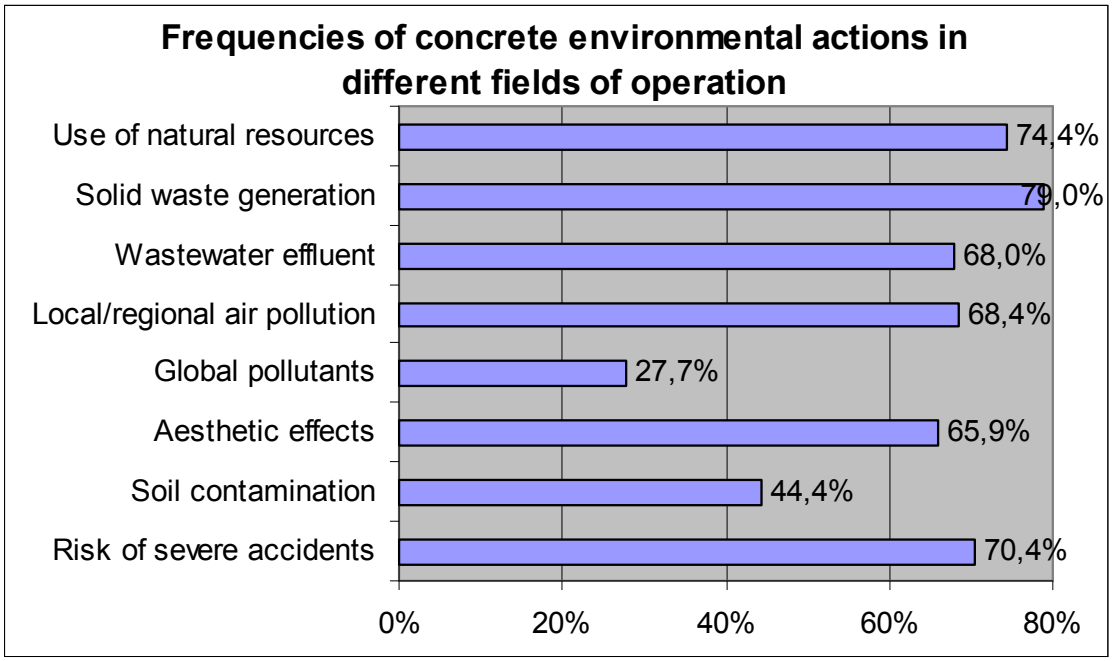
4. Appendix. Some descriptive statistics of the survey.

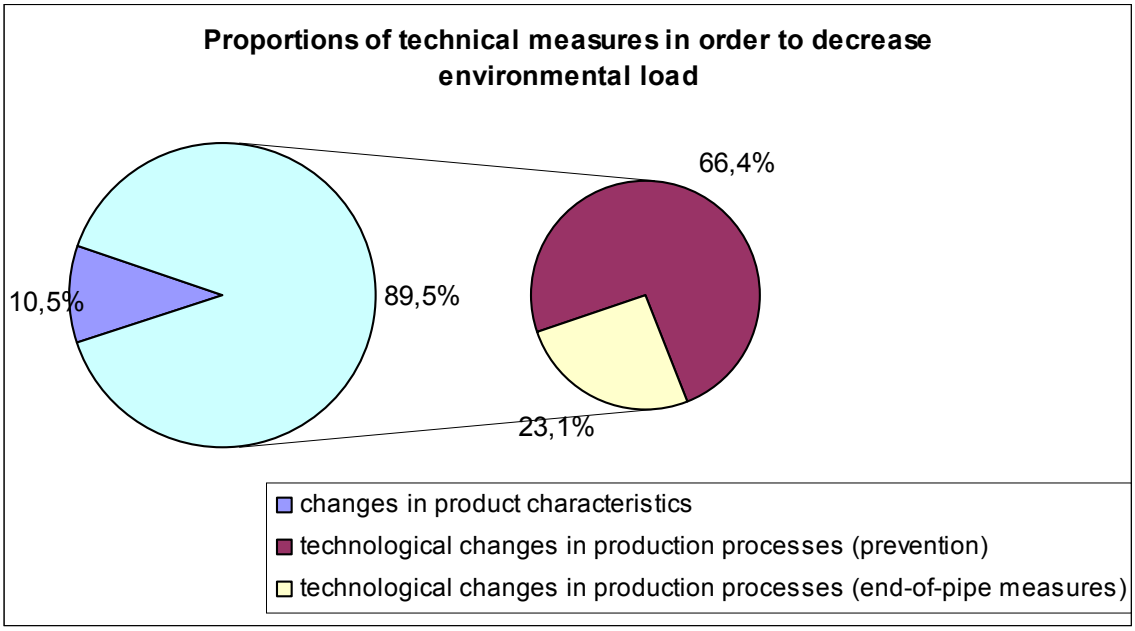
Distributions regarding company size and industrial activity can be found in 2. Appendix and 3. Appendix.

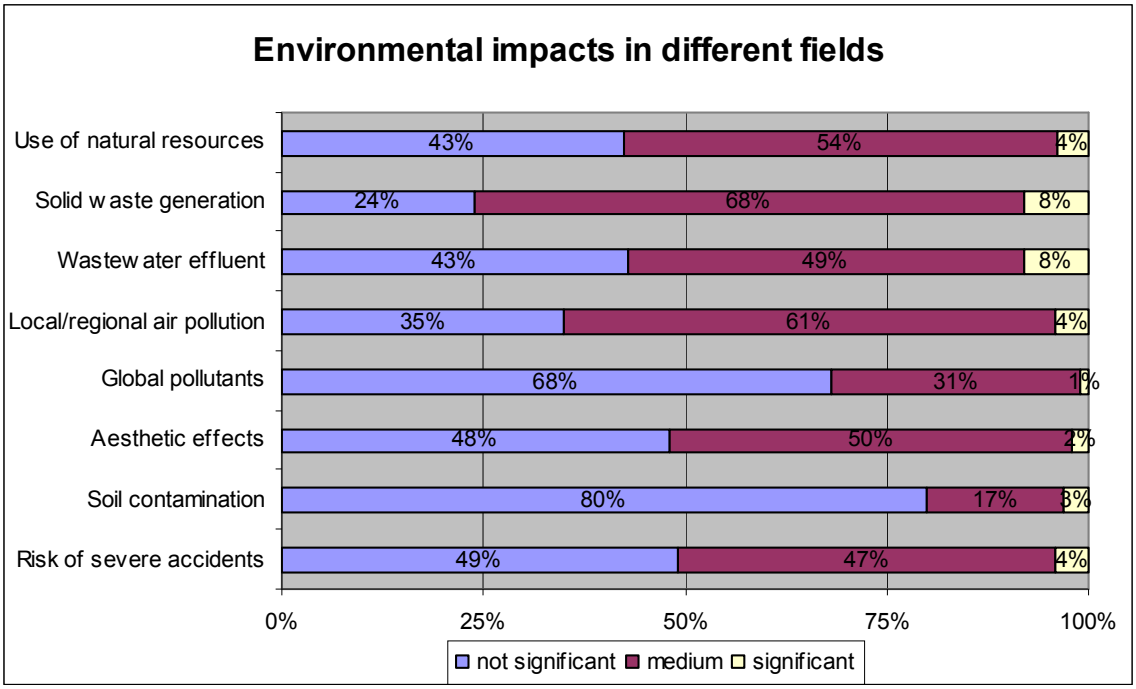
3. Appendix

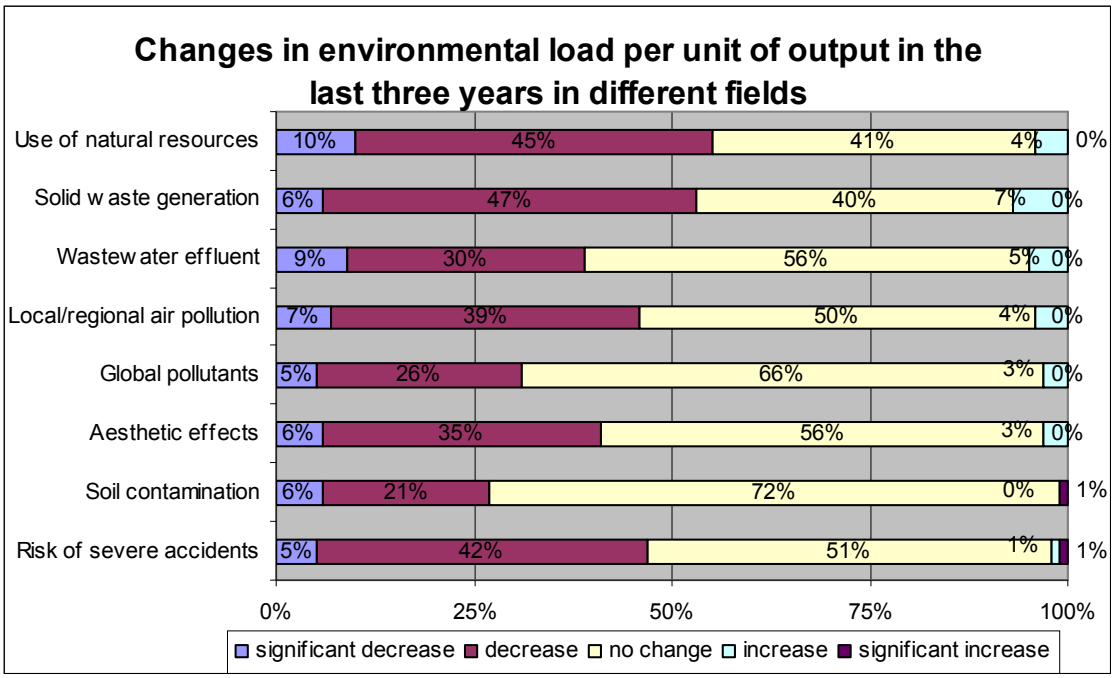


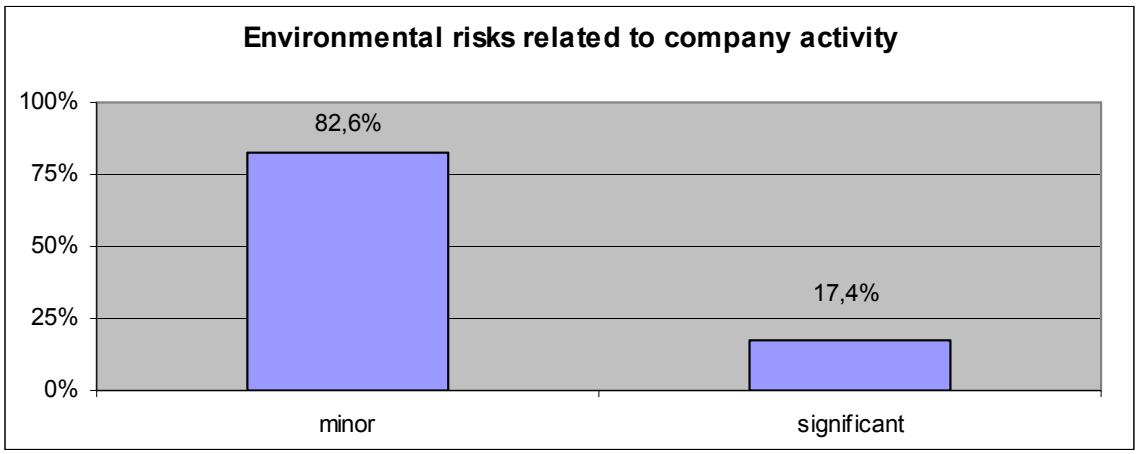

Introduction of EMS and year of implementation
11,9%
10,8%
27,9%
7,3%
60,2%
9,8%
no EMS
introduction in process
introduced betw een 2002 and 2003
introduced betw een 2000 and 2001
introduced betw een 1996 and 1999

