BUDAPEST UNIVERSITY OF ECONOMIC SCIENCES
Business Administration Ph.D. Program

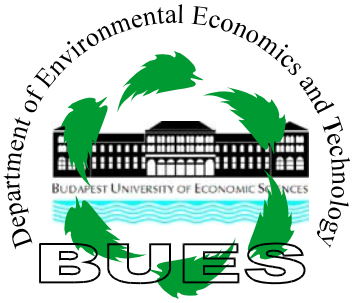
MÁRIA CSUTORA:

The accommodation region

- the missing link in understanding environmental strategies

PhD Dissertation

1998



Tutor:

DR. SÁNDOR KEREKES

PROFESSOR, HEAD OF DEPARTMENT

DEPARTMENT OF ENVIRONMENTAL ECONOMICS AND TECHNOLOGY

Foreword

For me, the protection of the environment has never simply been a scientific concern. It is an old attachment going back to childhood when, following the footsteps of my mother, I dreamed of becoming a forestry engineer. For better or worse, my dream was never realized and yet, by a twist of fate, the forest and the environmental movement led me on a long journey investigating the economic aspects of environmental protection.

The excitement that goes with research and creative work acted as an additional impetus. I managed to combine these two commitments when I started to research and teach environmental economics at the Budapest Technical University, and later at the University of Economics.

The obligation of writing a thesis goes with a career in research and teaching. Following the thrill of conceptualizing my topic, giving it a final shape proved to be a daunting task and I hungered for large doses of encouragement and support to finish the work you now hold in your hands. Accompanied by acute labor-pains, at the end, the paper was completed at a furious pace. To a great extent this was made possible by a Rochester Institute of Technology grant, for which I am deeply grateful to Professor John Morelli.

I thank many people who contributed to the birth of this work. My husband's patience and encouragement was indispensable to its success. I owe many thanks to Professor Arpad von Lazar whose assistance took me to Fletcher School in Boston, where I was able to work in the libraries of such renowned universities as Harvard, Tufts and MIT. Even more important, I had three uninterrupted months to conduct research laying the foundations of my thesis. I thank Kate Kershaw for her help and inspiration during that period. My colleagues, especially Ágnes Zsóka and András Sugár, also deserve my gratitude for their invaluable advice. I thank Professor Kindler for suggesting the term "accommodation region" to denote my concept. The credit goes to Adrienn Éda Pósvai for the painstaking editing and correction of the manuscript. Although I presented László Mészöly, our computer specialist, with innumerable problems, he always came up with the right solution. My thanks go to Mrs. Szuhay for her logistical help, and my colleague József Brisztriczky for his useful advice. I'd would also like to mention my mother, who is probably the most pleased with this paper.

Finally, for a host of reasons I owe many thanks to my head of department and teacher, Sándor Kerekes, who would often believe in me when I had already lost faith in myself, and to whom I dedicate this paper. In word or in thought, whenever I write, he is always there, somewhere in the background.

August, 1998, Budapest

CONTENTS

1. Introduction

A major focus in the current environmental management literature stream is the question whether and when the necessity of environmental protection represents threat or opportunity to companies and consequently what kind of strategies companies have to follow in order to survive in the long run and increase profit. In the first chapter I am going to overview the theoretical approaches developed to answer this question and summarise empirical results gained in this filed. The focus is put on what kind of strategy should be recommended to different types of companies.

"Win-win" type answers advocate the presence of simultaneous economic and environmental benefits for companies. Improving environmental performance can be a means of profit increase. Another approach deals with environmental responsibility as one of the limiting factors a company must to keep in mind if it wants to survive in the long run. Companies are suggested complying with but not doing more than what is required by the law or the society. Besides these one-dimensional answers a group of academics offers situation dependent answers. These are founded on identification of strategic factors and suggest different strategies to companies with different natures.

Besides outlining the relevant literature I am going to summarise empirical findings to answer the above listed questions. Unfortunately most of the empirical results are inconclusive about judging the validity of competing theories and sometimes they are even misleading.

In the next chapter I will show that deficiencies are partly due to the improper inclusion of companies into categories of environmental strategies and partly to the difficulties in the comparison of environmental performance of different companies`. Mostly only multinational and large companies have the chance to get the label "proactive" or "offensive" as the categories are based on indicators (innovation, product development, development of the environmental

management system, etc.) that only the largest have the chance to comply with. “The large is beautiful” according to the literature. There are not good sounding categories formulated that would take into account the capabilities of SME’s.

There are not reliable physical measures of environmental performance based on easy to collect data available at the moment. Different measures of environmental management systems, environmental investments or pollution are used instead. These lead to different results. The EMS measures devaluate technological measures taken by companies, environmental investments based measures ignore the success of those investments, etc.

These difficulties drive my attention to the reformulation of the definition of good, adequate and bad environmental performance and also the classifications of the widely used categories of environmental strategies based on new definitions.

I introduce the term “accommodation region” that represents the socially required strength of environmental response of companies. On the other hand it shows the required environmental management response as a function of environmental risks and pressures related to the activity of companies. Only the companies above the accommodation region can be labelled as good or offensive in environmental sense.

This concept has the advantages of:

- Showing EMS response and technological measures on one picture, thus allow us to base our judgement on different types of environmental response. It takes account EMS, cleaner production and end-of-pipe responses simultaneously.
- The concept helps us to compare the performance of companies with different size, level of pollution or cultural background. It takes into account the different nature of companies not expecting all of them to meet the same environmental requirements.

Using this concept the introducing question of the dissertation can be rewritten as follows:

Are the above accommodation region companies more successful or less successful in economic terms or are the two things uncorrelated with each other?

I show that most of the strategic categories formalised in the literature can be rewritten and used by the help of the accommodation region, while assignment of the companies into the strategic categories might change. This change makes the already existing categories more meaningful.

In the second part of the paper I am going to outline the framework for the empirical survey. The survey has the aim to show how the accommodation region concept can be used to explain the behaviour of Hungarian companies and the factors influencing their environmental strategies. Hypotheses will be worded about the existence and characteristics of the accommodation region. They include hypothesis about the factors influencing the shape of the region, the economic situation on bellow the region companies, the alternative nature of EMS based and technology based environmental strategies, etc. Multivariate regression and cluster analysis are applied and special attention is paid to the outliers.

The second part of the dissertation then describes the results of the empirical survey.

2. Overview of current state of environmental management research - major problems

The international research of environmental management has nowadays at least seven different lines which deal with somewhat different but interrelated issues.

The *"stages of environmental management"* line has a focus on the identification of different stages a company can go through until an ideal level of environmental awareness is reached. (See for example Hurt-Auster's five stages or the ROAST stages developed by Welford) The measurability of the company's position was also surveyed.

Those interested in *"environmental performance and competitiveness of firms"* ask the question, whether companies with better environmental records are more successful in economic terms or not (Porter (1995), Palmer, Oates and Portney (1995). One group of authors regards environmental protection as an opportunity for expending markets while others prefer to consider it as a threat.

The *"environmental strategies"* literature concentrates on driving forces influencing the environmental strategies companies should choose as well as the identification of different types of environmental strategies. This line shows up recently a fast development. (See Steger (1993), Kerekes et al. (1995) or for a good summary Welford (1996).

A group of authors sees the expected environmental performance from an ethical rather than an economic viewpoint and emphasise *"social accountability"* of firms. It is interesting that they still ask whether environmental conscientious firms are more profitable than the other ones.

All of the above mentioned approaches are struggling with a measurement problem of environmental performance. The root of the different answers for some questions can be found many times in the different and improper

measurability of company's environmental performance. This very striking issue is the research topic of the *"environmental performance measures"* branch.

All of the above mentioned lines can be broadened by inclusion of additional aspects of sustainability not just environmental protection. These aspects may embrace local employment issues, safety issues, human rights etc. Sometimes these aspects conflict with each other. For example automation comes together with less pollution but works against local employment. We have to simultaneously consider these issues otherwise we evaluate companies' performance in a narrow minded way. Although this *„sustainability approach"* is now handled as one separate line of environmental management I expect that in its further stage it would break into branches along the above mentioned issues.

Finally the efficiency and spread of different *environmental management tools* is always under supervision by researchers. These include EMS, environmental reporting, environmental audits, etc.

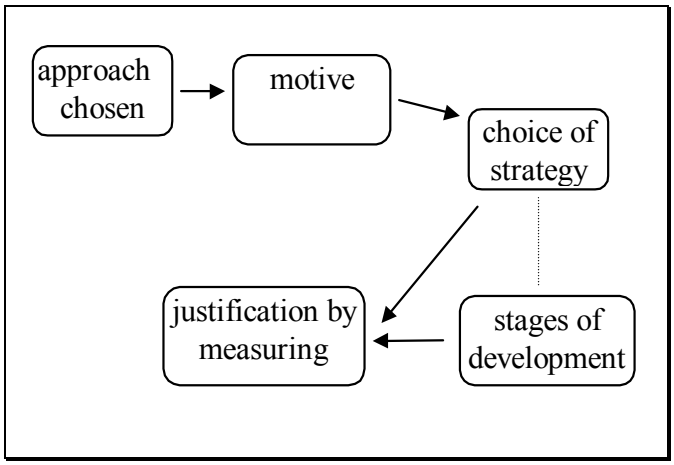
The 2-1 table and chart illustrate the interrelationship among the different lines of research.

Table: 2.1-1. Lines of environmental management research

Approach	**Motive for environmental protection**	**Role of the environmental responsibility**	**Strategy of economic success**	**Effect of environmental excellence**
Competitiveness	a) Profit (market opportunity)	Might increase profit through cost savings or finding new markets	Environmental excellence including going beyond compliance	Increase profitability
	b) Threat from the authorities or the society	Limiting factor that must be considered in order to survive	Compliance	Decrease profitability
Social accountability	a)Ethics	Ethical obligation	Operate ethically beyond the requirement of the law	Increase profitability
	b)Ethics	Personal aim of company owners or managers	Compliance with laws, but profit is not the final aim	Decrease profitability
Environmental	Profit or threat	Opportunity or threat depending	Situational factors determine the	Overreaction or lagging behind the

Approach	Motive for environmental protection	Role of the environmental responsibility	Strategy of economic success	Effect of environmental excellence
strategies		on situational factors	„best strategy" that must be followed	„best strategy" result in less profit

Illus. 2.1-1: Links of research lines



There are two strange things I must mention after studying the literature:

- The development of the „stages" line is completely independent from the development of the „environmental strategies" literature. This is strange a bit as we could assume that the „environmental stages" literature describes how companies can develop until they accomplish the environmental strategy chosen. It seems, however, that „environmental stages" actually describes different environmental strategies or the authors assume that all companies have to go through all stages until they reach the highest ranked stage and timing is the only difference among companies. This is not only my feeling. Welford (1996) does not either differentiate between „environmental stages" and „environmental strategies" as described in the literature. He deals with them as competitive ideas rather than supplementary ones.

  There are only two differences. First, the strategies literature always says something about the factors forming the strategies the „stages" line not necessarily does so. Second, the „environmental stages" line assumes that the

highest ranked or „best" stage must be sooner or later achieved by each company. This is not a expectation in the „environmental stages" line.

- The competitiveness approach should actually be handled as a kind of one dimensional strategic approach. The strategic literature finds the answer to the question: which is the best strategy to follow in order to make the business more profitable or to keep it sustainable. The „competitiveness" research answers this question in a simply way: the more environmental friendly is the more profitable or on the contrary, the less environmental friendly is the more profitable.

Although the relationship between competitiveness and the companies` environmental strategies was among the most earliest research areas of the environmental business management issues, by this day research has a tremendous debt concerning the question. The next chapter overviews the major issues revealing in current publications, reflects the problems and deficiencies involved and at the same time makes an attempt toward drafting the fields of future research needs.

At first the major questions in these fields will be discussed.

Whether environmental programs initiated by companies support companies` competitiveness or deter it? Whether the companies judge environmental protection as a threat, an opportunity, a responsibility or an irrelevant side-issue and how should they regard it? (Corbett and Wassenhove, 1993) These questions raised recently the most debate among the most eminent researchers of management and economics.

Several aspects can classify the papers concerned:

- descriptive or normative focus
- looking for general one dimensional answers or consider the situation dependence of the question (two or multidimensional answer)

The purpose of this paper is best supported by the latter classification while I will always give notations to other aspects.

In the following section I am going to give an overview of the strategic literature starting from the one dimensional approaches and advancing toward the more sophisticated ones. The purpose of the section is to show the current status of the research, theoretical as well as empirical research, and highlight some problems that hinder the further development of research.

2.1 The one dimensional „win-win" approach

Some of the papers consider environmental protection an opportunity for companies, while others argue that it is a threat or a pressure on them. No descriptive survey argues that majority of the companies actually regards environmental protection as an opportunity and they behave voluntary to protect the environment and promote their competitiveness at the same time. Even those authors who encourage companies to do so agree that enterprises recently deal with environmental issues as a threat rather than an opportunity (see Porter, 1995 or Cairncross, 1991).

Several authors, however, argue that a number of companies definitely have advantage from the environmental era and moreover, it could be an opportunity for most of the companies. The normative literature of this stream is very broad. A lot of researchers do not even raise the question; rather they handle the environment-as-opportunity as a matter of fact. They give practical advice to use this opportunity. Anecdotal evidence is given to show the environmental requirements of consumers and suppliers, but without statistical proof of its significance. The study of this stream is beyond the scope of this paper.

Porter and ***van der Linde*** (1991, 1995) have related the question of company environmental performance to the ***question of quality***. Porter argues that harmful emissions can be regarded as a waste of resources so by reducing pollution and promoting recourse efficiency ***competitiveness will actually increase***. This pay-off is realised through less waste disposal and compliance costs as well as reduced resource costs and litigation. It means that pollution should be prevented rather than dealt with once it occurred. Competitiveness and environmental goals could be supportive in most cases. Less waste, increased product value involving less

risk will be favourable for both companies and consumers. ***Resource efficiency and innovation*** together with ***competitiveness*** are the landmarks of his views. They gathered a large number of case studies to prove that environmental protection projects can pay off.

They argue that innovation and pollution prevention oriented environmental management can actually help competitiveness at national level, as well as at the level of companies. The trade-off between environmental protection and economic performance is not necessary, in fact the efficiency gains from environmental protection are the rule, even though they are overlooked by most companies at this moment.

Nations with more stringent environmental requirements are more competitive than countries with lax ones. This is the case when the effective regulations of emission levels result in innovation which 'addresses environmental impacts while simultaneously improving the affected product itself and/or related process'[1] so it pays off.

Greeno[2] has an interesting point. He argues that industry historically adjusted to the cost of environmental regulations by price adjustments. Those companies achieving superior efficiency compared to their competitors can improve their ***cost structure*** and find themselves in the classical win-win situation.

This concept became very widespread during the last couple of years under the title "pollution prevention" or "cleaner production". The UNEP, UNIDO, OECD and EU all promote the concept as a more efficient way of pollution control that actually pays off. [3] Demonstration projects of the UNIDO (see for example UNIDO 1995) show that cleaner production can pay back. Still it is true that

---

[1] Porter - van der Linde, 1995, p.100.

[2] in: „The Challenge of going green" 1994

[3] OECD (1992) gives the following definition: „cleaner production is meant to reduce the amounts of energy and raw materials based on natural resources needed to produce, market and use products. At the same time production, marketing and disposal of these products should also be such that releases of potentially harmful contaminants to environmental media are kept as low as possible." (p.4.)

companies tend to adopt the low or no cost housekeeping options while costly technological adjustments are not so popular.

Product differentiation is also a frequently mentioned opportunity. The demand of consumers for greener products and requirement from the side of suppliers can be an encouraging factor to develop these products (see, for example Cairncross, 1991). Green consumerism can be regarded as a

In summary representatives of the opportunity stream support the existence of Sustainability strategies with the following meaning:

> „Sustainability strategies are not compromise strategies; they are not designed merely to earn a profit while doing as little damage as possible to the ecosystem. Rather, they are integrative strategies; they provide competitive advantages to organisations by simultaneously enhancing the quality of the ecosystem and the long-term survivability of the firm." (Stead&Stead, 1992, 172.p.)

2.2 The „limiting factor" approach

A group of researchers argues that win-win solutions, though can be found in certain cases, are not the rule, rather the exemptions. „Fear, not greed has driven most environmental policies [of companies]." (Cairncross in The Challenge of Going Green, 1994.) This stream started as a response to the `over-optimistic` environmental opportunity literature. Certain authors (see, e.g., Walley and Whitehead or The Challenge of Going Green, 1994) felt to be terrified by the possible overestimation of opportunities in going green and expressed serious fears about its impacts like possible unfounded expectations of policy makers. Such expectation could lead to very strict regulations, increase in production costs, competitiveness loss and even slow down of growth. These fears even increased after the publication of the politician Al Gore`s book who shared the opportunity approach, as well..

Walley and Whitehead express their doubt about the idea that 'environmental initiatives would systematically increase profitability.' They do not argue that win-win solutions do exist, but they think they are very rare, they are not the rule, rather the exemptions. Trade-off between environmental and economic goals does exist when all the low hanging fruit has already been picked. Stricter

environmental regulations would result in excess costs and competitiveness losses. If we cannot get something for nothing, ***companies should rather concentrate on cost-effective methods to achieve the required environmental objectives***. Going beyond compliance will not pay in most cases.

However, the increase of direct abatement and operational costs is not the only threat the companies have to face.

In the US companies can be held liable for environmental and health damages even when they were in compliance with all the legislation and they did not even know about the hazards of their products. The consequence is that 'managers must well beyond appearances, union demands and the letter of law. They must anticipate and lead the drive to head off environmental hazards and risks.' (Sells, 1994, 76.p.)

Environmental protection was always a costly matter, and becoming more and more costly with little pay-back. Even the gains from certain successful environmental projects are overshadowed by the total environmental costs of the same company (Walley and Whitehead, 1994.) The authors also raise the lack of empirical evidence for the innovation stimulating effect of environmental regulation. (Stavins in The Challenge of Going Green, 1994.) Palmer, Oates and Portney (1995) interviewed the companies which Porter and van der Linde mentioned as positive examples of economic opportunities in environmental protection. They found that although environmental projects listed by Porter and van der Linde were economical, environmental protection as a whole was very costly even in these companies and pay-off was far more not realised.

The suggested strategy based on the threat stream is that companies search for cost efficient solutions instead of initiating costly environmental programs with unfounded hopes for pay off. They ***should do what needs to be done to ensure a company's existence in the long run and it should has to be done as cheaply as possible***. That is the environmental strategy of companies should be in most cases a reactive one to the legislation and social expectations.

2.3 Environmental protection as social responsibility

The social responsibility stream regards environmental protection as a part of the broader social responsibility obligation of companies. It means that it is out of true business considerations, does not necessarily need justification from a business point of view (not necessarily opportunity) nor from the viewpoint of legal enforcement (not necessarily threat). It can be part of the companies` broader culture. They are doing it just because it is the right thing to do.

To find the responsible or right way of doing business we have to find an answer to a broader question. Which direction goes the world specially in the judgement of value of environment? If there is only a temporally revaluation of its importance, then a short term cost benefit analysis can be applied and the short term returns of environmental progress have to be compared to the costs of them. This can cause a fall in environmental initiatives after the former enthusiasm had gone because of the steeply rising costs of further environmental investments. However, if we calculate that the environmental issue will find its roots in the society's value system and will become a part of our culture, then there is no way to go backward. Companies have to accommodate themselves to the long term trends in the social values or they will remain no viable. Most of the authors agree that the demand for a cleaner environment and the strengthening of environmental requirements is „not a cyclical or temporally phenomenon, but rather a consequence of more permanent socio-historical change." (Mc. Graw, p. 18. in Smith, 1993). In this respect it is not possible to declare whether a company is ethically driven or it is just a long term thinker concentrating on mere business that regards environment as a success factor in the long run.

Besides stating what companies' social responsibility should involve, the responsibility literature is still dealing with the question whether the more responsible companies are financially better than the not responsible ones. A number of studies prove the positive relationship and in response a number of studies demonstrate a negative correlation. One study even found that companies with typical behaviour were the most successful in financial terms while neither the most nor the least responsible ones were really successful. (Aupperle et al.

1985) Most of the surveys lacked significance analysis for the stated relationship and struggled with other methodological problems. By this time no reliable study could find any significant relationship between social and financial performance of companies.

As the social performance literature embraces a much broader field than environmental protection and is struggling with even more serious problems in definition and measuring than the environmental management literature does, it would not give additional insight into the topics of our study. For this reason I will not deal with it in more details in the following. Another reason for this neglecting is that the stream of this literature, with most attention to environmental protection, concentrates on the relationship of financial and social performance. It can be channelled into the previous first topics. A number of surveys were conducted to ask companies about this issues which offer different answers to this question.

Surveys in the seventies (see Abott and Monser) and in the eighties (see Aupperle) found not conclusive relationship between environmental and financial performance. Several surveys carried out in the 1990s have found a positive relationship, see White (1995). In my opinion; however; a possible correlation between environmental responsibility and good financial performance can be simply due to the fact that only companies with good financial performance can afford to be green. Environmental responsibility is not necessarily an explanation for good financial performance.

Maucher (1993) argues that his company, Nestle, was socially responsible and it could behave in a responsible way because it could afford it despite the cost increase. The cost increase due to environmental protection was offset by productivity gains from other sources.

> „My basic objection to these fundamentalists is that they do not take the cause of environmental protection seriously enough. For if they did, they could not escape the conclusion that, as in any other large-scale human undertaking, it is necessary to weigh

costs and benefits. No society, no organisation will ever have the means to do everything at once." (10.p.) [4]

2.4 Situation dependent and strategy oriented answers

A few authors do not assume a general answer to the question: what is the most desirable level of environmental initiatives in a certain company. They rather place the environmental strategy into a broader context of general business strategy and they try to find out the best environmental strategy depending on the situation factors and general strategy of companies. The underlying philosophy is that „more than one pattern of environmental behaviour can be successful in the long run" (Azzone et al, 1997).

Within this stream different concepts were developed depending on:

- What factors are considered to have major influence on the situation of company related to environmental protection?
- What kind of strategy is suggested for companies depending on their situation?

---

[4] The environmental issue resembles much the history of the issue of employer safety questions that were also considered as part of companies' social responsibilities. However, safety issue has a longer history and is more deeply built in by now into the culture than environmental issues. It is interesting to see that some 40 or 50 years ago problems raised in relation to safety are quite similar to questions raised now in relation to environmental issues: responsibility, the possibility of pay-off in efficiency and the necessity for a new approach. That time about 40 percent of industrial workers have received some kind of health protection in the US. Clark and Ewing (1950) state that employee that 'many thoughtful executives have felt that industry has a certain moral responsibility for the well-being of individual workers.' (109.p.) He also states that although health and safety programs saved a lot of money for families, the results in stepping up efficiency have not been very rewarding. However, the measurement of success of these programs was not satisfactory. It counted only the days away from work but neglected the productivity loss due to the fact that workers are unable to work at normal efficiency. He argued that not only more health programs were needed, but also better ones and an entirely new approach. Although the proper level of health is safety is also a question that is not question whether we can go back to the level we were 50 years ago if it supports economic efficiency.

Some regard environmental protection as different degree of threat or opportunity depending on the environmental burden the company's operation causes and the market opportunity of company's products. This approach pays attention to the different situation that different industries have to face. Instead of generalised solutions it offers different strategies depending on the special situations of a certain company. This approach was initiated by German researchers, Steger, Wicke and Meffert are among the most eminent representatives.

Steger considered environmental risks from corporate operation and the market opportunity of product as the two major factors that influence the importance of environmental issues in the life of company and also the choice of most preferable strategy (See Illus. 2.4-1.). Low risk and low opportunity mean that environmental problems have no much relevance to the company's activity thus environment is not a strategic issue. Companies with high market opportunities can market environmental sound products, while companies with high risk tend to react defensively, concentrating on legal obligations. The most challenging situation is associated with high risks and high opportunities, where innovations of technology to reduce risks and innovations of environmental sound products have field at the same time.

For example, a coal based power station, those product - electricity - cannot be even differentiated from the product of other power stations, cannot see many opportunities in environmental production. An example for a low risk, high opportunity industry can be the cosmetics industry. It can be characterised with high opportunity to operate offensively.

Defensive environmental strategy can be characterised by:

- not meeting the legal requirements (or meeting them but not going beyond)
- end-of-the-pipe methods
- waste management means no more than waste treatment
- defensive marketing through denying or underrating environmental risks, etc.

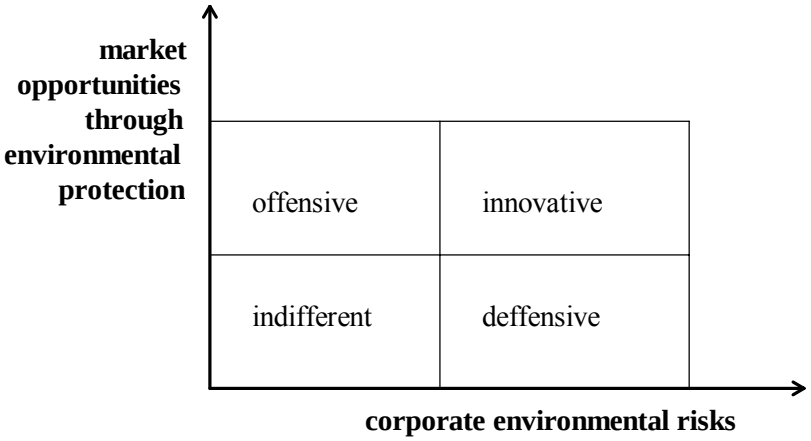
Offensive companies:

- go beyond compliance
- reduce wastes
- follow the development of environmental policy and environmental technologies
- develop environmentally benign products
- communicate their results to the public

Innovative companies:

- use innovation to improve their market position
- they prefer cleaner technologies to the end-of-the-pipe ones.[5]

Illus. 2.4-1: Strategies based on Market Opportunities and Environmental Risks[6]



Meffert and Hopfenbeck prefer spotting environmental strategic possibilities as a function of threats and opportunities instead of risks and opportunities. Hopfenbeck suggests the following strategies for different groups of companies:

For those companies combining low environmental threat with low advantages of environmental oriented business management:

- It is better to wait for further developments.

[5] after Gottlieb (1991)

[6] Source: Steger (1993, 151.p.)

For those involving high threats and no major advantage:

- Withdraw from the environmental market sector or improve environmental performance, although no advantage to be gained. Cost minimisation of environmental management can be an important goal for this group.

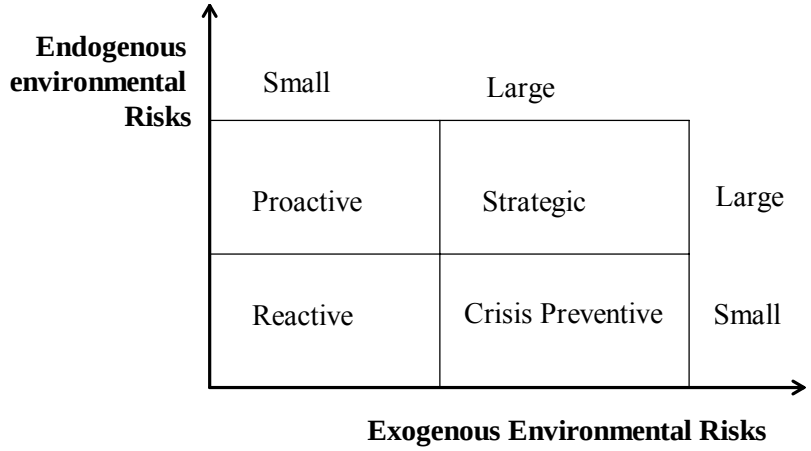
For the high threat and high advantage group:

- Innovation in communicative policy, concentration through specialisation on lucrative areas of environmental protection markets.

The above mentioned authors do not list cost savings from reduced resource use and waste disposal as opportunity. Opportunities rather come from market opportunities, marketing of environmental services, technologies or environmental sound products. Their position is different from that of Porter who thought opportunities would stem from savings due to better resource efficiency while regarded environmental market opportunities as of only marginal importance.

Kerekes et al. (1995) think that the primary criterion for designing an appropriate environmental strategy should be the company's ability to manage its environmental risks. They analysed environmental risks in two dimensions. One dimension involved the internal operation of the company, e.g., materials, technologies. Exogenous environmental risks, the other dimension, are determined by the external world of the company: location, community, ecological characteristics, etc. The environmental management strategy to be chosen should be in accordance with the level of this risk.

Illus. 2.4-2: Exogenous and endogenous environmental risks



If both exogenous and endogenous risks are at low level, no extraordinary precaution is needed. Environmental management calls merely for complying with regulations and responsibility thus it can be delegated to middle level management. (reactive strategy).

Companies that are highly polluting ones and operating in a sensitive external environment should adopt a strategic approach. For them environmental management has a strategic importance and should have representation at the highest level of the organisation.

Companies with unsafe environmental operation but good location, that is not high environmental consequences of their operation, should be proactive. Environmental management should anticipate environmental regulation. Responsibility is highly centralised at the level of plant with the dangerous operation.

Companies with low but highly visible pollution should devote large effort in public education to prevent crisis.

Azzone et al (1997) identified four variables that influence the sustainability of different environmental strategies: the company's environmental culture, its strategic attitude, the available infrastructural resources and the employees' 'green' competencies. Four patterns of environmental behaviour are identified based on the companies' strategic focus (market vs. regulation) and their strategic attitude (re-act or „gamble").

Companies with a passive, lobbying-based environmental strategy try to delay the introduction of more binding regulations and/or the evolution of market expectations. According to the authors this strategy is usually adopted by companies with limited key human resource and equipment or with high sunk costs derived from the introduction of past investments. They may be large corporations introducing significant, environment-based investments or small firms with a compliance-based attitude.

Re-active environmental strategy mainly involves reactions to external stimuli coming from 'green' movements, authorities or firms operating in other fields. Such a strategy would usually be adopted by managers with a compliance based attitude or by companies with low environmental awareness among employees. It is widespread among small firms with limited resources and among companies with low environmental risks.

Roome's Strategic Options Model identifies three driving forces including the environmental pressures (e.g. legislation pressure), constraints within the firm and the ability of managers to initiate an organisational change. He classifies strategies into five types: non-compliance, compliance, compliance-plus, commercial and environmental excellence and leading edge. The third three strategies express the companies' attitude toward meeting the legislation while the latter two can lead to gain competitive advantage. (Welford (1996))

Other authors did not identified strategic factors. They rather divided companies into environmental stages that are usually ranked in an ascending order and companies operating in the highest ranked environmental stage are labelled as „excellent" or „leaders", etc. Welford's categorisation of small and medium size companies or Topfers categories (resistant, passive, reactive and innovative), Dodge and Welford's ROAST scale or Beaumont's six levels are good examples of this approach. (See: Welford(1996).

The problems of characterisation become evident when we compare the environmental performance of a small company with relatively less developed environmental management system with a large company characterised by sophisticated environmental management system. Those approaches identifying the driving forces of environmental strategies usually do not expect that small firms would build up an EMS with the same level of sophistication the multinationals are characterised by. Smaller firms cause less environmental risks and do less for the environment. We have to live with that.

The „environmental stages" literature, however, often suggests, although not explicitly state, that the more developed environmental management system or environmental strategy a company has the better. (an exception from this rule is

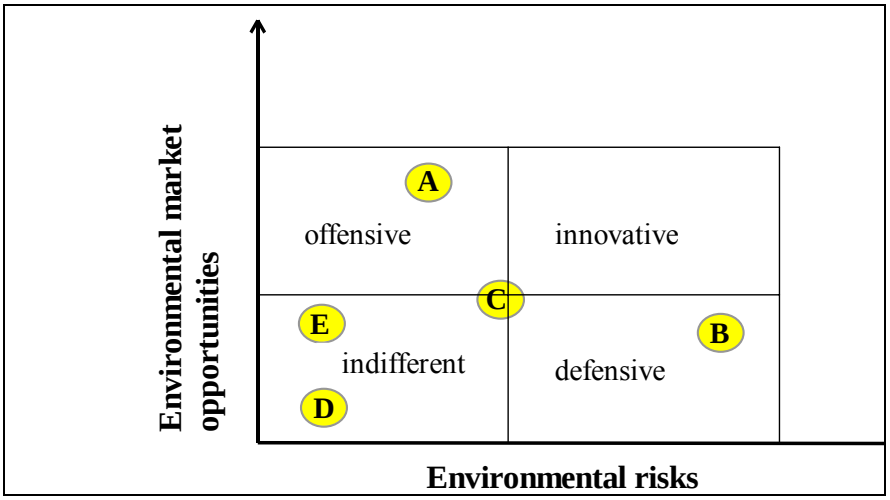
the 10 stages classification of Welford. See Welford (1996). This implicit assumption leads to the conclusion that preferable all the companies should get to the stage of „environmental excellence". This cannot be the case, however, neither in theory nor in practice. The choice of the environmental strategy should be closely related to the choice of the general competitive strategy. A number of companies, for example, can use environmental claims as their „selling point". If everybody behaves the same way, however, then this strategic advantage is gone. There is no competitive advantage in acting the same way the others do. Environmental stages cannot be evaluated in isolation from the environmental strategy the company had chosen. A company has to go through different stages until it finds itself in the stage that corresponds with the environmental strategy it has chosen.

In summary, currently used strategic concepts share the following major deficiencies:

- they do not have the type of common nor required strategy
- neutral strategic categories are missing
- they are not differentiated enough: all companies are assigned into a few strategic categories
- comparison of companies with varying situation is problematic
- they are over-ambitious considering their expectations toward companies
- they are not operational or not standardised

The above mentioned deficiencies will be shown on Steger`s model, which is a widespread and most advanced model.

Illus. 2.4-3: Steger's strategic model



None of the four categories show the common or the required strategy. For example, under what circumstances is a defensive strategy acceptable or even required? Following Steger such circumstances arise when the operation of the company is associated with high environmental risks and low market opportunities. A defensive approach is then not considered bad rather necessary. Description of such kind of strategy involves, however, severely negative elements, such as "non-compliance with environmental laws". Positioning a defensive strategy as not bad strategy contradicts to those elements. It would make more sense the separate a "bad defensive" strategy from a "good defensive" strategy. The first should describe the attitude of non-compliance with legal as well as social expectations. Defensive strategy is not a negative term, however, when it is dictated by circumstances and does not involve non-compliance. The same is true for all of the other strategic categories: e.g. an offensive strategy is not "good" when followed by a company that should rather go for an innovative strategy.

There is no neutral sounding category reserved for those companies that follow a strategy that fits best their circumstances, especially their risks. Offensive or defensive behaviour would become more meaningful from this perspective when it is compared to what is necessary to do.

The number of categories is insufficient and they are not differentiated enough. Border-line situation is not defined. What shall we say for example about the position of company "C" in Illus. 2.4-3.?

Comparison is not offered either within the categories or between them. "E" or "D" does better with the environment? Can we compare the performance of "C" and "E"?

Most of the strategic classifications are somewhat over-ambitious (Steger is an exception). Companies complying with all the laws but doing no more are put into extreme negative categories.

The final problem is a practical one: theoretical concepts are not operational in the practice, or are not standardised. Empirical surveys use survey instruments on a case by case basis so that the results gained are not comparable and the connection to the theoretical concepts is questionable.

2.5 Overview of empirical surveys

The overview of empirical survey results reinforces the bad feeling about the undifferentiated evaluation of companies' environmental performance.

The following table summarises the findings of some selected empirical surveys. The emphasis is put on the identification of factors that influenced the perceived good environmental performance of the companies surveyed. Factor marked with „+" express opportunity rather than threat while those marked with „-„ show that the factor in question is perceived as pressure or threat. Sometimes it depends on the context and the disposition of the researcher how a certain factor is evaluated. These cases bear both signs as „+-„.