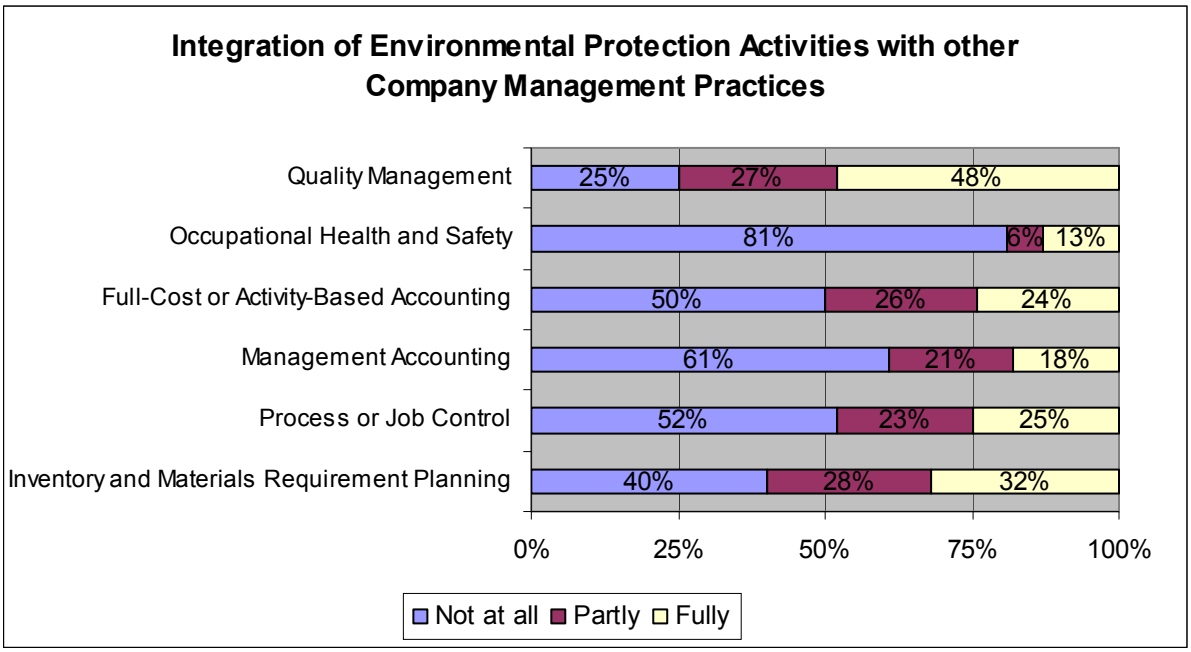

Frequencies of concrete environmental actions in different fields of operation
Use of natural resources
74,4%
Solid waste generation
79,0%
Wastewater effluent
68,0%
Local/regional air pollution
68,4%
Global pollutants
27,7%
Aesthetic effects
65,9%
Soil contamination
44,4%
Risk of severe accidents
70,4%
0%
20%
40%
60%
80%

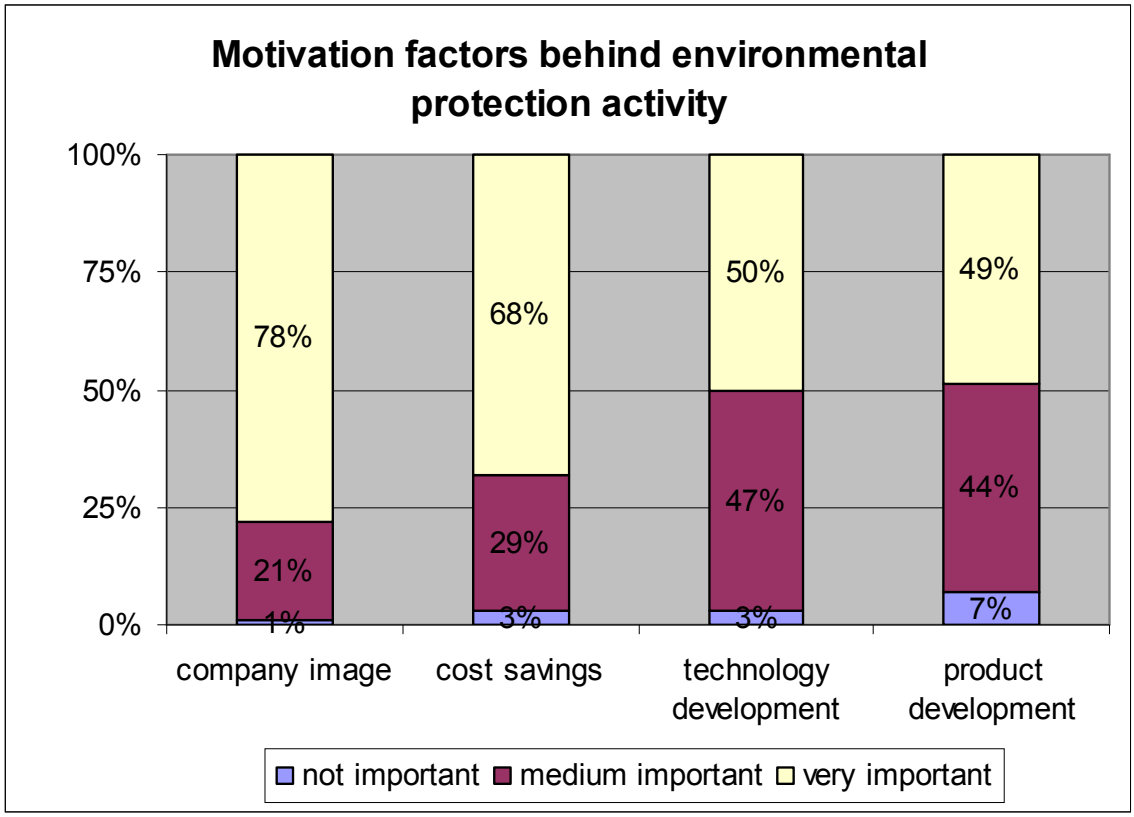

Proportions of technical measures in order to decrease environmental load
66,4%
10,5%
89,5%
23,1%
changes in product characteristics
technological changes in production processes (prevention)
technological changes in production processes (end-of-pipe measures)

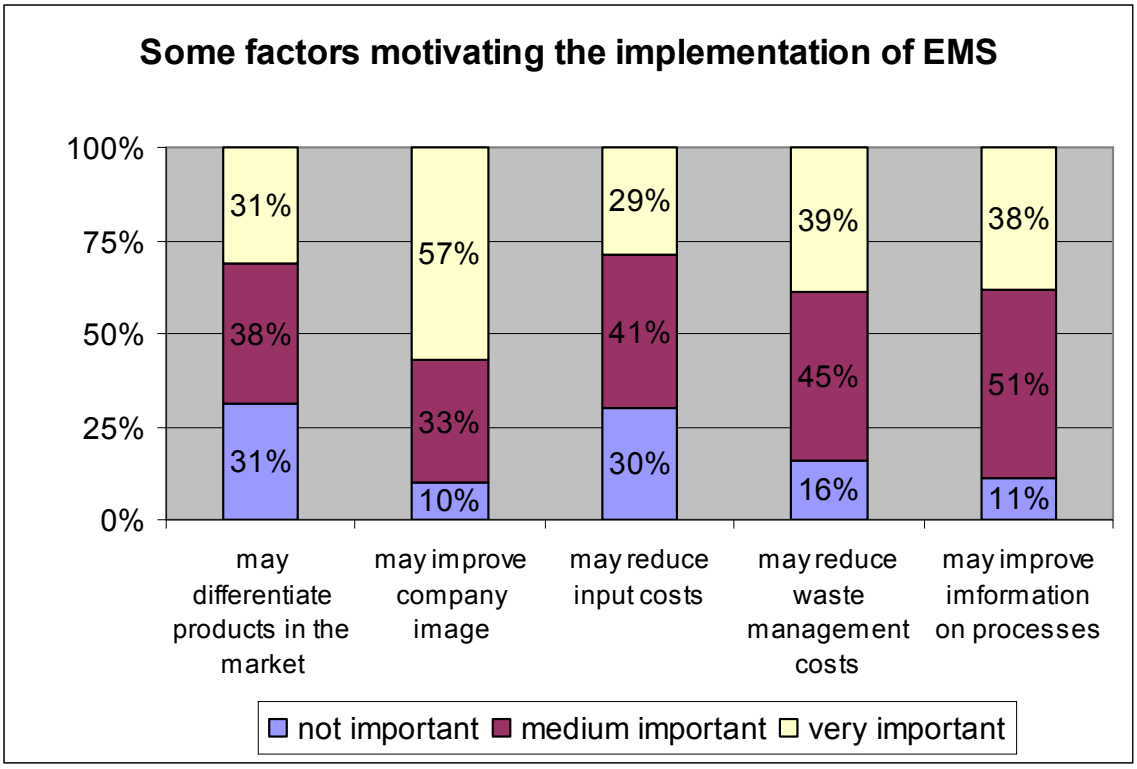

Environmental impacts in different fields
Use of natural resources
Solid waste generation
Wastewater effluent
Local/regional air pollution
Global pollutants
Aesthetic effects
Soil contamination
Risk of severe accidents
43%
54%
4%
24%
68%
8%
43%
49%
8%
35%
61%
4%
68%
31%
1%
48%
50%
2%
80%
17%
3%
49%
47%
4%
0%
25%
50%
75%
100%
not significant
medium
significant

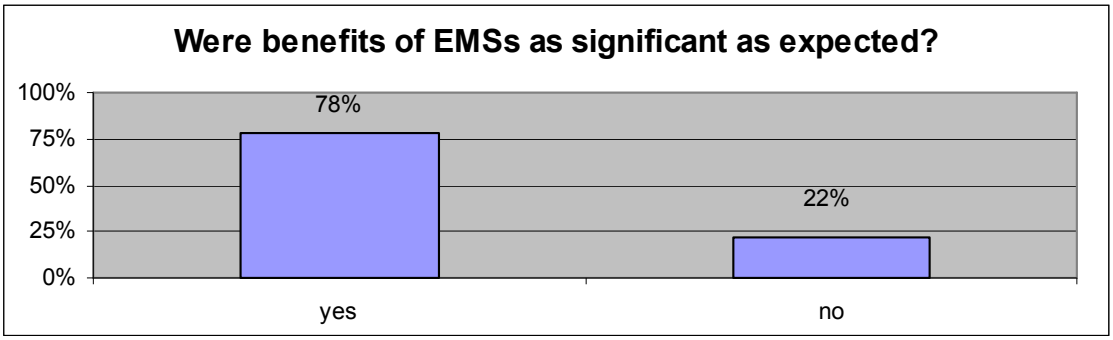

Changes in environmental load per unit of output in the last three years in different fields
Use of natural resources
Solid w aste generation
Wastew ater effluent
Local/regional air pollution
Global pollutants
Aesthetic effects
Soil contamination
Risk of severe accidents
10%
45%
41%
4%
0%
6%
47%
40%
7%
0%
9%
30%
56%
5%
0%
7%
39%
50%
4%
0%
5%
26%
66%
3%
0%
6%
35%
56%
3%
0%
6%
21%
72%
0%
1%
5%
42%
51%
1%
1%
0%
25%
50%
75%
100%
significant decrease
decrease
no change
increase
significant increase

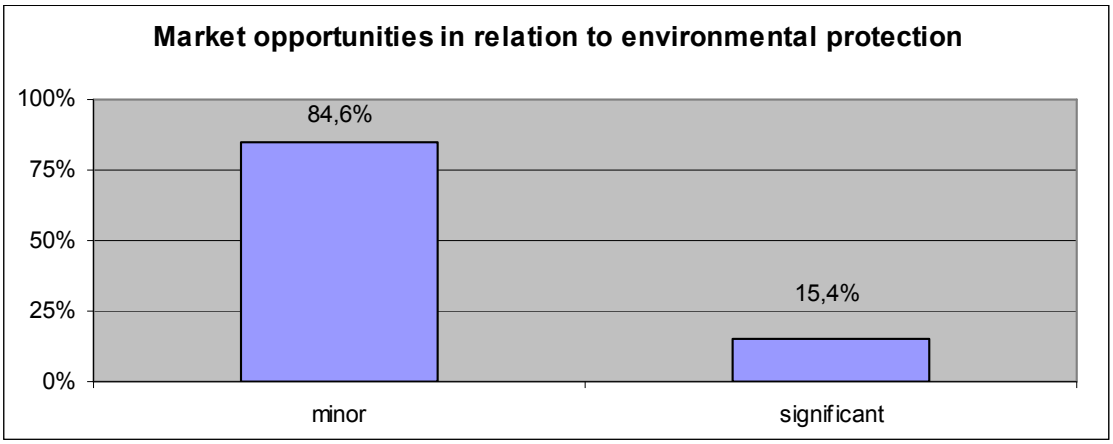

Environmental risks related to company activity
100%
75%
50%
25%
0%
82,6%
17,4%
minor
significant