Table 2.5-1. Overview of selected empirical surveys

Survey	Better env. performance in case of	Major focus of the survey	Methods used
1. Benchmark	larger company size[7] • (-+)	Current state of	cross-

[7] The impact of company size may be in correlation with the higher environmental risk from larger amount of pollution. Larger companies also have more investment resources

Survey	Better env. performance in case of	Major focus of the survey	Methods used
	extractive industries - finished good industry + stricter regulatory environment - certain regions •[8] better enforcement - risk of litigation -	international corporate environmental management in case of companies with annual sale over USD 1 billion 169 respondent companies	tabulation frequencies
2. Cebon	stricter laws - savings at waste disposal -	the performance of two waste reduction programs at one company (FLECSCOCO)	case study
3. ECOTEC	1.strict legislation - larger company size -+ certain industries • raw material price - energy price - enforcement - local community pressure -	corporate environmental strategies in certain pollution intensive industries, UK, 117 firms	Cross tabulation Frequencies
4. Kerekes	endogenous risk - exogenous risk -	140 companies in Hungary	
5. FUUF	1.long term risk considerationS - 2.cost reduction -+	environmental management at German companies, 592 companies	Cross tabulation Frequencies
6. Hutchinson	manufacturing (opposed to service and primary sectors) • exporter companies -[9]	env. mgment of small and medium sized companies, UK, 240 companies	Frequencies
7. Peattie & Ringler	manufacturers (vs. services)	organisational env.responsiveness, 108 large companies in UK and Germany	Frequencies
8. Patton & Lenaghan	• non-hazardous processes (vs. potentially hazardous processes) • legislation - • cost reduction opportunity +	responsiveness in highly regulated vs. less regulated sectors, 106 firms, Midlands, UK	Frequencies
9. Rappaport (1992)	1. stricter government enforcement - 2. liability - 3. stricter laws / regulations - 4. community opinion -+ 5. customers pressures + 6. high-visibility accidents or releases	environmental management of US based multinational companies, 98 companies, 1992	Frequencies Cross tabulation

and more formal environmental procedures, that is better opportunities, in environmental management. The method used in the survey does not allow to separate these impacts.

[8] Might be in correlation with different regulatory and cultural environment.

[9] Exporters toward countries with stricter legislation

Survey	Better env. performance in case of	Major focus of the survey	Methods used
	to the environment -		
10. Klassen-Whybark	in-plant learning and technology transfer larger firm size - age of the plant equipment public interaction - regulatory awareness -	environmental strategies in the US furniture industry; 83 plants	correlation regression
11. Boda-Pataky	state ownership certain sector of industry (construction, water, electricity and gas service) larger company size	Hungarian companies 325 companies	frequencies cluster analysis
12. Craig Mickle	strict legislation (in Germany) - cost reduction by waste minimisation+ certain sectors	five EU countries 5 sectors 58 companies	Frequencies Cross tabulation
13. Euro-barometer	company size profitability (Norway) foreign companies (Norway) + rlegislation -	607 companies, 5 countries	Frequencies Cross tabulation
14. Florida	modernisation strategy + high R&D spending + product innovation + advanced manufacturing practices stricter environmental regulation corporate citizenship	256 firms in the USA	cluster analysis correlation frequencies

Most of the empirical surveys found that larger companies show more sensitivity toward environmental issues than the smaller ones do. The impact of strict regulation also was identified as a major driving force that fosters the improvement of environmental management. Potential savings in the cost of raw materials, energy or water may have a positive effect, as well. The type of the industry or the activity (e.g. chemical industry or service activity) and in some cases the customers have an impact. Environmental risks are also identified, but they are more or less related to the issues already mentioned. High community pressure and highly visible events are identified as driving forces in some cases.

All the variables listed in the above mentioned surveys can be classified into one of the following categories:

Table 2.5-2: Driving forces of environmental management

Factors	***Associated variables***
Cultural and economic factors:	legislation (including enforcement) and litigation, community pressure
Local environmental risks and pressures:	larger size, high risk industries, accidents, age of equipment, community pressure, internal risk, external risk
Cost saving opportunities:	energy saving, waste disposal savings, energy price, raw material price
Market opportunities or pressures:	consumers' demand, exporting companies
Company strategy	modernisation strategy, product innovation

Certain variables may be associated with different factors. Community pressure can be associated with environmental risks, cultural factors and certain human factors: a powerful environmental NGO leader is likely to have more influence on the companies operating in the region.

Company strategy is a distinct category: it actually influences how companies deal with the other factors. To put in another way: we can draw conclusions on the company strategy by examining how it deals with the four factors of culture, risk, market opportunity and cost saving.

Most of the empirical surveys used very simple statistical techniques thus the major factors for initiating environmental programs can not be unequivocally identified. High level of multicorrelation among the listed factors is most likely. Almost all of the surveys found that larger companies tend to have more developed environmental management systems than smaller ones. The underlying reasons can be, however, quite different. It might be the case that companies actually react to the level of risk they cause. Positive relationship can be found

just because the size of the company and the environmental risk are highly correlated. Rappaport and Flaherty found that when asked about the basis for determining EHS staffing levels, respondents named risk of operation at first place and the strictness of regulatory requirements as second (more than 75 percent each). The number of employees was mentioned only by 25 percent and even less mentioned the production size. Environmental management systems assume the existence of well-defined reporting and sophisticated organisational system and large companies operate in a more formal way while smaller ones tend to be more informal.

Until we do not clear our performance indicators from the effect of such factors like size or risk, we are not able to evaluate and compare the companies' environmental performance in an impartial way.

Kerekes at al. give more in-depth analysis of environmental risks on the company strategy than Steger did in his two dimensional model. Their empirical survey came up with evidence that their environmental strategy categorisation works in the practice as well. They put emphasis on the position of the environmental function within the company's organisational structure and the expected attitude of companies toward environmental issues. Both of them are a function of external and environmental risks. We should not expect eminent performance and high level representation of environmental issues within a firm that works under low level of environmental risks (e.g. small companies).

Florida created a link between environmental strategies and general company strategy in his study. His survey is unique in this respect among the listed ones. He has found positive association between environmental performance and modernisation strategy, high R&D costs, product innovation and state-of-the-art processes. It is also true, however, that all these strategies are most common among large companies. This leads to a problem somewhat similar to that of environmental performance measurement and of the impact of company size on common used performance indicators.

Certain German researchers stress the importance of strict regulation and risks as a major force directing companies toward environmental excellence. Based on the

survey of 592 German manufacturing and service companies Steger (1993) found that:

- ***the motives for environmental protection strongly „based on long-term risk consideration*** - that is, safeguarding of corporate viability - and only secondarily on the exploitation of opportunities for cost reduction and/or revenue increase." (154.p.)
- Companies viewed the current attitudes of consumers as the main factor ***inhibiting*** the further development of environmentally sound products.
- The almost complete identification of corporate environmental protection with ***technical functions.*** „Thus, environmental protection departments, or personal entrusted with environmental tasks, are almost without exception found in the technical divisions." (159.p.)
- „***Defensive and remedial measures*** have predominated in corporate environmental protection." (155.p.)
- In the evaluation of R&D projects the modifications of traditional methods to include environmental aspects were ***regarded as inappropriate***.
- ***Marketing divisions*** gather environmental information mainly ***about the technological development*** and the activities of ***competitors***. Only fifth of the companies gathered data about the consumers' consciousness and requirements.

Steger`s findings are interesting and surprising. The seemingly negative conclusions came from a survey on companies in a country that is a leader in environmental management. It raises the question whether theoretical environmental management literature is realistic or over-ambitious in wording strategic categories and judging the performance of companies „just" meeting legal requirements. ***Meeting legal requirements but not going beyond compliance is not the manner of careless companies, rather that of the typical ones. „Defensive" companies are quite common. Several authors do not even***

create categories for companies that are in non-compliance with legal requirements.[10]

In my opinion strict domestic requirements can raise trade barriers to foreign competition that have to upgrade their environmental performance if they want to market successfully in the aimed country. This upgrading can spill over into other countries with relatively lax regulations and influence the performance of companies there. So competition may enforce a company to meet stricter environmental requirements. ***Companies facing the strictest domestic regulations might seem as only defensively reacting to the regulations at home. Companies in other countries following only their competitors while going beyond the compliance of own looser environmental requirements may seem as proactively and offensively attacking the challenges of the market and consumers***. This picture, however is a misleading one.

It is noteworthy to mention that environmental organisation of Hungarian companies (see Kerekes and Kobjakov, 1994) usually has the same structure as the German ones. At the same time the environmental performance of Hungarian companies is very far from that of German companies. This fact reinforces the impression that ***the environmental management system itself cannot give reliable information about the environmental performance of companies, although proper environmental response does assumes certain system of environmental functions.***

In summary, empirical surveys and the resulting findings share the following deficiencies:

- They are rarely linked to theoretical concepts
- They tend to use simplistic statistical techniques; thus they do not reveal correlation and connection among the variables: e.g. all the risk related

[10] It is interesting to note that ISO14000 an be rewarded to companies not meeting all the laws, only having a program that would ensure compliance.

factors, such as company size or industry type show up as unrelated genuine variables.

- It follows that the methods applied do not allow us to draw final conclusions. Conclusions gained relate to the symptoms rather than to the root cause.
- Misleading findings are quite common. Performance of large companies appears to be better than that of the small ones, although most frequently the higher level of risks explains the sophisticated environmental management system found in large entities.
- The overuse of environmental management based indicators is disputable, because it does not give enough credit to technology related pollution reduction.

I will demonstrate in the following section that environmental performance improvement might result from different approaches. Empirical findings become questionable when one single approach is preferred as performance indicator.

2.6 Different approaches to the improvement of environmental performance

Environmental protection strives to reduce usual or accidental emissions of harmful pollutants during production and to reduce environmental load caused by products in an extent that corresponds with the strategy of the company and meets requirements of the society in the long run. Thus environmental strategy has to address three questions: how far a company should go in improving its environmental performance, which fields or functions need environmental improvement and how this improvement could be achieved.

There are different approaches of improvement in environmental performance. Development of the environmental management system or investment in technological solutions represent two alternatives. Cleaner technologies focusing

on prevention of emission or end-of-pipe technologies are different ways of carrying out technological changes.

There are overlapping areas like good housekeeping that is part of EMS and cleaner production, as well.

Environmental management system focuses on continual improvement and developing a system that assures the intended improvement. Objectives are left to the company.

The environmental management system approach also involves 'good housekeeping' practice that can result in less pollution and less resource use even *without* major investments in end-of-pipe technologies or pollution prevention technologies. Most of the implemented measures tend to be incremental by nature, that is do not necessarily assume major changes in the technology applied. The implementation assumes a top management support, but the responsibility for environmental management has to be spread throughout the company and pushed even to the shop floor. It requires the training and conscientiousness of all employees.

This approach has found the roots in Total Quality Management that also aims at continuos and incremental improvement of operations through the involvement of preferably all interested employees and using their ideas in the process. The aim is not to change the world at once.

EMS has, however, no alternative when we are speaking about the control of accidental risks that are unavoidable. When we do not have possibility to completely eliminate the source of risk then we have to control it. The lack of possibility might be due to the existence of technological alternatives, financial problems or technological lock-ups. ***EMS, like TQM, intends to minimise the risk of deviation from intended operation.*** Especially when operating under high risks, it is important to keep the risks under control.

Cleaner production focuses the prevention of harmful emissions and wastes through improving resource efficiency and thus resulting in environmental benefits and economic savings simultaneously. It involves technological changes

and good housekeeping measures. This is a relatively new concept. Cleaner production is technology focused. In the first stage it might result in significant reduction of wastes and emissions at no or little costs mainly by housekeeping measures. After these cheap opportunities are exhausted cleaner production becomes more and more expensive, although it has huge potential for emission reduction. Evidence as far shows that mainly cheap house keeping measures get support from companies. Major technological changes, resulting in less pollution, are carried out when forces other than environmental protection dictate them. Environment is not sufficient to be a driving force for major changes in the manufacturing technologies, although might be considered when those changes are carried out anyway.

End-of-pipe technologies have bad reputation in the literature of environmental management and they are the most conventional approach to environmental protection. The responsibility lies mainly with engineers who plan and install these technologies and have the necessary technological expertise. Other departments are usually not involved. The environmental department works separately from other departments subordinated to the manager of production or other chief officer with technical background. End-of-pipe is cheap in the short run but may hinder the necessary technological changes.

Although the least preferred alternative***, end-of-pipe solutions cannot be completely forgotten.*** One hand we cannot completely prevent the production of the wastes. On the other hand financial troubles favour short-run thinking that can also lead to the instalment of these technologies.

All of the approaches can result in significant pollution reduction and resource savings for which we can find empirical evidence. Cebon (1993) has analysed the waste reduction programs of two plants of an American company, FLESCOCO (Florida and East Coast Synthetic Olefins Corporation). Both plants initiated a large number of projects to reduce the amount of wastes. However, one of them used an approach quite similar to what I described as EMS approach. The other used mainly the expertise and ideas of its engineers to develop technological change resulting in waste reduction. In the first case the operators, who regarded

the technology as fixed, were asked for their ideas about the possible waste reduction sources. In the other case a contest was announced for designing less polluting technologies. Both plants were successful with their programs, but ***the technical approach resulted in more savings, although required more capital investment at the same time. It was more successful despite the fact that the most often suggested best practices and EMS elements were more comprehensively used in the other case.***

In the Netherlands researchers developed waste and emission reduction projects for 10 companies in the framework of the PRISMA project (Dieleman et al. 1993). They have identified good housekeeping methods that could result in waste and emission education up to 30 percent and technological changes resulting in reduction up to 80-100 per cent. Of course, the financial viability of these projects has to be analysed to allow decision on their feasibility.

The Klassen-Whybank survey has some findings that stand against what theorists prefer to assume. According to his survey proactive companies, usually more open to public interaction than other types, balance their investments in adaptive (clean) technologies with conventional (end-of-pipe) ones. End-of-pipe technologies are very visible to the public, so high level of public interaction might result in high proportion of end-of-pipe technologies.

Although no researcher favours end-of-pipe, there is tense discussion among those preferring EMS and those preferring cleaner production.

Whoever suggests the application of EMS and total quality management mostly regards technological changes as part of the EMS. (see Hirschorn, 1993) On the other hand „cleaner production" concept is also meant to include management elements, as well as cheap good house-keeping practices. The difference is mainly in the focus and the balance of different measures. EMS has more to say about the system while cleaner production is more to say about efficiency and the reduction of wastes.

Different approaches coexist toward environmental protection and no one lacks success. The literature, however, often evaluates company performance based on one single type of indicator, e.g. how far they implemented EMS, or the level of their environmental investments, regardless of the reduction they actually achieved or the load they pose on the environment. This leads to distortions. It handicaps companies that implemented successful technical solutions or are not major sources of pollution at all. Even indicators based on several criteria can be unbalanced: an indicator with 80 percent of questions focusing on EMS and only 20% of questions focusing on physical indicators is likely to lead to distortions.

The review of the theoretical and empirical findings of environmental management research suggests that research is still in the phase of building and testing of basic models. No consensus has been achieved on what basic models can be accepted or refused yet and there is not much empirical evidence available for comparing the reality of these models. Most of the theoretical models lack empirical evidence and most of the empirical surveys use simplistic statistical methods or are not built on firm theoretical basis.

It follows that a new concept is needed that:

- defines what is the required level of environmental performance
- allows to handle different pollution reduction and risk reduction strategies at the same time
- makes comparisons of companies with different situation manageable.

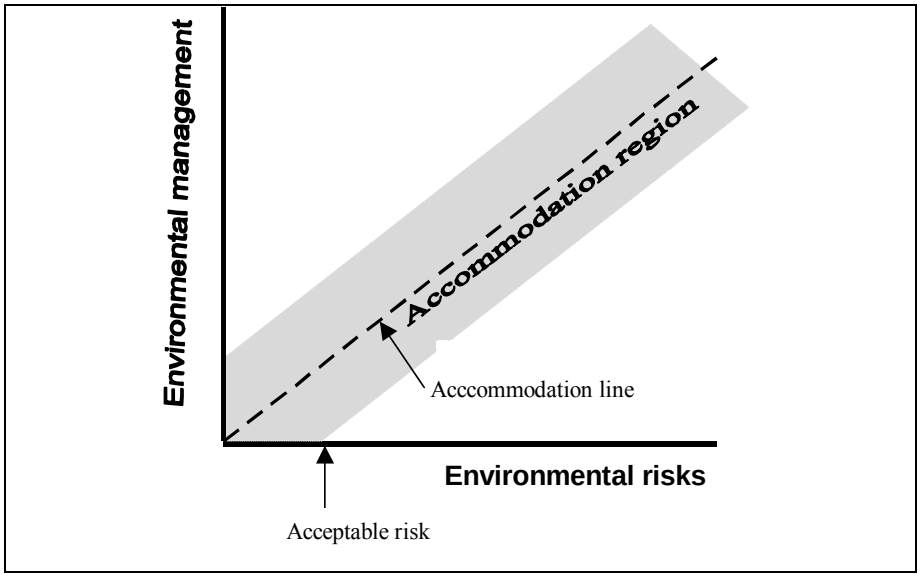
3. The accommodation region

In this section I will introduce a new concept that evaluates environmental performance in an undistorted way, cleared from varying requirements toward different companies. It also allows handling the issues of technological modifications and EMS measures simultaneously. Thus, the most common problems shared by theoretical concepts as well as empirical research become more manageable.

Interpreted literature (see Kerekes(1995), Williams et al (1993)) as well as empirical surveys fortify my assumption: environmental management response of companies was mostly determined by risks and pressures companies face, while only minor impact can be attributed to other factors. Thus, ***I will regard to companies` reaction to threats as a rule while opportunities will be regarded as exception from the rule***. This approach characterises well the current practice of companies. Not that there are no additional opportunities beyond what companies actually recognise, that is Porter is wrong. Recently, however, most companies` environmental response is due to different kinds of threats they face.

We can go, however, beyond identifying different environmental strategy types as related to the magnitude of risks companies pose. ***I will make an attempt to measure risks as well as resulting company responses in a quantitative form and later I will define when and how they are concordant with each other.*** The new concept of accommodation region to be introduced serves this very purpose.

Illus. 3.0-1: The accommodation region of environmental risk and environmental response



The essence of the concept of accommodation region: the companies' environmental management system must be adequate to handle the environmental risks the company operation induced. Unavoidable risks must be kept under control and environmental management system is a powerful tool for this purpose. Environmental risks dictate a certain level of environmental management and companies may divert from this level within limits. Those limits determine the borders of the accommodation region.

Environmental risks include both endogenous and exogenous elements (see Kerekes et al. 1995). The former embraces pollution risks, accidental hazards, etc. induced by the company operation. Exogenous risks include authority pressures or NGO activity all of those not under the direct control of company. Companies may react in different ways to these risks: with technological adjustments, increasing the level of control or developing their environmental management system.

> *Environmental risks are to be interpreted as risks and pressures coming from the society and perceived by companies (in a subjective way) as „people base their decisions on the subjective perception of risks rather than on the objective level of risks". (Kindler(1988, 232.p.))*

The environmental management axis, related to responsiveness of companies, shows environmental controlling measures. These include, for example, internal audits, risk assessment and risk management tools as well as other elements that assure the regular and consequent management of environmental issues (e.g. environmental policy, environmental program). The third group of measures relates to developing and communicating environmental benefits of products. This element is not a risk related one by nature.

Thus, the horizontal axis shows a state of pollution type indicator, while the vertical axis represents a measure type indicator.

The cross-section of the border of the accommodation region and the horizontal axis gives the upper limit of acceptable risks. There is no need for additional environmental measures or pollution control when this level is reached. Environmental investments or EMS development are not necessary beyond this point. Any low level of EMS is acceptable.

3.1 How theoretical problems can be solved in the new concept

Now I will show that the new model performs well in point of theoretical problems described in the previous sections.

- **Differentiated expectations toward companies**

  The model involves differentiated expectations toward different types of companies: those operating under low risk level are not required to introduce highly sophisticated environmental management systems. The accommodation region is continual by nature so that the expectations are fine tuned without increments.

- **Technological vs. environmental management development**

  The model looks at technological and environmental management development at the same time. The former is represented by a shift along the

horizontal axis while the latter is shown by shift along the vertical axis. I have shown that the accommodation region can be reached following either path.

This representation allows us to see the impact of non-environment related technological adjustments in addition to environmental developments. For example, we experience a shift toward zero along the horizontal axis when the manufacturing equipment is replaced and state-of-the-art less polluting technology is installed. The shift does not require that companies invest in environmental technologies. That is, the concept does not prefer end-of-the pipe solutions to pollution prevention. Morover, cleaner pollution (horizontal shift) and EMS development (vertical shift) are also represented at the same time.

- **Comparability**

  The concept facilitates the comparison among companies operating under varying circumstances. The performance of companies positioned along the accommodation line must be regarded as equal, no matter that some of those companies operate under high risk and with sophisticated EMS while others with low risk and low level of EMS. The farther a company above the accommodation region is the better its environmental performance must be evaluated. The farther a company bellow the worse its environmental performance is.

- **Neutral strategic category**

  The term of accommodation region is neutral by nature. Companies operating inside the region just meet social requirements (that are not necessarily the same as legal ones.) The accommodation region can be used as a base for reformulating negative and positive sounding categories.

3.2 Characteristics of the accommodation region

In certain respects accommodation region is attached to the strictness of legal requirements the companies face. Higher risk companies are usually subject to

stricter requirements. A close to the accommodation line position, however, cannot be interpreted such that the company would meet legal requirements, but does not go beyond. On one hand over-ambitious and economically not feasible emission limits or BAT regulation can result in a situation that a large number of accommodation region companies fail to meet some legal requirements. This was typical for the Hungarian environmental policy for a while or the US air quality policy in the 70's. Exceeding the limit values was rather the rule than the exception. Laws do not always reflect true desires of the society. ***Whenever we find that large number of accommodating companies are fined for non-compliance, we suspect that a society is under the pretence.*** On one hand the rigidity of environmental legislation expresses wishful thinking of society for high level environmental expectations toward companies. On the other hand the large number of non-compliance companies shows that these expectations exist only until no sacrifices are needed for the sake of the environment. Whenever environmental expectations interfere with economic interests the latter take priority above the environment.

High-risk enterprises are, however, expected to show more sensitivity toward environmental issues than what is required by the law. Environmental internal audits, initiated by large chemical companies, reflect worries that meeting legal requirements may not be sufficient for feeling safe about environmental accidents.

Cost pressures, like high energy cost per total production cost ratio, will frequently result in energy cost saving measures even when no regulation exists to encourage energy savings.

Most companies operate close to the accommodation line that is they choose a risk and pressure adequate strategy: they accommodate their environmental management system to the level of environmental pressures and risks they face. The term 'accommodation region' will be used for the area neighbouring the accommodation line while the environmental strategy corresponding to this region will be called the 'accommodation strategy'.

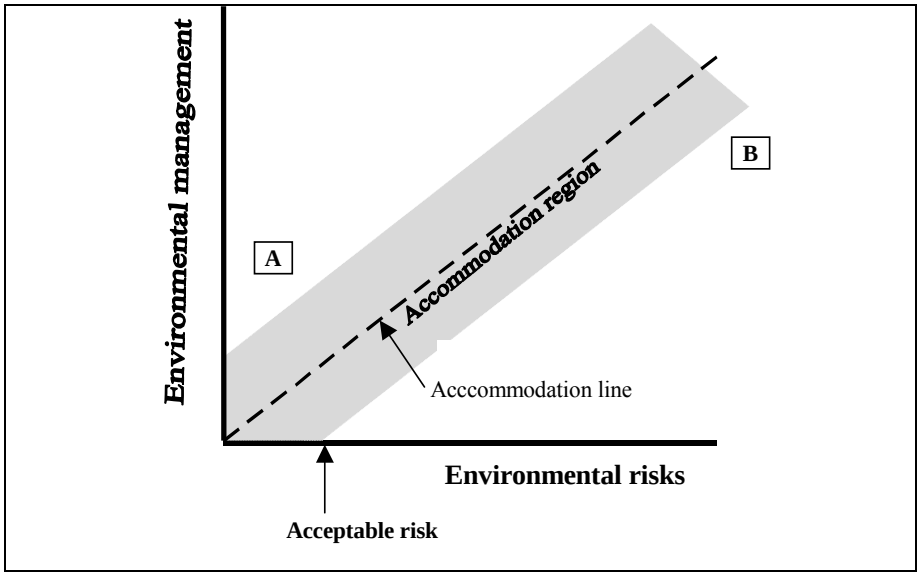
An above the accommodation region position means a company actually does more than what is expected. A bellow the accommodation line position involves

that this company gives an inadequate environmental response to the pressures it is exposed to or the risks it imposes. The ***slope of the accommodation*** line expresses the strength of usual responses in a certain country. It is closely linked to the environmental sensitivity and the level of economic development of a given society. „Higher ranked motives have a dominance in richer societies while lower level ones prevail in poorer societies. (Kindler (1988), 282.p.)

The higher response level of larger companies and high-risk industries might be attributed to the fact that they operate under severe environmental risks while the slope of the accommodation line is the same within the country. Alternatively we can assume varying slopes among industries and among different company size groups. Differences in the regulatory environment for industries can result in varying accommodation lines among industries. Disproportionate strictness of regulation in certain industries can be justified by the well known phenomenon of risk aversion. (See Kindler (1991))

I will assume a uniform slope for all companies and across industries, as well. Big companies and large risk industries probably occupy the upper right corner of the accommodation region, while small companies and low risk industries occupy the lower left corner. ***We still have to anticipate, however, a variation of slopes among countries***. Different regulatory, as well as cultural environments and divergent desires of societies for the quality of environment shall result in varying accommodation line slopes.

Illus. 3.2-1: Comparing environmental performance in the new concept



Based on this concept qualification of companies can be very different from that of the „Five stage" or „ROAST" approach. The latter would give a better score to company **B** than to company **A** because **B** has a more sophisticated environmental management system. Based on the accommodation region concept, however, **A** seems to do more than what is required while **B** gives inadequate response to its environmental risks.

The most interesting information can be captured when we are studying the outliers.

Above accommodation line companies could be:

- The „Porter hypothesis" companies, those seeing more opportunity in the environment than other companies. They expect financial gains from being green. The existence of the accommodation region is not a point against Porter's arguments. He does not deny that most companies would regard environmental protection as threat and neglect opportunities in it. If such kind of opportunities exist, however, then at least some companies should occupy an above the accommodation region position and they should be more competitive than the accommodating ones. Above the accommodation region

companies not alone can gain from environmental management, but they are the ones that probably see competitive advantage in environmental opportunities. If all other companies followed them then competitive advantage would discontinue to exist. If one company decreases its price by 10 percent it can gain advantage from doing so. However, if each competitor behaves the same way, nobody will get into a better competitive position.

- developed an over-sophisticated environmental management system that actually costs more than would be reasonable. They are likely to think about developing it back. They are simple too good compared what they could afford. Their environmental efforts actually deter their competitiveness. Although pollution prevention may sometimes pay off, going green should not be the suggested strategy for each company. Actually, if everybody goes green at the same path then going green is not a competitive advantage any more.
- can simply afford to be green, that is they are very good in financial terms and they built environmental responsibility in the corporate culture. It is just the right thing to be green.

Bellow accommodation region companies:

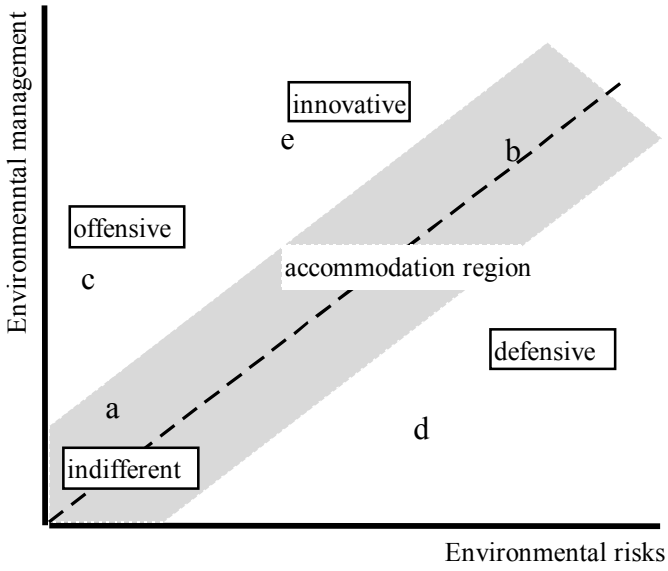
- might be the ones struggling with financial difficulties and can not afford environmental measures regardless of the necessity of those measures.
- do not properly recognise risks. In the future they are likely to get in trouble because of their environmental negligence. We can use this information for forecasting purposes and predict the unsustainability of certain companies' operation.
- Outliers can be found because of the deficiencies in measuring. This is a first attempt to measure the accommodation region, so outliers are quite likely to be found just because the measuring method does not fit their specific situation. To minimise this problem I will use different indicators and identify those companies that are outliers according to several indicators. Detailed analysis of this group can contribute valuable information to the further adjustment of the accommodation region concept as well as measuring.

The large number of outliers above the accommodation region suggests that the simple risk based theoretical approach is not applicable, and should be replaced with an opportunity-threat approach.

3.3 Redefinition of environmental strategies

The accommodation region concept does not necessarily rule out other approaches. Rather, it can be used to refine them. For example, the approach suggested by German authors, see Ulrich Steger (1993), can be reformulated on the basis of the accommodation region approach. Companies inducing low level of risks while acting above the accommodation region can be labelled as offensive companies. Companies with high risks and above the accommodation region position are labelled innovative companies. Another group of Steger's innovators can be found in the upper right corner of the accommodation region. Those operating bellow the accommodation region are resistant or defensive regardless the level of risks their technology involves.

Illus 3.3-1: The risk-opportunity approach and the accommodation region



I can spot most of the strategic categories in this picture, different regions characterising different strategies. Categories and name of the researcher proposing them are given bellow:

a) passive (Topfer)
   indifferent (Steger)

b) defensive (Steger)
   observe and comply (Welford)
   compliance (Roome)

c) offensive (Steger)

d) resistants (Topfer)
   non-compliance (Roome)
   ostriches (Welford)

e) innovative (Steger)
   enthusiasts (Simpson)
   excellence and leading edge (Roome)

Strategic categorisation requires a kind of redefinition. The above mentioned authors might put certain companies into a different category than my picture

suggests. Some of the innovative ones lost their label as they just accommodate to the high level of pressures. In addition to negative or positive categories I have a neutral one that most researchers do not have.

The accommodation region concept is not restricted to a two dimensional approach. Although not visually demonstrable, a multidimensional approach is also applicable in addition to the two dimensional one. This case the accommodation line as well as the outliers and the deviation from the accommodation line can still be calculated.

Now we have to deal with the issue of measuring of environmental risks, pressures and responses. Without measuring the existence of the accommodation region ca not be proofed nor refused. We have already seen that currently used methods, relying too much on environmental management system indicators, show serious distortions such as:

- favour large companies to the small ones
- favour good housekeeping practice to technological solutions
- cannot differentiate between lip service and actual. It is an interesting question whether companies with better environmental management systems and better communication and environmental reporting policy are also superior in terms of environmental load and pollution or not. Whenever we put too much emphasis on EMS and evaluate companies on an EMS basis, a quite sophisticated EMS system can be resulted without a significant decrease in pollution.

These deficiencies encourage me to look for other kinds of measuring methods and use them parallel with the traditional ones.

3.4 Factors determining the accommodation region

The horizontal axis expresses environmental pressures influencing the company's environmental behaviour. These factors can be classified into the following groups:

Cultural factors

Different countries raise different environmental expectations toward companies. Countries with high GDP usually have stricter environmental legislation and higher level of environmental sensitiveness. Foreign ownership of companies or foreign top management may result in an environmental policy that is significantly different from that of domestic companies with local top management. The shareholders or top management of the company may force stricter environmental standards than what required by the local environmental legislature.

Direct pressures

Pressures may stem from different sources, e.g. from environmental authorities or from the local community as a response to risks caused by the operation of the company.

Market pressures

Pressures from customers, banks, insurance companies and competing companies also have an effect on the behaviour of the company. Customers' pressure, however, is usually regarded as a market opportunity that can lead to higher profit provided the company faces the challenge.

Indirect pressures

Long run survival is a central issue for most companies. In order to survive companies have to keep in mind the future trends in environmental legislation and in the environmental sensitivity of customers and citizens. This may encourage them to go beyond what is required as a minimum at a certain point of time.

The strength of the pressure arriving from the authority, local community or clients is linked to environmental risks posed by the company. The term 'environmental risks' is used in the same meaning as defined by Kerekes-Rondinelli-Vastag. Pressures and environmental risks will be used in the dissertation as factors influencing companies` environmental response.

The environmental management and control have to be risk adequate.

Some factors can work against the above mentioned pressures, might neutralise their effect and lead to ignorance of environmental pressures. Among those factors the following are the most important ones:

Instability of financial position

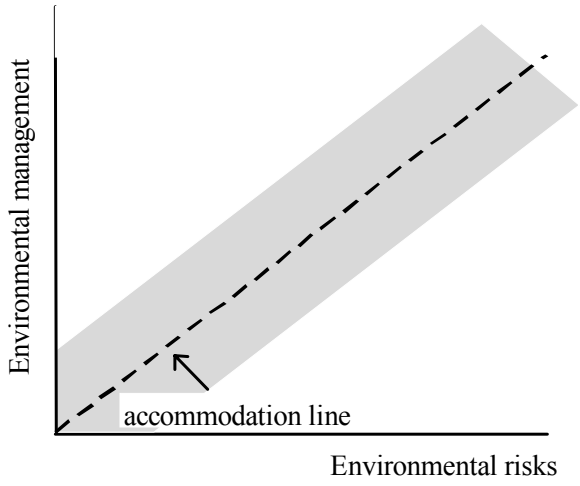
Short run issues come into the forefront when the company is in trouble and fights for survival. During this period environmental and other long run issues are pushed back.

Lack of financial resources

Even profitable options may be dropped out when financial resources are limited. In case of limited resources only the most profitable options will be implemented.

3.5 The possible shape of the accommodation region

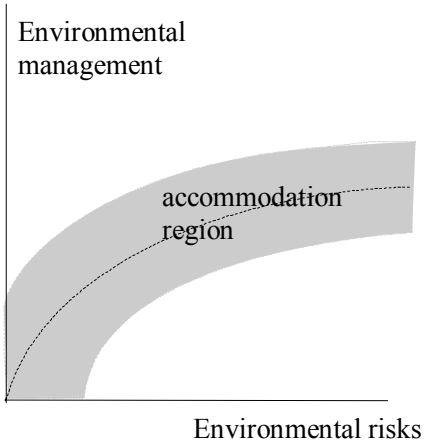
Illus. 3.5-1: Risk proportionate accommodation region



The accommodation region and its centerline are not necessarily straight. Other shapes can be reasonably asssumed, as well. Illus. 3.5-1. shows the shape we had as far. This picture involves that reaction of companies due to the pressures is

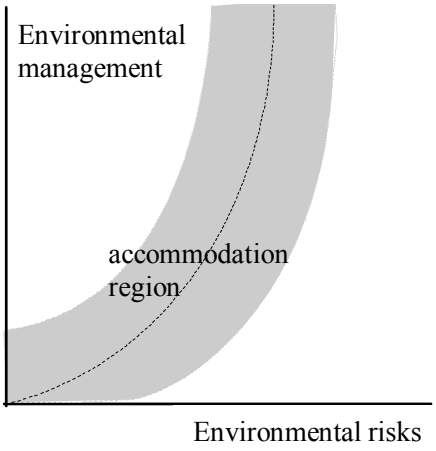
proportional to the strength of those pressures.

Illus. 3.5-2: Accommodation region with limited responses



Illus. 3.5-2. assumes that reaction is limited in a way that pressures beyond a certain value cannot have additional effect any more. Multinational companies may build up their EMS and adopt international standards like ISO 14000 and EMAS, but there might not be additional difference among multinational companies depending on their size and environmental impacts.

Illus. 3.5-3: Accommodation region with risk aversion



Illus. 3.5-3. explains a situation when pressures from different sources have some kind of synergetic effect. Thus companies are forced to do more than what's justified by the sum of the single pressures. People are often more sensitive to

high hazard low probability risks (e.g. nuclear power station) than to the same level of everyday risks. The risk aversion of the society may result in a curve like that (see Kindler, 1991). Overreaction from the side of the community may result in extreme efforts of companies.