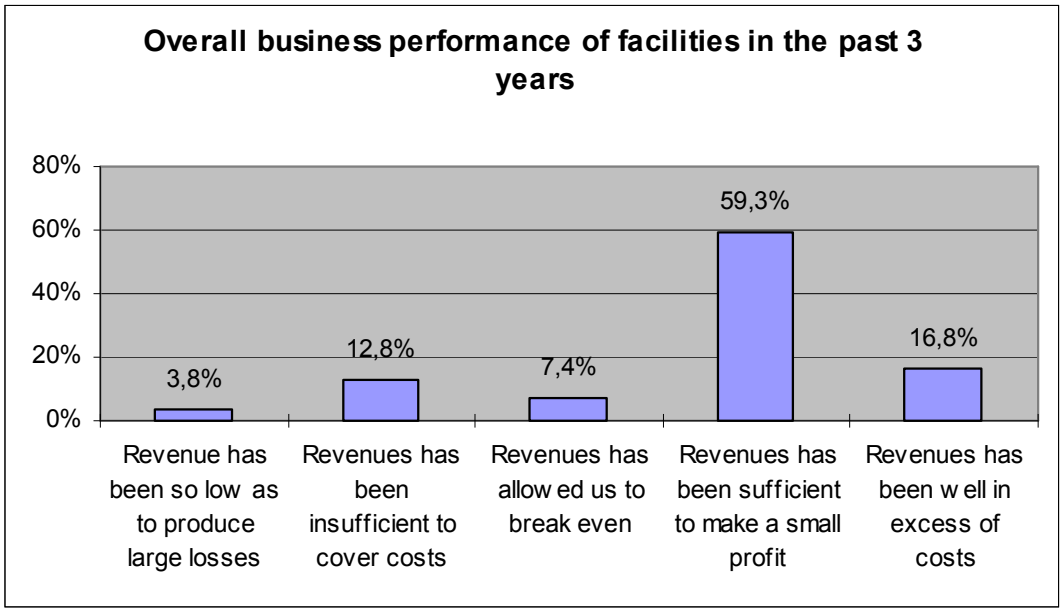

Integration of Environmental Protection Activities with other Company Management Practices
Quality Management
Occupational Health and Safety
Full-Cost or Activity-Based Accounting
Management Accounting
Process or Job Control
Inventory and Materials Requirement Planning
25%
27%
48%
81%
6%
13%
50%
26%
24%
61%
21%
18%
52%
23%
25%
40%
28%
32%
0%
25%
50%
75%
100%
Not at all
Partly
Fully

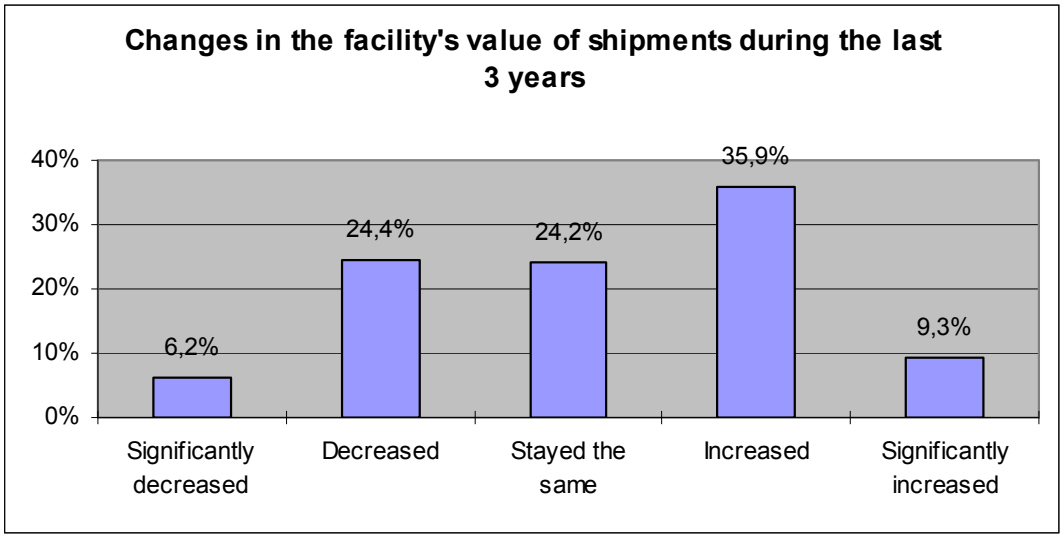

Motivation factors behind environmental protection activity
100%
75%
50%
25%
0%
78%
21%
1%
68%
29%
3%
50%
47%
3%
49%
44%
7%
company image
cost savings
technology development
product development
not important
medium important
very important

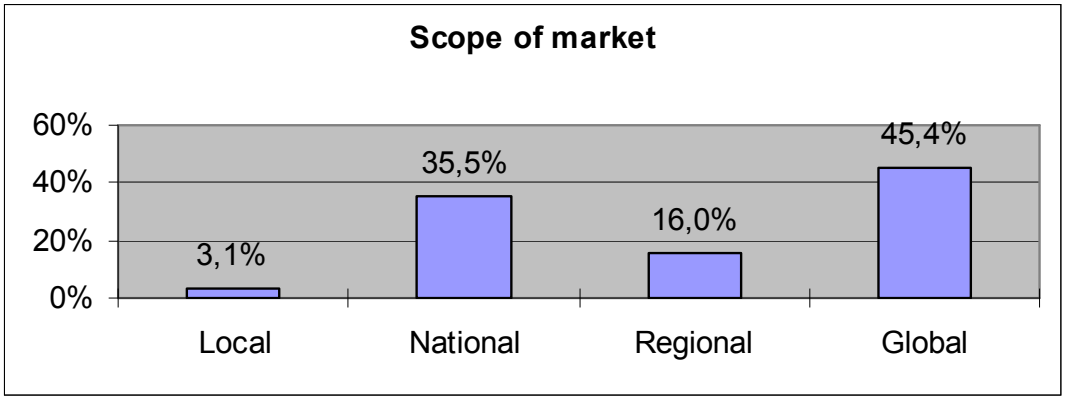

Some factors motivating the implementation of EMS
100%
75%
50%
25%
0%
31%
38%
31%
57%
33%
10%
29%
41%
30%
39%
45%
16%
38%
51%
11%
may differentiate products in the market
may improve company image
may reduce input costs
may reduce waste management costs
may improve imformation on processes
not important
medium important
very important

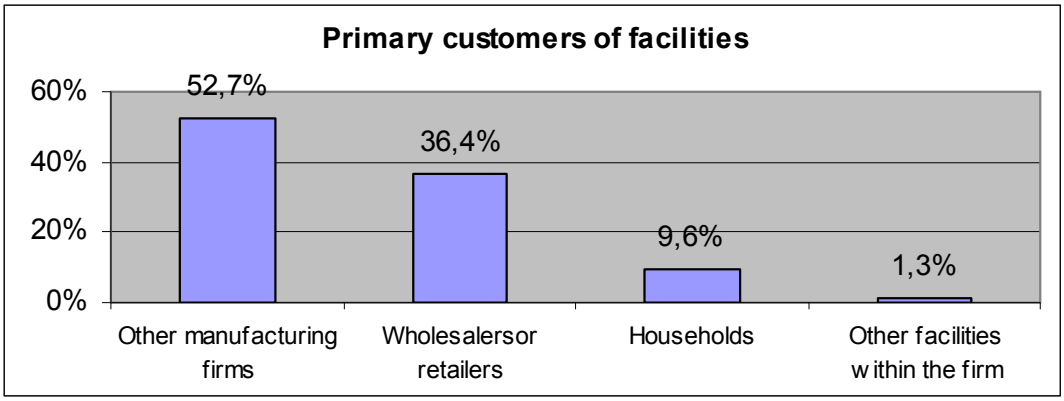

Were benefits of EMSs as significant as expected?
100%
75%
50%
25%
0%
78%
22%
yes
no

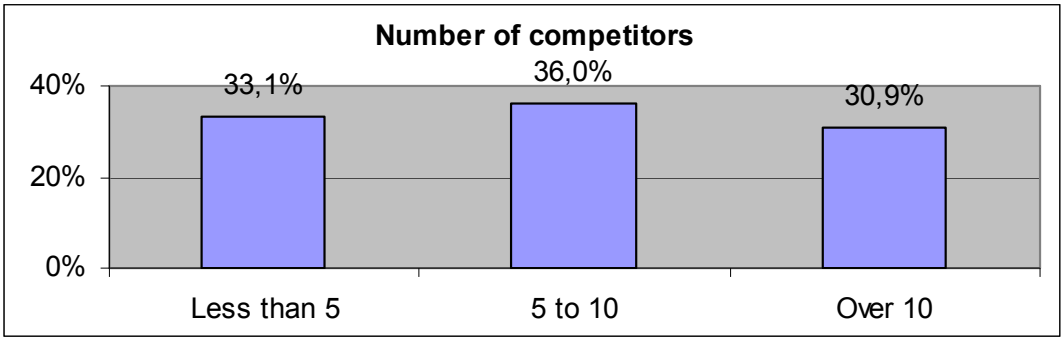

Market opportunities in relation to environmental protection
100%
75%
50%
25%
0%
84,6%
15,4%
minor
significant

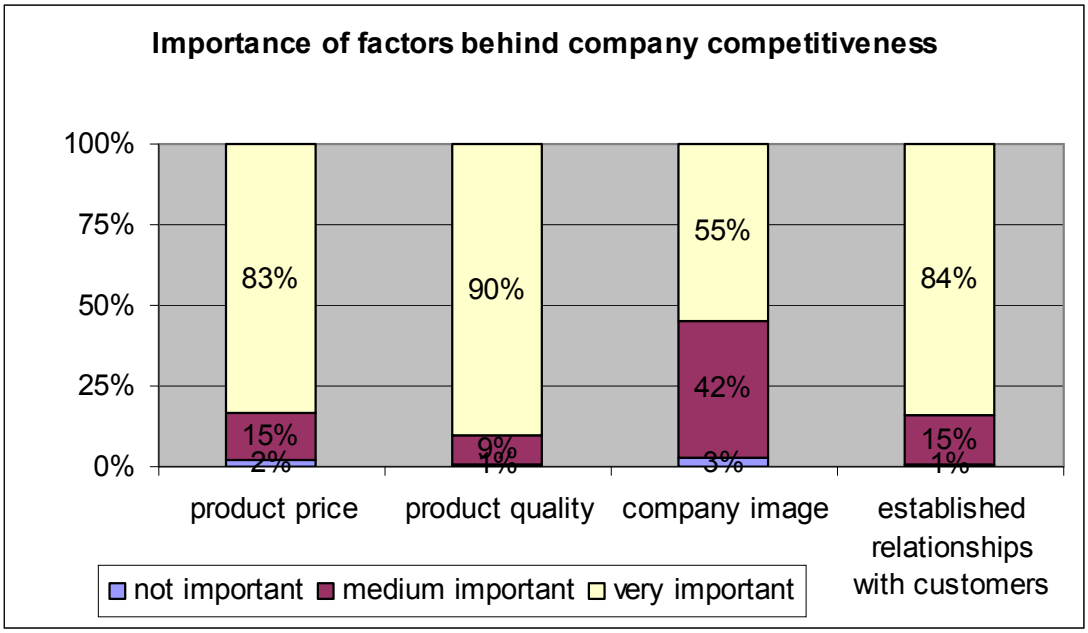

Overall business performance of facilities in the past 3 years
80%
60%
40%
20%
0%
3,8%
12,8%
7,4%
59,3%
16,8%
Revenue has been so low as to produce large losses
Revenues has been insufficient to cover costs
Revenues has allow ed us to break even
Revenues has been sufficient to make a small profit
Revenues has been w ell in excess of costs

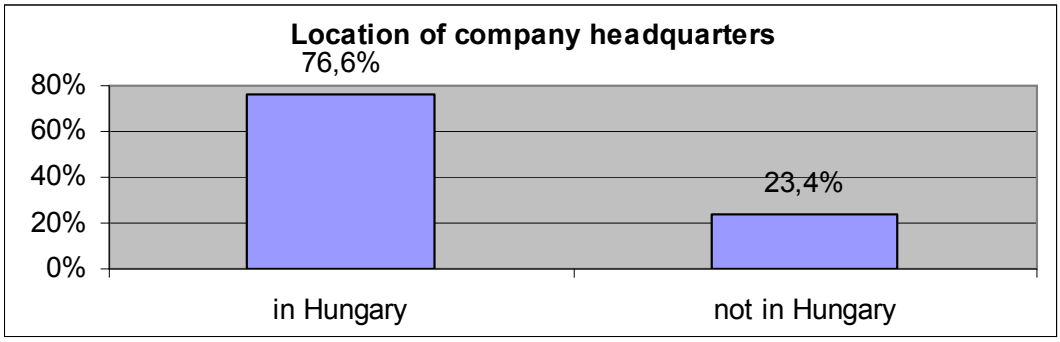

Changes in the facility's value of shipments during the last 3 years
40%
30%
20%
10%
0%
6,2%
24,4%
24,2%
35,9%
9,3%
Significantly decreased
Decreased
Stayed the same
Increased
Significantly increased


Scope of market
60%
40%
20%
0%
3,1%
35,5%
16,0%
45,4%
Local
National
Regional
Global


Primary customers of facilities
60%
40%
20%
0%
52,7%
36,4%
9,6%
1,3%
Other manufacturing firms
Wholesalersor retailers
Households
Other facilities within the firm


Number of competitors
40%
20%
0%
33,1%
36,0%
30,9%
Less than 5
5 to 10
Over 10


Importance of factors behind company competitiveness
100%
75%
50%
25%
0%
83%
15%
2%
90%
9%
1%
55%
42%
3%
84%
15%
1%
product price
product quality
company image
established relationships with customers
not important
medium important
very important


Location of company headquarters
76,6%
23,4%
80%
60%
40%
20%
0%
in Hungary
not in Hungary

5. Appendix. Introduction of variable groups used for analysis

Tables show in most cases original variables based on the questionnaire, however, many further variables have been created by recoding or computing.

Variables on environmental management:

Content of variable	Variable name	Potential answers
Environmental position in company hierarchy		
Presence of person with explicit responsibility for environmental concerns	persenv	yes - no
Environmental position in company hierarchy	persloc	Senior management Production/operations Finance/accounting Specialised environmental department (or equivalent) External/media relations Marketing/Sales Purchasing Human resources Product development
Presence of a specialised environmental department	kvoszt	yes - no
Implementation of specific environmental management tools		
Written environmental policy	empwrit	yes - no
Environmental criteria used in the evaluation and/or compensation of employees	empeval	
Environmental training program in place for employees	emptrain	
Carry out external environmental audits	empeaud	
Carry out internal environmental audits	empiaud	
Benchmark environmental performance	empbnch	
Environmental accounting	empacct	
Public environmental report	emprprt	
Environmental performance indicators/goals	empindic	
Environmental R&D activities	facRD1	
Assessing the environmental performance of our suppliers	asssupl	
Requiring suppliers to undertake environmental measures	reqsupl	
Informing buyers of ways to reduce their environmental impacts	infbuy	
Application of environmental management systems		
Potential introduction of a system	emsact2	yes – in process - no
Type of the system (EMAS or ISO 14001)	emscert iso14001	yes - no yes - no
Year of certification	emsevkat	No EMS - 2002-2003 - 2000-2001 - 1996-1999

Variables on concrete environmental actions:

Content of variable	Variable name	Potential answers
Concrete environmental actions in the following fields		
Use of natural resources (energy, water, etc.)	actnr2	yes - no
Solid waste generation	actwst2	
Wastewater effluent	actww2	
Local or regional air pollution	actapol2	
Global pollutants (e.g. greenhouse gases)	actgpol2	
Aesthetic effects (noise, smell, landscape)	actaes2	
Soil contamination	actsoi2	
Risk of severe accidents	actris2	
Significant measures specifically related to production technologies	abatcpp	Preventive actions End-of-pipe actions
Significant technical measures reducing the environmental impacts associated with activities	abatcpt	Production process Product characteristics

Variables on environmental load:

Content of variable	Variable name	Potential answers
Severity of potential negative environmental impacts		
Use of natural resources (energy, water, etc.)	impnr2	No negative impacts Moderately negative impacts Very negative impacts
Solid waste generation	impwst2	
Wastewater effluent	impww2	
Local or regional air pollution	impapol2	
Global pollutants (e.g. greenhouse gases)	impgpol2	
Aesthetic effects (noise, smell, landscape)	impaest2	
Soil contamination	impsoil2	
Risk of severe accidents	imprisk2	
Changes in environmental load per unit of output in the past three years		
Use of natural resources (energy, water, etc.)	cimpnr2	Significant decrease Decrease No change Increase Significant increase
Solid waste generation	cimpwst2	
Wastewater effluent	cimpww2	
Local or regional air pollution	cimpapo2	
Global pollutants (e.g. greenhouse gases)	cimgpo2	
Aesthetic effects (noise, smell, landscape)	cimpaes2	
Soil contamination	cimpsoi2	
Risk of severe accidents	cimpris2	
Environmental risks related to company activities	endrisk2	Insignificant Considerable

Variables on the relationship of environmental performance and other fields of company performance:

Content of variable	Variable name	Potential answers
Integration of environmental activities with different company management practices (if these latters exist)		
Quality management	intqms5	Not at all Partially Fully
Health and safety management	inthsms5	
Full-cost or activity-based accounting	intfca5	
Management accounting	intmas5	
Process or job control	intpcs5	
Inventory or materials requirement planning	intirp5	
Factors motivating environmental practices		
Corporate profile/image	amtimg2	Not important Moderately important Very important
Cost savings	amtsav2	
New technology development	amttech2	
New product development	amtprod2	
Motivations behind introducing an environmental management system		
may allow for differentiation of products	emtdiff	Not important Moderately important Very important
may improve profile/image	emtimg	
may create cost savings in terms of use of inputs	emtsvinp	
may create cost savings in terms of waste management	emtswst	
may improve information about operations	emtinfop	
Did benefits of EMS satisfy expectations	emsbenef	yes – no
Market potential connected to environment protection	envopp2	insignificant considerable

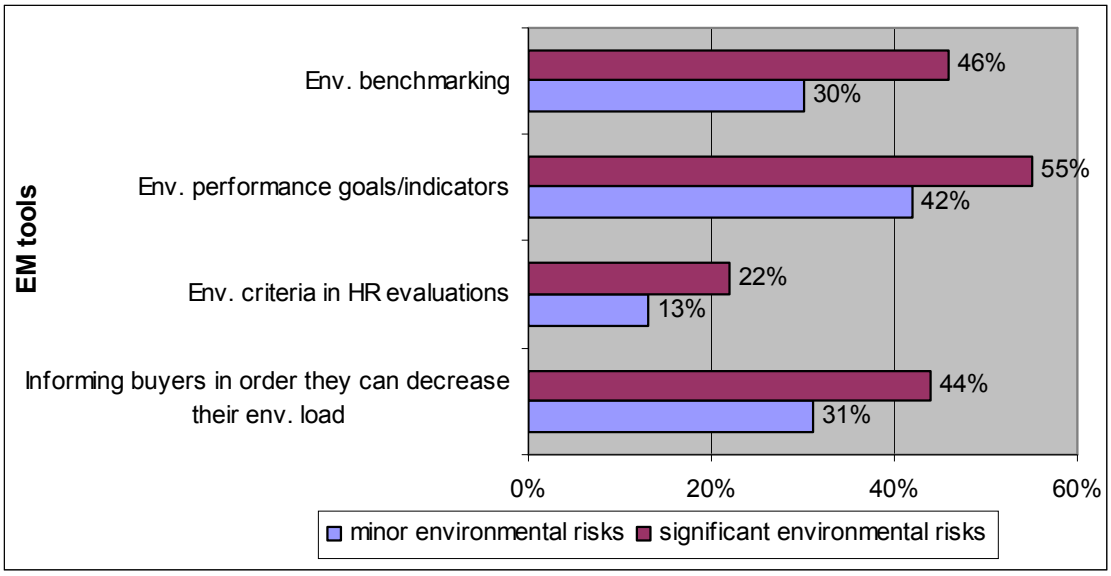
Variables on economic performance:

Content of variable	Variable name	Potential answers
Overall business performance in the last three years	facbperf	Large losses Slight losses Breaking even Small profit Significant profits
Changes in the values of shipments in the last three years	facvosc	Significant decrease Decrease No change Increase Significant increase

Other background variables:

Content of variable	Variable name	Potential answers
Company size (measured by number of employees)	meretksh	50 to 99 employees 100 to 249 employees 250 to 999 employees more than 1000 employees
Industrial activity (based on statistical codes)	indcat	15-16 Food products, beverages and tobacco 17-19 Textile and leather products 20 Wood products 21-22 Paper and printing 23-25 Chemical industry 26 Other non-metallic mineral products 27 Basic metals 28 Fabricated metal products 29-33 Machinery industry 34-35 Vehicles 36 Furniture 37 Recycling
Primary customers of the company	primcust	Other manufacturing companies Wholesalers or retailers Households Other facilities within the same firm
Scope of market	mrktscop	Local National Regional Global
Number of competitors	mrktconc	Less than 5 5 to 10 More than 10
A versenyképességet meghatározó tényezők értékelése		
Product price	compprice	Not important Moderately important Very important
Product quality	compqual	
Company image	compimg	
Established relationships with buyers	compbyrs	
Location of company headquarters	firmintl	In Hungary Not in Hungary

6. Appendix. Frequencies of application of some environmental management tools based on environmental risks of activity.



7. Appendix. Position of person responsible for environmental matters in company hierarchy

in case of different potential environmental impacts (impavkat: alacsony - low; közepes - medium; magas - high).

Location of the person with environmental responsibility (categorized2) * impavkat Crosstabulation

			impavkat			
			alacsony (1-1,38)	közepes (1,4-1,67)	magas (1,7-3)	Total
Location of the person with environmental responsibility (categorized2)	Senior mgmt	Count	30	28	28	86
		% within impavkat	46,9%	34,1%	29,8%	35,8%
	Env. dept. or equivalent	Count	16	22	44	82
		% within impavkat	25,0%	26,8%	46,8%	34,2%
	Other functional dept.	Count	18	32	22	72
		% within impavkat	28,1%	39,0%	23,4%	30,0%
Total		Count	64	82	94	240
		% within impavkat	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14,129[a]	4	,007
Likelihood Ratio	13,721	4	,008
Linear-by-Linear Association	,592	1	,442
N of Valid Cases	240		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 19,20.

8. Appendix. Effects of company size (meretksh) and environmental load (kelleeper) on application of environmental management tools with EPER-data on 2001 and 2004.