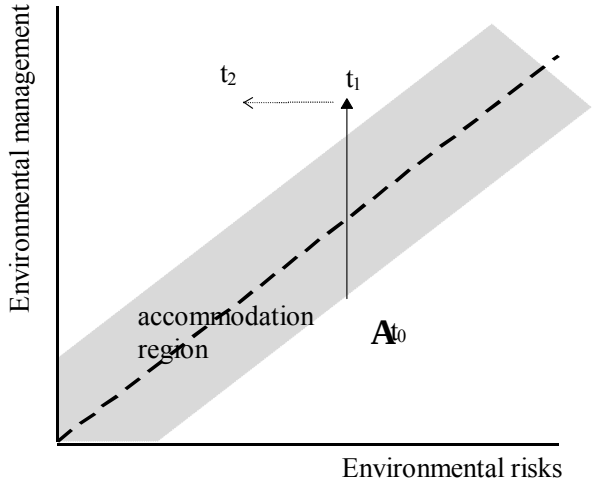
There is no reason for assuming a certain shape of accommodation region. Different shapes must be tested during the survey analyses.

3.6 Dynamics in the accommodation region concept

The change in a company's position as well as change in the position of the accommodation region itself have some interesting consequences that are noteworthy to mention.

Let's suppose company „A" realised that its environmental efforts were no more sufficient in period t_0. It developed its environmental management system in period t_1 in order to improve its position and finally reaches the point marked by t_1 in the picture. Has it completed its homework?

Illus. 3.6-1: Changing the relative position compared to the accommodation region

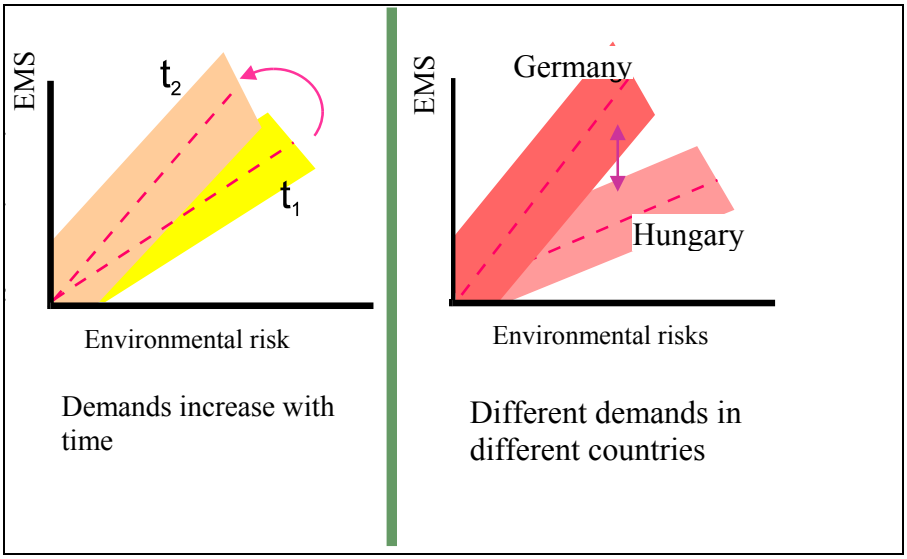


No single answer exists. We have to consider the company's position in period t2. If company A has not changed its horizontal position compared to period one we

can evaluate this as a suspicious sign of inefficiency in implementing environmental measures. It is quite likely that environmental measures introduced in the first period were only formal, as they did not have any impact on pollution or environmental risks. Perhaps the company just put another paragraph about the environment in its mission statement. By doing so it changed its vertical position, the number of formal environmental management elements increased, but these measures have not resulted in less wastes or emission. An effective environmental program should have resulted in a horizontal shift too, e.g. to the point marked by t_2.

The accommodation region itself may also change its position over time. Pressures on companies are increasing all the time, enforcing them to make more and more efforts for the quality of the environment. Environmental legislation also becomes stricter and stricter. So the slope of the accommodation line is likely to increase over time, that is, the line becomes steeper. Hopefully it will encourage companies to reduce their environmental load, pushing them to occupy a position that is closer to the vertical axis, which means less environmental load.

Illus. 3.6-2: The accommodation region in change

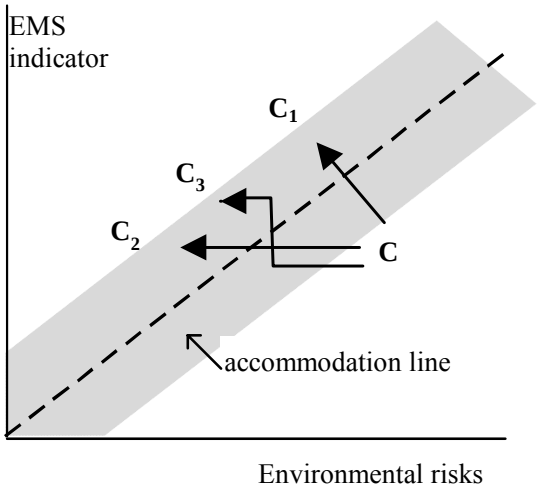


3.7 Environmental strategies and the accommodation region

3.7.1 Consequences of the overuse of EMS indicators

Although environmental management systems involve product/process changes, they usually represent only one factor among the dozen EMS elements. Most EMS indicators show only the number of the EMS elements used by a certain company or the number of projects initiated. That is, process or product changes get only a low weight, even when this single element results in more improvement than any other measures altogether. Most of the users of EMS indicators do not test their indicators and the companies' performance on an environmental load or environmental load change basis at all.

Illus. 3.7-1: Strategies of environmental improvement



Let's suppose company C wants to decrease its environmental risks. It has two major options: EMS development is the first.

Another option can be the replacement of the most polluting technology, which does not necessarily require the development of EMS. Installation of manufacturing equipment that uses less input to produce the same product will result in less emission and waste, although it does not involve any kind of environmental action. It is not even regarded as an environmental project.

Let's compare the two strategies. When using an EMS based indicator, only a slight improvement shows up in the case of the technological solution (C_2) and a larger improvement in the case of the EMS development, C_1, although the former resulted in more significant pollution reduction (see illus. 3.7-1.).

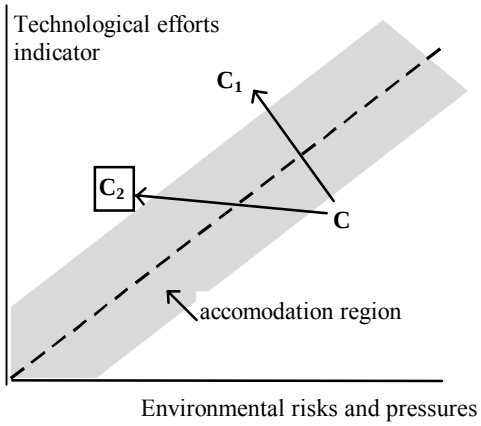
The pressure axis itself expresses the result of past pollution control measures. Most successful companies tend to be closer to zero, regardless of their present environmental response, while less successful companies tend to be in a distance from zero along the horizontal axis.

C_3 represents a mixed strategy: the company starts with the installation of some better technology then develops its environmental management system. When a combined strategy is chosen, it usually starts with technological modifications, especially when major changes are carried out, while EMS development comes after those changes took place. Environmental management and environmental control procedures usually assumes the knowledge of the technology, so they are reasonably developed only after the technology was installed.

The accommodation region described above shows environmental in a special way: EMS measures can be described as a move along the vertical axis while technological responses are shown as a movement along the horizontal axis.

We can also create or rather derive the technological accommodation region that would be a kind of mirror image of the EMS accommodation region (see illus. 3.7-2.).

Illus. 3.7-2: Technology based accommodation region



Technological response can be measured as a percentage of environmental investments or as a number of pollution prevention projects applied, etc.

The shift from C to C1 shows the technological response to environmental risks and pressures and the resulting decrease in pressures. The move form C to C2 shows the organisational measures that result in less pressure but do not involve environmental technology projects. Technological response is associated with a shift along the vertical axis (response axis), while EMS measures are associated only with a move along the horizontal axis.

Note, however, that replacement of manufacturing technology, with the largest emission reduction potential, is not shown even in this picture. As replacement of productive equipment cannot be regarded as environmental measure, it does not involve any vertical move along the environmental technology axis. Like EMS measures it only influences the horizontal position of companies.

Regardless which accommodation region we use can anticipate whether the level of environmental measures is risk adequate or not. Both of them correctly show the position of the company compared to the accommodation region.[11] When interested in the effort level of companies, however, we have to plot companies' position in both pictures: each picture shows only one side of the possible efforts a company can take.

[11] Actually it would be only true if the EMS and the environmental technology were a solution for exactly the same problem. Differences exist, however, in the purpose of the

3.8 Product policy as the other major element of environmental strategy

As far I neglected the impact of competitive strategy on the environmental responsiveness, although it can result in significant departure from the accommodation region that is defined by environmental risks and pressures alone. Pressures and risks mainly linked to the harmful emissions of processes. Products themselves may also damage the environment during their lifecycle, e.g. use or disposal. That is, company strategy, as related to product policy has an importance, too.

In this section I will show that ***process and product policies not necessarily show the same level of environmental awareness.*** Positive deviation from the accommodation region can usually be attributed to this difference: environmental product policy shows a higher level of development than the process policy does. Later I will define some strategic types of product policy.

Steger's risk-opportunity matrix may lead us to the conclusion that companies working under low environmental risk and characterised by high market potential should follow an offensive environmental product and process strategy, while those characterised by high risks as well as good environmental opportunities should follow an innovative strategy. In this concept a defensive process policy is bound to a defensive product policy while an offensive product policy is bound to an offensive process policy (or no process policy at all). The company's product policy is assumed to be in line with its process policy. This is not always the case, however. On one hand we have seen companies that, although taking care of the environmental and health impacts of their products, produce these products in a

two means of environmental protection that would result in slightly different position of the same company when it is measured in different accommodation concepts.

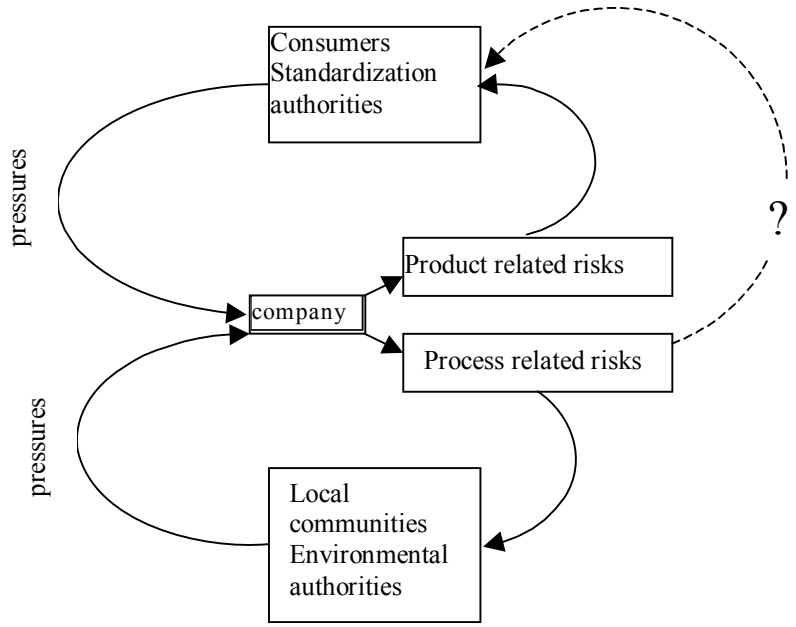
polluting way. On the other hand clean production is not always accompanied by good communication about the product's environmental advantages.

In my opinion a company can follow different strategies when it comes to its product vs. process strategy. Temptation exists for doing do especially in countries with less sensitive local communities toward pollution. When exporting high quality products for consumers with high environmental awareness, even the polluting companies have to meet all the environmental product standards of those countries. This is the case in Hungary.

Free trade agreements,the EU and OECD environmental laws encourage the separation of product and process policies. OECD and WTO strictly prohibits that countries would require importers to comply with any non product related environmental requirement the country imposed (See for example WTO(1996) or OECD (1995)). A product produced abroad cannot be expected to comply with the importing country`s environmental regulations as it would be regarded as intervention to another country's environmental policy. When characteristics of a product is affected, however, so that the consumers are subject to environmental and health effects, product related environmental requirements and standards are clearly permitted. This may encourage companies of countries with looser environmental policy to fulfil the strictest product related environmental requirements but ignore process related ones. They might have straightforward environmental product policy but those products might be produced in a polluting way.

Companies in countries with strict environmental legislation often use environmental arguments in order to keep competition of other regions far from the market. Most cases not the consumers themselves, but this pressure from the competitors force companies to do something for the environment. Japanese and other Asian countries have leading positions in the adoption of ISO14001 standard because they are afraid that ignorance of those voluntary standards would disqualify them from their European markets.

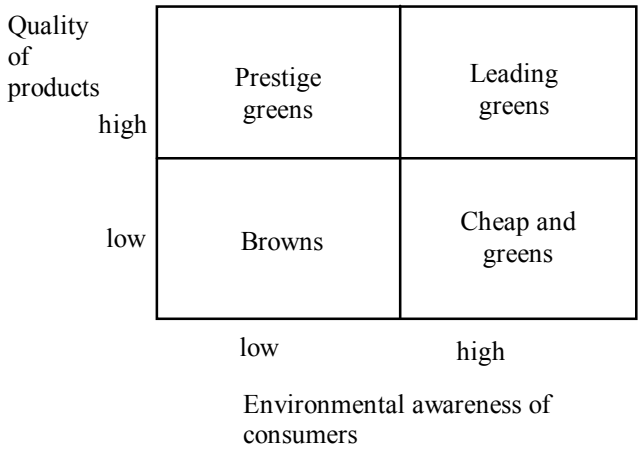
Illus. 3.8-1: Product and process related environmental pressures



Most strategy concepts are related to the production processes (whether the production itself is polluting or not and managed properly) or to the production process and the product strategy at the same time. Much less is said about the differences in strategy in relation to the product policy (high quality at high price, or low quality at low price, level of services, etc.) I suggest a new matrix of environmental product strategies that differentiates among strategies on the basis of the quality of product or service and environmental awareness of the consumers.

Four types of strategies are suggested based on the above mentioned factors.

Illus. 3.8-2: Types of environmental product strategies



Prestige greens: These companies enjoy monopolistic position based on product differentiation and offer high quality products at high price or enjoy monopolistic position in the market in another way. They can afford to be green even when there is no direct pressure for that. Those in monopolistic position (no matter what is the source of the monopoly) are not under actual pressure from competitors or consumers. Nevertheless they can build the costs of environmental measures into the price of their products and consumers are likely to be willing to pay this price. When asked about why they are interested in environmental issues they usually answer: "We want to be the best in the market in all respects including the environment" or "All of the leading companies in the world do it this way". For them it is not painful to be green. Large telecommunication companies forcing leading environmental strategy, e.g. AT&T belong to this group.

Leading greens: For leading greens there is a pressure from the side of the consumers to be green. On the other hand, like prestige greens, they can afford it. Pressure and possibility exist at the same time, so green strategy is simple a necessity for them. Volkswagen enjoys monopoly in a certain market niche with its unique image. It also faces German consumers with high environmental sensitivity. No surprise that it is so much interested in environmental issue, e.g. recycling car parts.

Cheap and greens attack a market where consumers are highly sensitive toward environmental issues, although they do not accept a price increase for

environmental reasons. They expect certain green characteristics from products but do not pay for the most up-to-date and expensive solutions. Cheap and greens follow environmental development rather than dictate it. They do something to make consumers feel they care about the environment.

Browns are not interested in environmental issues. They work in a market that absorbs products at moderate or low price and they do not care about their prestige.

Companies defining consumers as their major external stakeholders are likely to put the emphasis on product related EMS while those defining authorities and local communities as major external stakeholders put the emphasis on technological solutions, that is on the use of end-of-pipe technologies or clean technologies.

The implementation of ISO 14001 and other EMS standards may sometimes be much more related to the issue of quality and quality management systems than to the level of environmental pollution. Two kinds of companies may show high interest toward ISO14001: companies with high environmental risks and companies that sell high quality products.

4. Measuring the characteristics of the accommodation region

4.1 Types of possible indicators

In theory different types of indicators exist that can measure the aggregate company response to environmental issues. They can be arranged into two categories. *Physical indicators* are to measure the environmental risk resulting from the company's activities. These indicators could also be labelled as achievement based indicators as they show environmental results achieved rather than environmental measures taken. *Effort based indicators* show the magnitude of the effort companies take in order to reduce their environmental risks. The former indicators show results of environmental measures and characterise environmental efficiency while the latter show intentions and are related to expected future results and targets. We must use both types of indicators otherwise we would be subject to one of two major mistakes. We could underestimate the achievements of "clean" companies that do not need to take further environmental actions or devaluate the efforts of those "dirty" ones that would like to change.

Most popular physical indicators are the following:

- Aggregate environmental load
- Emission per turnover
- Resource use per turnover
- Decrease in aggregate environmental load
- The technology in use compared to the best available technology

Most popular effort based indicators are the following:

- Status of the environmental management system
- Environmental investments
- Number of environmental projects in different fields

The pressure axis of the accommodation region is based on the use of physical indicators, while the environmental response axis is measured by effort based indicators. Thus the accommodation region can be interpreted as a region where the environmental measures taken are adequate to the risks the company impose.

Unfortunately there is no one single physical indicator of environmental performance that would be reliable and easy to use for statistical purposes (easy to calculate for a large number of companies). Working out such kind of indicator is the most challenging task the academics must resolve because it requires:

- The aggregation of very different environmental factors (toxic emissions, input use, CO2 emissions, etc. Recently a number of indicators are developed that offer a kind of solution to this problem.
- Detailed description of the best available technologies. Different industries have different potentials in decreasing the environmental risk. Environmental performance of companies belonging to different industries should not be compared directly. Work is in progress in the European Union in this respect. The first numbers are expected in several years.
- A practical solution for measuring performance. Most of the currently used indicators require terrible amount of information that can be gathered only on-site on a case by case basis. Companies can not be required to produce them themselves for the purpose of a survey.

If we solved the above-mentioned problems we would be able to produce a single physical indicator of environmental performance. It should be an aggregation of deviations from the environmental loads of best available technologies multiplied by the production volume. For certain purposes the use aggregate environmental load would be still more appropriate regardless of BAT.

As the above mentioned indicators do not exist I am pressed to use substitutes. Though I have to bear in mind that distortions will arise in the findings due to the substitution for exact indicators.

Environmental pressures involve the following factors:

- pressure from environmental regulators
- environmental pressure from community
- threat of stricter legislation
- risks (e.g. risk of accidents, risk from products, risks on communities) that can result in present and possible future fines, penalties, liabilities, clean-up costs or even shut down of a plant
- high resource costs (electricity, fuel water, raw material costs)

I will test whether companies react to the direct or rather to the long term pressures and threats. The difference between the results when using EMS or physical indicators in measuring performance will also be tested. So, the following approaches will be used in looking for the accommodation region:

Environmental management axis

1. EMS (number of elements used)
2. Number of environmental projects
3. Environmental investments

Environmental risks

1. Perceived external risks (number of sources, strength of pressures)
2. Internal risk (risk of accidents)
3. Environmental load

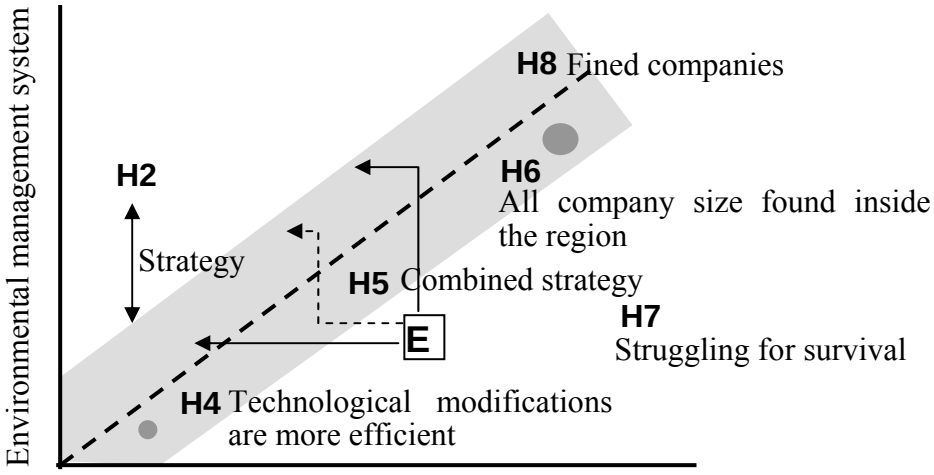
For the purpose of survey analysis several models will be tested. They will be used for prediction of company performance with the help of the environmental risks companies face.

5. Hypotheses

Testing hypotheses is not possible for all the consequences that can be derived from the previously described concept. Only several of the major issues will be subject to empirical analysis while others will be let sleep until some later research.

The first group of hypotheses is related to the existence of the accommodation region. The connection to the accommodation region is shown in the following picture:

Illus. 4.1-1: Accommodation region related hypotheses



Factors effecting the accommodation region: **H1**

H1: The largest portion of the variance in the environmental management responses of the companies can be explained by the risks and threats they face. These pressures include legal requirements, authorities' pressure, local communities, the threat of prospective stricter legislation, the risk of a major accidents and cost pressure from of resource and wastes costs. The pressure adequate responses give the accommodation region.

H2: The other major factor determinig environmental responses is the strategy followed by the company. Different environmental strategies can be separated based on the above mentioned factors as well as the position of the company compared to the accommodation region.

For example, if the company strategy is based on producing and selling high quality consumer products we can expect that the company pays attention to environmental considerations and shows high level of environmental responsiveness. Whenever a company struggles with problems of survival it usually lacks available resources to finance economical but costly investments in the field of environmental protection.

The second hypothesis addresses the question whether large companies manage environmental issues more efficiently than the small ones or not. Previous surveys described in the first part of the dissertation have found so. These findings are not conclusive, however, due to the simplistic statistical method they used and the high correlation between the company size and other factors influencing the observed environmental response. Large size of companies is correlated with higher environmental risk.

H3: The environmental load per unit of production is lower for larger firms than for small ones; that is larger firms tend to manage environmental issues more efficiently than small ones.

The following hypotheses are connected to the issue whether companies regard environmental manaemnt system, modification of technology and end-of-pipe solutions as alternative rather than complementary strategy or not.

H4: The modification of the manufacturing technology is the most efficient way for decreasing pollution.

Previous case studies showed that modification of the manufacturing technology would generally result in more pollution reduction than the development of the environmental management system. In the practice companies often lack the necessary financial resources that are needed to buy the most pollution efficient

up-to-date technologies. The hypothesis is tested for a Hungarian industry.

H5: Development of the environmental management system and instalment of end-of-pipe technologies are alternative strategies for companies. Those companies developing their EMS are less likely to invest in environmental technologies.

This hypothesis questions the existence and diffusion of the combined strategy.

H6: In the accommodation region we find small as well as large companies. The companies` vertical position from the accommodation line is independent of the company size.

The environmental performance of small companies is not put a false complexion on. With the same token, we find a larger concentration of smaller companies in the lower left corner and that of the large companies in the upper right corner of the region.

H7: Companies striving to survive are more likely to be found bellow the accommodation region.

Environmental protection does cost money in the short run. Even good housekeeping measures take at least time - if not money - from the company. Time is a kind of costs, as well. Companies often work under strict budget constrains and they cannot borrow money without limitations so they are not able to implement all of the profitable environmental projects and measures.

H8: Those companies paying fine for not meeting the Hungarian environmental regulation can be found bellow the accommodation region as well as inside the accommodation region.

Paying the fines rather than meeting all the environmental requirements is somewhat acceptable behaviour in Hungary. I have to mention though that our environmental limit values are often stricter than European ones and are sometimes technically not feasible.

H9: Companies with a developed EMS system initiate environmental projects in more areas than those seeking for technological solutions do.

Environmental management systems integrate all areas of environment related operations. It follows that companies with a sophisticated EMS tend to have projects in more areas than those without an EMS. These projects do not have to be large ones: some of them may be small scale housekeeping measures.

H10: In the short run economic success does not depend on environmental performance.

Fast growing and highly profitable companies are not necessarily the ones that show the highest level of environmental awareness. Environmental protection is a costly matter in the short run but pays back in the long run.

H11: Environmental performance is closely linked to the long run performance of companies.

Pervious surveys showed the importance of environmental protection in the long run survival of companies. Whenever environmental performance does not meet the requirements of customers, local communities or the broader society, the company might be disqualified from the market.

H12: Companies having some kind of ISO9000 registration are more interested in ISO14000 than those that do not have regardless of their environmental performance.

It is an exeption in Hungary when a company starts to implement ISO 14001 before the implementation of ISO9000.

If ISO14001 is more closely linked to the issue of quality than to the issue of the environnment, then it no longer can be regarded a good indicator of environmental performance.

H13: Environmental strategies can be classified as environmental product strategies and environmental process strategies. A polluting company might have an advanced environmental product strategy and vice versa.

Not all the companies using clean production methods are striving to develop green products. Exporters to sensitive European markets have to meet product standards of those markets but are not forced to reduce their pollution.

II.

RESULTS OF THE EMPIRICAL STUDY

6. Framework of the Empirical Study

The purpose of any empirical research is to test proposed hypotheses. The present survey is based on two sets of samples, containing responses gathered in 140 enterprises. The first of these sets - intended to be a pilot study - involved 52 chemical and food-processing companies, and was conducted in 1997. Based on its results, I prepared an improved version and mailed it to 600 machinery companies. The 88 valid responses returned constitute the principal sample of the empirical study.

Designing the research to cover only one industry, I was able to avoid dealing with such issues as technology, capitalization, different market conditions and environmental problems typical of each sector - all having an effect on environmental investment, characteristic emission levels and overall company strategy. I chose an industry where the relative concentration of production is neither too high, nor too low: company size is a major factor in required environmental performance. To study the effect of company size, the sample had to include small -, medium- and large-size companies in approximately equal numbers.

The contacted companies were chosen from the list of the 1000 largest Hungarian enterprises, employing 10 or more people. Companies with fewer employees have no independent environmental strategy or management systems and therefor could not provide measurable data. I sent questionnaires to all companies with at least 50 employees, while a random selection of enterprises with payrolls between 50 and 10 were asked to respond.

6.1 Methods of analysis

The empirical study is fundamentally cross-sectional in nature, while containing some questions on environmental pollution and environmental management as well.

A detailed description of the industry, the sample, and the observed and derived variables are given in the appendix.

The most frequently used method in the course of the analysis is that of multivariate regression. With its help the tools of applied environmental management, the number of projects and independent variables (e.g. the correlation between the degree of pressures and company size) can all be described. I also applied factor and principal component analysis methods to shed light on the relationship between the drop in dimension numbers and variables. Some of the hypotheses were tested with simpler methods, e.g. ANOVA or correlation.

7. Elements of the Accommodation Region - Definition

I make the assumption that the accommodation region is defined by standard company responses concerning endogenous and exogenous (see Kerekes, 1995) environmental risks. In the course of the empirical research I studied the following components:

Objective risk:

- Air pollution, industrial waste water emission, hazardous waste production **(endogenous [internal] risk factors).**

Perceived risks:

- Hungarian environmental regulations, target market environmental requirements, pressure from regulatory agencies, pressure from environmental organizations and the population, pressure from banks and insurance firms, consumer demands, competition to maintain market position, proximity of settlements, proximity of hospitals or schools, proximity of vulnerable natural resources, fines for environmental offenses.

  (exogenous [external] risk factor).

- Risk of accidents and polluting technology creating pressure within the company **(endogenous [internal] risk factors).**

Because of the nature of the data, instead of endogenous and exogenous factors, in the questionnaire I applied the objective and perceived risk categories. Concerning endogenous accident risk factors I was unable to obtain objective, measured data (which, in most cases, does not exist in the first place). As I had to rely on respondents' opinions, one part of internal (endogenous) risk factors is based on objective, the other on observed data.

The risks perceived by the company are summarized under the PRESSURES variable, while objective factors are described by the following variables: HAZARDOUS WASTE, AIR POLLUTION, INDUSTRIAL WASTE WATER.

In the first approximation, the vertical axis of the function defining the accommodation region is characterized by numbers assigned to environmental-management-system (EMS) elements by the company. The EMS variable incorporates 14 elements, values ranging from 0 to 14. The value of each fully implemented element is 1, while partial implementation is awarded a score of 0.5. The EMS is the most significant variable defining a company's environmental performance but, of course, I use a number of other indices to describe companies' environmental records.

7.1 Two-dimensional accommodation region: the effect of perceived risks (PRESSURES) on the company's EMS

The PRESSURES variable gives a summary of internal and external constraints experienced by companies. I aggregated the strength of 14 types of observed force; the value of the variable can move between 0 and 56.

In addition, I examined the effect of PRESSURES on company environmental management systems.

There is a significant, positive correlation between the number of environmental management elements applied and the degree of pressures encountered by businesses.

Table 7.1-1: Correlation between the number of environmental management elements applied and the degree of pressures encountered

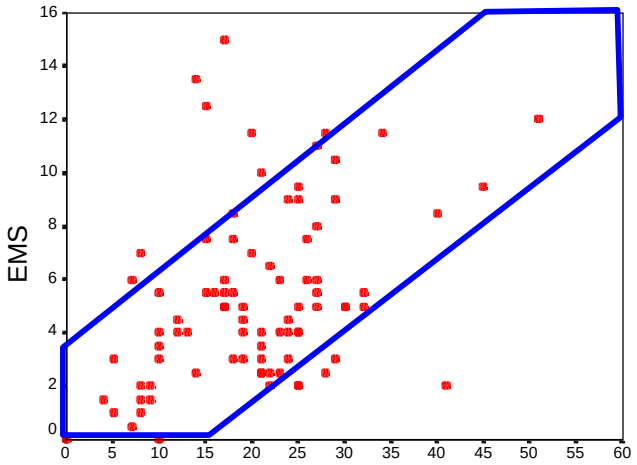
		PRESSURES	EMS
Pearson Correlation	PRESSURES	1,000	,415**
	EMS	,415**	1,000
Sig. (2-tailed)	PRESSURES	,	,000
	EMS	,000	,
N	PRESSURES	88	85
	EMS	85	85

**. Correlation is significant at the 0.01 level (2-tailed).

The x-y curve of PRESSURES and EMS variables show a loose, positive correlation. The majority of points can be found within a wide area, while some "outliers" can be observed as well. The easily perceived, central zone is considered the first approximation of the two-dimensional accommodation region. It is apparent that one way companies react to internal and external pressures they encounter is by improving their environmental management system. Companies with "well" functioning environmental management systems are not necessarily committed environmentalists or well-run organizations. More likely, this is how they choose to deal with pressures brought on by the high environmental risks they present.

The connection between pressure intensity and the number of applied environmental management tools is shown in Illus. 7.1-1.

Illus. 7.1-1: connection between pressure intensity and the number of applied environmental management tools



Although the connection between pressure intensity and the sophistication of the management systems is a loose one, it is worthwhile taking a closer look at the most salient values. I assume these originate from companies that see significant commercial opportunity in environmental protection or where an excellent environmental record is part of the company image (i.e., the company is following

an offensive or innovative environmental strategy). With 2 points the standardized residuums in linear regression exceed threefold deviation, while in the case of 5 points by twofold. These five points represent an outlier, deserving closer scrutiny.

Table 7.1-2: Outlier diagnostic of the two-dimensional accommodation region

	Case number	Std. Residual	EMS	Predicted Value	Residual
	30	2,626	12,50	4,5573	7,9427
	42	3,355	15,00	4,8536	10,1464
	44	-2,119	2,00	8,4090	-6,4090
	79	3,006	13,50	4,4092	9,0908
	88	2,051	11,50	5,2980	6,2020

In the positive direction the PRESSURES variable reaches the highest point at 17, while the EMS variable (indicating the sophistication of the environmental management system) reaches 15. It is interesting to note that only two companies agreed to be named in the study, TAURUS EMERGE being one of them. This is a significant indicator in itself. The company is foreign owned, part of large conglomerate. The EU, with 43%, represents the largest share of its market, while 27% of its products are sold outside Europe. It is one of the few organizations with ISO 14001 certification: the most likely reason it has a highly developed environmental management system. The quality of its products is better than average and, when it comes to company image, it places a high value (4) on environmental protection. It is one of the largest waste water dischargers among the selected companies (it considers its internal risks to be high). The company places great emphasis on reducing pollution and believes that EU regulations and its own management play a crucial role in the protection of the environment.

Another company with outstanding scores is INDA Hungaria Kft., which also agreed to have its name published. As part of its implementing the ISO 14001 standard, the company installed its own environmental management system. The company is foreign owned with 85% of its output sold on the EU market. Of all

the environmental pressures, it gave top scores to EU regulations and the attitude of company management.

ISO 14001 is in the process of being implemented at the third positive outlier as well, which explains the high score received for its environmental management system. The system has only recently been introduced, most elements being implemented within the last six months. It gave a high score (5) for pressure coming from target-market consumers, as well as for the importance of EU environmental regulations. Management commitment and company image are equally strong points. 80% of the company's output is destined for the EU market.

It can be stated that environmental protection constitutes a part of these three companies' marketing strategy, they approach environmental issues with more sensitivity than would be justified by the pressures exerted on them. This also means that ***the position they occupy above the accommodation region meets our expectations based on their environmental strategies.***

The picture presented by the fourth positive outlier is somewhat different. The company claims it has implemented the majority of environmental management devices (eco-audit by outside experts, published environmental report, etc.) some 15 years ago. As these devices are considered quite new even in international practice, gaining wider acceptance only in the last 5 years, the authenticity of these claims is highly questionable. It is conceivable that the respondent misconstrued the meaning of these concepts.

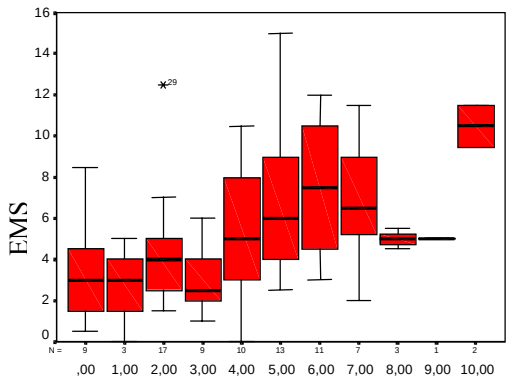
The most prominent value in the negative direction (PRESSURE = 41; EMS = 2) represents a medium-size Hungarian, 70% publicly owned company, which has its primary activity in the service sector and works entirely for the domestic market. Here, with almost no exception, all pressures were given a value of 4, making hardly any distinctions and resulting in the dominant PRESSURE value. It is quite probable that in common with the industry average, the respondent overestimated the weight of environmental pressures affecting the company. Further information would be needed to determine whether it fits the accommodation region or is in fact below that level. In other words, of the five points, in two cases, the veracity of the returned data must be treated with caution. The inaccuracy of measurements

and the answers given in the questionnaire is a major reason for the incidence of outliers, a phenomenon that must be recognized and treated separately from real strategic variations.

In Hungary, very few businesses have ISO 14001 certification (at the time of writing this dissertation only about 20 companies received certification. The number of programs under development is obviously much greater.) It must be emphasized that ISO 14001 has been or is in the process of being introduced at three outliers - all three companies being leaders in the field of environmental protection. According to the concept of accommodation region, leaders in environmental protection can actually be found among outliers. This also means that the first draft of the region supports my assumption concerning the applicability of the concept.

Two other set of factors play an important role in the occurrence of positive outliers: market opportunities being one, and subjective factors the other. Opportunities in environmental protection have an effect on company environmental management systems. This is well illustrated by the boxplot chart of environmental management system and market opportunities variables - including opportunities offered by environment-friendly products, conservation and the company's environmental image.

Illus 7.1-2: Boxplot chart of environmental management system variables and market opportunities

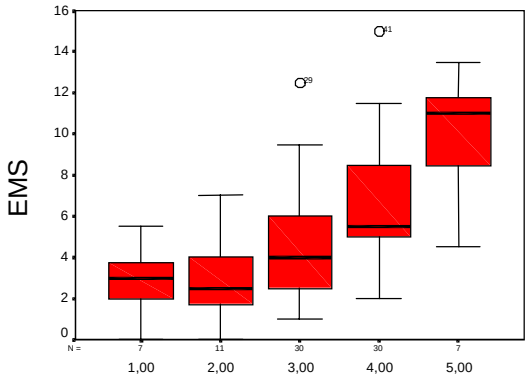


It is evident that companies seeing greater opportunities in environmental protection have usually implemented more sophisticated environmental

management systems.

Illus. 7.1-3. Illustrates the effect management's environmental attitudes have on environmental management systems. Clearly, the role of this subjective factor is far from negligible.

Illus.7.1-3: The effect of management's environmental attitudes on environmental management systems



With the introduction of additional dimensions, I shall next refine accommodation region borders.

7.2 Multi-dimensional accommodation region

To define the accommodation region, besides perceived risks, we must take into account the amount of emissions as well. This is an objective criteria, independent of our judgment of the company. With its integration a multi-dimensional-based accommodation region can be described, taking into account both perceived and measured endogenous and exogenous risks. Below I shall present the steps that lead to the definition of a multi-dimensional accommodation region.

7.2.1 Measurement of objective risks

The estimation of objective risks in the study is based on an aggregate of pollution discharges (e.g. air pollution, industrial waste water, production of hazardous waste).

In aggregation I applied a procedure customarily used in life-cycle analysis, where the amount of emission is multiplied by its toxicity index, adding up all the emissions weighted in this manner. This method ensures that the emission of more hazardous materials is weighted more in aggregate emissions than of those posing less of a hazard.

For air pollution, the summation was based on MSZ (Hungarian Standards) 21854 IM #1 Protected Zone Thresholds, while for that of waste water, thresholds for emissions into living water were applied. I took the inverse of these values to indicate hazard weights. The group of hazardous wastes is highly heterogeneous, categories are not based on names of material, rendering weighing meaningless.[12] In these cases I took into account the entire amount produced, regardless of the composition of the waste. This is how I arrived at the AIR POLLUTION, HAZARDOUS WASTE, INDUSTRIAL WASTE WATER variables.[13]

---

[12] Paint cans or animal cadavers are hazardous waste, for instance. These would be most difficult to sum up, however. Moreover, once category 1. hazardous waste is mixed with communal waste, the entire amount of communal waste must be treated as category 1. hazardous waste.

[13] For air pollution self-reporting is applied, which means that companies required to report annually can usually provide relevant records. In the case of waste water, however, they only have data when regulatory agency measurements indicate concentrations over threshold values, meaning, in most cases they have no information on the type and concentration of their waste emissions. Consequently, reported data is often incomplete. Although the Ministry of the Environment keeps records on company reports and official measurement data, these numbers are treated confidentially and are not made available even for statistical analysis. Therefor I was unable to complement and check the received information. In addition to toxicity weights, in life-cycle analysis other factors are considered as well (e.g., contribution to global warming, carcinogenic effect). This assumes a huge information requirement, something that can be obtained for some products or from certain companies. In the case of an analysis involving a large number of enterprises, however, companies cannot be expected to have the amount of data needed for sophisticated analysis.

7.2.2 Reducing the effect of size-differentials

Pollution variables can equally be small or large, while I measure dependent variables along a relatively narrow scale of 1 to 14. Furthermore, the effect of size-differentials is unlikely to be applied proportionately when developing the EMS. Here, instead of pollution variables, for analytical purposes I find the use of natural logarithm justified.

7.2.3 Definition of aggregate pollution factor

Subsequently, using three pollution variables, I derived an aggregate pollution factor. Here, I applied the method of principal-component analysis. Thus I arrived at one principal-component, the linear combination of the three original pollution-related variables, that accounts for 72% of all deviations in the three-variable system.

Illust. 7.2.-1: Tables of the principal-component analysis

Communalities

	Initial	Extraction
LN wastewater	1,000	,642
LN air pollution	1,000	,674
LN hazardous wastes	1,000	,855

Extraction Method: Principal Component Analysis.

Total Variance Explained

	Initial Eigenvalues		
Component	Total	% of Variance	Cumulative %
1	2,171	72,364	72,364
2	,590	19,681	92,045
3	,239	7,955	100,000

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
LN wastewater	,801
LN air pollution	,821
LN hazardous wastes	,925

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

To describe waste emission in some later analysis, instead of the three pollution variables, I will use the aggregate pollution index. Unfortunately, the index can only be computed for less than half of companies studied (39 in all), for in most cases data on all three pollution types is not available. The data provided by the 39 companies is sufficient to carry out certain calculations, while neglecting the other cases leads to a substantial loss of data, and I cannot draw conclusions for the entire sample based on this limited database. This prompted me to look for an index that can, at least in some analyses, replace the aggregate pollution emission and is available at the majority of companies under study. As the amount of emission is roughly in direct proportion to production volume, the most logical choice fell on total turnover logarithm, which correlates to specific pollution indices, as well as to aggregate pollution. [14]

[14] Variable POLLUTION stands for aggregate pollution which is sometimes referred as the aggregate pollution indicator.

Table 7.2-1: Correlation between sales and different types of pollution variables

Correlations

		LN turnover	Pollution	LN hazardous wastes	LN wastewater	LN air pollution
Pearson Correlation	LN turnover	1,000	,760**	,633**	,622**	,568**
	Pollution	,760**	1,000	,925**	,801**	,821**
	LN hazardous wastes	,633**	,925**	1,000	,672**	,587**
	LN wastewater	,622**	,801**	,672**	1,000	,395**
	LN air pollution	,568**	,821**	,587**	,395**	1,000
Sig. (2-tailed)	LN turnover	,	,000	,000	,000	,000
	Pollution	,000	,	,000	,000	,000
	LN hazardous wastes	,000	,000	,	,000	,000
	LN wastewater	,000	,000	,000	,	,008
	LN air pollution	,000	,000	,000	,008	,

**. Correlation is significant at the 0.01 level (2-tailed).

The aggregate pollution indicator gained through principal-component analysis correlates well with the total turnover logarithm. The correlation for industrial waste water is average-to-good, good for hazardous waste and average for air pollution. This is not surprising as my sample was quite homogeneous: it involved companies of the same sector, with typical technologies and waste emissions. The fact that data relates to production plants contributes to homogeneity; large units like giant firms were left out of the sample.

To describe environmental risks, in the majority of cases, resulting correlation values justify the use of total turnover logarithm (79 companies provided relevant data), instead of specific pollution indices. In certain countries companies do not have to provide detailed reports on pollution emission to the extent required in Hungary. Consequently, in most cases, data needed for aggregate pollution indices cannot even be obtained. In this case, if the sample is relatively homogenous, this can be substituted by some production-volume index.

When total turnover indicator is used in the future, one must never forget that it does not primarily serve to indicate the size of a company, rather, it is used as an index closely related to environmental risk. When I find that companies with

larger turnover operate a more developed environmental management system, this means that companies with larger environmental risk have developed a more sophisticated environmental management system, and not that large companies are "better" or more sensitive to the environment.[15]

7.2.2 Joint application of perceived and objective risks

PRESSURES, the only independent variable applied as far, indicated only the *perceived level* of endogenous and exogenous risks. In this point I build two previously described variables of objective risks into my model: POLLUTION (aggregate pollution) and LNTURNOVER (logarithm of the annual turnover). By doing it the as far two-dimensional model is expanded to a three dimensional one.

The risks perceived by the company (PRESSURES) and the volume of production (LNTURNOVER) together defines the accommodation region, that will be estimated by using multivariate regression. The summary table of the calculation is given bellow.

Illus. 7.2-2: Estimation of the accommodation region by using pressures and the logarithm of turnover as independent variables

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,530[a]	,281	,262	2,8165

a. Predictors: (Constant), LN turnover, PRESSURES

b. Dependent Variable: EMS

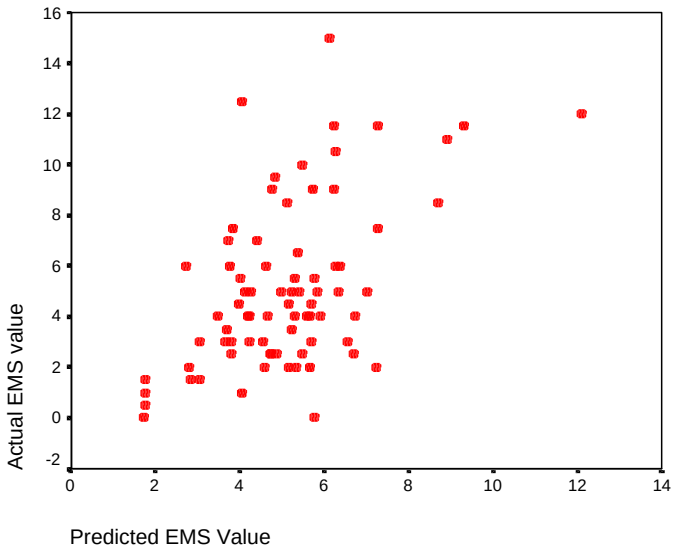
[15] Large companies often need more standardized systems to detect minor environmental risks. Due to their size, they are not as "transparent" as a small company, their operation is more bureaucratic. Consequently, for the same level of environmental risk the EMS of a large company may be more sophisticated than at a small or medium-size company. This, however, does not diminish the importance of the fact that environmental management systems are set up for the control of risks, and that larger risks call for the development of more sophisticated systems.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1,318	1,323		-,996	,322
	PRESSURES	,114	,039	,316	2,963	,004
	LN turnover	,635	,210	,323	3,029	,003

a. Dependent Variable: EMS

Illust.: 7.2-3: Actual and predicted values of environmental management system (predicted value is based on pressures and company size)



Perceived risks and production volume have a significant effect on the development level of a company's environmental management system: together they account for 28% of EMS variable variation. This value is still too low, and requires further refinement of our model.

There is a medium-strength (r = 0.515) positive correlation between aggregate pollution and PRESSURES variables. Therefore, the joint application of the two indicators as independent variables in the linear regression model is not

recommended. It is logical and to be expected the more pollution a company produces, the more environmental pressures it will have to cope with. However, relative to the amount of harmful emission by a company, the degree of pressure can be disproportionately high or low. As a next step, I set out to identify pressures that are not proportionate to the level of pollution.

7.2.5 Purifying the PRESSURES variable from the effects of pollution volume

Community or official pressure usually follows in response to pollution caused by industry. There are some other factors, however, that have no direct bearing on the amount of pollution (e.g., proximity of sensitive natural areas or schools). It is also conceivable that an unusually active environmental group overstates the environmental risks posed by a company.

For the reasons cited above, it is important that we purify the PRESSURES variable and remove those parts that can be clearly related to the volume of pollution emissions. This allows us to determine external (exogenous) risk factors that, instead of pollution volume, have primarily to do with local conditions (i.e., proximity of public institutions or sensitive areas, aggressive official or community activism).

This is achieved by applying linear regression between the aggregate pollution as independent and PRESSURES as dependent variables, using residuals derived from this regression in later analysis as values containing external risk and incidental factors, values that are independent of the amount of pollution. These residuals incorporate risks that are not proportionate to pollution volume and, of course, the error term, too.

Illus. 7.2-4: Impact of pollution on the pressures the company faces

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,515[a]	,265	,246	8,5798

a. Predictors: (Constant), Pollution

b. Dependent Variable: Pressures

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1036,049	1	1036,049	14,074	,001[a]
	Residual	2870,927	39	73,614		
	Total	3906,976	40			

a. Predictors: (Constant), Pollution

b. Dependent Variable: Pressures

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	19,976	1,340		14,908	,000
	Pollution	5,089	1,357	,515	3,752	,001

a. Dependent Variable: Pressures

Pollution accounts for approximately 26.5% of all pressure variation. In the rest of this chapter, I will concern myself with the part independent of pollution volume.

7.2.6 The effect of pollution volume and external pressures on the management system

Next, I will apply residuals derived from the first regression and the aggregate pollution indicator as variables explaining management systems. The former indicates perceived risks independent of pollution volume, while the latter indicates objective risks. It is clear that the combination of the two variables already accounts for 44% EMS variable deviation. Our model has been greatly

improved by the introduction of the new variable.

Illus. 7.2-5: Independent risks and the model of aggregate pollution

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,664[a]	,441	,411	2,3968

a. Predictors: (Constant), pollution, independent external risks

b. Dependent variable: EMS

ANOVA

Modell		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	167,851	2	83,925	14,609	,000
	Residual	212,549	37	5,745		
	Total	380,400	39			

Coefficients[a]

Modell		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(konstans)	5,420	,379		14,292	,000
	Independent external risks	,196	,046	,527	4,291	,000
	Pollution	1,218	,381	,393	3,194	,003

a. Dependent Variable: MENEDZS

Perceived risks free of the effects of volume and turnover logarithm can also be used as independent variables. This regression model accounts for 55% of variation in management system variables.

Illus. 7.2-6: Regression model using independent risks and the logarithm of turnover as independent variables

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,727[a]	,529	,501	2,2611

a. Predictors: (Constant), LN turnover, Independent external risks

b. Dependent Variable: EMS

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	195,288	2	97,644	19,100	,000[a]
	Residual	173,820	34	5,112		
	Total	369,108	36			

a. Predictors: (Constant), LN turnover, Independent external risks

b. Dependent Variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,425	1,505		-,283	,779
	Independent external risks	,153	,047	,405	3,242	,003
	LN turnover	,847	,219	,484	3,872	,000

a. Dependent Variable: EMS

7.2.7 Endogenous and exogenous risks and the effects of production volume

Finally, the effects of pollution volume may be further divided in two. One factor expresses relative pollution caused by specific types of technology, measured by

an indicator (PROPOLLUTION) for pollution/total turnover.[16] PROPOLLUTION is an indicator of endogenous risks, excluding risk of accidents. Along with relative pollution, internal risks are related to production volume as well. I call this the 'size-effect'.

Exogenous risks are indicated by PRESSURES free of pollution volume effects. The effect of these three variables on environmental management systems is illustrated by the following model.

Illus. 7.2-7: The model of exogenous risks, and volume of production

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,685[a]	,469	,420	2,4380

a. Predictors: (Constant), Independent external risks, Pollution per sales, Number of employees

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	172,963	3	57,654	9,700	,000[a]
	Residual	196,145	33	5,944		
	Total	369,108	36			

a. Predictors: (Constant), Independent external risks, Pollution per sales, Number of employees

b. Dependent Variable: EMS

[16] The PROPOLLUTION is a fraction where the numerator is derived directly from aggregate pollution indicators (and not from their logarithm), while the denominator represents total turnover.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,484	,541		10,137	,000
	Pollution per sales	,595	,309	,252	1,927	,063
	Number of employees	4,942E-04	,000	,262	1,824	,077
	Independent external risks	,164	,053	,434	3,103	,004

a. Dependent Variable: EMS

Beta values indicate that independent external pressures have the greatest influence on environmental management systems. The company reacts primarily to these external impulses. Pollution volume-effect and relative pollution (pollution intensity) have approximately the same impact on companies' environmental behavior. The latter two variables are significant only at significance levels higher than the usual 0.05.

7.3 A comparison of models

Before moving on, I will summarize the characteristics of models applied so far, their strengths and weaknesses. From the point of ***practical feasibility,*** the following factors should be considered when choosing the appropriate model:

- **theoretical soundness:** which model relies the most on theoretical principles? When theory is the least compromised in the course of analysis, the work will turn out to be more valuable from a scientific point of view.
- **standardization:** the model holds more promise if, with the help of a standardized questionnaire, it can be reproduced under various circumstances (e.g., other sector, other country). This allows the comparison of results because in this case, as the characteristic features of the given sample do not overly influence the model.

- **information requirements:** it is best when the model relies on information that can be obtained with relative ease; so a large number of missing answers does not distort results.
- **power of explanation:** of models possessing all the desired requirements, the one with the most explanatory power should be chosen.

Unfortunately, the above requirements are often in conflict with each other, the model with ideal features from one aspect usually offers only an average or poor 'performance' when it comes to other stipulations.

Based on the above listed factors, the following table offers a comparison of applied models:

Table 7.3-1. Comparison of applicable models

Dependent variable:
EMS (number of environmental management system elements applied

	Independent variables	theoretical soundness	Standar-dization	information requirement	power of explanation
1a	PRESSURES LNTURNOVER	++	+++	+++	+
2a	POLLUTION (INTERNAL RISK) INDEPENDENT EXTERNAL RISK	+++	++	+	++
2b	LNTURNOVER INDEPENDENT EXTERNAL RISK	++	++	+	+++
2c	INDEPENDENT EXTERNAL RISK POLLUTION INTENSITY VOLUME EFFECT	+++	++	+	++

The first model used risk factors (both internal and external), ones perceived by the company, as explanatory variables. It has the great advantage of easy reproducibility. With the help of the questionnaire I used, the model can be reproduced any time, the creation of variables is independent of sample

characteristics. From a theoretical point the model is deficient as far as it lacks variables for objective risks, while, from a practical point of view, it is poor in explanatory power.

The second model is relies most on theoretical foundation as its explanatory variables show the endogenous and exogenous factors of environmental risks in a purified form. The volume-effect has already been removed from exogenous factors. Today in Hungary, its information requirement can only be met partially. For aggregate pollution data I had to rely on information provided by company respondents. Thus, the design of variables is not entirely independent of subjectivity and the sample characteristics. However, this obstacle can be overcome. We can agree in the design method for setting the aggregate pollution indicator. If, for instance, we make the necessary calculations for all Hungarian companies (or for a representative sample thereof), and define the method of designing aggregate pollution, then in later surveys we can disregard sample characteristics.

Model 2.b is a variation on model 2a. It is poorer than model 2a. on all counts, except when it comes to its explanatory power. The reason might be that the treatment of the same degree of risk requires more formalized methods in a large organization, than in a small one. The total-turnover variable, which, besides the effect of pollution, includes this volume-effect as well, gives a better account of EMS variable deviation than aggregate pollution.

Model 2c. is also a variation on model 2a, where I further divided the internal risk factor into pollution/production (relative pollution or pollution intensity) and volume-effect. Risks purified of pollution volume-effects correspond to pure exogenous risks; pollution intensity describes the danger inherent in the activity, in other words the internal risk, while the volume-effect is the common range that characterizes both exogenous and endogenous risks. The knowledge of relative pollution is crucial as it actually shows to what extent a company's operation threatens the environment. Size-effect is related "merely" to production volume.

Eventually, the amount of available data must be the decisive factor when choosing between the first two models. Number 2 category models are preferred

to number 1, whenever possible.

7.4 Summary

After a review of the above models, the following conclusions can be made:

- The accommodation region is a category that lends itself to interpretation in practice. The majority of management system deviation can be explained by perceived and objective risks.
- The edges of the accommodation region plotted with received data are rather hazy. The reason might be that the machinery sector is usually not considered to fall into the high risk category. Industries with higher environmental risks probably present a figure that is more confined with cleaner edges. Further refinement of the model is needed to arrive at more defined borders.
- From a theoretical point of view, of all the approaches delineated so far the application of the model characterized by external risks free of pollution volume-effects and pollution volume can be recommended.
- Where there is no opportunity to measure pollution and the analyzed sample is sufficiently homogenous, some kind of indicator referring to company size can be used to characterize pollution levels.

Below, I will present models where the risks serving as explanatory variables and market opportunities were not determined a priori, rather they were derived with statistical methods from a variety of impact-factor clusters found in the questionnaire. Although models designed in this fashion are not standardized, they function well and even better than the variations discussed so far when it comes to other aspects of the study.

8. Isolation of factors affecting environmental performance

by factor analysis

8.1 The model containing aggregate pollution

Previous models followed methods that were based on the point values of various variables (e.g., sum of pressures, number of management system elements). Their advantage lies in easy reproducibility under different circumstances, as the components of certain explanatory variables (e.g., types of pressures) are independent of the given sample. With the help of standardized questionnaires, measurements can be carried out using explanatory variables with the same components.

In defining explanatory variable components I relied on professional literature and my own professional experience. As the components (variables) are not dependent of each other, indicators based on their aggregation can distort certain effects. The finer the resolution of a given factor group, the higher values it can assume, carrying more weight in the aggregate indicator. For instance, in PRESSURES one can further divide the effect of Hungarian regulations into pressures by legal and official measures, as well as the threat of fines. There is a correlation among these three sub-variables, they are not independent of each other. If regulations were taken as a single variable, its values would move between 0 and 4, while after finer resolution the same ranges between 0 to 12. As a result of finer resolution, the weight of the factor group has increased. Consequently, the degree of breakdown of factor clusters making up aggregate variables is clearly crucial; it has an effect on results by itself.

The correlation between variables calls for factor analysis to discover the common elements.

Taking these factors, new models can be constructed; with their help questionnaires can be further adjusted in the future.

The table below illustrates the correlation between PRESSURES variables.

Table 8.1-1: Correlation between the pressure factors affecting company activity

Correlations

	INCIDENTSpr	BANKSpr	FINESpr	TMARKETPR	ECOSYSTEMpr	EUpr	CONSUMERpr	AUTHORITYpr	PUBL.BUILDpr	RESID.AREA.pr	HUNG.LAWpr.	NGOpr.	TECHNOLpr	COMPET.pr.
INCIDENTSpr	1,000	,421**	,241*	,327**	,534**	,230*	,138	,202	,414**	,322**	,347**	,273*	,602**	,202
BANKSpr	,421**	1,000	,135	,529**	,290**	,440**	,502**	,188	,345**	,299**	,200	,468**	,392**	,449**
FINESpr	,241*	,135	1,000	,207	,352**	,236*	,048	,587**	,105	,014	,358**	,156	,356**	,261*
TMARKETPR	,327**	,529**	,207	1,000	,375**	,681**	,362**	,389**	,245*	,243*	,274**	,398**	,274**	,495**
ECOSYSTEMpr	,534**	,290**	,352**	,375**	1,000	,240*	,150	,337**	,360**	,325**	,318**	,352**	,544**	,193
EUpr	,230*	,440**	,236*	,681**	,240*	1,000	,327**	,253*	,311**	,151	,247*	,268*	,287**	,539**
CONSUMERpr	,138	,502**	,048	,362**	,150	,327**	1,000	,103	,240*	,216*	,202	,438**	,163	,457**
AUTHORITYpr	,202	,188	,587**	,389**	,337**	,253*	,103	1,000	,166	,108	,461**	,311**	,268*	,289**
PUBL.BUILDpr	,414**	,345**	,105	,245*	,360**	,311**	,240*	,166	1,000	,601**	,119	,364**	,437**	,197
RESID.AREA.pr	,322**	,299**	,014	,243*	,325**	,151	,216*	,108	,601**	1,000	,130	,495**	,329**	,204
HUNG.LAWpr.	,347**	,200	,358**	,274**	,318**	,247*	,202	,461**	,119	,130	1,000	,305**	,207	,330**
NGOpr.	,273*	,468**	,156	,398**	,352**	,268*	,438**	,311**	,364**	,495**	,305**	1,000	,281**	,330**
TECHNOLpr	,602**	,392**	,356**	,274**	,544**	,287**	,163	,268*	,437**	,329**	,207	,281**	1,000	,240*
COMPET.pr.	,202	,449**	,261*	,495**	,193	,539**	,457**	,289**	,197	,204	,330**	,330**	,240*	1,000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The following table shows correlation between pressures affecting companies (integrated by type), the role of management and opportunities in environmental protection.

Table 8.1-2: Correlation between pressures affecting companies (integrated by type)

	INTERNALpr= INCIDENTSpr+ TECHNOLpr	CULTURE= EUpr+ HUNG.LAW.pr	CEOpr.	MARKETpr=BANKSpr+ CONSUMERpr+ COMPETpr+TMARKETpr	OPPORTUNITIES=IMAGEpr+ SAVINGSpr+PRODUCTpr	LOCALpr=ECOSYSTEMpr +AUTHORITYpr+ PUBL.BUILD.pr+NGOpr.
INTERNALpr=INCIDENTSpr+ TECHNOLpr	1,000	,369**	,218*	,379**	,274**	,604**
CULTURE=EUpr+HUNG.LAW.pr	,369**	1,000	,355**	,666**	,482**	,500**
CEOpr.	,218*	,355**	1,000	,547**	,293**	,271*
MARKETpr=BANKSpr+CONSUMERpr+ COMPETpr+TMARKETpr	,379**	,666**	,547**	1,000	,528**	,533**
OPPORTUNITIES=IMAGEpr+ SAVINGSpr+PRODUCTpr	,274**	,482**	,293**	,528**	1,000	,326**
LOCALpr=ECOSYSTEMpr+ AUTHORITYpr+PUBL.BUILD.pr+NGOpr.	,604**	,500**	,271*	,533**	,326**	1,000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

To uncover latent effects, I applied factor analysis. The study incorporated all PRESSURES sub-variables, total turnover, the pollution indicator, the indicator for environmental market opportunities, as well as management commitment. This means that pressures, objective risks, opportunities and the role of subjectivity are all part of the analysis. These are the factor clusters that can have a significant effect on company environmental performance.

An important aspect of the study is that it contains the aggregate pollution indicator.

Table 8.1-3: Factoranalysis: Communalities

	Initial	Extraction
ACCIDENTSpr	,722	,651
BANKSpr	,764	,705
FINESpr	,630	,666
TMARKETPR	,846	,563
ECOSYSTEMpr	,776	,630
EUpr	,810	,764
CONSUMERpr	,685	,468
AUTHORITYpr	,748	,792
IMAGEpr	,836	,840
PUBL.BUILDpr	,694	,554
RESID.AREA.pr	,788	,844
HUNG.LAWpr	,753	,622
NGOpr	,714	,579
TECHNOLpr	,778	,674
PRODUCTpr	,729	,534
COMPETpr	,781	,721
CEOpr	,842	,719
POLLUTION	,806	,741
LNTURNOVER	,849	,867

Extraction Method: Principal Axis Factoring.

Table 8.1-4: Factoranalysis I.: Variance explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7,781	40,952	40,952	7,478	39,359	39,359	3,573	18,804	18,804
2	2,093	11,018	51,970	1,754	9,230	48,589	3,368	17,729	36,533
3	1,953	10,277	62,247	1,633	8,595	57,185	2,441	12,848	49,381
4	1,551	8,163	70,410	1,245	6,554	63,738	1,867	9,825	59,206
5	1,064	5,600	76,010	,822	4,325	68,064	1,683	8,858	68,064
6	,848	4,465	80,474						
7	,675	3,554	84,028						
8	,565	2,974	87,002						
9	,479	2,520	89,522						
10	,431	2,268	91,790						
11	,328	1,728	93,518						
12	,272	1,433	94,951						
13	,242	1,275	96,226						
14	,213	1,120	97,346						
15	,171	,902	98,248						
16	,116	,612	98,860						
17	9,748E-02	,513	99,373						
18	7,007E-02	,369	99,742						
19	4,910E-02	,258	100,000						

Extraction Method: Principal Axis Factoring.

The analysis shows five well-defined factors that account for 68% of all variations.

Table 8.1-5: Factoranalysis I.: Rotated Factor Matrix

Rotated Factor Matrix[a]

	Factor				
	1	2	3	4	5
CEOpr	,738	-6,302E-02	,337	,168	,166
COMPETpr	,698	,138	,240	,340	,205
CONSUMERpr	,662	-3,873E-03	3,028E-02	5,294E-02	,161
NGOpr	,661	,350	9,797E-02	7,539E-02	-5,902E-02
RESID.AREApr	,634	,573	-8,631E-02	-4,436E-02	-,322
BANKSpr	,594	,425	3,506E-02	,242	,336
TMARKETpr	,415	,305	,333	,405	,154
TECHNOLpr	-2,871E-02	,723	,268	7,268E-02	,271
ACCIDENTpr	,204	,719	,218	7,398E-02	,200
ECOSYSTEMpr	,122	,711	,144	9,471E-02	,284
PUBL.BUILDpr	,123	,710	7,016E-02	,161	-5,959E-02
AUTHORITYpr	,264	8,995E-02	,843	-3,753E-02	5,212E-02
FINESpr	-4,834E-02	,263	,744	,122	,161
HUNG.LAWpr	,482	,156	,575	4,860E-02	,178
IMAGEpr	,199	,279	,373	,737	,201
PRODUCTpr	5,485E-02	-3,774E-02	-,118	,692	-,191
EUpr	,314	,442	4,531E-02	,635	,253
LNTURNOVER	,437	,351	,162	-7,284E-03	,725
POLLUTION	,173	,269	,468	-1,063E-02	,647

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 9 iterations.

The first factor covers pressures on the company coming from interested parties. These are pressures primarily involving the market environment (competitors, Hungarian consumers, banks, target market consumers), but two local-type pressures (NGOs, proximity of residential areas) and pressures from company management belong here as well. Therefor, the first factor can be referred to as STAKEHOLDERS.

The second factor incorporates four local environmental risk variables: risks as a function of technology, risk of accidents, proximity of ecologically sensitive areas, proximity of public institutions (hospitals, schools). In short, the second factor incorporates LOCAL RISKS.

The third factor describes the effect of regulations and includes three variables: pressure from the environmental agency, pressures exerted by fines and the effects of Hungarian legal regulations. The factor is called REGULATION.

The fourth factor covers variables related to market opportunities. It covers the following three components: the potential of marketing environmentally friendly products, the company's image and European environmental regulation. The inclusion of the latter may not be self-evident, but if we consider the dynamic growth in the volume of machinery-sector exports, it becomes clear that companies look to the EU as a potential market. This also explains their sensitivity to EU environmental directives. The factor goes by the term: MARKET POTENTIALS.

The last factor incorporates two variables related to pollution volume: aggregate pollution indicator and total turnover logarithm, called POLLUTION.

Following the identification of factors I examined to what degree they provide explanation for the level of environmental management systems. For this analysis I applied linear regression models.

The model excluding the fifth factor (MARKET POTENTIALS) provides an estimation of the accommodation region. The recognition and application of MARKET POTENTIALS is more related to company strategy, which characterizes the position occupied relative to the accommodation region (bellow or above region).

Next, I present summary tables of regression models, based on the risk factors delineated above.

8.2 The regression model based on risks

The purpose of the regression model that contains risk factors as independent variables and EMS as dependent variable is to provide an estimate of the centerline of the accommodation region. The latter is defined as the linear combination of factors.

The illustration below shows tables of models.

Illus. 8.2-1: Regression model 1. based on risk factors, summary tables

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,693[a]	,480	,415	2,4500

a. Predictors: (Constant), POLLUTION, LOCAL RISKS, REGULATION, STAKEHOLDERS

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	177,023	4	44,256	7,373	,000[a]
	Residual	192,085	32	6,003		
	Total	369,108	36			

a. Predictors: (Constant), POLLUTION, LOCAL RISKS, REGULATION, STAKEHOLDERS

b. Dependent Variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,324	,403		13,219	,000
	STAKEHOLDERS	1,706	,431	,506	3,962	,000
	LOCAL RISKS	,897	,436	,263	2,055	,048
	REGULATION	,532	,437	,155	1,216	,233
	POLLUTION	1,065	,437	,311	2,439	,020

a. Dependent Variable: EMS

Based on our model the results are surprising: Hungarian environmental regulations have no significant effect on the environmental management systems of machinery and equipment producing firms. In shaping environmental management, the most crucial impact turns out to be the pressure exerted by stakeholders, followed by the effects of pollution. The explanatory power of local risks is weak, a borderline case at the traditional 0.05 significance level. The result is unexpected only on the surface. Let us remember: the machinery sector is one of the most dynamically developing industries, with growing exports which, at the same time, does not fall into the "environmentally most risky" category. It is easy to see that a sector so focused on development pays more attention to market conditions than to environmental regulations.

Leaving the REGULATION factor aside, we arrive at the following accommodation region estimation:

Illus. 8.2-2: Regression model based on risk factors

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,675[a]	,456	,406	2,4677

a. Predictors: (Constant), POLLUTION, LOCAL RISKS, STAKEHOLDERS

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	168,154	3	56,051	9,205	,000[a]
	Residual	200,954	33	6,090		
	Total	369,108	36			

a. Predictors: (Constant), POLLUTION, LOCAL RISKS, STAKEHOLDERS

b. Dependent Variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,324	,406		13,124	,000
	STAKEHOLDERS	1,713	,434	,508	3,950	,000
	LOCAL RISKS	,906	,440	,265	2,061	,047
	POLLUTION	1,083	,440	,317	2,464	,019

a. Dependent Variable: EMS

The three factors account for 46% of management system deviations.

At this point I bring in the MARKET POTENTIALS factor in the analysis to see how this variable improves the model.

Illus. 8.2-3: Regression model including market potentials

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,782[a]	,612	,564	2,1148

a. Predictors: (Constant), MARKET POTENTIALS, POLLUTION, STAKEHOLDERS, LOCAL RISKS

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	225,987	4	56,497	12,632	,000[a]
	Residual	143,121	32	4,473		
	Total	369,108	36			

a. Predictors: (Constant), MARKET POTENTIALS, POLLUTION, STAKEHOLDERS, LOCAL RISKS

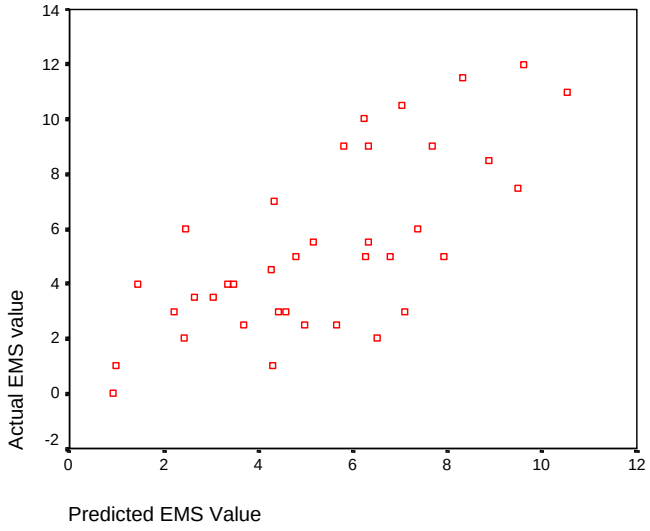
b. Dependent Variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,324	,348		15,314	,000
	STAKEHOLDERS	1,724	,372	,512	4,638	,000
	LOCAL RISKS	,875	,377	,256	2,322	,027
	POLLUTION	1,089	,377	,318	2,891	,007
	MARKET POTENTIALS	1,327	,369	,396	3,596	,001

a. Dependent Variable: EMS

Illus. 8-4: Chart of the predicted and actual values of EMS



The results further strengthen the assumption that, when it comes to environmental protection, in the case of the machinery sector, market conditions carry more weight than the burden of regulations. Including MARKET POTENTIALS, the model's explanatory power is drastically improved: it accounts for 61% of environmental management system deviations. After STAKEHOLDERS, this factor has the second strongest explanatory power.

Later I will further examine the role of regulations from two aspects:

- Do we get the same results if we study environmental performance with more complex indicators?
- What can we say about the relationship between market conditions and regulations when it comes to other industries developing not so fast?

First, however, I present tables for principal component analysis conducted without pollution indicators, based on data from many more companies, and examine to what extent results gained this way support my previous findings.[17]

8.3 The model not including aggregate pollution

Again, the model not including aggregate pollution plays an auxiliary role. It has the major advantage of being built on easily available data. This also helps to avoid data loss, a result of incomplete information on pollution levels, which renders valid responses from other companies useless for our analytical purposes.

It is interesting to note the way results of the substitute model differ from those found in the original model.

[17] The method of principal factor analysis has resulted in exactly the same factors as the principal component factor analysis. Compared to the principal component analysis, however, its explanatory power was much weaker, the reason why I eventually opted for the latter.

Table 8.3-1: Factor model without aggregate pollution: Variation explained

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5,760	31,999	31,999	2,994	16,634	16,634
2	1,915	10,641	42,640	2,527	14,041	30,675
3	1,775	9,860	52,500	2,230	12,388	43,063
4	1,416	7,869	60,369	2,217	12,317	55,380
5	1,224	6,798	67,166	2,122	11,787	67,166
6	,772	4,289	71,456			
7	,722	4,011	75,467			
8	,671	3,728	79,195			
9	,573	3,182	82,377			
10	,512	2,845	85,222			
11	,499	2,773	87,995			
12	,437	2,426	90,422			
13	,415	2,303	92,725			
14	,340	1,891	94,616			
15	,305	1,692	96,308			
16	,262	1,458	97,766			
17	,240	1,336	99,102			
18	,162	,898	100,000			

Extraction Method: Principal Component Analysis.