2001

Tests of Between-Subjects Effects

Dependent Variable: KMszint15

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	608,889[a]	6	101,482	8,265	,000
Intercept	2725,574	1	2725,574	221,989	,000
meretksh	272,694	3	90,898	7,403	,000
Kelleeper2001	20,479	1	20,479	1,668	,197
meretksh * Kelleeper2001	3,461	2	1,730	,141	,869
Error	5156,745	420	12,278		
Total	19938,000	427			
Corrected Total	5765,635	426			

a. R Squared = ,106 (Adjusted R Squared = ,093)

2004

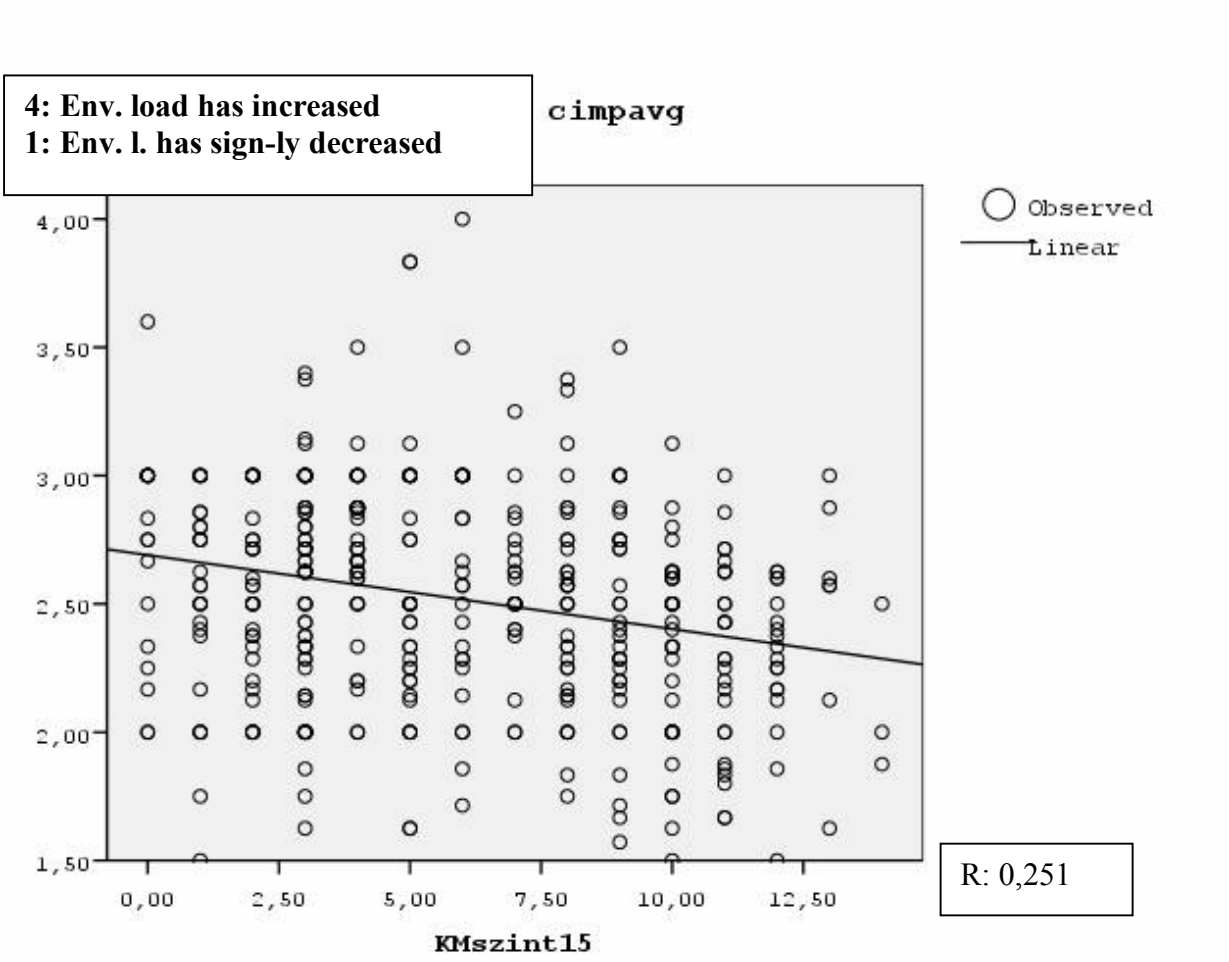
Tests of Between-Subjects Effects

Dependent Variable: KMszint15

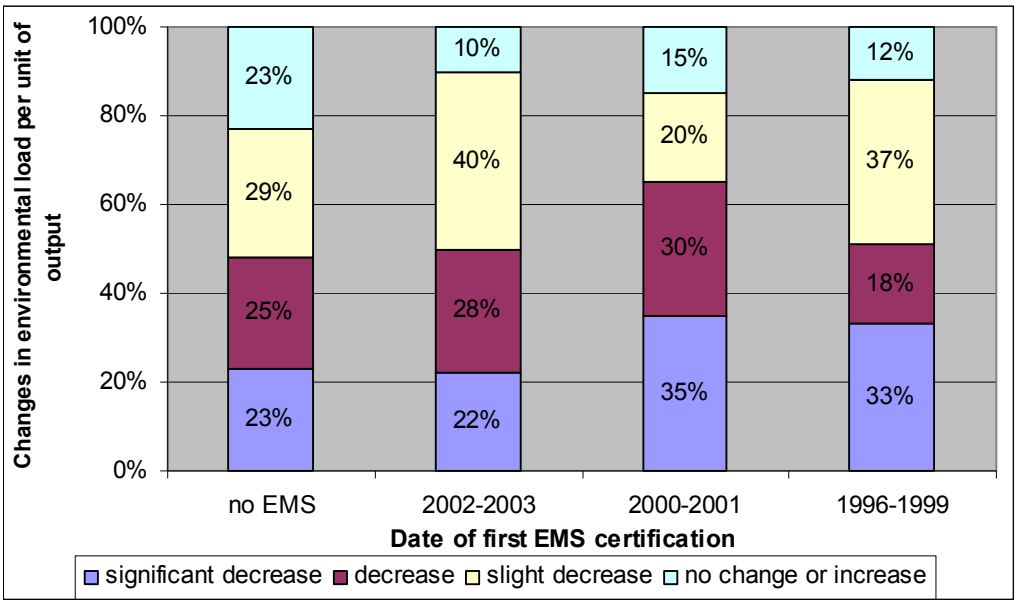
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	665,261[a]	6	110,877	9,130	,000
Intercept	3184,241	1	3184,241	262,212	,000
meretksh	210,099	3	70,033	5,767	,001
Kelleeper2004	56,952	1	56,952	4,690	,031
meretksh * Kelleeper2004	3,498	2	1,749	,144	,866
Error	5100,374	420	12,144		
Total	19938,000	427			
Corrected Total	5765,635	426			

a. R Squared = ,115 (Adjusted R Squared = ,103)

9. Appendix. Links between changes in environmental load per unit of output and number of environmental management tools (KMszint15).



10. Appendix. (Absence of) relationship between EMS and changes in environmental load per unit of output.



11. Appendix. Factor analysis for variables on integrating environmental protection and company management.

Correlation Matrix

		5QMS integrating environmental activities is established	5HSMS integrating environmental activities is established	5Full-cost or activity-based accounting integrating environmental activities is established	5Management accounting system integrating environmental activities is established	5Process or job control system integrating environmental activities is established	5Inventory or materials requirement planning integrating environmental activities is established	emsact2	KMszint15kat
Correlation	5QMS integrating environmental activities is established	1,000	,187	,139	,157	,184	,289	,463	,481
	5HSMS integrating environmental activities is established	,187	1,000	,169	,170	,198	,154	,112	,212
	5Full-cost or activity-based accounting integrating environmental activities is established	,139	,169	1,000	,686	,401	,565	-,071	,108
	5Management accounting system integrating environmental activities is established	,157	,170	,686	1,000	,417	,463	-,011	,127
	5Process or job control system integrating environmental activities is established	,184	,198	,401	,417	1,000	,558	-,024	,103
	5Inventory or materials requirement planning integrating environmental activities is established	,289	,154	,565	,463	,558	1,000	,012	,130
	emsact2	,463	,112	-,071	-,011	-,024	,012	1,000	,711
	KMszint15kat	,481	,212	,108	,127	,103	,130	,711	1,000
Sig. (1-tailed)	5QMS integrating environmental activities is established		,000	,004	,002	,000	,000	,000	,000
	5HSMS integrating environmental activities is established	,000		,001	,001	,000	,002	,018	,000
	5Full-cost or activity-based accounting integrating environmental activities is established	,004	,001		,000	,000	,000	,092	,021
	5Management accounting system integrating environmental activities is established	,002	,001	,000		,000	,000	,418	,008
	5Process or job control system integrating environmental activities is established	,000	,000	,000	,000		,000	,327	,026
	5Inventory or materials requirement planning integrating environmental activities is established	,000	,002	,000	,000	,000		,413	,007
	emsact2	,000	,018	,092	,418	,327	,413		,000
	KMszint15kat	,000	,000	,021	,008	,026	,007	,000	

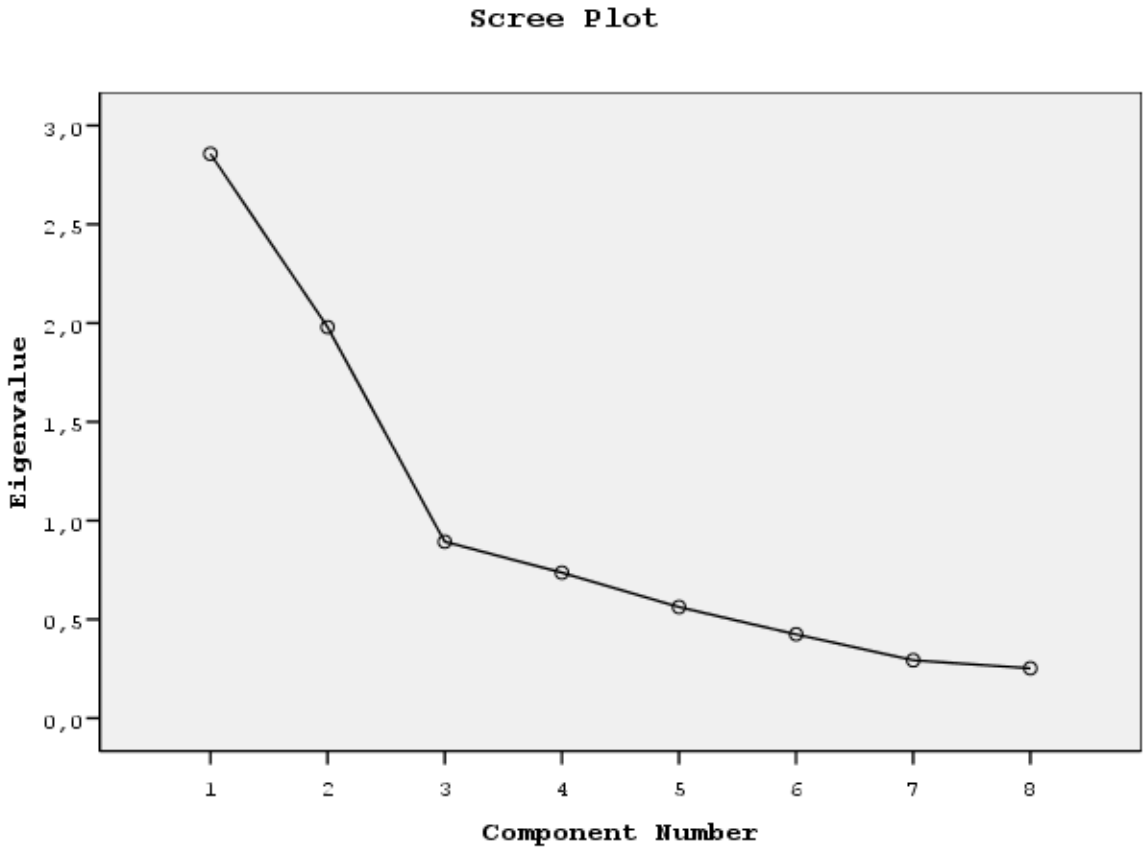
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,707
Bartlett's Test of Sphericity	Approx. Chi-Square	956,275
	df	28
	Sig.	,000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,857	35,714	35,714	2,857	35,714	35,714	2,599	32,485	32,485
2	1,980	24,748	60,462	1,980	24,748	60,462	2,127	26,583	59,069
3	,893	11,167	71,629	,893	11,167	71,629	1,005	12,560	71,629
4	,737	9,211	80,840						
5	,563	7,032	87,872						
6	,425	5,308	93,179						
7	,293	3,666	96,845						
8	,252	3,155	100,000						

Extraction Method: Principal Component Analysis.