The model accounts for some 67% of variations in a system containing 18 variables. The analysis has resulted in 5 principal components (factors): their composition is shown in the table below.

Table 8.3-2: Factor model without aggregate pollution

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
CONSUMERpr	,733	-6,29E-02	-6,87E-02	,104	,227
CEOpr	,710	,167	,269	4,723E-02	-8,98E-02
BANKSpr	,661	,353	-4,78E-02	,286	,226
COMPETpr	,642	4,244E-02	,259	,401	8,531E-02
TMARKETpr	,491	9,649E-02	,340	,391	,309
ACCIDENTpr	,134	,783	,143	-2,25E-02	,252
TECHNOLpr	-1,38E-02	,750	,189	,214	,234
LN TURNOVER	,508	,641	-8,56E-02	4,372E-02	-,271
ECOSYSTEMpr	6,913E-02	,621	,349	7,984E-03	,305
AUTHORITYpr	,125	6,133E-02	,861	,129	5,889E-02
FINESpr	-8,38E-02	,276	,732	,318	-,165
HUNG.LAW.pr	,374	,199	,630	-,211	,115
PRODUCTpr	4,365E-02	-8,34E-02	-6,39E-03	,834	7,834E-02
IMAGEpr	,247	,247	,101	,700	4,372E-03
EUpr	,392	,110	,190	,601	,241
RESID.AREApr	,137	,243	-8,67E-02	3,811E-02	,762
PUBL.BUILDpr	-5,81E-02	,359	-1,87E-02	,218	,726
NGOpr	,425	-3,15E-02	,232	5,150E-02	,639

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 18 iterations.

[18]

Two principal components contain the same 3 variables, also part of the former model with the aggregate pollution indicator. These are the factors of REGULATION (third principal component) and MARKET POTENTIALS (fifth principal component). Three factors have been slightly modified. The first one has been cleaned up, no longer containing local interest groups carrying out their agenda independent of the market place. Consequently, this factor is directly related to business competition, which is why I call it MARKET PRESSURES. The second principal component contains pollution-related risks (POLLUTION RISK). The factor incorporates accident risks, company size, technology-based

[18] Two sub-variables of PRESSURES are not included in the principal component analysis. Very few companies responded to the question concerning environmental load fees, while savings opportunities derived from conservation had a very weak correlation with all factors.

pollution, and the proximity of sensitive natural areas. The fifth principal component includes all LOCAL PRESSURES (i.e., proximity of populated areas, as well as pressure from local community and environmental organizations).

8.4 The regression model not including aggregate pollution

Using the four risk factors as the explanatory variables of the regression, I arrive at the first approximation of accommodation region centerline.

Table 8.4-1: The regression model not including aggregate pollution: summary tables

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,597[a]	,356	,321	2,7018

a. Predictors: (Constant), LOCAL PRESSURES, REGULATION, POLLUTION RISK, MARKET PRESSURES

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	290,938	4	72,734	9,964	,000[a]
	Residual	525,582	72	7,300		
	Total	816,519	76			

a. Predictors: (Constant), LOCAL PRESSURES, REGULATION, POLLUTION RISK, MARKET PRESSURES

b. Dependent Variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,060	,308		16,425	,000
	MARKET PRESSURES	1,503	,311	,458	4,839	,000
	POLLUTION RISK	,981	,308	,301	3,187	,002
	REGULATION	,601	,307	,185	1,956	,054
	LOCAL PRESSURES	-,462	,321	-,136	-1,440	,154

a. Dependent Variable: EMS

The regression result indicates that local pressures do not have a significant effect on company environmental management systems, and the effect of regulations is negligible as well. Market pressure is the major driving force, followed by pollution risks. The impact of regulation is rather weak, reaching significant levels only when dropping below the traditional 0.95 level.

The development level of environmental management system is determined primarily by market forces, while environmental regulation and the fallout associated with the company's own perceived risks (e.g., the likelihood of accidents and its consequences) play a reduced role. Of all market forces, direct pressure exerted by market stakeholders figure dominantly. Pollution is an important variable as well. The role of local pressures is insignificant in this model.

Most likely, the results reflect the characteristic feature of the machinery sector; it is possible that in other industries, market forces have less influence on companies' environmental behavior. Between 1992 and 1996 the machinery sector has increased its exports by 174.2%, while the industry average is only 7.2%. A large proportion of its exports goes to EU countries, whose high standards have a stimulating effect on companies. The machinery industry has adjusted with lightning speed to new requirements.

The tables below show the regression results without the effect of local pressures.

Illus. 8.4-1: Regression model with three risk factors

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,581[a]	,338	,311	2,7216

a. Predictors: (Constant), REGULATION, POLLUTION RISK, MARKET PRESSURES

b. Dependent Variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,069	,310		16,338	,000
	POLLUTION RISK	,994	,310	,306	3,209	,002
	MARKET PRESSURES	1,484	,313	,452	4,749	,000
	REGULATION	,614	,310	,189	1,982	,051

a. Dependent Variable: EMS

Casewise Diagnostics[a]

	CASE NUMBER	Std. Residual	EMS	Predicted Value	Residual
	30	2,986	12,50	4,3731	8,1269
	42	3,126	15,00	6,4928	8,5072
	44	-2,146	2,00	7,8409	-5,8409

a. Dependent Variable: EMS

8.4.1 Elimination of outliers

Some outliers were recognized already in the most simple models. So far I have not dealt with them separately, although their identification is crucial for two reasons:

- As they fall outside the accommodation region, its centerline must be redefined after the identification and elimination of outliers. If I estimate parameters using values lying outside the region, I get a distorted value concerning the coefficients of risk factors.

- They carry vital information. It is my assumption that positive outliers take advantage of opportunities offered by environmental protection. At the same time, companies whose environmental strategy is unsustainable over the long run can be found among the negative outliers.

The elimination of outliers is done by the method of iteration: I re-estimate regression-model parameters by disregarding the three values lying outside two deviation.[19] This results in somewhat different regression parameters and further outliers show up in the adjusted model. The iteration of outlier elimination and re-estimation of parameters will be repeated until no further outliers would be found. Detailed description of the process can be found in the Appendix.

The procedure yielded the following model:

8.4-1. Table: Steps of eliminating outliers

Steps	Eliminated companies (points)
1.	30, 42, 44
2.	75, 88
3.	80
4.	54, 69
5.	27

This accommodation-region model accounts for 53% for the development level of environmental management systems. This is an excellent percentage as the definition of our model does not extend to MARKET OPPORTUNITIES, playing a major role in influencing company behavior. The purpose of the model,

[19] The definition of outliers used in this study requires some explanation. I took as outlier values that deviate from the predicted value by more than two deviation. I found only one value three times over the deviation: substantially more than one companies can be, however, "suspected" of following unorthodox strategies. At less than double deviation there is the danger of excluding values that a later iteration model would not have defined as an outlier. In eliminating outliers I tried to avoid this latter mistake, and therefor eliminated fewer, rather than more, values when estimating parameters.

however, was not a comprehensive explanation of deviation but, instead, an explanation of the problem of determining the position of the accommodation-region.

Based on the above model, the following estimate can be given on the number of environmental management elements implemented by the company:

EMS elements to be applied = 4.5333+1.536 * MARKET PRESSURES + 1.009 * POLLUTION RISKS + 0.681 * REGULATION

I use the above equation on the accommodation map to estimate expected environmental management (EMS) values based on risks.

9. Accommodation map and company strategies

In this chapter I will draft an accommodation map, suitable for the identification of different company-strategy types. Following that, I shall examine and analyze the characteristics of various types.

9.1 The accommodation map - an outline

As a starting point, I rely on risk components delineated at the end of the previous chapter. One of them (LOCAL PRESSURES) did not prove to be significant, while the principal component of MARKET OPPORTUNITIES describes, instead of the accommodation region, deviations from it. With the help of MARKET PRESSURES, POLLUTION RISKS and REGULATION principal components as explanatory variables, the expected level of environmental management systems can be defined.

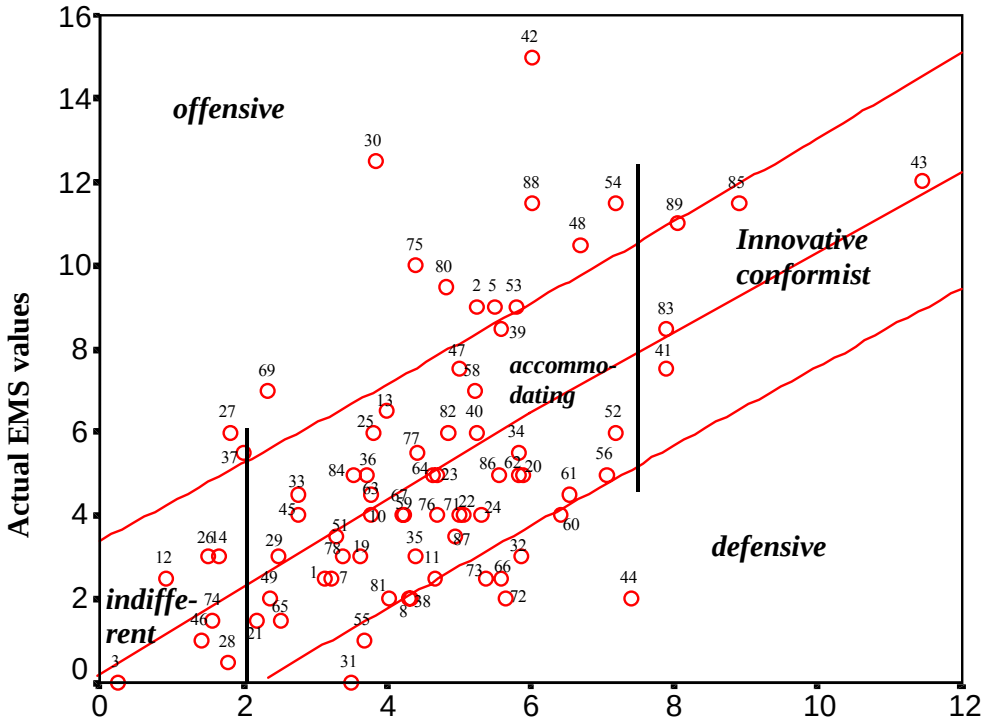
Along the horizontal axis of the following graph one can find expected EMS values based on the three risk factors, while actual management values are lined up against the vertical axis. If the three variables perfectly defined companies' environmental management systems, than all values would fall along a straight line at 45^0 from both axes. In fact most values are arranged in one zone, while there are values and clusters lying on the periphery. The zone emerging in the center of the graph is the accommodation region. In the case of multi-dimensional models, this method is suitable for the two-dimensional presentation of the accommodation region.

The graph is based on the regression model (excluding aggregate pollution), after the elimination of outliers. The equation of projected environmental management values is as follows:

EMS elements to be applied = 4.5333+1.536 * MARKET PRESSURES + 1.009 * POLLUTION RISKS + 0.681 * REGULATION

By definition, the number of EMS elements to be applied equals predicted EMS value based on risks. The graph shows all values representing companies that could be calculated using the above equation, including those ignored when estimating parameters. The accommodation map incorporates outliers as well.

Illus. 9.1.-1: The accommodation map



Points on the graph serve to identify companies forming the sample.

Plotting the accommodation region can be done by statistical methods, as well as by free-hand drawing. An example of defining border lines is given in the appendix. In reality the borders are not sharply defined; they should not be interpreted too narrowly. The majority (60 to 80%) of companies must by necessity fall within the accommodation region as we cannot speak of common strategy if it does not describe the behavior of the bulk of companies under study. The region is defined by the zone where the majority of companies are clustered,

while the incidence of points fall precipitously at its outer border. In this instance the borders were defined by statistical means where the accommodation region contains 2/3 of companies and the two edges are equidistant from the centerline.

The point where the accommodation region and the vertical axis intersect represents the limit of acceptable risk. Companies operating with lower risk factors can be ignored from the point of environmental management: they do not need to set up an environmental management system.

To this point I assumed that significant deviation from values defined by internal and external risks are due to companies' offensive and defensive environmental strategies. I test this by demarcating the assumed strategic areas on the accommodation map, define which companies belong to a specific region, and compare the characteristics of various groups with each other as well as with the description given by other professional literature.

With two vertical lines I divided the area into four segments, where every zone denotes a distinct environmental strategy group. The first line marks the zone of acceptable risk. The second is placed arbitrarily where inside the accommodation region the density of companies starts to fall off. This separates large-risk operations from the rest. Since their activity may be critical from an environmental point of view, they are closely watched by society and researchers alike.

Outlines of the accommodation region are not well defined. I treat borderline cases as part of the region and selected only companies for the out-of-the-region strategy group that are "clearly" far off.

By this method, I arrived at the following groups:

Group 1.

Indifferent ones: 3, 12, 14, 26, 28, 46, 74. Their environmental risk is low, we do not "expect" them to pay special attention to environmental protection.

Group 2.

Innovative conformists: (42, 43, 83, 85, 89). This group occupies the upper-right

corner inside the accommodation region. It is notable for the fact that companies in this group are usually seen as role models and leaders in environmental protection. In my judgment their activity is part of the accommodation region, their sophisticated environmental system can be related to their high risk factors.

Group 3.

Defensive ones: (31, 32, 44, 55, 66, 72, 73). All companies that lie below the accommodation region are defensive.

Group 4.

Offensive ones: (2, 5, 27, 30, 42, 48, 54, 69, 75, 80, 88). Companies above the accommodation region apply an offensive strategy. I assume that these companies see more opportunities in environmental protection than companies in other groups.

Group 5.

Accommodating ones: all companies that lie within the accommodation region. This is the largest group, collecting all firms that follow a strategy that is customary and accepted within the industry.

In a strict sense, all indifferent and innovative firms belong here as well. The reason one should distinguish them is that other authors treat these strategic categories separately. Therefore, I believe it is important to define by what criteria they differ, and by what other criteria they still fit in the accommodation region. On the other hand, they might differ greatly in risk levels, which goes to explain the notable differences between customary and expected strategies among these three groups.

9.2 Projects completed by the strategic groups

The following table shows the proportion of completed projects undertaken by companies in various groups. The average column can be interpreted as the portion of companies that carried out a given project. Obviously very few companies fall in each column, so the table serves only as an illustration.

Table 9.2-1: Proportion of companies with environmental projects in different strategic groups

		N	Proportion of companies initiating project
product development	indifferent	7	,0000
	innovative conformist	5	,8000
	defensive	7	,0000
	offensive	11	,3636
	accommodating	49	,3673
	Total	79	,3291
purchase of materials	indifferent	7	,2857
	innovative conformist	5	,6000
	defensive	7	,0000
	offensive	11	,8182
	accommodating	49	,4286
	Total	79	,4430
production technology	indifferent	7	,0000
	innovative conformist	5	,8000
	defensive	7	,1429
	offensive	11	,7273
	accommodating	49	,3265
	Total	79	,3671
harmful emissions	indifferent	7	,0000
	innovative conformist	5	1,0000
	defensive	7	,2857
	offensive	11	,9091
	accommodating	49	,4286
	Total	79	,4810
logistics	indifferent	7	,1429
	innovative conformist	5	,4000
	defensive	7	,0000
	offensive	11	,4545
	accommodating	49	,1429
	Total	79	,1899
waste management	indifferent	7	,2857
	innovative conformist	5	1,0000
	defensive	7	,2857
	offensive	11	,6364
	accommodating	49	,4286
	Total	79	,4684
equipment/ infrastructure	indifferent	7	,0000
	innovative conformist	5	,6000
	defensive	7	,0000
	offensive	11	,7273
	accommodating	49	,2245
	Total	79	,2785
management techniques	indifferent	7	,0000
	innovative conformist	5	,4000
	defensive	7	,0000
	offensive	11	,6364
	accommodating	49	,2245
	Total	79	,2532
resource reduction	indifferent	7	,1429
	innovative conformist	5	,8000
	defensive	7	,1429
	offensive	11	,5455
	accommodating	49	,2449
	Total	79	,3038
marketing	indifferent	7	,0000
	innovative conformist	5	,2000
	defensive	7	,0000
	offensive	11	,3636
	accommodating	49	,1633
	Total	79	,1646

Based on the number of environmental projects launched by each company, environmental strategy groups can be clearly differentiated.

Answers concerning environmental projects were not used in defining outlines of the accommodation region. Nevertheless, the general use of projects by various groups offers valuable information on the usefulness of the accommodation region as it demonstrates that groups formed by other criteria are well differentiated from this aspect as well.

In the completion of almost all types of projects, offensive and innovative businesses are on top. Offensive companies lead with projects related to marketing, management methods, infrastructure and materials purchase. All companies conforming through innovation operate waste management and pollution reduction projects - indeed, justified by high levels of hazardous emissions - while they are also leaders in areas of product development and resource reduction. When it comes to pollution emission, offensive companies launch projects almost as often as innovative firms do: in all likelihood it is a prerequisite of offensive strategies to leave no room for criticism over risk management.

The seven defensive companies barely have any environmental projects. The few in operation are in technology, waste management, emission reduction and resource reduction (conservation of electricity or water). These areas all point to a defensive strategy. In areas characterized by proactive strategies, such as marketing, product development or management style, none of the defensive companies are involved.

Indifferent companies have also completed very few projects which, in their case, is entirely acceptable.

From an environmental point of view, accommodating companies are quite active in areas of material purchase, waste management, emission reduction and product development.

These results coincide with expectations characteristic of each group. Indeed, we

expect innovative companies to do the most for the protection of the environment, justified by their high risk level as well. In the case of offensive companies it is not the element of risk but a proactive company strategy that justifies a high level of activity. The environmental performance of indifferent and defensive firms is equally poor but, while it is natural and accepted in the former, it shows failure in the latter. Average behavior patterns are represented by companies found in the accommodation region.

It must be noted, that individual projects cannot always be clearly classified by type. Specific projects can fit a number of types, and the same procedure was often placed in a number of different categories by respondents. Consequently, differentiation between project categories is somewhat arbitrary.

9.3 Level of sophistication of environmental management systems in various groups

Here, I will examine the diverse elements of environmental management to see how prevalent they are in the practice of various strategic groups. The table shows average values related to distinct management elements within groups.

There is little difference in the application of most elements between the offensive and innovative groups. The former is leading in the application of five, while the latter in that of eight management elements, in most cases only by a small margin.

There is a one-to-one correspondence between the description of project launching behavior and the formalized operation of the environmental management system (i.e., written policy, environmental protection program, measurable targets, representation in upper management, etc.). The highest values are achieved by innovative companies, followed by the offensive group. Average behavior is represented by the accommodating group, defensive and indifferent companies coming last.

Table 9.3.-1: Frequency of individual EMS elements in different strategy groups

		N	Mean
The company has written environmental policy	indifferent	7	,1429
	innovative conformist	5	,9000
	defensive	7	,0000
	offensive	11	,8182
	accommodating	49	,2959
	Total	79	,3671
The company has stated measurable targets concerning the protection of the environment	indifferent	7	,1429
	innovative conformist	5	,9000
	defensive	7	,2143
	offensive	11	,8636
	accommodating	49	,5306
	Total	79	,5380
The company develops programs to reach environmental goals	indifferent	7	,1429
	innovative conformist	5	1,0000
	defensive	7	,1429
	offensive	11	,7727
	accommodating	49	,4796
	Total	79	,4937
Someone in top management is personally responsible for the environment	indifferent	7	,0000
	innovative conformist	5	,8000
	defensive	7	,0000
	offensive	11	,5909
	accommodating	49	,2959
	Total	79	,3165
The company's own experts conduct regular eco-audits	indifferent	7	,0000
	innovative conformist	5	,7000
	defensive	7	,0000
	offensive	11	,7273
	accommodating	49	,1633
	Total	79	,2468
The company hires outside experts to conduct regular eco-audits	indifferent	7	,0000
	innovative conformist	5	,5000
	defensive	7	7,143E-02
	offensive	11	,5000
	accommodating	49	,3469
	Total	79	,3228
The company has established procedures to communicate with the public at large	indifferent	7	,1429
	innovative conformist	5	,7000
	defensive	7	7,143E-02
	offensive	11	,5455
	accommodating	49	,1531
	Total	79	,2342
The company has published public environmental reports	indifferent	7	,0000
	innovative conformist	5	,3000
	defensive	7	,1429
	offensive	11	,4545
	accommodating	49	,1531
	Total	79	,1899
When acquiring real-estate, other plant facilities, the company makes environmental assessment of the property	indifferent	7	,3571
	innovative conformist	5	,5000
	defensive	7	,2857
	offensive	11	,7273
	accommodating	47	,4468
	Total	77	,4675
The company checks suppliers' environmental performance	indifferent	7	7,143E-02
	innovative conformist	5	,8000
	defensive	7	7,143E-02
	offensive	11	,7273
	accommodating	49	,2653
	Total	79	,3291
The company takes advantage of environment-oriented marketing opportunities	indifferent	7	,286
	innovative conformist	5	,700
	defensive	7	,286
	offensive	11	,773
	accommodating	49	,276
	Total	79	,373
The company has a training program for its employees	indifferent	7	7,143E-02
	innovative conformist	5	,700
	defensive	7	,143
	offensive	11	,682
	accommodating	49	,194
	Total	79	,278
The company has an emergency plan	indifferent	7	,2143
	innovative conformist	5	,8000
	defensive	7	,3571
	offensive	11	,9091
	accommodating	48	,5417
	Total	78	,5641
The company applies procedures for the evaluation and management of environmental risks	indifferent	7	7,143E-02
	innovative conformist	5	,8000
	defensive	7	7,143E-02
	offensive	11	,7273
	accommodating	49	,2857
	Total	79	,3418

In one area of environmental management, that of communication-marketing, offensive companies lead all other company groups. They are the most active when it comes to publishing environmental reports and applying environment-oriented marketing. The group also plays an outstanding role in preparing emergency plans.

Defensive companies have reached significant values only in the areas of preparing accident-prevention plans, the valuation of real-estate and environment-oriented marketing. (Unfortunately, I have no information on what they mean by the latter.)

We have to note that the environmental assessment of property, as it relates to real-estate transactions, is primarily meant to protect the company from environmental risks, and not society from the environmentally harmful effects of its operations. In this respect it differs from the other elements.

Indifferent companies have the least developed environmental management system. Half the elements are applied by none of those companies either in full or in part which, however, is acceptable for that group.

Therefor, innovative companies lead in the level of sophistication of management systems, followed closely by the offensive companies. This, again, coincides with our prior expectations concerning various company groups.

9.4 Deviation in pressures affecting companies within strategic groups

Below I will demonstrate what effects elicit reaction from various strategic groups. The following table shows how sensitive companies are to external pressures identified above (see Table 9.4.-1.)

Due to standardization, the interpretation of various pressure factors differs from generally used methods. Looking at all companies, the average for each factor stands close to zero. Negative values indicate above average, positive values

below average pressures. Large positive numbers point to strong, while negative numbers with large absolute values to weak pressures.

Market pressures are most keenly felt by the five innovative companies, while defensive companies are also under slightly greater than average pressure. Companies in the indifferent and accommodating group show little concern for requirements coming from the market place.

Table 9.4.-1: The mean of pressures felt by companies in different strategy groups

		N	Mean	Std. Deviation	Minimum	Maximum
MARKET PRESSURES	indifferent	7	-1,14464	,3381333	-1,64579	-,78886
	innovative conformist	5	1,6830545	,8804325	,55888	2,95807
	defensive	7	,2189913	,6928905	-,48307	1,11349
	offensive	11	,3169182	,9124192	-1,02980	1,70444
	accommodating	49	-,1106494	,8854431	-1,61243	2,26692
	Total	79	-1,3E-16	1,0000000	-1,64579	2,95807
POLLUTION RISK	indifferent	7	-,7482148	,4636291	-1,45355	-,19789
	innovative conformist	5	1,7462415	1,5221808	-,20174	3,87502
	defensive	7	,5233757	,9853917	-,53206	2,04556
	offensive	11	-3,9E-02	,8451404	-1,25310	1,56119
	accommodating	49	-,1373505	,8222117	-1,90689	1,46409
	Total	79	-2,2E-17	1,0000000	-1,90689	3,87502
REGULATION	indifferent	7	-1,06306	,6267086	-2,00027	-,09726
	innovative conformist	5	-7,4E-02	1,0270739	-1,46529	,93213
	defensive	7	-,1584283	,6756003	-1,05398	,93639
	offensive	11	-,1287871	,7988207	-1,82158	,80015
	accommodating	49	,2109715	1,0390988	-1,92118	3,03376
	Total	79	-1,1E-16	1,0000000	-2,00027	3,03376
MARKET OPPORTUNITIES	indifferent	7	-,2976075	1,0287814	-1,46026	1,24992
	innovative conformist	5	,2670986	,6638416	-,34432	1,00082
	defensive	7	-,3456827	,4548099	-1,04171	,46487
	offensive	11	,5452348	,7741643	-,46455	1,80449
	accommodating	49	-5,8E-02	1,0935967	-2,42389	2,68944
	Total	79	1,46E-16	1,0000000	-2,42389	2,68944
LOCAL PRESSURES	indifferent	7	,3769945	,8812903	-,69786	1,92735
	innovative conformist	5	,1104481	,9945914	-1,04020	1,28467
	defensive	7	-8,5E-02	1,1260818	-1,29709	2,00337
	offensive	11	-,3230039	,9190835	-1,71810	1,26322
	accommodating	49	1,95E-02	1,0313318	-2,12875	2,42568
	Total	79	8,15E-17	1,0000000	-2,12875	2,42568

Table 9.4-2. ANOVA of pressure factors among strategic groups

		Sum of Squares	df	Mean Square	F	Sig.
MARKET PRESSURES	Between Groups	25,375	4	6,344	8,921	,000
	Within Groups	52,625	74	,711		
	Total	78,000	78			
POLLUTION RISK	Between Groups	22,024	4	5,506	7,279	,000
	Within Groups	55,976	74	,756		
	Total	78,000	78			
REGULATION	Between Groups	10,477	4	2,619	2,871	,029
	Within Groups	67,523	74	,912		
	Total	78,000	78			
MARKET OPPORTUNITIES	Between Groups	5,247	4	1,312	1,334	,265
	Within Groups	72,753	74	,983		
	Total	78,000	78			
LOCAL PRESSURES	Between Groups	2,273	4	,568	,555	,696
	Within Groups	75,727	74	1,023		
	Total	78,000	78			

The risk of pollution is greatest among innovative companies, while smallest among the indifferent ones. Defensive companies' concern for their pollution emission is above, that of offensive companies is at the average level.

Indifferent companies are the least pressured by regulations. Incidentally, this factor carries relatively few implications for all strategic groups. It is interesting to note, however, that its effect assumes above-average value in the group of accommodating companies, while in all other categories it remains below the average. It appears that, at any given time, the group intent just on meeting social expectations pays the closest attention to regulations.

Market opportunities were valued the highest by offensive companies, followed by innovative firms, while indifferent companies sees the least opportunity in this area.

Local pressures are felt most directly by small indifferent firms. At the same time, offensive companies consider its role the least important in their environmental program. This is not only demonstrated in local-pressure group averages, but in the fact that the value of this factor falls in the positive (above average) range for all 11 offensive companies.

As regards the two last effects, there is no significant difference among various groups.

The assessment of pressures affecting companies corresponds to the picture developed in professional literature on specific strategic categories. The risk of pollution and market pressures is the most significant for innovative companies, offensive companies are the most open to market potentials, while those in the indifferent group are the least likely to be the target of pressuring forces. Average behavior is represented by the accommodating firms. This analysis, again, appears to bolster the usefulness of the accommodation region method.

The following table contains summary data on the number of environmental management elements and the strength of pressures impacting them, offering a general picture on strategic groups.

Table 9.4.-3: The strength of pressures and the level of EMS in the different strategy groups

		N	Mean	Std. Deviation
EMS	indifferent	7	1,6429	1,2150
	innovative conformist	5	10,1000	1,9812
	defensive	7	1,8571	1,0293
	offensive	11	10,1364	2,5109
	accommodating	47	4,3830	1,7264
	Total	77	5,0974	3,2778
PRESSURES	indifferent	7	8,5714	6,9007
	innovative conformist	5	35,6000	10,3102
	defensive	7	21,7143	10,9196
	offensive	11	20,3636	7,8902
	accommodating	49	19,7347	6,8215
	Total	79	20,0127	9,0858

As indicated by the EMS (level of environmental management system) variable, innovative and offensive groups operate the most sophisticated environmental management systems. Those evaluating a company's activities out of context, looking only at its environmental management system, are liable to let these two categories merge, although, as has been shown before, they differ in significant aspects. The system at indifferent and defensive companies is less developed,

however. In the case of the former, it is quite acceptable, while in the latter it can point to a strategy that cannot be sustained in the long term.

The above observations are particularly interesting if, concurrently with PRESSURES (all pressures affecting companies), we examine the development of the management system as well. The indifferent group is under little pressure and operates rudimentary forms of environmental management; here, the two factors are in harmony. The innovative group is under large pressure, and its environmental management system is proportionately developed. The two defensive companies are characterized by high PRESSURES, while their system is rather underdeveloped. In the offensive group the case is exactly the opposite: companies are never subjected to excessive pressures, yet they do a lot for the protection of the environment. Finally, both values for accommodating companies are near the average.

9.5 Environmental performance indicators in strategic groups

To this point companies' environmental performance was described by the development of their management system and the number of projects launched. Both indicators are directive-motivated, indicating company effort, regardless of their effectiveness. The use of effectiveness oriented environmental performance indicators is crucial to counteract the shortcomings of directive indicators.

Below I will present parameters typical of each strategic group as they relate to issues of pollution intensity, pollution reduction and environmental investment.

The pollution intensity indicator (POLLUTION INTENSITY=pollution/total turnover) is particularly low in the indifferent group, and lower than average in the offensive group as well. Pollution intensity in the defensive group is above average, and especially high in the innovative group.

Table 9.5.-1: Indicators of environmental performance in different groups

		N	Mean	Std. Deviation	Minimum	Maximum
POLLUTION INTENSITY	indifferent	4	-2,5381	2,3287	-5,86	-,73
	innovative conform	5	2,27E-04	3,195E-02	-,05	,04
	defensive	3	-,1689	,2339	-,44	-,03
	offensive	6	-1,1586	1,3588	-3,66	-,28
	accommodating	19	-,8812	1,1544	-3,61	,99
	Total	37	-,9285	1,3578	-5,86	,99
FINED	indifferent	7	,0000			
	innovative conform	5	,8000			
	defensive	7	,2857			
	offensive	11	,3636			
	accommodating	48	,2083			
	Total	78	,2564			
FINE PAID	indifferent	7	,0000	,0000	,00	,00
	innovative conform	5	2299261	4320669,2	,00	10000000
	defensive	7	144000,0	328032,52	,00	880000,0
	offensive	10	67189,50	159010,43	,00	500000,0
	accommodating	48	107581,2	648760,35	,00	4500000
	Total	77	238183,1	1246776,3	,00	10000000
POLLUTION REDUCTION	indifferent	7	,1429			
	innovative conform	5	1,0000			
	defensive	7	,4286			
	offensive	10	,6000			
	accommodating	45	,6444			
	Total	74	,5946			
AMOUNT OF POLLUTION REDUCTION	indifferent	7	7,1429	18,8982	,00	50,00
	innovative conform	3	17,3333	16,1658	,00	32,00
	defensive	7	19,2857	30,0595	,00	70,00
	offensive	8	23,1250	27,3780	,00	60,00
	accommodating	37	22,7027	27,6786	,00	100,00
	Total	62	20,3548	26,3757	,00	100,00
ENVIRON-MENTAL INVESTMENT R&D	indifferent	7	,5714	,7868	,00	2,00
	innovative conform	5	13,3400	14,6246	2,00	35,00
	defensive	7	,0000	,0000	,00	,00
	offensive	10	5,7000	9,1536	,00	25,00
	accommodating	45	1,7062	2,8903	,00	10,00
	Total	74	2,7632	6,1531	,00	35,00

Four out of 5 innovative companies pay fines, in other words, they do not fully comply with the Hungarian legal code. These are the two indicators where members in this category "come up short", for which reasons will be discussed in the following section. None of the indifferent companies pay fines. The group

includes small businesses with low level emission in absolute terms. One third of offensive companies also pay environmental duties.

Over the past five years all five firms in the innovative group have achieved pollution reduction. It is interesting to note that this ratio is also very high among accommodating companies; more than 60% managed to cut harmful emission over the past 5 years. In this regard, indifferent and offensive companies performed under average. Being small polluters they most likely had neither the means nor the motivation to carry out major pollution-reduction programs. There is no significant difference in the degree of reductions among groups, while only the low value of indifferent companies stand out.

9.6 Statistical characteristics of strategic categories

The table on the following page gives a summary of companies' major financial indicators. Leaving aside change in total assets and membership in a particular corporate group, difference among groups were significant for all variables.

Indifferent companies specialized primarily for the domestic market, serving almost exclusively the needs of domestic consumers. At the same time, the proportion of these enterprises is very low among innovative companies: even the company with the largest domestic market sells only 38% of its total output in the country.

Practically none of the indifferent small businesses made it to the EU market, while it plays a major role (68%) for innovative companies. Exports from offensive companies to the EU is also well above average. It can be stated generally that, with the exception of indifferent businesses, sales to EU countries represent a major proportion of turnover in all groups.[20]

[20] The table contains average values provided by the companies, rather than the average weighted by the volume of sales.

Table 9.6-1: Characteristics of strategic groups

		N	Mean	Std. Deviation	Minimum	Maximum
DOMESTIC MARKET	indifferent	7	93,2857	7,6749	80,00	100,00
	innovative conformist	5	20,6000	13,6675	,00	38,00
	defensive	6	64,1667	38,7630	16,00	100,00
	offensive	11	45,8182	33,7782	,00	100,00
	accommodating	48	66,7729	27,4434	8,00	100,00
	Total	77	62,9883	31,3656	,00	100,00
EU MARKET	indifferent	7	2,1429	3,9340	,00	10,00
	innovative conformist	5	68,2000	28,8739	21,00	100,00
	defensive	6	27,8333	30,6491	,00	70,00
	offensive	11	37,1818	25,9608	,00	80,00
	accommodating	48	24,5875	24,8924	,00	89,00
	Total	77	27,4312	27,6750	,00	100,00
NUMBER OF EMPLOYEES	indifferent	7	29,5714	18,1829	2,00	56,00
	innovative conformist	5	3386,2000	3812,7060	881,00	10000,00
	defensive	7	280,5714	385,2540	10,00	1111,00
	offensive	10	278,5000	366,9070	28,00	1100,00
	accommodating	49	195,5714	201,9738	14,00	957,00
	Total	78	403,4615	1195,5048	2,00	10000,00
TURNOVER	indifferent	7	179,5714	128,3769	35,00	400,00
	innovative conformist	5	58116,60	64114,2996	5299,00	160000,0
	defensive	7	3174,4857	4332,7732	447,00	11459,00
	offensive	11	1699,6364	2112,2938	80,00	5800,00
	accommodating	49	970,8857	1562,3434	25,00	8561,00
	Total	79	4814,3139	20230,2414	25,00	160000,0
HUNGARIAN TOP MANAGERS (%)	indifferent	7	100,0000	,0000	100,00	100,00
	innovative conformist	5	87,0000	21,0950	50,00	100,00
	defensive	7	92,8571	18,8982	50,00	100,00
	offensive	10	96,5000	7,4722	80,00	100,00
	accommodating	49	94,9796	14,1443	50,00	100,00
	Total	78	94,9231	13,7593	50,00	100,00
NON HUNGARIAN TOP MANAGERS (%)	indifferent	7	,0000	,0000	,00	,00
	innovative conformist	5	13,0000	21,0950	,00	50,00
	defensive	7	7,1429	18,8982	,00	50,00
	offensive	10	3,5000	7,4722	,00	20,00
	accommodating	49	5,0204	14,1443	,00	50,00
	Total	78	5,0769	13,7593	,00	50,00
CORPORATE GROUP MEMBERSHIP (y/n)	indifferent	7	,1429			
	innovative conformist	5	,4000			
	defensive	7	,4286			
	offensive	11	,4545			
	accommodating	49	,1633			
	Total	79	,2405			
CHANGE IN ASSESTS	indifferent	4	61,5000	109,5612	-16,00	222,00
	innovative conformist	4	58,5000	90,5851	-9,00	191,00
	defensive	7	41,5071	40,8294	10,45	117,60
	offensive	9	80,5811	165,6452	-1,10	518,00
	accommodating	43	33,4533	67,3041	-45,50	362,00
	Total	67	43,7951	86,9799	-45,50	518,00

		N	Mean	Std. Deviation	Minimum	Maximum
FOREIGN OWNERSHIP (%)	indifferent	7	15,2857	28,6631	,00	74,00
	innovative conformist	5	69,9900	44,1865	,00	100,00
	defensive	7	30,0000	47,9583	,00	100,00
	offensive	11	39,3909	49,0314	,00	100,00
	accommodating	49	17,6612	34,7983	,00	100,00
	Total	79	24,8816	39,9641	,00	100,00

It is interesting to note that, in the innovative and defensive group, change of total assets assumed values at or higher than the rate of inflation. This indicates that these companies are growing and developing in real terms as well.