Rotated Component Matrix[a]

	Component		
	1	2	3
5Full-cost or activity-based accounting integrating environmental activities is established	,844	,002	,030
5Inventory or materials requirement planning integrating environmental activities is established	,807	,126	,021
5Management accounting system integrating environmental activities is established	,805	,046	,039
5Process or job control system integrating environmental activities is established	,707	,043	,170
emsact2	-,116	,894	,004
KMszint15kat	,072	,874	,108
5QMS integrating environmental activities is established	,226	,727	,072
5HSMS integrating environmental activities is established	,132	,124	,978

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

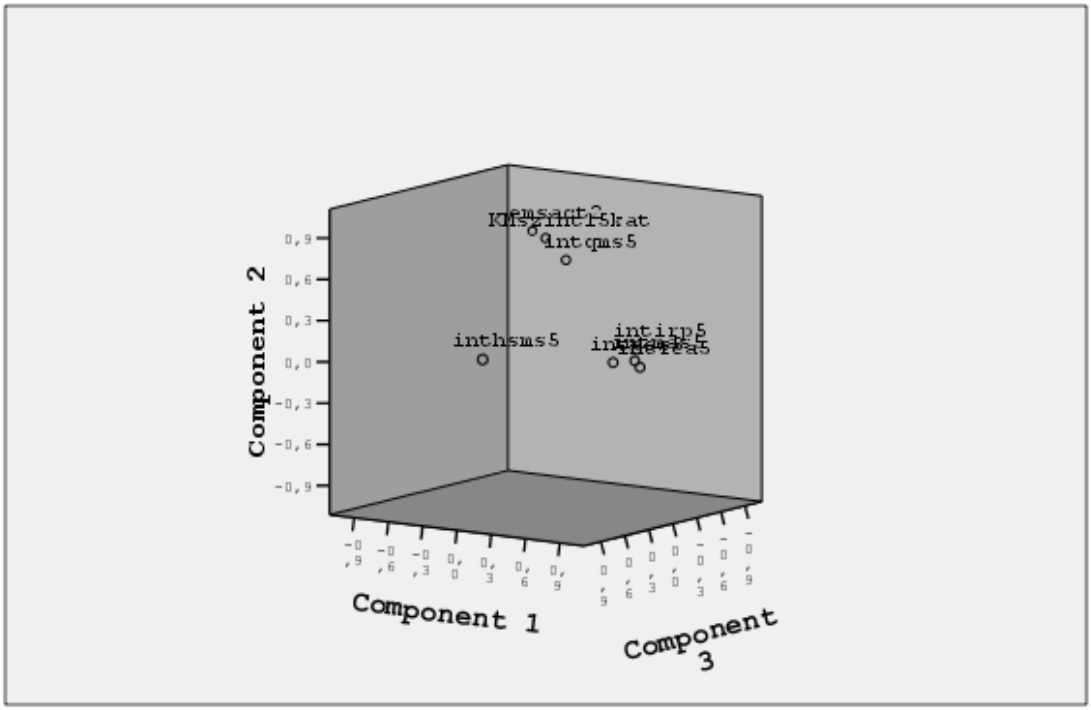
a. Rotation converged in 4 iterations.

Component Transformation Matrix

Component	1	2	3
1	,860	,456	,231
2	-,484	,871	,081
3	-,164	-,181	,970

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Component Plot in Rotated Space



12. Appendix. Letter of invitation for taking part in company interviews.

Dear Ms./Mr. X,

My name is **Gábor Harangozó, PhD-student** of the **Corvinus University of Budapest.** I would like to ask for your help to my currently running doctoral research – in the field of environmental awareness and business performance of manufacturing companies.

The **first phase** of **the research project – in which Company Y also took part** – started in the year of 2003, when we monitored all of the middle and large companies in the Hungarian manufacturing sector within an international (OECD) survey. Based on this survey we have got a **general overview on the environmental management, main environmental motivations and goals** of the companies in Hungary. Please find attached the final report based on this phase of the research.

In the **current, second phase of the research project** I would like to **deepen the knowledge** gained by the survey with the mean of several **corporate interviews** – carried out with the professionals of few companies with outstanding environmental and social awareness.

At one company – if possible – I would like to make an interview with the following professionals:

- a member of the management,
- an environmental professional,
- an economic professional,
- a production professional,
- a non-professional employee,

of course an overlap is possible.

The interviews are planned to be carried out in May or June, in a time appropriate for the Company. An interview is planned to take about 45 minutes.

Of course I handle the information confidentially, use only for research purposes and do not give to third parties.

After the research on request **I submit the whole research report** that can serve as a **benchmark for Company Y** in different fields against the Hungarian manufacturing industry.

Hoping that your Company can take part also in the second phase of the research,

Sincerely,

Gábor Harangozó

Corvinus University of Budapest
Department of Environmental Economics and Technology

13. Appendix. Structure of company interviews – an example.

Planned interview outline - top manager

(Similar preliminary outlines has been made for interviewing environmental, production and financial professionals, as well as non-professional employees)

- (Brief introduction of the research and the author)

- If talking about environmental protection, what is the first thing coming into your mind?
- What are the main environmental aspects regarding the operation of the Company?
- What does environmental performance of a company mean in general?
- How do you interpret the concept of environmental excellence in case of your Company?

- Are environmental aspects present in Company strategy to some extent?
- What do you regard as most important objective of the Company concerning environmental protection?
- How does the Company try to improve its environmental performance?
- What is the position of environmental responsibility in the organisational structure of the Company? (How does organisational structure of the Company look like?) (Is there possibly an environmental council or similar?)
- Do you have environmentally related tasks/responsibilities?
- Does environmental protection appears in your daily work? If yes, in what form?
- What role does environmental protection receive in organisational culture? Is it recognised?

- In general do you agree with the statement that good environmental performance contributes to improvement of company performance? If yes, can you give examples?
- What role environmental protection can play in the success of your Company?
- Can you give concrete examples, when your Company has directly or indirectly profited also economically from environmental protection?
- Do you think better environmental performance would improve market performance/customer evaluation of your Company?
- To what extent can environmental protection play a role in differentiating your Company from competitors?

14. Appendix. Environmental Awareness Questionnaire at Denso.

Weather forecast

Please indicate your opinion about the activity if DMHU in one of the boxes !				
How do we save energy?				
How do we manage well the raw materials?				
How do we manage well the auxiliary materials?				
How do we save communal water?				
How do we save industrial water?				
How do we take attention to reduce air emission?				
How do we manage selective waste handling?				
What is the recycling ratio of the waste?				
How safe is the storage of the hazardous materials?				
How safe is the transport of hazardous materials?				
How safe is the hazardous material handling?				
How do we use the safety equipment?				
How do we manage noise protection?				
How environmental conscious are our employees?				
How environmental conscious is our management?				
How are involved our business parteners in our environmental strategy?				
How do we consider the environmental protection in the purchasing processes?				
How do we manage fire protection?				
How do we take care of prevention af accidents?				
How useful is our documentation system (forms, work instructions)?				
Is there environmental training in the company?				
How was changed your environmental knowledge and consciousness by the environmental training?				

In your opinion which is the most important environmental measurement for improving the company?

Thanks for your help!

10 References

Afsah, S.; Ratunanda, D. [1999]: Environmental Performance Evaluation and Reporting in Developing Countries: The Case of Indonesia's Programme for Pollution Control, Evaluation and Rating (PROPER), in Bennett, M.; James (ed.): Sustainable Measures, p. 185-201. Greenleaf Publishing, Sheffield, 1999.

Allee, V. [1999]: The art and practice of being revolutionary. Journal of Knowledge Management, 3,2, p. 121-126., 1999.

Ammenberg, J. [2003]: Do Standardised Environmental Management Systems Lead to Reduced Environmental Impacts? Dissertation, Linköping University, Environmental Technology and Management, Sweden. Linköping, 2003.

Anton, W.; Deltas, G.; Khanna, M. [2004]: Incentives for environmental self-regulation and implications for environmental performance. Journal of Environmental Economics and Management, 48, p. 632-654., 2004.

Ashford, N.A.; Meima, R. [1993]: Designing the sustainable enterprise - summary report. Second International Research Conference, The greening of industry network. Cambridge, Massachusetts, 1993.

Balaton Károly et al. [2000]: Stratégia és szervezet. KJK-Kerszöv, Budapest, 2000.

Baranyi Árpád [2001]: Környezetvédelmi stratégiatípusok a magyarországi feldolgozóipari vállalatok körében. Ph.D. értekezés, BKÁE, Budapest, 2001.

Barbosa, N.; Louri, H. [2005]: Corporate Performance: Does Ownership Matter? Review of Industrial Organizations, Boston, 27/1, Aug 2005.

Bennett, M.; James, P. (ed.) [1999]: Sustainable Measures - Evaluation and Reporting of Environmental and Social Performance. Greenleaf Publishing, 1999.

Bezegh András [2006a]: Vállalati menedzsmentrendszerek integrálása I. Minőség és Megbízhatóság, 2006/1. p.14-19.

Bezegh András [2006b]: Vállalati menedzsmentrendszerek integrálása II. Minőség és Megbízhatóság, 2006/2. p.108-113.

Birkner, L.; Birkner, R. [1999]: The Health and Safety Scorecard. Occupational Hazards, 61, 6, p. 27-28., June 1999.

BMUJF [1998]: Leitfaden - Kennzahlen zur Messung der betrieblichen Umweltleistung. Bundesministerium für Umwelt, Jugend und Familie, Wien, 1998.

BMU-UBA [1997]: Betriebliche Umweltkennzahlen - Leitfaden. Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), Umweltbundesamt (UBA). Bonn, Berlin, 1997.

Bourguignon, A. et al. [2001]: Balanced Scorecard versus French Tableau de Bord: Beyond Dispute, a Cultural and Ideological Perspective. Groupe HEC, Jouy-en-Josas Cedex, 2001.

Brunner, J. [1999]: Value-Based Performance Management. Gabler, Wiesbaden, 1999.

BSI [2003]: The SIGMA guidelines - Putting sustainable development into practice: A guide for organisations. London, 2003.

Burritt, R.; Schaltegger, S. [2001]: Eco-efficiency in corporate budgeting. Environmental Management and Health; 2001; 12, 2/3, p.158-174.

Caduff, G. [1998]: Umweltorientierte Leistungsbeurteilung - Ein wirkungorientiertes Kennzahlensystem. Gabler, Wiesbaden, 1998.

Carnall, C.A. [2003]: Managing change in organizations. Prentice Hall, Harlow, 2003.

CEFIC [2001]: Responsible Care Report. Európai Vegyipari Szövetség (CEFIC), Brüsszel, 2001.

Chikán, A., Czakó, E., Zoltayné, P. Z. (ed.) [2002]: Vállalati versenyképesség a globalizálódó magyar gazdaságban. Akadémiai Kiadó, Budapest, 2002.

Clausen, J. [1998]: Monitoring von Umweltleistung und Umweltmanagementsystem. Eine Panelbefragung von Unternehmen: 1. Jahr 1997/98. Bericht an die Hessische Landesanstalt für Umwelt. Diskussionspapier des IÖW 43/98. Berlin, 1998.

Coelho, M.; Moy, D. [2003]: The new performance evaluation methodology and its integration with management systems. The TQM Magazine; 2003; 15, 1; p. 25-29. ABI/INFORM Global adatbázis.

Csutora Mária [1998]: Az alkalmazkodási tartomány. Ph.D. értekezés, BKÁE, Budapest, 1998.

Csutora Mária [2001]: Vállalati környezetvédelmi költségek számbavétele. Tisztább Termelés Kiskönyvtár, Budapest, 2001.

Csutora Mária; Kerekes Sándor [2004]: A környezetbarát vállalatirányítás eszközei. KJK-KERSZÖV Jogi és Üzleti Kiadó, Budapest, 2004.

Davis, S.P. [2000]: Maintaining your EMS: The stages of EMS development. Environmental Quality Management; Summer 2000; 9, 4; p. 77-85. ABI/INFORM Global adatbázis.

Dias-Sardinha, I. et al. [2002]: From Environmental Performance Evaluation to Eco-Efficiency and Sustainability Balanced Scorecards. Environmental Quality Management, Winter 2002, 12, 2. p. 51-64. ABI/INFORM Research Database.

Dias-Sardinha, I.; Reijnders, L. [2001]: Environmental Performance Evaluation and Sustainability Performance Evaluation of Organisations: An evolutionary framework. Eco - Management and Auditing; Jun 2001; 8, 2; p. 71-79. ABI/INFORM Global adatbázis.

Dobák Miklós [2001]: Szervezeti formák és vezetés. KJK-Kerszöv Jogi és Üzleti kiadó, Budapest, 2001.

Dow Jones Sustainability Indexes website: http://www.sustainability-index.com.

Dyllick, T. [1995]: Vom technischen Umweltschutz zum Umweltmanagement. In: Jean-Paul Thommen (ed.) [1995]: Management-Kompetenz. Versus, Zürich 1995.

Dyllick, T. [2002]: Die Unternehmung und die Natur. In: Dubs, R.; Euler, D.; Rüegg-Stürm, J. [2002]: Einführung in die Managementlehre. Paul Haupt, Bern, Stuttgart, Wien, 2002.

Dyllick, T.; Belz, F-M.; Schneidewind, U. [1997]: Ökologie und Wettbewerbsfaehigkeit. Hanser, München, Wien, 1997.

Dyllick, T.; Hamschmidt, J. [2000]: Wirksamkeit und Leistung von Umweltmanagementsystemen Eine Untersuchung von ISO 14001-zertifizierten Unternehmen in der Schweiz. Hochschulverlag, Zürich, 2000

Edwards, D. [1998]: The link between environmental and financial performance. Business and environment series. Earthscan, London, 1998.

EFQM [2003a]: European Foundation for Quality Management (EFQM) Excellence Model: Introducing Excellence. Brusselles, 2003.

EFQM [2003b]: European Foundation for Quality Management (EFQM) Excellence Model: Fundamental Concepts of Excellence. Brusselles, 2003.

Epstein, M. [1996]: Measuring corporate environmental performance - Best practices for costing and managing an effective environmental strategy. Irwin, Chicago, 1996.

Epstein, M. J.; Manzoni, J. F. [1997]: The Balanced Scorecard and Tableau de Bord: A Global Perspective on Translating Strategy into Action. INSEAD Working Paper. 97/82/AC/SM, 1997.

Epstein, M. J.; Wisner, P. S. [2001]: Using a Balanced Scorecard to Implement Sustainability. Environmental Quality Management, Winter 2001, 11, 2. p.1-10. ABI/INFORM Research Database.

Epstein, M.; Roy, M. [1998]: Managing corporate environmental performance: A multinational perspective. INSEAD, Fountainableau, 98/12/AC, 1998.

Epstein, M.; Young, D. [1998]: Improving corporate environmental performance through economic value added. INSEAD, Fountainableau, 98/15/AC, 1998.

ETHOS Fund website: www.ethosfund.ch.

European Green Table [1993]: Environmental performance indicators in industry - report 3, draft handbook. Unpublished, Oslo, 1993.

Feldman, S.; Soyka, P.; Ameer, P. [1997]: Does improving a firm's environmental management system and environmental performance result in a higher stock price? Journal of Investing, 6, 4, p.87-97., 1997.

Figge, F.; Hahn, T.; Schaltegger, S.; Wagner, M. [2002]: The Sustainability Balanced Scorecard - Linking Sustainability Management to Business Strategy. Business Strategy and the Environment, 11, p.269-284., 2002.

Fiksel, J. [1994]: Quality metrics in design for environment. Total Quality Environmental Management, Winter, 1994, p. 181-192.

Fonyó Zsolt; Szépvölgyi János; Harangozó Gábor [2002]: A megelőző környezetvédelmi szemlélet térnyerése a hazai vegyiparban. BKÁE Környezettudományi Intézetének kiadványai, 15. szám. Budapest, 2002.

Freimann, J.; Walther, M. [2001]: The impacts of corporate management systems: a comparison of EMAS and ISO 14001. Green Management International, Winter, 2001.

Frigo, M. [2002]: Nonfinancial performance measures and strategy execution. Strategic Finance, 84, 2, p.6-8., Aug. 2002.

Füstös, L.; Kovács, E.; Meszéna, Gy.; Simonné, M. N. [1986]: A sokváltozós adatelemzés statisztikai módszerei. Akadémiai Kiadó, Budapest.

GEMI [1992]: Total Quality Environmental Management - The Primer. Global Environmental Management Initiative (GEMI), Washington, 1992.

Gerde, V.; Logsdon, J [2001]: Measuring Environmental Performance: Use of the Toxic Release Inventory (TRI) and other US Environmental Databases. Business Strategy and the Environment, 10, p. 269-285., 2001.

Gleich, R. [2001]: Leistungsebenen von Performance Management-Systemen. in: Klingebiel, N. (ed.) [2001]: Performance Measurement & Balanced Scorecard. Verlag Franz Wahlen, München, 2001.

GRI [2002a]: Global Reporting Initiative - Sustainability Reporting Guidelines. Boston, 2002.

GRI [2002b]: Global Reporting Initiative - Introducing the 2002 Sustainability Reporting Guidelines. Amsterdam, 2002.

Gruman, G. [2004]: Corporate Performance Management: The right information, right now. Infoworld, p.49-52., 26/41, 2004.

Hahn, D. [1996]: PuK. Controllingkonzepte - Planung und Kontrolle, Planungs- und Kontrollsysteme, Planungs- und Kontrollrechnung. Wiesbaden, 1996.

Hamschmidt, J. [2001]: Wirksamkeit von Umweltmanagementsystemen. Bamberg, 2001.

Hamschmidt, J. [2003]: Prozessorientiertes Umweltleistungsmanagement Leitfaden zur Selbstbeurteilung. IWÖ-Diskussionsbeitrag, Nr. 103. HSG, St. Gallen, 2003.

Harangozó Gábor [2002]: Szürke vagy zöld? - A magyar vegyipar környezetvédelmi teljesítménye a rendszerváltástól napjainkig. Szakdolgozat, Budapest, 2002.

Harkai Attila; Matolay Réka; Pataki György; Szántó Richárd; Zilahy Gyula [2003]: Vállalati környezeti menedzsment Magyarországon: az empirikus kutatások

eredményei és tapasztalatai. BKÁE Környezettudományi Intézetének kiadványai, 24. szám. Budapest, 2003.

Havemann, R.; Webster, P. (EIRIS - Ethical Investment Research Service) [1999]: Does Ethical Investment Pay? - EIRIS research and other studies of ethical investment and financial performance. EIRIS, London, 1999.

Heinke, V. [2001]: Kapitalmarktorientierte Leistungsberichterstattung. In: Klingebiel, N. (ed.): Performance Measurement & Balanced Scorecard. Verlag Franz Wahlen, München, 2001.

Hibiki, A. [2004]: Determinanants of adoption ISO 14001 by a japanese publicly held manufacturer and the market valuation of a certified firm. EAERE konferencia, Budapest, 2004.

Hoffmann, O. [2000]: Performance Management. Systeme und Implementierungsansätze. Bern-Stuttgart-Wien, 2000.

Horváth Péter; Kaufmann, L. [1999]: Kiegyensúlyozott mutatószámrendszer - a stratégiák valóra váltásának egyik eszköze. Harvard Business Manager, 2/99, p.47-55.

Hukkinen, J. [2003]: Ecological Economics, 2003, p.11-27.

Ilinitch, A.; Soderstrom, N.; Thomas, T. [1998]: Measuring corporate environmental performance. Journal of Accountig and Public Policy, 17, p. 383-408, 1998.

ISO [1998]: ISO 14031 - Draft international standard, ISO/DIS. American National Standards Institute, New York, 1998.

ISO [2004]: Umweltmanagementsysteme - Anforderungen mit Anleitung zur Anwendung. (prEN ISO/FDIS 14001:2004). Deutsche Fassung. European Committee for Standardization, Brüssel, 2004.

ISO [2004]: Environmental management systems Requirements with guidance for use. (final draft ISO/FDIS 14001:2004 (E)). International Standard Organization, Geneve, 2004.

ISO 9001 [2000]: Quality Management Systems - Requirements (EN ISO 9001:2000). Deutsche Fassung (Trilingual). European Committee for Standardization, Brüssel, 2000.

Johnston, A.; Smith, A. [2001]: The characteristics and features of corporate environmental performance indicators - A case study of the water industry of England and Wales. Eco-Management and Auditing, Mar 2001; 8, p.1-11.

Kaplan, R. S.; Norton, D. P. [1996]: The Balanced Scorecard - Translating Strategy into Action. Harvard Business School Press, Boston, 1996.

Kaplan, R. S.; Norton, D. P. [2000]: Balanced Scorecard Kiegyensúlyozott stratégiai mutatószám-rendszer. KJK, Budapest, 2000.

Kenny, G. [2003]: Strategy: Balanced Scorecard - Why it isn't working. New Zealand Management, p.32-34. Mar, 2003.

Kerekes Sándor; Baranyi Árpád; Csutora Mária; Kovács Eszter; Nemcsicsné Zsóka Ági; Zilahy Gyula [2000]: A hazai vállalatok környezeti teljesítményének értékelése. MTA-KöM Zöld belépő sorozat, Budapest, 2000.

Kerekes Sándor [1998]: A környezetgazdaságtan alapjai. Budapest, 1998.

Kerekes Sándor [2002]: A magyar gazdaság környezeti teljesítménye az átmenet korában. MTA doktori értekezés, Budapest, 2002.

Kerekes Sándor; Szlávik János [2003]: A környezeti menedzsment közgazdasági eszközei. KJK-Kerszöv, Budapest, 2003.

Kerekes, Sándor; Harangozó, Gábor; Németh, Patrícia; Nemcsicsné Zsóka, Ágnes [2003]: Environmental Policy Tools and Firm-level Management Practices. OECD National Report: Hungary. Budapest University of Economic Sciences and Public Administration (BUESPA), 2003.

Kiss Gabriella, Pál Gabriella [2006]: Környezetgazdaságtan. Universitas Győr Kht, Győr, 2006.

Klingebiel, N. (ed.) [2001]: Performance Measurement & Balanced Scorecard. Verlag Franz Wahlen, München [2001].

Klingebiel, N. [2000]: Integriertes Performance Measurement. Wiesbaden, 2000.

Kolk, A.; Mauser, A. [2002]: The evolution of environmental management: From stage models to performance evaluation. Business Strategy and the Environment, 11, p. 14-31. 2002.

Kósi Kálmán et al. [1997]: Auditálás, menedzsment rendszerek. Közgazdasági és Jogi Könyvkiadó, Budapest, 1997.

Kovács Eszter [2000]: A környezeti jelentések szerepe a vállalatok környezeti és társadalmi felelősségének előmozdításában. Ph.D. értekezés, BKÁE, Budapest, 2000.

Kuisma, M.; Lovio, R.; Niskanen, S. [2001]: Hypoteeseja ympaeristöjaerjestelmien vaikutuksista teollisuusyrityksissae (Hypotheses on the impact of environmental management systems on industry). Ympaeristöministeriö, Helsinki, 2001.

Lober, D. [1996]: Evaluating the environmental performance of corporations. Journal of Managerial Issues, 8(2), p. 184-205., 1996.

Lomborg, B. [2001]: The Skeptical Environmentalist - Measuring the Real State of the World. Cambridge University Press, 2001.

Lynch, R.; Cross, K. [1995]: Measure Up! Yardsticks for continuous improvement. Cambridge, 1995.

Malorny, C. [1996]: TQM umsetzen. Der Weg zur Business Excellence. Stuttgart, 1996.

Marshall, R.S.; Brown, D. [2003]: Corporate environmental reporting: What's in a metric? Business Strategy and the Environment, Mar-Apr 2003, 12, 2, p. 87-106.

Mauser, A. [2001]: The greening of business - Environmental management and performance evaluation: an empirical study in the dutch dairy industry. Delft, 2001.

MAVESZ [2002]: Hungarian Chemical Industry 2001/2002. Magyar Vegyipari Szövetség, Budapest, 2002.

Meadows, D.; Meadows, D.; Randers, J.; Behrens, W. [1972]: The limits to growth - A report for the Club of Rome's project on the predicament of mankind. Universe Books, New York, 1972.

Mearns, K.; Havold, J.I. [2003]: Occupational health and safety and the balaneced scorecard. The TQM Magazine, 15,6, p.408-423., 2003.

Miles, M., P.; Russell, G., R. [1997]: IS0 14000 Total Quality Environmental Management: The Integration of Environmental Marketing, Total Quality Management, and Corporate Environmental Policy. Journal of Quality Management, 1997, Vol. 2, No. 1, p. 15 l-168.

Miles, M.B.; Huberman, A.M. [1994]: Qualitative data analysis: An expanded sourcebook. Sage. Thousand Oaks, London, New Delhi, 1994.

Moll János [1993]: Teljesítmény-menedzsment. VOSZ Vállalkozói Alapítvány, BKE Kisvállalkozás-kutató csoport, Budapest, 1993.