Looking at the number of employees, it is evident that companies in the innovative group are typically large enterprises, while those in the indifferent group are overwhelmingly small in size. On average, innovative companies employ 3386 people and even the smallest among them have close to 900 employees on their payroll. The average at indifferent companies is 30, the largest in the group employing 56 people. The other three groups include small, medium and large businesses, the majority of them falling in the medium-size category.

Concerning total turnover, the previous findings apply.

Hungarian management is dominant in all strategic groups; on average, the proportion of foreign management does not reach more than 13% even in innovative companies.

Membership in a larger corporate group ranges between 17% to 45% in the various categories. It reaches the highest percentage among the innovative, offensive and defensive firms: here, more than 40% of the companies are controlled by corporate headquarters.

Concerning total assets changes, there is no significant difference among the various strategic groups.

The innovative group is characterized by foreign majority ownership. Shares held by foreigners are also common among offensive and defensive companies, while rare in indifferent and accommodating firms.

It is interesting to see the level of technology applied in production by various strategic groups; more advanced technologies are less wasteful and lead to smaller per-unit pollution emission. Corresponding data is provided in the table below.

Table 9.6.-2: The level of technology applied by various strategic groups

level of technology applied

	Mean	Median	Modus
indifferent	3,1429	3,0000	3,00
innovative conformist	4,4000	4,0000	4,00
defensive	3,7143	3,0000	3,00
offensive	3,8000	4,0000	3,00
accommodating	3,3404	3,0000	3,00
Total	3,4868	3,0000	3,00

In the Hungarian environment, innovative companies are characterized by the use of modern technology. Even by European standards, some firms are equipped with state-of-the-art technology. Offensive companies also use more advanced technologies than currently common in Hungary. In small and accommodation-region companies average Hungarian technology is the norm, while companies in the defensive category employ relatively advanced technologies.

Summarizing all findings for various company groups, the typical company for each group looks as follows:

Indifferent company:

> Hungarian owned small enterprise, serving the domestic market. Small polluter, with little awareness of environmental risks, feels very little pressure from regulating agencies, the market or the local community. Sees no opportunity in environmental protection. Its management system, if there is one, is underdeveloped, as nothing had justified the creation of a sophisticated system. It invests and launches environmental projects haphazardly.

Innovative company:

A large company, majority stakes usually held by foreigners, serving primarily the EU market. Developing and growing dynamically. Due to its size, a large polluter in absolute terms, although the amount of its harmful emissions has declined over the last few years. Has the most sophisticated environmental management system, leads in the area of documentation and the application of risk management tools. Market pressures play a significant role in shaping its environmental behavior. The ISO 14001 standard is in the process of implementation.[21] Launches a number of environmental projects and devotes significant amounts for environmental investments. Still, it does not fully measure up to Hungarian regulations and pays fines.

Offensive company:

Medium-size company with substantial EU market. Member of larger corporate group, supplier to other companies. Characterized by small level pollution, little affected by regulations or pressures coming from the local community or environmental organizations. Sees market potential in environmental protection. Has well-developed environmental management system, particularly in the areas of communication and marketing. Also, it takes management of environmental risks seriously. Launches many environmental projects and, in the Hungarian context, employs advanced technology.

Defensive company:

Fast developing, majority stakes held by Hungarians. Does not spend on environmental improvement projects. Its environmental management system is backward, concentrating on the most urgent areas. It carries significant environmental risks and is under strong market pressure. The company is not closely watched by environmental or regulatory agencies:

[21] On the introduction of ISO 14001: see chapter titled *Reasons for Introducing the Standard*

is only moderately sensitive to regulatory pressures and pays no fines. Employs advanced technology by Hungarian standards. Its capital investments are far ahead of environmental investments.

Accommodating company (with the exception of indifferent and innovative conformist companies):

Is under average pressure, with average environmental management system as well. Usually a medium-size company (although it can also be small or large), selling a quarter of its output on the EU market. Foreigners hold minority stakes, its output is destined for further industrial processing. In the last five years it managed to reduce its pollution level. It initiates projects primarily in areas such as waste treatment, emission reduction and material purchase.

The categories are well-defined and, at the same time, reflect the general features of the strategic group and Hungarian conditions. They provide answers to the question of what it means in today's Hungary to comply with social expectations, to carry out an offensive or defensive strategy. The assessment of company's performance is firmly tied to time and place, to the local environment.

9.7 Environmental management in chemical and food-processing companies

In some aspects the questionnaire for chemical and food-processing companies varies significantly from that mailed to machinery producing firms. First of all, the questions that allow the formulation of PRESSURES variable are still missing. Therefor, here I had to rely primarily on total turnover logarithm (as an indicator with significant correlation to pollution of the environment), variables reflecting corporate culture (company ownership, its market) and data related to company strategy. The first two factors have bearing on the accommodation region, while the third one is an indicator of vertical deviation from the region.

Illus. 9.7.-1: Environmental management in chemical and food-processing companies, summary tales

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,707[a]	,500	,456	2,9305

a. Predictors: (Constant), market share increase, LNturnover, Hungarian owned

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	292,234	3	97,411	11,343	,000
	Residual	291,983	34	8,588		
	Total	584,217	37			

b. Dependent variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3,094	1,861		1,662	,106
	LNturnover	,846	,230	,478	3,672	,001
	Hungarian owned	-2,275	1,101	-,270	-2,066	,047
	market share increase	2,281	1,254	,225	1,819	,078

a. Dependent variable: EMS

It is clearly shown that larger (polluting) companies have developed higher-level management systems here as well. This variable has the strongest explanatory power in the model. The opportunity of increasing market share has also acted as a stimulus.

The cultural variable, ownership, is introduced - not typical in the case of machinery and equipment producing firms. Privately owned Hungarian companies lag far behind companies partly owned by foreigners (the sample included only four wholly publicly owned firms, too few to draw any conclusions). It is noteworthy that companies with mixed ownership have built more advanced environmental management systems than companies owned entirely by foreign

interests, suggesting that the former had more concern for the interests of the host country than the latter.

Foreign owners usually bring a different environmental culture with them, which persists at least for some time. The gap can be overcome in two ways: either Hungarian companies start to follow these example, or the foreign owner adapts to the lower standards of local environmental culture. The chemical-food industrial questionnaire showed up these cultural differences in responses on company operation unrelated to the environment, as well. For instance, without exception, domestically owned companies all operate in functional organizational form. Other forms are evident only among companies owned by foreigners or with mixed ownership structure.

On the other hand, the environmental behavior of machinery producing firms showed no great variations, regardless whether the company is owned by foreigners or Hungarians. In the early phases of the transition period foreign companies perhaps acted with more environmental sensitivity but, in this sector, Hungarian-owned companies were quick to adopt to new market demands and EU requirements. Adjustment in the chemical industry follows a slower pace, the likely reason why two parallel cultures persist. While the food-industry reacted quickly, its sales are primarily limited to the domestic market (80%). Consequently, EU regulations do not act as such an important motivating force as they do in the machinery sector. As a result, in the chemical and food industries environmental protection does not appear in the form of direct market pressure, rather it has more bearing on companies' long term objectives, such as increasing market share or improving company image. ***The effects of global market forces in 1998, as they relate to the environment, are primarily reflected in the machinery sector, while developments in 1997 in the chemical and food industries can be associated more with future trends.***

The important lessons to be drawn from the two studies are the following: environmental risks, market pressures, cultural factors and company strategy - following the classification given at the beginning of the study - must all be taken into account when evaluating companies' environmental performance. ***The fact***

that, in a given company category or in a given period, one or another factor has more effect or exerts no effect at all does not mean that it can be ignored when examining other groups. All factors must be considered in defining the accommodation region, even if only part of them are relevant in a given period or a given company category.

Cost-cutting opportunities did not emerge as a dominant factor in any sector. The reason is that in most cases costs traced by accounting departments are very low. On average, the cost of waste disposal represents 1/1000 that of energy and less than 1% of total costs. Savings realized in material purchasing are not treated as part of environmental costs and, consequently, in most instances it cannot be demonstrated how environment-related savings and greater diligence actually affected overall finances. Development in environmental accounting and rising material costs are expected to change the situation.

10. Connection among various environmental performance indicators

Environmental performance can be measured by several indicators, and they do not necessarily point in the same direction. It is interesting and instructive to note which indicators correlate positively and which ones relate to alternative environmental strategies.

To this point, I tested environmental activity by looking at only one indicator, the state of the environmental management system. However, company performance can be measured by a number of other indicators as well (e.g., the proportion of environmental investments, the number of environmental projects initiated, etc.). Here I introduce these into the study and examine the joint effects of directive-type and result-oriented indicators

To describe environmental performance I applied the following indicators:

Directive-type indicators:

EMS - the number of applied environmental-management-system elements. An indicator for risk control (and its communication), and the development level of

the management system for integrated environmental management.

ENVIRONMENTAL INVESTMENTS - environmental investments as a percentage of total investments. In most cases this refers to end-of-pipe solutions as, by definition, these are considered part of environmental investments.

PROJECTS - number of environmental projects launched. These can include projects aimed at cleaner production, more sensitive behavior, and conservation.

DEVIATION - anticipated deviation from environmental management value as a result of risks. High positive values are related to offensive strategies, while negative values with large absolute numbers to defensive strategies. In accommodation-region companies it assumes a value close to zero.

Physical-type result-oriented indicators:

CLEAN PRODUCTION - the inverse of pollution-intensity variable. When effective, environmental measures result in the reduction of pollution intensity.

POLLUTION REDUCTION - percentage of pollution reduction achieved over the last five years.

10.1 Correlation among indicators

The table below illustrates correlation among indicators.

Table 10.1. –1: Correlation among environmental performance indicators

	EMS	ENVIRONMENTAL INVESTMENT, R&D	PROJECTS	EMS DEVIATION	AMOUNT OF POLLUTION REDUCTION
EMS					
ENVIRONMENTAL INVESTMENT, R&D	,432** ,000 77				
PROJECTS	,521** ,000 85	,207 ,066 80			
EMS DEVIATION	,798** ,000 77	,253* ,032 72	,418** ,000 77		
AMOUNT OF POLLUTION REDUCTION	-,003 ,983 66	-,009 ,944 62	,077 ,531 68	-,050 ,699 61	
CLEAN PRODUCTION	-,235 ,161 37	-,076 ,664 35	-,205 ,222 37	-,017 ,919 37	-,069 ,732 27

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

It is evident that the EMS indicator correlates to all other directive-type indicators, although in the case of environmental investments the correlation is weaker than average. The deviation index correlates to all directive-type indicators. The close link with EMS indicator is a function of EMS DEVIATION-variable definition.

The relationship between environmental investments and the number of environmental projects shows a slightly positive partial correlation.

Table 10.1.-2: Partial correlation coefficient

```
Controlling for..    LNTURNOVER

             ENV.INV.       EMS     PROJECTS

ENV.INV.     1,0000       ,3249       ,2566
             (    0)     (   69)     (   69)
             P= ,         P= ,006     P= ,031

EMS            ,3249      1,0000       ,5579
             (   69)     (    0)     (   69)
             P= ,006     P= ,        P= ,000

PROJECTS       ,2566       ,5579      1,0000
             (   69)     (   69)     (    0)
             P= ,031     P= ,000     P= ,
(Coefficient / (D.F.) / 2-tailed Significance)
```

Taking the three directive-type indicators (ENVIRONMENTAL INVENSTEMENT, EMS, PROJECTS), I performed a cluster analysis of the data. The study resulted in groups that differ from each other primarily along the level of the three directive-type indicators. One of the groups, for instance, has outstanding values by all three indicators, while the other one remained average. The levels of the three directive-type indicators do not become disengaged from each other. In other words, ***companies do not treat development of the environmental management system and environmental investment as alternative strategies. In general, machinery producing firms apply a combined strategy.***

It is apparent that directive-type indicators show no correlation with result-oriented indicators. Also, I found no non-linear-type relationship between the two groups. We should not forget, however, that result-oriented and directive-type indicators relate to different time periods. And CLEAN PRODUCTION, the indicator defining clean production, expresses the cumulative effect of all other measures, regardless of when they were actually carried out. On the other hand, directive-type indicators are connected to the present and the previous year. Later I will demonstrate that pollution reduction is primarily the result of economic decisions rather than compliance with environmental regulations. This fact also explains the lack of correlation with directive indicators.

10.2 Payment of fines as an indicator of environmental performance

In my assumption, fines-paying companies can be found in the accommodation region as well as below it. This, in fact, means that in today's Hungary, paying fines is acceptable, that the flouting of regulations is common and tolerated behavior.

The number of those penalized among accommodation region companies is an expression of social self-deception. When this proportion is high, in theory (i.e., in

a legal sense) society has loftier environmental expectations from companies than in practice (i.e., demanding compliance with regulations).

I have already shown that this phenomenon is common in all strategic groups. This suggests that it is not only "renegade" companies that fail to respect the law. Let us now see what is the relationship between penalty payments and environmental performance indicators. Looking at the averages of environmental indicators, the following table illustrates the great difference between paying and non-paying companies.

Table 10.2.-1: Environmental indicators of fine payers vs. not payers

		N	Mean	Std. Deviation
EMS	not paying	62	4,6371	3,0477
	paying	21	7,2619	3,4264
	Total	83	5,3012	3,3303
ENVIRONMENTAL INVESTMENT, R&D	not paying	58	1,8393	4,6754
	paying	21	6,3857	10,4653
	Total	79	3,0478	6,9385
EMS DEVIATION	not paying	56	3,587E-02	2,5730
	paying	20	,9863	3,0288
	Total	76	,2860	2,7123

10.2-2. Table: Environmental performance of fine payers vs. non payers: analysis of variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
EMS	Between Groups	108,076	1	108,076	10,924	,001
	Within Groups	801,394	81	9,894		
	Total	909,470	82			
ENVIRONMENTAL INVESTMENT, R&D	Between Groups	318,681	1	318,681	7,141	,009
	Within Groups	3436,414	77	44,629		
	Total	3755,096	78			
EMS DEVIATION	Between Groups	13,312	1	13,312	1,830	,180
	Within Groups	538,426	74	7,276		
	Total	551,738	75			

From the point of environmental management system development, the penalized present a "better picture" than those who are not, but we should not forget that the

value of EMS is higher among larger companies, where the number of big polluters and those penalized is also higher. Therefor the result should not be interpreted as if companies with sophisticated management systems paid more fines.

The proportion of environmental investment is also higher among those penalized - fines may act as motivation to invest more in the environment.

In regard to the two above indicators, there is a significant difference between penalized and non-penalized - the advantage being with the former. As the two indicators are not free from the effects of measurement, no definite conclusions should be drawn from them.

EMS DEVIATION is the most crucial variable which indicates the degree and direction the company's environmental management system deviates from the level determined by company's risk level and the nature of its operations. It can be seen that, while in the case of non-payers this value stands close to zero, for payers it is generally in the positive. ***At the same time, there is no significant difference between the two groups.*** This means that ***penalized companies react to their environmental risks the same way non-penalized do. In practical terms, there is no difference between these two groups.***[22]

Now we shall see what is the proportion of penalty paying among companies that have already or are in the process of implementing ISO 14001 environmental management standards. The introduction of these standards is often seen as one of the criteria of outstanding environmental performance.

[22] Payment of fines is a distorted indicator of non-compliance with regulations: scofflaws can be found among non-payers as well.

Table 10.2.-3: Connection between fine-paying and the introduction of ISO14001

Count

		FINE		
		not paying	paying	Total
ISO14001	unfamiliar with the standard	7	1	8
	does not plan implementation	24	4	28
	is considering	24	11	35
	is being implemented	5	3	8
	already implemented	3	2	5
Total		63	21	84

The sample contains five companies that have already implemented ISO 14001, two of which paid environmental fines last year. The standard is being introduced in eight companies; of these 3 paid fines in 1997. Of the 35 companies considering introducing the system 11, of the 36 firms unfamiliar or unwilling to introduce the standards 5 have paid fines.

The table indicates that ***even among companies leading in environmental performance and companies with functioning ISO 14001 standards, the proportion of those penalized is high.***

In fact, fine paying is closely related to only one indicator, i.e. the absolute value of the company and/or its pollution level. In this respect, the difference between payers and non-payers is significant.

Table 10.2.-4: The level of pollution for fine-payers vs. non-payers

		N	Mean	Std. Deviation
TURNOVER	not paying	58	1182,1345	2230,6156
	paying	20	15511,05	38780,4976
	Total	78	4856,2154	20357,7322
NUMBER OF EMPLOYEES	not paying	64	170,3438	245,6975
	paying	20	1123,6000	2222,6483
	Total	84	397,3095	1159,1080
WASTE WATER	not paying	40	27129,28	86549,4124
	paying	15	2,6E+07	56426157
	Total	55	7029422	30961871
HAZARDOUS WASTE	not paying	60	185,7648	1263,2453
	paying	18	13706,10	53535,3408
	Total	78	3305,8411	25823,5208
AIR POLLUTION	not paying	46	971,5614	2109,6699
	paying	15	4683,4731	13017,8739
	Total	61	1884,3265	6743,6948

Table 10.2-5: The level of pollution for fine-payers vs. non-payers: analysis of variance

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
TURNOVER	Between Groups	3,05E+09	1	3,05E+09	8,041	,006
	Within Groups	2,89E+10	76	3,80E+08		
	Total	3,19E+10	77			
NUMBER OF EMPLOYEES	Between Groups	13846819	1	13846819	11,626	,001
	Within Groups	97666279	82	1191052,2		
	Total	1,12E+08	83			
WASTE WATER	Between Groups	7,19E+15	1	7,19E+15	8,551	,005
	Within Groups	4,46E+16	53	8,41E+14		
	Total	5,18E+16	54			
HAZARDOUS WASTE	Between Groups	2,53E+09	1	2,53E+09	3,940	,051
	Within Groups	4,88E+10	76	6,42E+08		
	Total	5,13E+10	77			
AIR POLLUTION	Between Groups	1,56E+08	1	1,56E+08	3,574	,064
	Within Groups	2,57E+09	59	43606651		
	Total	2,73E+09	60			

Today in Hungary big companies and large polluters in absolute terms are fined, regardless of how much they may contribute to the protection of the environment.

Payment of fines is common among companies with otherwise good environmental indicators. The reason for this lies in weak law enforcement which, in many cases, can be traced to overly stringent regulations that cannot be carried out in practice. ***In Hungary fine-paying shows no relation to most environmental performance indicators and, in general, is a poor indicator of companies' environmental activity. The proportion of due-payers is high (approx. one quarter) even among accommodation-region companies, suggesting that society lives in a dreamland when it comes to the protection of the environment.***

10.3 Reasons for the introduction of ISO 14001 standards

Recently gaining a foothold in Hungary, ISO 14001 is a voluntary, international environmental management standard, often associated with a leading role in environmental protection.

It is well known that companies already with some type of ISO 9000 certificate show greater readiness to implement ISO 14001 standard. This begs the question whether companies turn to ISO 14001 primarily for environmental reasons (to reduce environmental load) or they see it as an expansion of the concept of quality control. In the latter case they construe environmental performance as part of product quality.

The sample contains 5 companies that have already implemented ISO 14001 (some firms already have certification as well), while in another 8 it is in the process of being introduced. In this chapter I examine:

- the primary motivation behind implementation
- in what type of companies is implementation the most widespread
- how it is related to other environmental indicators.

First I will examine potential forces motivating the implementation of ISO 14001.

The following table shows the adaptation of ISO 14001 with the ISO 9000 series, as well as other forces exerting pressure on companies, which includes the Spearman rank-correlation coefficient for variables.

Table 10.3.-1: Potential forces motivating the implementation of ISO 14001

		Does the company plan to introduce ISO 14001
Spearman's rho	Does the company plan to introduce some ISO 9000	,452**
		,000
	MARKET PRESSURES	,265*
		,020
	POLLUTION RISK	,317**
		,005
	REGULATION	,094
		,417
	MARKET OPPORTUNITIES	,200
		,082
	LOCAL PRESSURES	-,176
		,125

**. Correlation is significant at the .01 level (2-tailed).

*. Correlation is significant at the .05 level (2-tailed).

It is evident there is a significant, positive correlation between the introductions of ISO 9000 and ISO 14001. The adoption of EMS has a positive relationship to market pressures, as well as pollution. Companies under strong market pressure and with high pollution level are the most likely to implement ISO 14001. At the same time, local pressures and regulations are not strong motivating factors, and even market opportunities are only significant at the level of 0.082.

It is particularly interesting to realize that from the market side companies do not see the opportunities (as is commonly assumed in connection to the ISO 9000 and ISO 14001 series), and are much more sensitive to pressures. This requires further explanation, which follows below.

It may be interesting to see from what direction market pressures effect a company. The following table shows the correlation of a variety of pressures after the introduction of ISO 14001 standards.

Table 10.3.-2: Pressures and the implementation of ISO14001 standard

	Does the company plan to introduce ISO 14001
HUNG.LAW.pr	,164
TMARKETpr	,258*
EUpr	,257*
AUTHORITYpr	,114
NGOpr	,018
BANKSpr	,206
CONSUMERpr	,094
CEOpr	,288**
COMPETpr	,246*
RESID.AREApr	-,026
PUBL.BUILDpr	-,002
ECOSYSTEMpr	,096
TECHNOLpr	,228*
ACCIDENTpr	,245*

*. Correlation is significant at the .05 level (2-tailed).

**. Correlation is significant at the .01 level

It shows that ***pressures pointing in the direction of ISO 14001 are related to consumers of a foreign target-market, to EU environmental regulations and pressures coming from competitors.*** The need to maintain the company image arises as well. At the same time, the Hungarian market and local regulations play no significant role. ***Evidently, companies are not pushed to adopt ISO 14001 by domestic requirements; instead, they are pulled in that direction by the demands of foreign target-markets.***

These findings correspond to results of my other studies conducted in the same field. The definition of these pressures as EU consumer demands or pressures from competitors appears to be too broad, however. In fact, ***although today the adoption of ISO 14001 does offer a company a competitive edge, companies are worried that failure to implement these standards may mean they will find themselves locked out of the European market place. In many instances European countries appeal to environmental regulations and use them as protectionist weapons, trying to keep out foreign products.*** It may be dangerous to fall far behind major European trends, because it can be predicted that in the near future those markets will favor already certified companies, later demanding that suppliers adopt the standards. ISO 14001 is quickly gaining ground in Europe and European countries are using it to protect their domestic markets and to keep foreign competitors out. Often, environmental requirements are a convenient cover for business interests.

This is underscored by the fact that there is huge interest in ISO 14001 in Asian countries. It is interesting to note that Japan is in the forefront of ISO 14001 implementation, and the percentage of participants is high in 'Small Tiger' countries as well. Korea is 5th, Taiwan the 8th in the world, while even Thailand, Singapore and Hong Kong are ahead of a number of EU countries. Asian countries fear that in the future environmental regulations will be used as a non-tariff-type devices to limit exports to European nations, explaining the figures cited above. Once suppliers will be required to prove ISO 14001 certification, all those without this document will find themselves at a disadvantage. The foresight evinced almost without exception by Asian nations in this matter *should be a warning sign to Hungary as well,* as it also tries to expand its trade in Europe.

In the area of environmental protection the introduction of ISO 14001 is connected to technology-related environmental pollution and the risk of accidents. This is not surprising, since the objective and principal function of the environmental management system is the reduction of deviations from established procedures, in other words, to reduce the likelihood of environment-related accidents and plant shut-downs.

The third important factor is whether a company has a standardized quality management system. The following table summarizes the incidence of the two standards.

Table 10.3.-3: Implementation of ISO14001 and ISO 9000 standards 1.

Count

Does the compan plan to introduce ISO 14001	Does the company plan to introduce some ISO 9000 standard					Total
	unfamiliar with it	does not plan implementation	is considering	is being implemented	already implemented	
unfamiliar with the standard	1	1	4	2		8
does not plan implementation		6	7	4	11	28
is considering			7	10	20	37
is being implemented			1	2	5	8
already implemented					5	5

Table 10.3.-4: Implementation of ISO14001 and ISO 9000 standards 2.

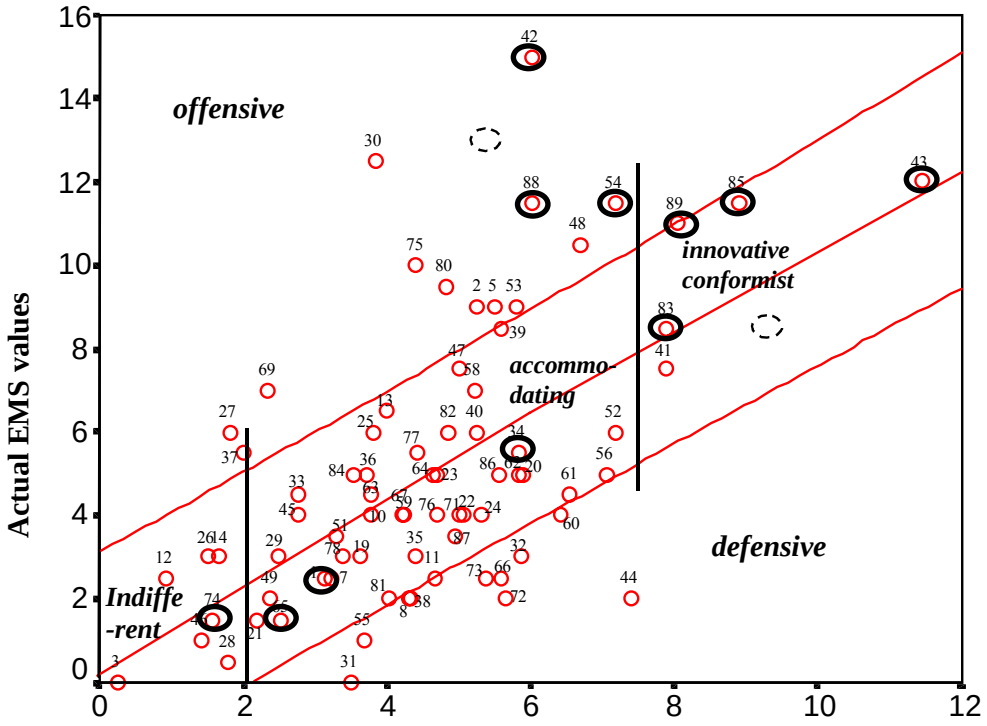
% within Does the company plan to introduce ISO 14001

Does the company plan to introduce ISO 14001	Does the company plan to introduce some ISO 9000 standard					Total
	unfamiliar with it	does not plan implementation	is considering	is being implemented	already implemented	
unfamiliar with the standard	12,5%	12,5%	50,0%	25,0%		100%
does not plan implementation		21,4%	25,0%	14,3%	39,3%	100%
is considering			18,9%	27,0%	54,1%	100%
is being implemented			12,5%	25,0%	62,5%	100%
already implemented					100,0%	100%

The lower triangle of the table is practically "missing". This means that ***the adoption of ISO 14001 usually lags behind the introduction of ISO 9000.*** It rarely happens that a company would develop its environmental management system without having some form of quality management system already in place.

Below I will examine where companies that have already implemented or are in the process of implementing ISO 14001 can be found on our accommodation map. The organizations in question are symbolized as black circles. Of the 13 companies, only 11 are on the map as two respondents failed to provide figures for their total annual turnover. As a result, in their case, the principal component for pressures could not be calculated. However, other available data allows us to make some estimates of the position the two companies occupy. One of them has 1400 employees with high PRESSURES and EMS values. ISO 14001 is in the introductory phase. This leads to the assumption that it would be found in the innovative-accommodating area (represented by a circle with a broken-line). The other company, INDA Kft., already referred to in the first chapter, was positioned on our simple accommodation map as one of the positive outliers. It has average (23) PRESSURES and high EMS values, with ISO 14001 already in place. Based on the above, it appears logical that it be found among the offensive companies. Its assumed position is marked with a broken-line circle.

Illus: 10.3.-1: Companies with ISO14001 on the strategic map



Looking at the illustration, it is immediately apparent that ***close to half of all values lie in or near the edge of the innovative conformist region. Even more striking, almost all companies in this region are about to introduce the ISO 14001 standard.*** We should not forget that companies in this group operate with high environmental risks, while the bulk of their output is sold on the EU market.

Offensive companies introducing ISO 14001 standards work with fewer but still significant risks and see publicity potentials in environmental protection.

Finally, there are some companies at the bottom of the accommodation region, near the indifferent zone. These small and medium-size organizations produce for the domestic market with small-to-medium environmental risk. Here, nothing seems to justify the introduction of the standard. Still, one should remember that decisions always contain a number of subjective elements, e.g. personal contacts, aggressive marketing by consulting firms, personal opinion, etc. Whatever their

decision-making process might be, they are still at the early stages of introducing the standards, otherwise their environmental management value would not be so low (in some cases it is not inconceivable that they were unable to distinguish the standards from ISO 9000).

To sum up so far, in the machinery sector there are three principal reasons why ISO 14001 is gaining ground: pressures from foreign, primarily EU markets, high level of environmental risks and, finally, the prior adoption of ISO 9000 standard. The rate of ISO 14001 implementation is the fastest among innovative-conformist companies with high environmental risks, and in this group it may soon become quasi-mandatory.

Obviously, values are in constant flux: the gradual introduction of more standard elements appears as a vertical shift. As a result, company 34, for instance, may soon slip into the offensive region.

Chemical companies, that are identified as highly prone to environmental accidents, have initiated the industry-wide introduction of ISO 14001. Implementation of ISO 14001 has become quasi-mandatory in this sector as well.

In conclusion, I would like to refer to interviews I made for a study entitled "Tasks for System Development and Certification of ISO 14001 standard series".[23] After visits to some companies with ISO 14001 system it became clear that there are three main reasons why organizations introduce standard EMS: they enjoy a reputation as large polluters and wish to prove the opposite; they ship to sophisticated markets or are members of multinational corporate groups where the concept of quality also includes environmental quality, or they are training/consulting firms themselves so they considered it important to be certified. The results of the present survey confirm the findings of that study.

[23] Manuscript, Bezegh and Partner Kft., 1998, Budapest.

11. The Economic Aspects of Environmental Performance

In this chapter I will deal with three major sets of questions which have a bearing on the relationship between environmental and business performance. These are the following:

- to what extent do business and environmental performance complement or compete with each other?
- to what extent can pollution-reduction achieved in the last five years be attributed to economic or environmental causes?
- which outside pressures have the most effect on companies ?

11.1 Business success and environmental performance

The relationship between companies' economic performance and environmental achievements constitutes a distinct area of research in environmental management. (see, for example, Porter- van der Linde (1995) or Stavins (1994)). Success is a complex concept, its measurement can be based on a number of indicators. In the machinery sector I focused on changes in total assets, while in the chemical and food-processing industries on profitability.

It became evident that at generally applied significance levels, neither change in total assets nor profitability correlated with any of the environmental performance indicators cited above (see Table 11.1.-1.).

Table 11.1-1: Correlation between the change in the assets and environmental performance indicators

		CHANGE IN ASSESTS
EMS	Pearson Correlation	,107
	Sig. (2-tailed)	,380
	N	69
EMS DEVIATION	Pearson Correlation	,085
	Sig. (2-tailed)	,497
	N	66
PROJECTS	Pearson Correlation	,211
	Sig. (2-tailed)	,078
	N	71
ENVIRONMENTAL INVESTMENT, R&D	Pearson Correlation	,115
	Sig. (2-tailed)	,359
	N	66

Change in total assets was not significantly different even among companies of various strategic groups (offensive, accommodating, etc.).

It appears, in the short term there is no correlation between business and environmental achievements.

I assume that companies struggling for short-term survival are less concerned with environmental issues. The special case of this hypothesis is the question of short-term profitability among companies whose futures, as a result of past economic failures, have become uncertain or who are on the verge of bankruptcy.

The questionnaire for chemical and food-industrial companies included questions concerning short-term survival. Based on responses, four companies are struggling for survival. On average, these companies apply fewer environmental management devices and launch fewer projects than do others.

Table 11.1.-2: Short term survival and the environment

			Sum of Squares	df	Mean Square	F	Sig.
EMS	short term survival	no	39	9,3462	4,0199	2,50	18,50
		yes	4	6,1250	2,5617	3,50	9,00
		Total	43	9,0465	3,9982	2,50	18,50
number of projects	short term survival	no	48	3,8750	4,0139	,00	13,00
		yes	4	1,2500	2,5000	,00	5,00
		Total	52	3,6731	3,9642	,00	13,00

The difference between the two groups did not prove to be significant, however. As very few companies are in the struggling category, no definite conclusions can be drawn from the sample.

11.2 The function of environmental protection in long-term survival

The connection between long-term success and environmental protection is more difficult to measure and demonstrate. Here I had to rely primarily on the opinion of respondents to find out how much importance they attribute to environmental protection in a company's long-term survival. Responses to this question are summarized in the table below.

Table 11.2.-1: Importance of the protection of the environment in economic success of companies

	(Mean)	Median	Mode
how important is the protection of the environment for the long-term survival of the company	3,85	4,00	4
how important is the protection of the environment to preserve market position	3,42	3,50	4
how important is the protection of the environment for new market opportunities	3,67	4,00	4

Table 11.2.-2: Long-term survival and environmental protection

How important is the protection of the environment for the long-term survival of the company

	Frequency	Percent	Valid Percent	Cumulative Percent
extremely	22	25,0	25,0	25,0
very	37	42,0	42,0	67,0
average	24	27,3	27,3	94,3
little/some	4	4,5	4,5	98,9
not at all	1	1,1	1,1	100,0
Total	88	100,0	100,0	

Table 11.2-3:The role of environmental protection in the preservation of market position

How important is the protection of the environment to preserve market position

	Frequency	Percent	Valid Percent	Cumulative Percent
not at all	11	12,5	12,8	12,8
little/some	32	36,4	37,2	50,0
average	29	33,0	33,7	83,7
very	10	11,4	11,6	95,3
extremely	4	4,5	4,7	100,0
Total	86	97,7	100,0	

Table 11.2-4. Environmental protection and market opportunities

How important is the protection of the environment for new market opportunities

	Frequency	Percent	Valid Percent	Cumulative Percent
not at all	20	22,7	23,3	23,3
little/some	30	34,1	34,9	58,1
average	27	30,7	31,4	89,5
very	6	6,8	7,0	96,5
extremely	3	3,4	3,5	100,0
Total	86	97,7	100,0	

In general, companies place considerable value on the role environmental protection plays for the survival of the company. On a scale of five, the average value came to four and, of the three factors, this one was given the highest score. [1] Two thirds of all respondents considered the issue of environmental protection vitally important from the point of long-term survival. The significance of this is emphasized by the fact that at the time of environmental-management development, market considerations (pressures, opportunities) are seen as more crucial than directly felt non-market pressures with short-term effects (authorities, NGOs, etc.)