Montabon, F.; Melnyk, S.A.; Sroufe, R.; Calantone, R.J. [2000]: ISO 14000: Assessing its perceived impact on corporate performance. Journal of Supply Chain Management. Spring 2000. Vol. 36, Iss. 2, p.4-16.

Nemcsicsné Zsóka Ágnes [2005]: Következetesség és rések a környezettudatos szervezeti magatartásban. Ph.D. értekezés, Budapesti Corvinus Egyetem, Budapest, 2005.

OECD [2000]: Environmental performance reviews - Hungary. OECD Publications, Paris, 2000.

OECD [2001]: Environmental performance reviews - Achievements in OECD countries. OECD Publications, Paris, 2001.

Palmer, K., Oates, W.E., Portney, P.R. [1995]: Tightening Environmental Standards: The Benefit-Cost or the No-Cost Paradigm? Journal of Economic Perspectives, 9, 4, p. 119-132., 1995

Pál Gabriella et al. [2004]: Magyarország üvegházgáz kibocsátásainak előrejelzése 2012-ig a jelentős kibocsátó ágazatok közgazdasági kutatása alapján. BKÁE, Regionális Energiagazdasági Kutatóközpont, Budapest, 2004.

Pataki György; Radácsi László [1997]: A magyar iparvállalatok környezeti orientációja. MTA Stratégiai Kutatások, Zöld Belépő sorozat, Budapest, 1997.

Pataki György [2002]: A magyarországi iparvállalatok környezetvédelmi teljesítménye. In: Chikán Attila et al.: Vállalati versenyképesség a globalizálódó magyar gazdaságban. Akadémiai Kiadó, Budapest, 2002.

Pearce, D. [1993]: Blueprint 3, Measuring sustainable development. London, 1993.

Podmaniczky László [2006]: Harangozó Gábor: "A környezeti teljesítmény mint a vállalati teljesítmény része" című PhD értekezés tervezetének bírálata. Gödöllő, 2006.

Pollitt, C. [1999]: Performance management and financial management - How to integrate them? OECD working papers, Nr. 19, Paris, 1999.

Porter, M. [1990]: The Competitive Advantage of Nations. Free Press, New York, 1990..

Porter, M. [1998, first edition 1980]: Competitive Strategy - Techniques for Analysing Industries and Competitors. Free Press, New York, 1998.

Porter, M. [1998, first edition 1985]: Competitive Advantage - Creating and Sustaining Superior performance. Free Press, New York, 1998.

Porter, M.; van der Linde, C. [1995a]: Green and Competitive: Ending the Stalemate. Harvard Business Review, Vol. 73, Issue 5, p. 120-133., 1995.

Porter, M.; van der Linde, C. [1995b]: Toward a new Conception of the Environment-Competitiveness Relationship. Journal of Economic Perspectives, 9, 4, p. 97-118.

Rappaport, A. [1998]: Creating Shareholder Value - A Guide for Managers and Investors. The Free Press, New York, 1998.

Reijnders, L. [1998]: The factor X debate: Setting targets for eco-efficiency. Journal of Industrial Ecology, Vol. 2., Nr. 1., p. 13-22., 1998.

Repetto, R.; Austin, D. [2001]: Quantifying the Impact of Corporate Environmental Perfromance on Shareholder Value. Environmental Quality Management, Summer 2001.

Rolstadas, A. (ed.) [1995]: Performance Management A Business Process Benchmarking Approach. Chapman & Hall, London, 1995.

Róth József; Adorján Csaba; Lukács János; Veit József [2002]: Számviteli esettanulmányok. Budapest, 2002.

Russo, M.; Fouts, P. [1997]: A resource-based perspective on corporate environmental performance and profitability. Academy of Management Journal, 40, 3, p. 534-559., 1997.

Sajtos, L.; Mitev, A. [2007]: SPSS kutatási és adatelemzési kézikönyv. Alinea Kiadó, Budapest, 2007.

SAPUZ (Dyllick, T., et al.) [2002]: Leitfaden zur kontinuierlichen Verbesserung von Umweltmanagement und Umweltleistung nach ISO 14001. Schweizerischer Ausschuss für Prüfung und Zertifizierung (SAPUZ). Final draft. Zürich, 2002.

Schaltegger, S.; Dyllick, T. (ed.) [2002]: Nachhaltig managen mit der Balanced Scorecard. Gabler, Wiesbaden, 2002.

Schaltegger, S.; Figge, F. [1997]: Environmental Shareholder Value. Basel, 1997.

Schaltegger, S.; Figge, F. [2000]: Environmental Shareholder Value: Economic Success with Corporate Environmental Management. Eco-Management and Auditing, Mar 2000; 7, 1. p.29-42.

Schaltegger, S.; Müller, K.; Hindrichsen, H. [1996]: Corporate Environmental Accounting. Wiley, Chichester, 1996.

Schaltegger, S.; Sturm, A. [1992]: Kurswechsel. Globale unternehmerische Perspektiven für Enrwicklung und Umwelt. Artemis, München, 1992.

Schaltegger, S.; Sturm, A. [1998]: Eco-Efficiency by Eco-Controlling. On the implementation of EMAS and ISO 14001. VDF, Zürich, 1998.

Schust, G. H. [1994]: Total performance management. Stuttgart, 1994.

Scruggs, L. [2003]: Sustaining abundance - Environmental performance in industrial democracies. Cambridge University Press, 2003.

SNV [2002]: Leitfaden zur kontinuierlichen Verbesserung von Umweltmanagement und Umweltleistung nach ISO 14001. SNV (Schweizerische Normen-Vereinigung), 2002, Winterthur.

Stahlman, V.; Clausen, J. [2000]: Umweltleistung von Unternehmen - Von der Öko-Effizienz zur Öko-Effektivitaet. Gabler, Wiesbaden, 2000.

Szabó László; Szabó Sándor [2001]: A különböző szabályozási alternatívák hatása a villamosenergia-termelők környezeti teljesítményére. Ph.D. értekezés, BKÁE Gazdálkodástudományi Doktori Iskola, Budapest, 2001.

Szintay István [2006]: EFQM alapú értékelés az Észak-magyarországi régió vállalkozásainak mintáján. Vezetéstudomány, Budapest, 2006/37, p.3-20.

Szlávik János [2005]: Fenntartható környezet és erőforrásgazdálkodás, KJK KERSZÖV, Budapest, 2005.

Tóth Gergely [2001]: Környezeti teljesítményértékelés. KÖVET, 2001.

Tóth Gergely [2002]: Vállalatok környezeti teljesítményének értékelése. Ph.D. értekezés. Budapest, 2002.

Tóth Gergely (ed.) [2002-2006]: Ablakon bedobott pénz - Lépések a fenntarthatóság felé I-V. KÖVET-INEM Hungária, 2002-2006.

Tóth Gergely [2006]: Bírálat Harangozó Gábor "A környezeti teljesítmény mint a vállalati teljesítmény része" című disszertáció tervezetéről. Keszthely, 2006.

Tyteca, D. [1994]: On the measurement of environmental performance in firms - literature review and productive efficiency approach; unpublished, idézi Welford, R. et al.: Corporate Environmental Management. Earthscan Publishing, London, 1996.

Tyteca, D.; Callens, I. [1999]: Towards indicators of sustainable development for firms - A productive efficiency perspective. Ecological Economics, 28, 1999, p.41-53.

Valkó László [2003]: Fenntartható/környezetbarát fogyasztás és a magyar lakosság környezeti tudata. BKÁE Környezettudományi Intézet, Budapest, 2003.

Verfaillie, H., A.; Bidwell, R. (WBCSD) [2000]: Measuring Eco-Efficiency - A guide to reporting company performance. 2000.

Walley, N.; Whitehead, B. [1994]: It's Not Easy Being Green. Harvard Business Review, May-June 1994, p. 46-52.

WBCSD [1996]: Eco-Efficient Leadership - For Improved Economic and Environmental Performance. 1996.

WBCSD, UNEP [1996]: Eco-Efficiency and Cleaner Production - Charting the Course to Sustainability. 1996.

Wehrmeyer, W. [1993]: The scientific measurement of environmental performance - EM & EARN Seminar, Environmental performance measurement and reporting. University of Wolverhampton, August, 1993.

Weizsäcker, E., U., von; Lovins, A., B.; Lovins, L., H. [1995]: Faktor Vier – Doppelter Wohlstand – halbierter Naturverbrauch – Der neue Bericht an den Club of Rome. Droemer Knaur, München, 1995.

Welford, R. et al. [1996]: Corporate Environmental Management. Earthscan Publishing, London, 1996.

Welford, R.; Gouldson, A. [1993]: Environmental Management and Business Strategy. Pitman Publishing, London, 1993.

Whittaker, M.; Kiernan, M. [no year indicated]: Environmental Performance in Industry: Hidden Risks and Value Potential for Strategic Investors. Innovest Strategic Value Advisors, Canada.

Wimmer Ágnes [2001]: A vállalati teljesítmény jellemzői. Vezetéstudomány, 32/2. 2002, p. 2-10.

Wimmer Ágnes [2002]: Az üzleti teljesítmény mérése és menedzsmentje. Budapest, 2002.

Wunderlin, G. [1999]: Performance Management. Schesslitz, 1999.

Yin, R.K. [1994]: Case study research: Design and methods. Sage. Thousand Oaks, London, New Delhi, 1994.

Young, C. [1996]: Measuring Environmental Performance. In: Welford, R. et al.: Corporate Environmental Management. Earthscan Publishing, London, 1996.

Zilahy Gyula [2000]: A szervezeti tagok motivációjának a szerepe az „energiahatékonysági rés" kialakulásában. Ph.D. értekezés, BKÁE, Budapest, 2000.

2000. C. act on accounting.

11 Publications of the author related to research field

1. Harangozó Gábor [elfogadva, megjelenés alatt]: Mitől zöld egy vállalat – avagy mit is jelent a jó környezeti teljesítmény? Vezetéstudomány.
2. Harangozó Gábor [elfogadva, megjelenés alatt]: A környezeti teljesítményértékelés módszerei. Vezetéstudomány.
3. Harangozó Gábor [2005]: Lehetőségek a környezeti menedzsment és a vállalatirányítás különböző területeinek integrálására. p. 185-206. in: Környezeti nézőpontok - Tanulmányok a Környezetgazdaságtani és Technológiai Tanszék 15 éves fennállása alkalmából. Pp. 232, Aula kiadó, Budapest. ISBN: 963 9585 548.
4. Harangozó Gábor [2004]: A környezeti tájékoztatás önkéntes formái. p. 45-71. in: Csapó Orsolya, Harangozó Gábor, Kiszela Gergő, Sándor Csaba (szerk.) [2004]: Kötelező és önkéntes környezeti tájékoztatás, különös tekintettel a szennyezéskibocsátásokra, pp. 120. EMLA Környezeti Management és Jog Egyesület, Budapest. ISBN 963 216 616 7.
5. Kerekes, Sándor; Harangozó, Gábor; Nemcsicsné Zsóka, Ágnes; Németh, Patrícia [2003]: Environmental Policy Tools and Firm-level Management Practices. OECD National Report: Hungary, pp. 58, Budapest.
6. Harangozó, Gábor [2003]: The environmental performance of the Hungarian chemical industry in the last 10 years. The Environmental Economics, Policy and International Environmental Relations: Focus on Visegrad Group Countries Conference Proceedings, p.67-78., Prague.
7. Harangozó Gábor [2003]: A Felelős Gondoskodás program mint önkéntes iparági környezetvédelmi kezdeményezés a vegyiparban. Műhelytanulmány, Budapesti Közgazdasági és Államigazgatási Egyetem, Környezettudományi Intézet, pp. 63. Budapest.
8. Harangozó Gábor [2002]: A magyar vegyipar környezetvédelmi helyzete és környezeti menedzsmentjének változása. Műhelytanulmány, p. 38-67., in: Fonyó Zsolt, Szépvölgyi János, Harangozó Gábor [2002]: A megelőző környezetvédelmi szemlélet térnyerése a hazai vegyiparban. A Budapesti Közgazdasági és Államigazgatási Egyetem Környezettudományi Intézetének tanulmányai, 15.szám, pp. 67. Budapest. ISBN 963 503 292 7, ISSN 1587-6586.