11.3 Economic and environmental reasons behind pollution reduction

Economic restructuring left its mark on the environmental management of companies: the amount of pollution emission decreased, while the number of applied environmental management tools increased. It is no secret that Hungary hopes to join the European Union and Europe cannot but look on with concern what impact East-Central European economic transition has on the environment. Due to economic decline, compliance with international treaties (e.g., on CO_2 and SO_2 emission) poses no problems in the short-term, but economic growth started last year will not result in increased environmental load only if emission/ production unit can be decreased by a larger proportion than the rate of growth. It is important to know how pollution emission is changing at companies and what are the underlying causes.

[1] Although no average should be calculated based on the 5-point Likert scale, it is quite common for researchers to make similar calculations requiring interval-scale (e.g., factor analysis). Many analyses can only be performed by using this method alone, especially when information concerning certain questions can be gained only by relying on respondents' opinion.

Taking the machinery sector as an example, emission figures changed over the past five years as follows:

Table 11.3.-1: Change of emission in the machinery industry

	Number of companies	%
Increased	9	11%
Decreased	48	58%
No change	26	31%
Total:	**83**	**100%**

Almost 60% of companies (48 companies) managed to reduce pollution over the past five years. However, in nine cases emission increased, in seven out of nine cases due to increased production, in two cases due to changes in technology and/or in the product line. In general, harmful emission has decreased over the period.

The following table shows underlying causes and the degree of pollution reduction.

Table 11.3.-2: Causes and magnitude of emission reduction

		N	Mean	Standard Deviation
Source of pollution reduction	drop in production	10	25,5000	17,7091
	change of key technology	6	40,0000	35,6371
	good housekeeping	2	25,0000	7,0711
	cleaner production	4	53,7500	38,5951
	end-of-the-pipe technologies	2	40,0000	28,2843
	replacement of technology+good housekeeping	1	50,0000	,
	cleaner prduction+good housekeeping	1	50,0000	,
	replacement of technolgy and drop in production	2	25,0000	35,3553
	change in the production line	3	47,3333	14,1892
	Total	65	18,1846	25,6874

Of 48 companies 31 offered concrete answers on reasons for pollution reduction.

It is interesting to note that ***in two thirds of cases (21 companies) responses refer to economic instead of environmental causes.*** Economic reasons include drop in production, replacement of key technology (modern equipment usually is less polluting), and change in the product line. In these instances we can call the environmental effect of the transition "gratis". This also explains why it did not correlate with indicators of various environmental measures.

At first glance, cleaner production has resulted in impressively high emission reductions. However, in many cases this only means an improvement in heating technology and/or a shift to natural gas as a source of fuel. While the percentage of achieved pollution reduction is high, it is not the case in absolute terms, for the companies involved are small polluters where the main source of emission is heating-related air pollution.

Below I present answers returned by **chemical and food-industrial firms.**

Table 11.3.-3: Change of harmful emission in the chemical and food industries

	Number of companies	
no change	11	(25 %)
increased	4	(9 %)
decreased	29	(66 %)
total	**44**	**(100 %)**
didn't answer	**8**	

The breakdown of changes in pollution emission is very similar to that in the machinery sector.

It is evident that in the majority of companies (approx. 2/3) harmful emissions have declined over the last five years. In all, only 4 companies reported increased emission, in all cases due to increased production.

The picture changes slightly when we examine the reasons for pollution reduction. The 29 companies offered the following responses:

Table 11.3.-4: Sources of pollution reduction in the chemical and food industries

	Number of companies
Drop in production	5
Cleaner technologies	5
Drop in production and cleaner production	5
Installation of end-of-the-pipe technologies	5
Replacement of key technologies	6
Didn't give answer	3
Total	**29**

Of 29 respondents 11 reported economic reasons for the decline, a result of lower production or changes in key technology. In all, this amounts to 40%, a figure lower than that in the machinery sector. At 1/6 of companies the decline can be attributed to the use of end-of-pipe technologies. Hungarian owned companies, lacking resources to upgrade their production equipment, try to cut back on harmful emissions primarily by turning to end-of-the pipe solutions.

More modern equipment is costlier but more economical, and results in lower emission. Replacement of outdated technology led to reduced pollution emission in 20% of all cases. In general, they do not need to implement any further environmental measures; they are already in compliance with Hungarian regulations. Finally, some companies have achieved reduction by introducing cleaner production methods, e.g., they shifted to natural gas heating, cutting air pollution. Of all alternatives mentioned, we emphasize the advantages of technology replacement (the combined means of modernization and specific pollution reduction), as well as cleaner production. The use of end-of-pipe technology is acceptable and necessary only when the desired emission reduction cannot be achieved by any other means.

Table 11.3.-5: Average level of pollution reduction

source	Average level of pollution reduction,%
drop in production	48,0
cleaner technologies	5,0
drop in production and cleaner technologies	28,0
end-of-the-pipe technologies	36,3
switch to state-of-the-art technologies	43,0

The largest pollution reduction was found in companies where production declined. Here, the drop in pollution was primarily due to a shrinking economy. In the period between 1991 and 1996, turnover in the chemical industry saw a precipitous drop, which also led to a decline in harmful emissions. Over the same period the machinery sector compensated for a drop in domestic sales by increasing the proportion of its exports.

At the same time there are already clear signs that emerging trends leading to specific pollution reduction per GDP-unit are beginning to have their effect.

The transitional period and restructuring favors the spread of technologies producing less harmful emissions. However, economic growth is just around the corner, bringing on changes in life-style and consumer attitudes - all pointing in the direction of wasteful consumption and increasing strain on the environment. It is impossible to tell today whether the transitional period brings about an overall reduction or an increase in pollution compared to levels before the systemic changes. Either way, the outcome will be the result of the combined effects of all factors cited above.

11.4 External pressures affecting companies

The PRESSURES variable and risk factors give a general understanding of those internal and external acting forces that provoke the most intense reaction in environmental management by companies in our sample.

Let us take a closer look at these acting forces as some significant elements may be present in a generally weak group, while some acting forces considered to be strong may hide low-impact elements as well.

The average pressure values affecting companies are ranked by their relative importance:

Table 11.4.-1: Pressures affecting companies

	N	Mean	Std. Deviation
EUpr	88	3,4091	1,3186
CEOpr	88	3,2386	1,0504
ENV.CHARGEpr	32	3,1563	1,2979
AUTHORITYpr	88	3,1477	1,0563
COMPETpr	88	3,1250	1,2206
TMARKETpr	88	3,0568	1,4333
RESID.AREApr	88	2,5455	1,2946
COSTpr	88	2,4205	1,1113
NGOpr	88	2,2955	1,0189
FINESpr	88	2,1477	1,1699
ECOSYSTEMpr	88	2,0568	1,2351
CONSUMERpr	88	2,0455	1,1029
TECHNOLpr	88	1,9773	1,0281
ACCIDENTpr	88	1,7159	,8435
PUBL.BUILDpr	88	1,6250	1,1071
BANKSpr	88	1,6250	,8619

EU environmental requirements are on top, followed closely by Hungarian regulations. The variable of EU requirements has the largest deviation of all: EU has only minor effect on companies producing exclusively for the domestic market; while companies specialized for the EU market are the most exposed to the rigors of those standards.

Other market influences, like the environmental demands of the target market or the race to preserve market position, received high values as well.

The attitude of company managers plays an equally important role. Although it is the only variable in the survey measuring subjective forces, it must be noted that invariably management attitude shows strong correlation with the effects of market factors.

Table 11.4.-2: Correlation between the pressure of top management and that of market factors

		TMARKETpr	EUpr	COMPETpr	CEOpr
Spearman's rho	TMARKETpr	1,000	,703**	,493**	,446**
		,	,000	,000	,000
	EUpr	,703**	1,000	,533**	,302**
		,000	,	,000	,004
	COMPETpr	,493**	,533**	1,000	,578**
		,000	,000	,	,000
	CEOpr	,446**	,302**	,578**	1,000
		,000	,004	,000	,

**. Correlation is significant at the .01 level (2-tailed).

It appears managers primarily favor acting on market demands within the company. In the course of factor analysis management attitude was also included in this principal component.

Another prominent acting force is coming from Hungarian environmental regulations and pressure from authorities. This finding is intriguing because up until this point, my analysis has indicated that regulations have had a weak effect on companies' environmental management. Examining the relationship between Hungarian regulations, pressures on the part of authorities and various environmental indicators, it appears there is hardly any significant correlation between the two groups of variables.

Table 11.4.-3: Correlation between Hungarian regulations, pressures on the part of authorities and various environmental indicators

		HUNG.LAW.pr	AUTHORITYpr
Spearman's rho	HUNG.LAW.pr	1,000	,455**
		,	,000
	AUTHORITYpr	,455**	1,000
		,000	,
	PROJECTS	,159	,139
		,140	,197
	EMS	,254*	,254*
		,019	,019
	ENVIRONMENTAL INVESTMENT,	,159	,140
		,158	,215

**. Correlation is significant at the .01 level (2-tailed).

*. Correlation is significant at the .05 level (2-tailed).

The reason for this apparent contradiction is that for the majority of companies (including a host of small enterprises on the periphery of official concern) Hungarian regulations do not pose a problem: either because they comply or because they are not inspected. High values may express the respondents' belief that in the course of their environmental actions they must pay special attention to environmental agencies and regulations, while this is far from the sole motivating force behind their measures.

At the same time, regulatory pressures correlate to companies' absolute and relative pollution emission (see table below): official pressure is stronger when it comes to large polluters (even if, concurrently, they have taken serious environmental measures). Large polluters are under constant official surveillance and feel the pressure of regulations, regardless of what measures they had already undertaken. For them it is almost impossible to avoid the intense gaze of the authorities.

Table 11.4.-4: Correlation between regulatory pressure and environmental indicators

		HUNG.LAW.pr	AUTHORITYpr
Spearman's rho	HUNG.LAW.pr	1,000	,455**
	AUTHORITYpr	,455**	1,000
	POLLUTION INTENSITY	,498**	,342*
	NUMBER OF	,248*	,184
	TURNOVER	,233*	,065
	POLLUTION	,488**	,477**

**. Correlation is significant at the .01 level (2-tailed).

*. Correlation is significant at the .05 level (2-tailed).

On the average, companies gave average values for local factors, such as pressure from environmental organizations or the proximity of settlements and sensitive natural areas. Company image and savings gained by conservation were also listed here as possible opportunities.

They rated factors related to the risk of accident as low, perhaps not surprising as the sector is usually not seen as posing high environmental risks.

Companies gave the lowest pressure values to banks and insurance firms: today their effect is barely perceptible.

12. General Features of Environmental Management

In this chapter I will present a general overview of environmental management by companies participating in the survey. The most widely used system elements will be studies and we will see how long they have been in operation. Based on the results, we can retrace various stages in the development of the environmental management system: which fundamental building blocks must be introduced in the initial phase, which elements are optional to be added later. I will also show what concrete measures characterize environmental performance in the machinery sector. I will examine why product and production policies have been divided and, finally, whether the degree of specific pollution is greater in small or large companies.

The sample is not representative, so the findings are not necessarily true for the entire machinery sector. Nevertheless, they offer a number of interesting lessons.

12.1 Applied environmental management elements

The following table and illustration both demonstrate how widely certain environmental management elements are used by the surveyed companies.

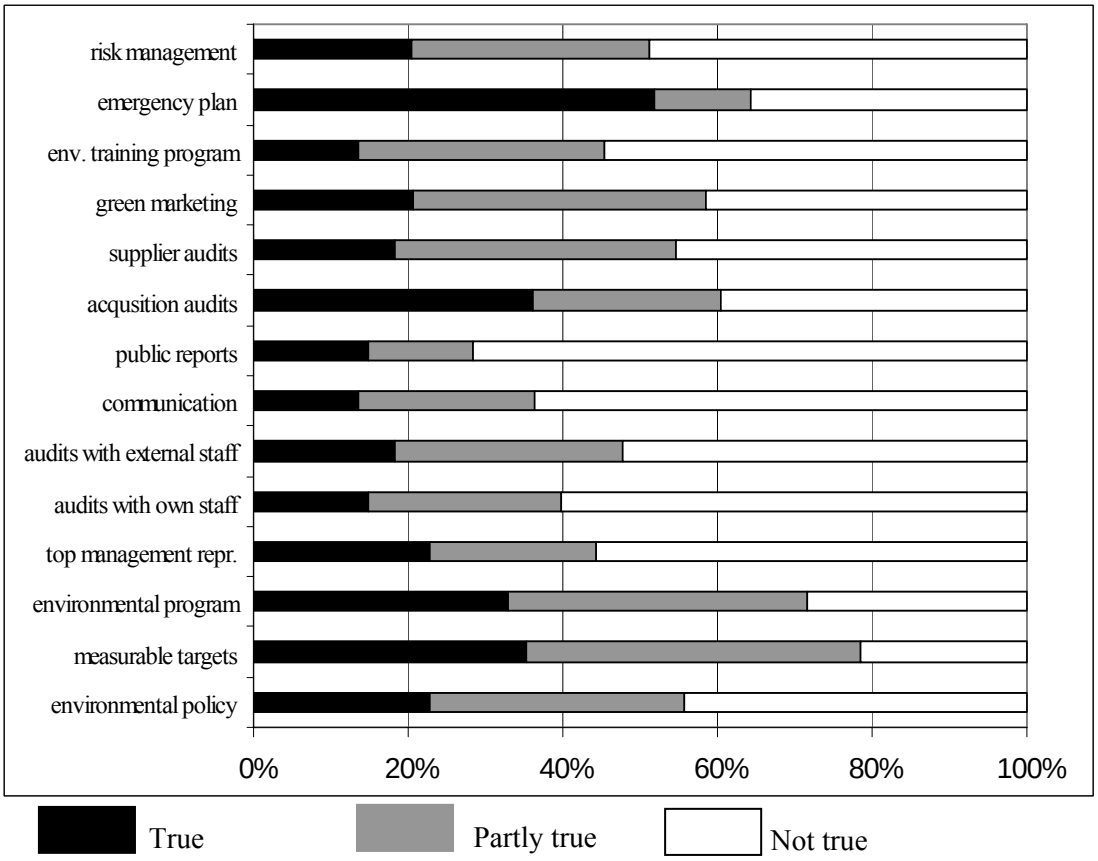
In the category of fully adopted elements, the accident-prevention plan is the most widespread, having been introduced by many companies a long time ago. Elements ensuring standardization and conceptualization of environmental management systems (e.g., environmental protection programs, measurable targets, environmental policy) are used with average frequency, while marketing and communication tools have become the least integrated parts of company operations.

In general, the proportion of companies adopting single elements is low. This has to do with the structure of the industry with many small enterprises that are not required to develop sophisticated systems.

Table 12.1.-1: EMS elements applied by machinery and equipment producing companies

	Absolutely true	**Partly true**	**Not true**
The company has written environmental policy	22,7%	33,0%	44,3%
The company has stated measurable targets concerning the protection of the environment	35,2%	43,2%	21,6%
The company develops programs to reach environmental goals	33,0%	38,6%	28,4%
Someone in top management is personally responsible for the environment	22,7%	21,6%	55,7%
The company's **own** experts conduct regular eco-audits (environmental reviews)	14,8%	25,0%	60,2%
The company hires **outside** experts to conduct regular eco-audits	18,2%	29,5%	52,3%
The company has established procedures to communicate with the public at large	13,6%	22,7%	63,6%
The company has published public environmental reports	14,8%	13,6%	71,6%
When acquiring real-estate, other plant facilities, the company makes environmental assessment of the property	36,0%	24,4%	39,5%
The company checks suppliers' environmental performance	18,2%	36,4%	45,5%
The company takes advantage of environment-oriented marketing opportunities (environment-friendly products, green labels, ads)	20,7%	37,9%	41,4%
The company has a training program for its employees in the area of environmental protection	13,6%	31,8%	54,5%
The company has an emergency plan	51,7%	12,6%	35,6%
The company applies procedures for the evaluation and management of environmental risks	20,5%	30,7%	48,9%

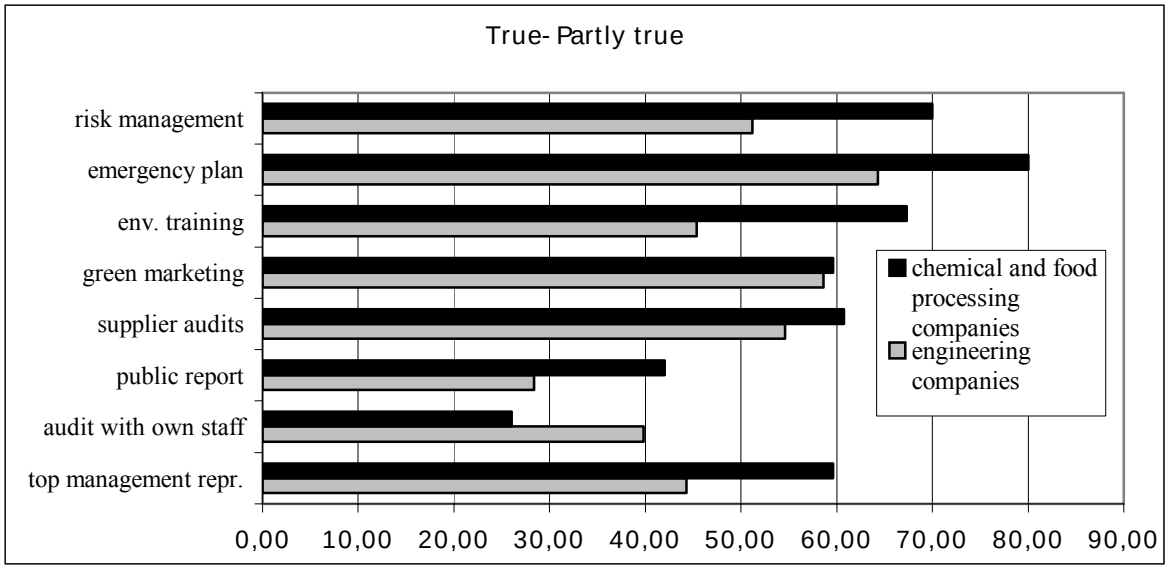
Illus. 12.1.-1: Environmental management elements applied by machinery producing companies



If I take elements introduced by companies at least in part then, surpassing the emergency plan, one finds environmental policy, environmental protection program and measurable targets. The latter three are related to the standardization and integration of environmental action, while their introduction is not expensive and does not necessarily require a major effort on the part of companies.

Risk management and eco-marketing are applied with average frequency. Again, elements related to communication (e.g., published reporting, communication) come last. It is instructive to compare responses by the machinery and chemical and food-industrial sectors.

Illus. 12.1.-2: Comparison of the chemical and food processing industries with the machinery industry sample



Chemical and food-industry companies often use risk -management type elements (i.e., risk assessment and management, accident-prevention plan, continuing training) and the responsibility of environmental protection is assigned to top management in proportionally more companies. At the same time, there is negligible difference in eco-marketing activity and in the audits of suppliers.

In the chemical and food-industrial sector there are more companies applying hazardous procedures; the increased potential of accidents requires the development of more advanced management systems.

This must serve as a warning that industrial sectors with differing risks and concentration, or the environmental management systems of countries with vastly different industrial structures should not be compared automatically, and no conclusions should be drawn concerning the level of environmental sensitivity of a given country or industry. Comparisons can only be made - especially when it comes to environmental risks - when unlike conditions are taken into account.

12.2 Stages in developing environmental management

It is interesting to see how long companies have applied various management system elements (see Table 12.2.-1.) This is not only an indicator of the overall development level of the system, but tends to suggest in what order elements are being introduced by companies.

It is immediately apparent that the management system is a new component in companies' environmental practice: the majority of elements have only been in use in the last 3 to 5 years (the average age of companies is 27). Systematic development started only after the economic transition.

In general, only two elements have been applied for more than 5 years. One of these is the emergency response plan, where application has been a legal requirement for quite a long time. The other one is pubic reporting. Here it is suspected that some companies believe that published reports means the annual documentation sent to the authorities.[2] To my knowledge, in today's Hungary only a handful of companies can boast of public reporting in the true sense of the word.

[2] Unfortunately, no reliable answer can be expected on issues where the respondent is poorly informed. The person completing the questionnaire is often uncertain whether he should be familiar with the given concept, interprets the question based on previous knowledge and may end up giving misleading answers. I call this the "we have been doing this for 20 years and it doesn't work" effect. While large companies can be expected to be aware of the meaning of environmental management, the same cannot be said for small businesses.

Table 12.2.-1: Years of application of EMS elements (number of years)

	N	Minimum	Maximum	Mean	Std. Deviation
environmental policy	40	1	12	4,41	3,19
measurable targets	54	,5	12,0	4,426	3,321
environmental program	45	,5	12,0	3,300	2,835
top management repr.	28	,1	12,0	3,932	3,130
audits with own staff	25	,5	12,0	4,040	3,017
audits with external staff	37	,5	15,0	4,419	3,443
communication	22	,5	10,0	3,818	2,514
public reports	17	1,0	15,0	5,176	4,489
aquisition audits	20	1,0	5,0	3,300	1,455
supplier audits	26	1,0	15,0	3,115	2,903
green marketing	26	1,0	10,0	3,577	2,139
emergency plan	35	,00	25,00	7,1000	6,3753
risk management	23	,00	15,00	4,2826	3,8371
environmental training	23	,5	15,0	4,761	4,188

The environmental assessment of real-estate is one of the most recently introduced elements, in use for no more than five years by anyone. Its appearance is closely linked to the start of the privatization process, to the sale of property often saddled with accumulated pollution. Of all listed elements, this is the only one that explicitly protects the company from the financial burden of environmental risks created by others, and not society from the environmental risks caused by the company.

The sample contains no firm that would use eco-marketing and communication as part of its environmental policy for more than 10 years. These are the most recent elements of environmental management. In the past companies considered the protection of the environment their "private" business. While acknowledging the concern of the authorities, these firms seem convinced that the public at large need not be informed of certain sensitive information.

For a long time, the protection of the environment was the responsibility of an environmental coordinator who, in issues of real consequence (investment, plant shut-down), had no decision-making power. Today it is already expected that, in large companies, environmental issues be taken up at top management level, by somebody in the board of directors. However, in general this has only been the practice in the last 4 years. Also, an environmental program - a method of dealing

with issues in a well-conceived manner - is a relatively new concept.

And finally, components related to the management of environmental risks and the standardized operation of environmental programs are of average age (4 to 5 years).

The table suggests that in developing their environmental systems, companies proceed in the following order:

1. first, provisions are made for accident control, for elements directly related to dealing with emergency situations

2. next, other elements of risk management are developed

3. later, environmental protection is elevated to top management decision-making level

4. in coordination with the latter, eco-marketing and/or communication elements are introduced (if at all).

In general, risk management tends to come before marketing-type tools.

Naturally, there is no need in every case for each company to build a fully-developed environmental management system. For instance, if its activities pose no danger to the environment, it is in no need of an accident-prevention plan or risks management tools before it turns to eco-marketing. ***If, however, the company is faced with serious environmental risks, elements capable of dealing with risks must be urgently introduced. The lack of these cannot be compensated with the wider use of eco-marketing or communication tools.*** The development of the entire system is expected primarily from innovative-conformist companies.

12.3 Environmental projects in the machinery producing firms

I asked companies what concrete steps they took for the protection of the environment in different areas. In this section I will summarize their responses. Most projects fit a number of categories: for instance, a switch to water-based

painting technology is relevant to material purchase (water-based paint), to pollution emission (reduced solvent evaporation) or to production procedures. Consequently, the same item shows up in different categories in different companies.

It should be noted that, compared to end-of-pipe solutions, there are many projects in the area of clean production. Some interesting examples are listed below.

Product Development:	**Materials Purchase:**	**Production Procedures:**
- using rust-free base materials (requiring no paint) - weight reduction - use of soil tillers to minimize damages to soil structure - development of mobile construction debris processor - reduction of evaporation of shock-absorber oil - disassembly-friendly technology - improvement of exhaust fumes - replacement of asbestos	- audit of suppliers - preference for using natural materials - to buy hazardous materials environmental permit is required - use of cooling emulsion that is repurchased buy the supplier - purchase of lead and chromate-free paints	- elimination of salt baths - binding of dust - material-sparing technology - freon-free polyurethane expansion - minimizing sheet clippings with CNC-controlled cutting torch - electro-static instead of manual spraying - replacement of tin plating with ultra-sound technology

Pollution Emission:	**Materials Handling:**	**Waste Management :**
- filtering system - improving quality of treated water - flue extension - regular inspection of gas-powered equipment - installation of advanced boilers	- instead of petrol-powered fork lifts - use of natural-gas powered lifts - closed-container rail transport - noise insulation, noise protection - recycling of packing	- agricultural use of sludge - neutralization - selective waste collection - collection of track rags - increasing rate of waste to be recycled - construction of waste-disposal sites

- improved exhaust suction - use of dust filters - oil traps - processing compressor condensate - replacement of ethynyl trichloride - instead of oil emulsion coolants, the use of environmentally-friendly coolants - reduction of heat pollution - installation of VOC equipment	material	- sale of metal scrapping as smelting base - use of spent oil at metal cutting

Equipment, Infrastructure:	**Management Methods:**	**Conservation:**
- landscaping - reconstruction of painting booths - closed industrial water systems - improved heating system - closed-system parts washer - heat trapping, used for heating, warming	- requesting environmental advice when buying new equipment, technology - setting up ISO 14001 teams - preparation for KMR audit - 3-year waste management program - development of environmental policy	- measures to save water, electricity and raw material - recirculation of equipment cooling waters - improved energy and lubricating oil consumption - feeding injector (close to pollution-free) - energy-saving glazing - radiant heating instead of boiler system

Marketing
- KMR publication - introduction at professional forums of products that can be maintained with ecologically sensitive technology - lectures, training sessions

Changing painting technology was the most commonly listed, e.g., switching to acrylic or spray paint. The result is the reduction of solvent evaporation.

Another frequently cited change is the introduction of electric fork-lifts, which results in lower exhaust emission on company premises. The balance of these measures on a macro-economic level is not as positive as on company level, as power plants producing electricity are also big polluters.

Various forms of conservation measures are also quite frequently applied.

Along with clean production methods, end-of-pipe solutions (e.g., waste water treatment) are still used.

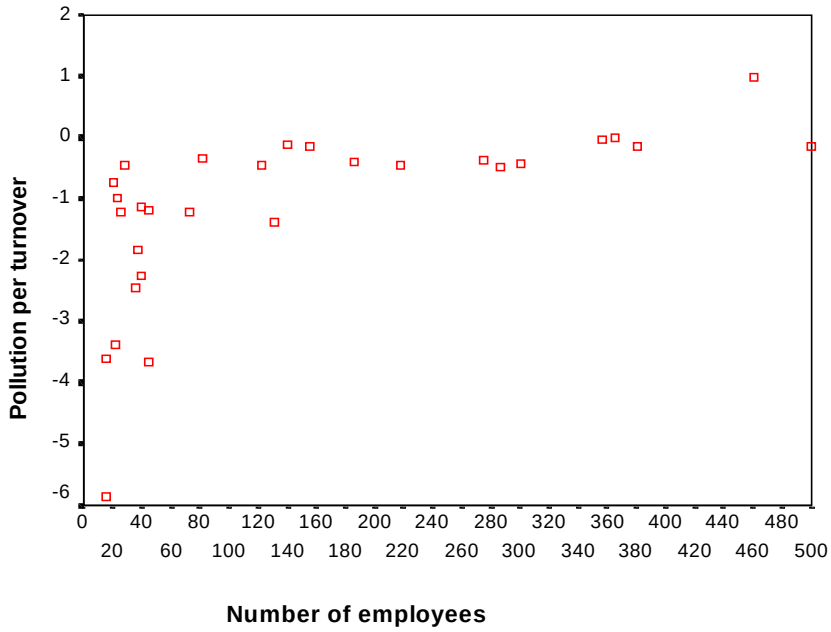
12.4 Who are bigger polluters - small or large companies ?

Absolute pollution level and, along with environmental measures, pollution intensity and specific pollution are all important indicators of environment-friendly operation. They show the level of pollution emission per unit-production.

The picture below gives pollution-intensity index[4] as a function of company size.

[4] Using pollution indicators, I arrived at the pollution index by principal component analysis. Negative values, instead of referring to "negative pollution", are a consequence of standardized indicators.

Illus. 12.4.-1: Pollution intensity and company size



It appears that up to a point (50 employees), pollution intensity grows at a steep rate with the growth in company size, or may be independent of that, later reaching a plateau and stabilizing there. This picture seems to support the theory of "small is beautiful" as small company size is usually accompanied by less pollution intensity. Unfortunately, these results are not free of distortion, for large companies are subjected to much more intense authority scrutiny. For instance, they cannot afford not to separate hazardous waste or to illegally dump waste water down the drain. Large producers are the main target of environmental regulation and inspection. It can be easily conceived that in some small companies there is no appreciable hazardous waste or industrial waste water because the former is mixed in with communal garbage, while the latter is discharged into the sewer system.

Without further study, one should not make conclusions about the relationship between company size and pollution intensity.

12.5 The separation of product and production policies

In general, European countries expect that products brought to their markets, including imported goods, meet high environmental standards. At the same time, international treaties ban discrimination against foreign producers when their environmentally sound products have been manufactured by using polluting technology. Product standards are satisfied with protecting the health and the environment of the receiving population. Meanwhile, technology used by foreign manufacturers cannot be expected to meet high local standards (e.g., keeping threshold levels) which might be stricter than in the country of origin. Besides, manufacturing is the concern of the producing nation, having no impact on foreign consumers. This can lead to export-oriented companies applying separate product and production policies concerning the environment. In other words, they may be diligent in ensuring the environmental safety of the product, yet ready to pollute the environment without hesitation.

The issue of product and production-policy separation can be stated in two ways:

1. Which impulses elicit stronger reaction from companies in their product policy and which in their production policy?

2. Do companies consistently develop their product and production policies at the same level, in other words, are the two necessarily in balance with each other?

Factors having different effects on product and production policies

The issue is approached based primarily on responses from the chemical and food-industrial firms.

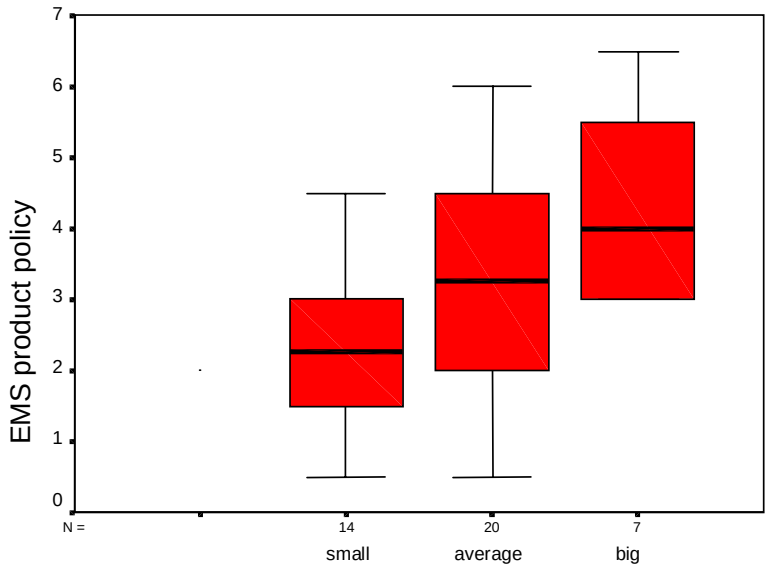
First, I divided variables expressing the number of environmental management system elements in two. One group includes EMS elements related to the product, the other EMS elements dealing with production. The positive correlation between EMS-product and EMS-production variables is above average (0.7496, P=0.000). This indicates that companies that apply environment-friendly

production technology have a more environment-oriented product policy as well, and vice versa.

Next, I examined what differences or similarities there are between the two variables when seen in relation to various aspects.

Companies that see market potential in environmental protection are more likely to introduce elements of EMS product policy (0.4609, P=0.002).

Illus. 12.5.-1: Environmental opportunities and product policy



However, there is no significant relationship between market potential and elements of EMS production policy. ***Recognition of market opportunities primarily affects a company's product policy, the environmental consequences of production are secondary.***

In the chemical-food-industrial sample cultural effects on the level of the environmental management system can be demonstrated (unlike in the machinery sector). Usually, foreign owned companies have integrated fewer EMS elements

in their system. The correlation between the EMS indicator and the domestic variable is negative. ***If, however, I examine the EMS production and EMS product variables separately, I find significant negative correlation only in the case of the former (-0.4888, P=0.001, and 0.2425, P=0.101). That is, domestic companies are more likely to lag behind foreign ones in respect to EMS production than in product policies.*** Whether the company is foreign, mixed or domestically owned, it faces an environmentally less conscious consumer and is not encouraged to develop environmental-friendly products.

Companies ranking quality as a foremost objective are more likely to see market opportunities in environmental protection than companies where high quality is not a primary concern. Companies faced with problems of survival put less value on market opportunities in environmental protection. ***In short, the protection of the environment is primarily the concern of "good" companies.***

In the machinery sector I found that in the majority of cases companies tend to develop product and production-related management elements at the same rate. ***However, in offensive companies one can observe that elements with direct bearing on the product (e.g., marketing and communication) are better developed*** than those related to production. When it comes to marketing and communication elements, offensive companies are ahead even of innovative-conformist companies characterized by higher risks.

In conclusion, it can be stated that it is useful to divide ***environmental strategy into environmental product and environmental production strategies.*** Although in most instances the two move and develop hand in hand, there are factors that companies react to by adjusting either their product or production policies.

13. Summary

In this study I proposed a new concept, offering a framework for treating a number of problems that so far have hindered the development of environmental management research. I demonstrated that with the introduction of the concept of accommodation region:

- we eliminate or reduce distorting effects that crop up when we try to set up similar criteria for companies regardless of size, profile or the country in which they operate - in other words, for companies faced with differing environmental risks. This tool allows us to evaluate companies under the bright light of fine-tuned criteria. An organization is considered successful when, based on its risks, its performance surpasses social expectations.
- company performance can be compared whether companies are part of the same or different strategic groups.
- we look at technological (cleaner production) and environmental management development at the same time. This can answer many questions raised in connection with preference for one or the other approach. I have shown that the accommodation region can be reached following either path.
- the concept of strategic groups used in the past can be applied in the future, only their content is expanded; categories with positive and negative values occupying positions outside the accommodation region become relative categories. This prevents us from labeling all companies in less developed countries as defensive.

In the empirical part of my study I examined how the new concept works in practice in the context of Hungarian machinery producing firms. I tested a number of models to measure the effectiveness of the accommodation region. One of them, while not the most useful from a theoretical point of view, can be standardized easily and used in diverse environments to map the accommodation region, in fact to compare various countries and industrial sectors. I showed that

theoretically unadulterated models are the most suitable for field work, although the choice is determined by the quality of data made available for research purposes. If possible, models treating pollution as a physical indicator must be used: an approach taking into account pollution intensity (objective internal risk), volume effects and independent external risks is highly recommended.

Next, using factor analysis, I identified groups of variables and the effects they bring about. I discovered the existence of the following five principal components: pollution, market pressures, market opportunities, local pressures and regulations. Using factors as explanatory variables, I defined the accommodation region with the help of multivariate regression. It became evident that among factors effecting the region some are active and some inactive. While, for instance, in the chemical-food-industrial sample the cultural background of the owners acted as an active force, its effect in the machinery sector was barely perceptible. This reminds us that variables determined to be inactive in one study should not be ignored when the study is repeated in another area.

In the next step I tested the effectiveness of the accommodation region and the strategic map derived from that. Based on the position they occupy in relation to the region, I divided companies into the following strategic groups: indifferent, offensive, defensive, accommodating, innovative-conformists. I examined to what extent the characteristics of various categories matched descriptions found in professional literature. I found a good fit between the characteristic features of real-life strategic groups and relevant theoretical concepts: offensive companies are characterized by appreciation for market opportunities, and well-developed marketing and communication elements. Innovative-conformist companies belong to the high-risk group, and they are the ones with the most sophisticated environmental management systems. Indifferent companies are typically small, carry little risk and their environmental management system is rudimentary.

By definition, the accommodation region gives a picture of Hungarian conditions as well. Organizations belonging to a group possess the features of their the strategic category and, at the same time, display the characteristics of their sector and cultural milieu. It would be pointless to label a company with a poor

environmental performance as “delinquent” if, in fact, social expectations push it in the direction of ignoring environmental issues. For instance, an interesting local peculiarity in Hungary, both in the offensive and the innovative-conformist groups, is the relatively high proportion of companies that do not fully comply with Hungarian environmental regulations. The technology used by offensive, defensive and innovative-conformist groups is considered advanced by Hungarian but not by European standards. Finally, in the innovative-accommodating group the introduction of ISO 14001 is becoming a requirement.

I demonstrated that in building their environmental management systems companies usually take the following path: first elements dealing directly with high hazard accidents are introduced; next other risk management elements are developed, later environmental protection is integrated at top management level and finally eco-marketing and/or communications devices are employed.

The new concept offers the following advantages for future studies:

- The creation of the accommodation region and the strategic map creates a framework for the evaluation and interpretation of results. This holds true even if the researcher chooses the simplest two-dimensional model. The concept does not require information virtually impossible to obtain while, at the same time, phenomena that cannot be explained by any other method can now be interpreted. To make a rough outline of the accommodation region, in the data collection phase a 1.5 to 2-page length questionnaire is sufficient. Most of it contains frequently-asked questions (environmental management elements, total turnover), so it fits in the 6 to 10-page questionnaire commonly used to study environmental management.

Strategic maps can be used by companies in the following way:

- Taking the strategic map based on representative industrial sample companies, companies that are not part of the study can conduct a self-analysis and locate their position on the map. This way unsustainable environmental attitudes and strategies can be identified

in time. More in-depth self-analysis or an audit is also recommended if the company‘s self-image and its position on the strategic map do not match. For self-analysis the company needs to acquire the map, fill out a short 1.5 to 2-page questionnaire and solve an equation involving a few additions and multiplication to establish the company’s vertical and horizontal position on the map. The self-analysis takes approx. 20 minutes.

To sum up, it can be stated that the accommodation region is an effective and well-functioning conceptual tool both in theory and practice, a concept deserving further and more detailed study.

14. Outlining future direction of research

Future research based on accommodation region fundamentally must be focused on the following topics:

1. A strategic map must be drawn for various industries and countries; with its help, comparisons must be made between company groups with diverse potentials. Results can help fine-tune the concepts of accommodation region and strategic map.

2. The concepts of accommodation region and strategic map must be applied to in-depth research of environmental management (e.g., risk management, marketing, etc.) Various strategic groups can be tested against diverse criteria. The accommodation region can be prepared for specific areas as well.

3. Environmental strategic categories based on the accommodation region must be integrated with theories of company strategy.

4. A questionnaire to calculate the accommodation region for multinational companies must also be prepared. Inevitably, this will be highly detailed, including questions covering issues with global ramifications (e.g., CFC use, CO_2 emission, animal tests, etc.).

5. With experience, we must fine-tune accommodation region measurements. Standard questionnaires must be created, suitable for making comparisons of accommodation region characteristics between various industrial sectors and countries.

6. Shifting social expectations concerning the protection of the environment can be traced if, every few years, we plot a strategic map for the same company group, relying on the same set of questions.

7. The accommodation map is a constantly changing concept, which means that strategic categories can be refined at any time. For instance, it may be appropriate to use, instead of my five, a division into eight groups. In this case the offensive group can be further split into offensive micro-companies (above

the indifferent region), offensive (above the centre of the accommodation region) and innovative companies (above the innovative-conformist region). In the defensive group it is justified to treat high-risk defensives separately, as the combination of high risks and a defensive strategy is most critical.

The question of measurement must not be taken to the extreme. If companies can provide more detailed information on their harmful emissions, this would clearly make future research more feasible. At the same time, monitoring and recording of data is quite costly and their expansion cannot be justified by the increased information requirements of environmental management researchers alone. It is best to rely on available data and find the most effective tools for measuring environmental performance.

In many respects, the method of calculating aggregate pollution is only a question of scientific agreement: no absolutely objective method exists, while there are acceptable and well-functioning subjective approaches. The choice is a question for agreement among researchers. Let us remember that GDP, for instance, is not a perfect measure of social welfare, yet it has been accepted by mutual agreement because no better solution was available at the time. The measurement of environmental risks and environmental performance indicators should be refined as well.

It is inevitable that we develop various measurement scales for companies vastly different in size. In the case of multinational corporate groups we must use more complex questionnaires with more questions (e.g. UNEP recommendation) that provide answers on issues with global impact. However, anything overly sophisticated may appear threatening to a small company. The questionnaires used in this study are suitable for evaluating companies on the production plant level; differences due to size are minor compared to looking at entire companies. Also, the environmental policies of multinational companies, that may differ country from country, are not lumped all together.

Measuring accommodation region is only justified when, with its help, phenomena never adequately described before can be elucidated. It would be worth examining what is the relationship between environmental strategic groups

and groups defined on the basis of company strategy. How suitable the accommodation region is to make forecasts is another intriguing question. For instance, if a company complies with all regulations, yet finds itself below the accommodation region, is it able to anticipate running into problems for failing to meet social expectations with its performance?

It would be of interest to establish the accommodation region by a number of methods and see the degree of overlapping among regions formed in this fashion. Surely, once the method of establishing the accommodation region is changed, some companies would still belong to the same environmental-strategy groups. In the case of others the reason for changing position must be investigated.

Comparison between industrial sectors and countries would bring interesting results as well. Is it actually true that in sectors with higher risks the centerline of the accommodation region follows a steeper incline? How does the accommodation region of a sector in a country with high environmental awareness compare to that in a country that lacks environmental consciousness.

Answers to the following questions can be the subject for further research and I hope to provide some of them in the course of my future work.

15. Appendixes

15.1 Characteristics of studied sectors

The proper interpretation of results requires that we recognize characteristics of the three sectors under study that have significant bearing on the shape of the accommodation region. The comparison of the three sectors can only be made by taking the differences of these factors into account, which can be divided into three major groups:

1. due to the typical feature of each sector, environmental risks defining the accommodation region differ by degree, because

- environmental risks described as "typical" vary in kind and degree (e.g., accidents carry the greatest consequences in the chemical industry)
- the degree of industrial concentration varies. In sectors where the number of small companies is high, we take less sophisticated environmental management systems for granted.

2. industrial sectors are subject to the effects of other cultures to varying degrees; in other words, the centerline's angle of incline in the accommodation region is not identical. Difference in cultural influence can be caused by:

- sectors' varying degree of export market. Companies serving primarily the domestic market are faced with Hungarian requirements, while those relying more on exports are concerned with requirements prevailing elsewhere.
- the prevailing owner-structure (ratio of Hungarian and foreign ownership) in each sector is another significant motivating force.

3. restructuring and privatization is carried out at varying speed in each sector. Some are leaders, while others lag behind, there are winners and losers as the result of reorganization. Faster adaptation offers better conditions for the creation

of a Euro-conform environmental culture, while slow reaction favors the perpetuation of well-rehearsed attitudes.

15.1.1 Degree of concentration in various sectors

The chemical industry is characterized by a high degree of concentration. Companies with annual turnover above HUF 10 000 million employ 47% of all people working in the sector. Concentration in the food and machinery sectors, however, is lower. The significant proportion of small and medium-size companies will become more crucial once we evaluate the average standard of environmental measures sector by sector.

Table 15.1.-1: The number of employees in turnover size groups of companies

	-100 Million Ft	100-500	500-1000	1000-5000	5000-10000	10000-	Total
Machinery industry	9938 (6,5%)	32170 (21,1%)	24173 (15,8%)	**42147 (27,6%)**	10315 (6,8%)	34045 (22,3%)	152788 (100%)
Chemical industry	5446 (6,7%)	6571 (8,0%)	5741 (7,1%)	15276 (18,8%)	10029 (12,3%)	**38179 (47%)**	81242 (100%)
Food processing industry	5174 (4,3%)	13256 (10,9%)	11721 (9,7%)	**43925 (36,3%)**	25394 (21,0%)	21460 (17,7%)	120930 (100%)

Source: Iparstatisztika Évkönyv, 1996 KSH, Budapest, 1997

15.1.2. Consequences of economic reorganization in each sector

Economic reorganization had widely varying effects in all three sectors. The following tables demonstrate the shift in weight of each sector:

Table 15.2.-1: Structure of industrial production, %

	1988	**1992**	**1996**
Food, beverages and tobacco	19,6	25,7	22,2
Chemical industry	21,8	21,6	18,7
Manufacture of machinery and equipment	17,9	13,4	22,3

Souce: KSH (1997)

The share of chemical production fell over the last 8 years. After initial gains, the food industry saw a decline but, overall, its share has increased. The machinery

sector is the most dynamic; although development started later than in the food industry, it has now achieved impressive gains (30%) among productive industries. Of all three sectors, the machinery sector is the biggest winner in the race for restructuring.

15.1.3. Export orientation by sector

The following table shows the role of exports in each sector.

Illus. 15.1.-1: Volume indices of domestic versus export turnover , 1996

Volume index of domestic turnover **Volume index of export**

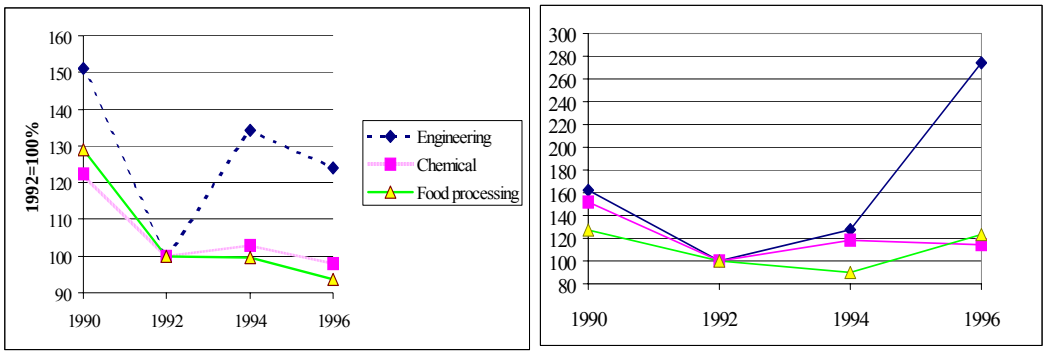


Table 15.1.-3: Production and turnover in industrial branches, 1996

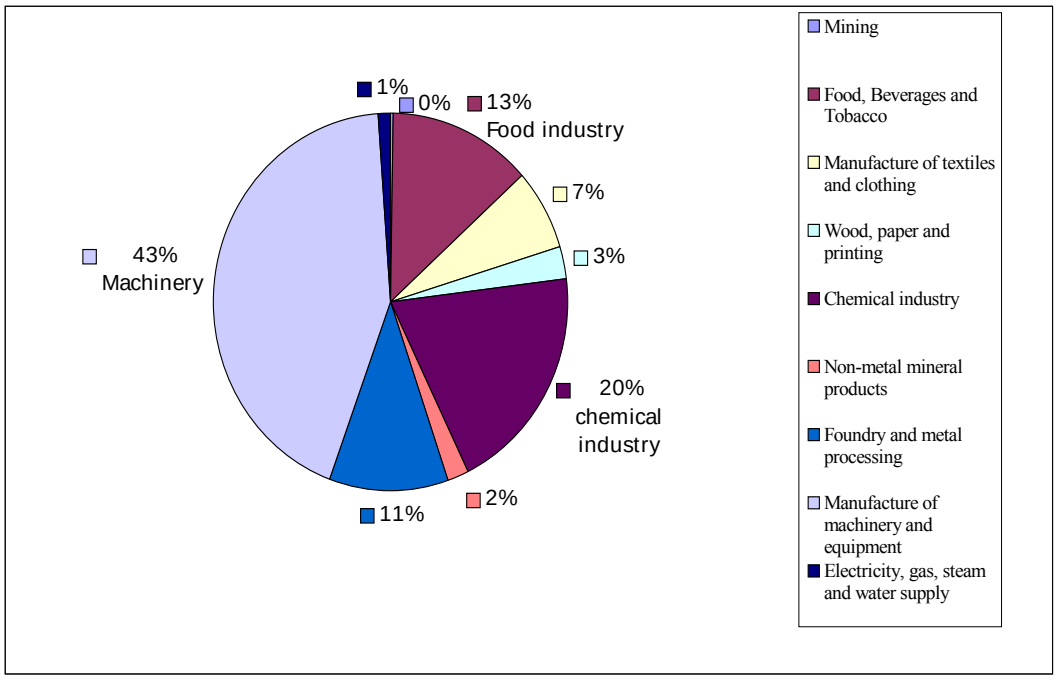
	Domestic turnover	**External trade turnover**	**Export as a percentage of total production**
Mining	44094	3728	8
Food, Beverages and Tobacco	***762876***	***199840***	***21***
Manufacture of textiles and clothing	82243	109260	57
Wood, paper and printing	195754	40258	17
Chemical industry	***513311***	***304702***	***37***
Non-metal mineral products	105904	31078	23
Foundry and metal processing	251491	162846	39
Manufacture of machinery and equipment	***310158***	***667559***	***68***
Electricity, gas, steam and water supply	516806	16943	3

Forrás: KSH (1997)

The exceptionally high, 68% ratio of external turnover by the machinery sector also means that, instead of domestic markets, foreign target markets are far more determining factors. While 37% of export sales by the chemical industry is a significant part of total sales, it is still no more than average within industry; and the 21% export ratio by the food industry is certainly low. In this sector performance on the domestic market is a question of survival; export is a secondary issue.

Looking at the share in exports by sector (see illustration), we see that the machinery sector is considerably ahead, providing a fraction under half of total industrial exports. Export by the chemical and food industries are also substantial, yet their combined share is less than that of the machinery sector alone.

Illus. 15.1.-1: Structure of industrial export, 1996



We can conclude that the machinery sector is highly export oriented, while the food-industry is more concerned with the domestic market. The chemical industry though, occupies the middle ground with substantial export sales, primarily targeting the domestic market.

15.1.4 Ownership

Of the three sectors, privatization took off first in the food industry, while it was the most protracted in the chemical industry. By 1995 more than 50% of machinery and food-industrial firms were in foreign hands. In the chemical industry in 1995 the percentage even of state ownership is remarkably high, the proportion of domestic ownership is low, which is easily understandable if we consider the high degree of concentration within the industry.

Table 15.1-4: Weight of at least 50 percent privatized companies in certain industrial branches

	Net sales revenue	**Stockholder`s equity**	**Number of employees**
Manufacture and repairing of machinery and equipment	13,82	15,46	20,46
Food and beverages	20,22	27,66	29
Chemical products	6,45	4,68	11,88

Source: A privatizáció , Privatizációs Kutatóintézet, Budapest, 1994.

15.1-5: Proportion of foreign versus state ownership in stockholder`s equity

	State owned	**Foreign owned**
Manufacture and repairing of machinery and equipment	12,7%	51,4%
Chemical products	42,6%	38,9%
Food and beverages	14,2%	51,5%

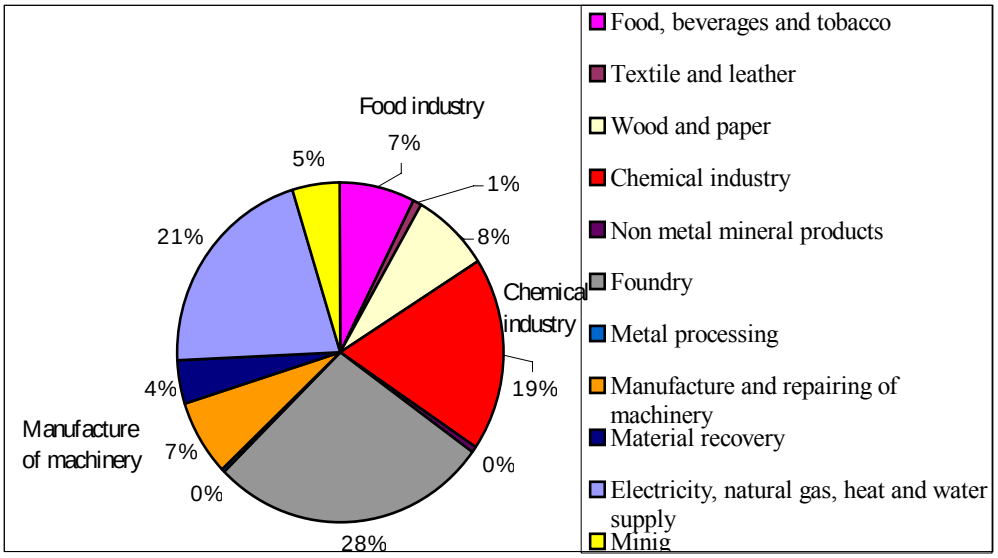
15.1.5 Deviations in environmental risk by sector

The chemical industry is characterized by potential industrial accidents with major consequences and the continuous (non-emergency-type), large-scale emission of

pollutants. As a result, from an environmental point of view, the industry is well regulated, frequently inspected and held under constant public scrutiny. The machinery industry, and even the food industry are seen in a much more positive light.

On the following pages I will introduce a few concrete environmental characteristics for each sector. Pollution emission by the chemical industry is very high, accounting for 1/5 of total industrial waste water discharges requiring treatment.[5]

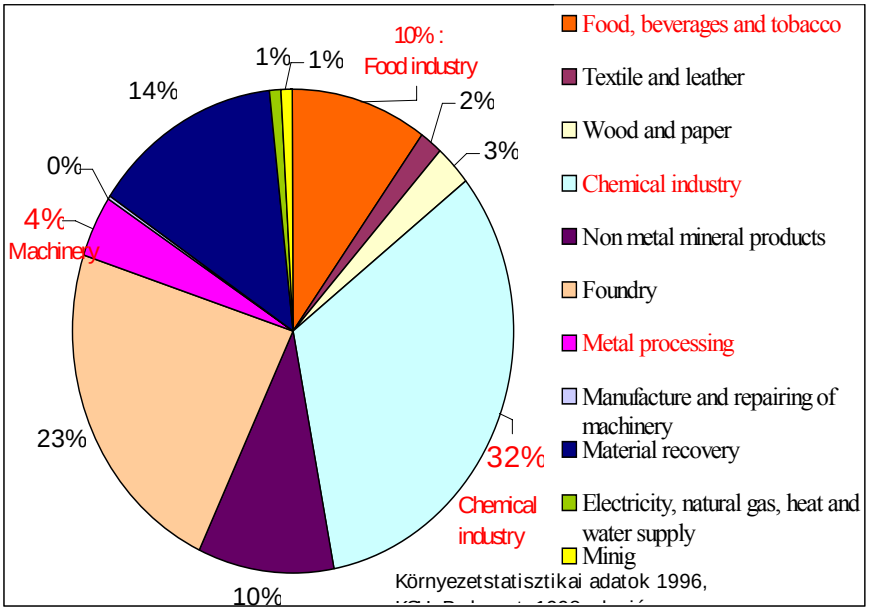
Illus. 15.1.-2: Structure of waste water discharge in industry, 1996



The bulk of air pollution is caused by the burning of fossil fuels. The following chart shows to what degree various sub-sectors contribute to the problem.

[5] From *Environmental Statistical Data*, 1996, KSH, Budapest, 1998.

Table 15.1.-3: Use of fossil fuels in industrial subsectors, 1995 (terajoul)



To sum up the above, it is evident that all three sectors have unique and intriguing features of their own, all of which may affect their environmental accommodation. The machinery sector, the most export oriented, is highly sensitive to foreign, primarily EU markets, its environmental regulations and the demands of its consumers. In fact, by now the domestic market plays a minor role and the sector is fundamentally tied to the EU market. Moreover, the machinery sector is expanding, creating the basis for investment in cleaner production technologies.

The chemical industry is noteworthy for its high environmental risks, large volume emissions and the intense public attention focused on its activities. The sector suffered major losses in the course of reorganization and it has not managed a full recovery to this day.

Finally, by most indicators the food-industry occupies the middle ground. At the same time, this sector is directly faced with consumers' (and as a consequence, environmental) expectations as the bulk of its products are intended for public consumption.

15.2 Characteristics of studied sample

The empirical research is based on two samples, together containing responses from 140 companies. The first survey - intended to be a pilot study - was conducted in 1997, and includes 52 chemical and food-industrial companies. Based on that experience, I prepared an improved version in 1998, which was mailed to 600 companies primarily engaged in machinery production. The 88 valid responses returned constitute the principal sample of the empirical study. The low return rate unfortunately is average for this kind of approach, which, in most instances, comes to anywhere between 15 to 25% for similar environmental surveys.[6]

Although both questionnaires tried to find answers to the same questions, due to effected structural changes, the diverse nature of surveyed industries and the passage of 1 year between the two surveys, the two sub- samples were treated separately in statistical analysis. Most analyses rely exclusively on responses from the machinery sector. At the same time, the two samples offer the chance to make interesting comparisons, especially when it comes to slow-changing variables and the differences among sectors.

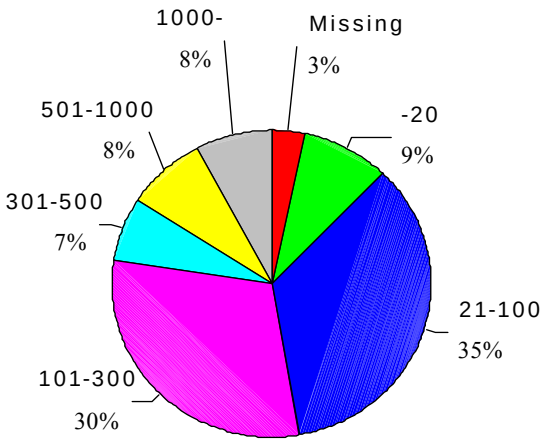
Below I will introduce the characteristics of the principal sample (machinery manufacturing firms). Large companies are over-represented in relation to their actual proportion within their sector. This is a consequence of the sampling method used.[7] In a representative sample of 90, of companies employing between 500 and 1000 people only 3, of those employing over 1000 only 2 would have been included. This proportion is much too low; I could not present any meaningful findings on large companies as they would be under-represented in the

[6] The return rate was adversely affected by that fact that not long before my survey, and running concurrently with it, other environmental management studies were under way (see, for instance, Pataki-Boda, 1997). Also, due to time constraints, I did not have the opportunity to make follow-up phone calls.

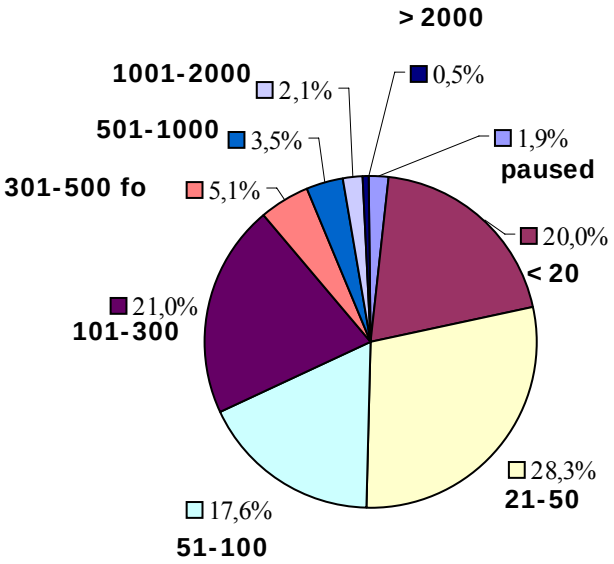
[7] I sent questionnaires to all companies employing at least 50 people. I took random samples among companies employing between 10 and 50 people, and ignored companies with less than 10 employees. In these companies environmental problems are negligible and would have fallen , almost without exception, into the indifferent category.

sample. Consequently, the resulting (non-representative) sample is better suited for the study of the effects of company-size than a representative sample would be and, as will be demonstrated, production volume is one the model's most important explanatory variables. However, I do not use the results to make extrapolation concerning the entire sector. The function of variables is not the definition of sector characteristics, but testing the practical application of the accommodation region concept.

Illus. 15.2.-1: Sample characteristics as number of employees at each sites

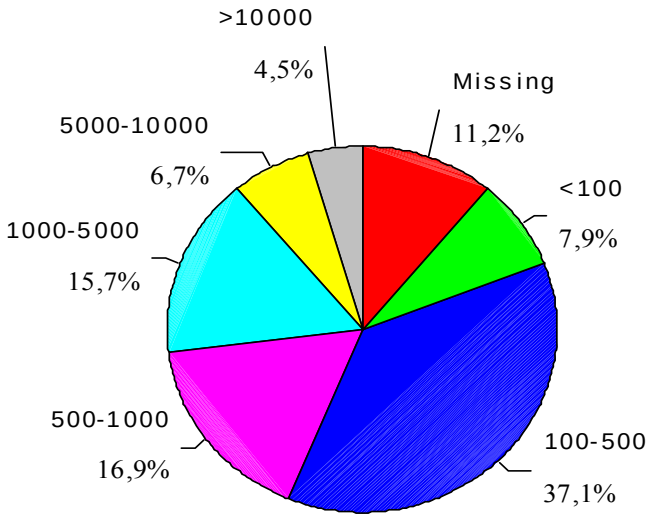


Illus. 15.2.-2: Industry characteristics as number of employees at each sites, 1996

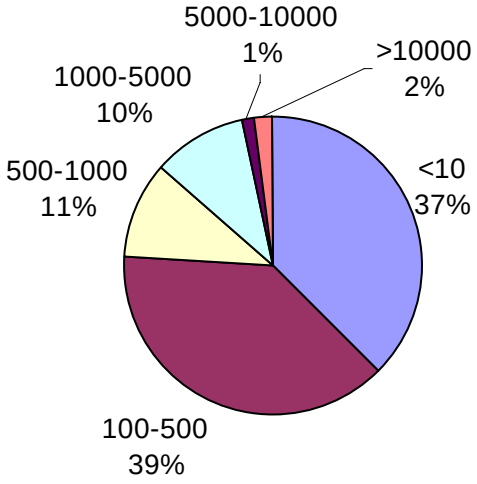


The chart below shows the actual share in total revenues by companies in the machinery sector.

Illus. 15.2.-3: The share in total revenues by companies in the sample (million HUF)



Illus. 15.2.-4: The actual share in total revenues by companies in the machinery sector, 1996 (million HUF)



This also demonstrates that large companies are somewhat over-represented. This renders the sample more useful, while most statistical methods filter out the effects of size. On the other hand, from averages and frequency indicators derived from the sample, no extrapolations can be made concerning the entire machinery sector.

Almost two-thirds of companies are owned domestically. Plants with mixed ownership make up close to one-fifth of all production facilities.

Table 15.2.1: Distribution of company ownership

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	domestic	56	63,6	64,4	64,4
	mixed	17	19,3	19,5	83,9
	foreign	14	15,9	16,1	100,0
	Total	87	98,9	100,0	
Missing	System	1	1,1		
Total		88	100,0		

When it comes to Hungary's EU accession and the adaptation of its standards by companies, it is a crucial question to what extent companies are subjected to foreign influences. The table below shows what percentage of the industry's output ends up on the EU market.

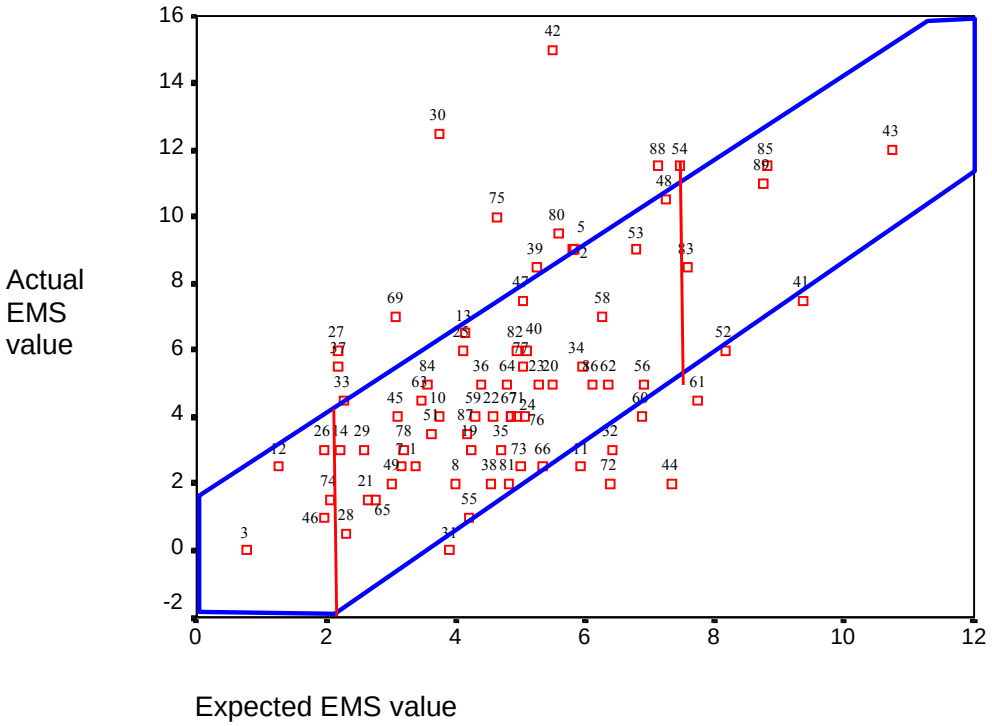
Table 15.2.-2: The share of EU market in the total sales of sample companies

	Frequency	Percent	Valid, %	Cumulative %
0	19	21,6	22,6	22,6
1-20%	26	29,5	31,0	53,6
21-40%	13	14,8	15,5	69,0
41-60%	14	15,9	16,7	85,7
61-80%	9	10,2	10,7	96,4
81-100%	3	3,4	3,6	100,0
Total	84	95,5	100,0	

It is apparent that the products of four-fifths of all companies are sold in the EU, as well. It is true, however, that in 30% of cases the proportion of EU exports does not reach 20%. At the same time, another 30% sells more than 40% of its products in that market, which means these companies have to make great efforts to adapt to local requirements there.

15.3 Definition of the accommodation region by manual methods

Illus. 13.3-1: Definition of the accommodation region by manual methods



I do not insist on eliminating outliers by computer iteration; we can arrive at a good estimate of the accommodation region by "manual" means as well. In that case we can estimate the projected risk-based value using the model that includes MARKET OPPORTUNITIES as well. This results in fewer distortions than using models without market opportunities that, however, include outliers. Here the horizontal axis looks as follows:

Expected EMS values based on risks = 4.802 + 1.786 factor of market pressures + 0.723 factor of pollution + 0.402* factor of regulation.*

After the plotting of points, the accommodation region is outlined by hand.

It is worth comparing values lying outside the accommodation region with outliers eliminated with the iteration method (see next section): values marked as outliers by the regression method fall outside the accommodation region here as well.

In the accommodation region, the position of some values differs from that assigned to them by statistical means, the position of most has not changed, however. Also, the characteristics of strategic groups do not differ from the ones described in the main body of the study.

15.4 Elimination of outliers by iteration

Initial model:

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,581[a]	,338	,311	2,7216

a. Predictors: (Constant), REGULATION, POLLUTION RISK, MARKET PRESSURES

b. Dependent Variable: EMS

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,069	,310		16,338	,000
	MARKET PRESSURES	1,484	,313	,452	4,749	,000
	POLLUTION RISK	,994	,310	,306	3,209	,002
	REGULATION	,614	,310	,189	1,982	,051

Dependent Variable: EMS

Casewise Diagnostics[a]

	CASE NUMBER	Std. Residual	EMS	Predicted Value	Residual
	30	2,986	12,50	4,3731	8,1269
	42	3,126	15,00	6,4928	8,5072
	44	-2,146	2,00	7,8409	-5,8409

a. Dependent Variable: EMS

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	,666[a]	,444	,420	2,2744

a. Predictors: (Constant), REGULATION, POLLUTION RISK, MARKET PRESSURES

b. Dependent Variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	4,909	,265		18,530	,000
	MARKET PRESSURES	1,682	,264	,569	6,381	,000
	POLLUTION RISK	,892	,268	,297	3,332	,001
	REGULATION	,501	,260	,171	1,923	,059

a. Dependent Variable: EMS

Casewise Diagnostics[a]

	CASE NUMBER	Std. Residual	EMS	Predicted Value	Residual
	75	2,294	10,00	4,7829	5,2171
	88	2,033	11,50	6,8768	4,6232

a. Dependent Variable: EMS

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
3	,681[a]	,464	,440	2,1384

a. Predictors: (Constant), REGULATION, POLLUTION RISK, MARKET PRESSURES

b. Dependent Variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
3	(Constant)	4,775	,252		18,927	,000
	MARKET PRESSURES	1,578	,253	,555	6,240	,000
	POLLUTION RISK	,902	,252	,318	3,578	,001
	REGULATION	,583	,247	,210	2,363	,021

a. Dependent Variable: EMS

Casewise Diagnostics[a]

	CASE NUMBER	Std. Residual	EMS	Predicted Value	Residual
	80	2,012	9,50	5,1971	4,3029

a. Dependent Variable: EMS

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
4	,690[a]	,477	,453	2,0860

a. Predictors: (Constant), REGULATION, POLLUTION RISK, MARKET PRESSURES

b. Dependent Variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
4	(Constant)	4,716	,248		19,040	,000
	MARKET PRESSURES	1,524	,248	,544	6,142	,000
	POLLUTION RISK	,978	,249	,348	3,936	,000
	REGULATION	,568	,241	,209	2,361	,021

a. Dependent Variable: EMS

Casewise Diagnostics[a]

	CASE NUMBER	Std. Residual	EMS	Predicted Value	Residual
	54	2,020	11,50	7,2855	4,2145
	69	2,043	7,00	2,7377	4,2623

a. Dependent Variable: EMS

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
5	,704[a]	,496	,473	1,9761

a. Predictors: (Constant), REGULATION, POLLUTION RISK, MARKET PRESSURES

b. Dependent Variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
5	(Constant)	4,592	,238		19,291	,000
	MARKET PRESSURES	1,476	,237	,548	6,217	,000
	POLLUTION RISK	,959	,236	,358	4,058	,000
	REGULATION	,658	,233	,248	2,818	,006

a. Dependent Variable: EMS

Casewise Diagnostics[a]

	CASE NUMBER	Std. Residual	EMS	Predicted Value	Residual
	27	2,036	6,00	1,9771	4,0229

a. Dependent Variable: EMS

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
6	,726[a]	,528	,506	1,9241

a. Predictors: (Constant), REGULATION, POLLUTION RISK, MARKET PRESSURES

b. Dependent Variable: EMS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
6	(Constant)	4,533	,233		19,424	,000
	MARKET PRESSURES	1,536	,233	,567	6,596	,000
	POLLUTION RISK	1,009	,231	,375	4,364	,000
	REGULATION	,681	,227	,258	2,994	,004

a. Dependent Variable: EMS

15.5 Machinery manufacturing sector questionnaire[8]

1. Basic data on the company

1.1 Name and address of production plant:

……

2. The strategic importance of environmental protection

2.1 In your opinion, how important is the protection of the environment:

	not at all	**little/some**	***average***	**very**	**extremely important**
for the long-term survival of the company					
to preserve market position					
for new market opportunities					

2.2 Over the next 5 years, how important is it for the company's environmental policy:

	not at all	**little/some**	***average***	**very**	**extremely important**
Meet Hungarian legal requirements					
Comply regularly with Hungarian legal requirements					
Comply with EU requirements					
Over-fulfill legal requirements					
Strengthen products' environmental qualities					

[8] In its original form the questionnaire was 6 pages long. I changed its lay-out to make editing this study more manageable.

	not at all	**little/some**	***average***	**very**	**extremely important**
Reduce environmental pollution caused by production					
Survive with changing variables					

3. Environmental management

3.1. How true are the following statements for the environmental management system operated by your company? (Circle the right answer) In the last column, please indicate approx. how long the given element has been used by the company!

	Not true	**Partly true**	**Absolutely true**	**No. of years Approx.**
The company has written environmental policy				
Someone in top management is personally responsible for the environment				
The company's **own** experts conduct regular eco-audits (environmental reviews)				
The company hires **outside** experts to conduct regular eco-audits (environmental reviews)				
The company has established procedures to communicate with the public at large				
When acquiring real-estate, other plant facilities, the company makes environmental assessment of the property				
The company checks suppliers' environmental				

	Not true	**Partly true**	**Absolutely true**	**No. of years Approx.**
performance				
The company takes advantage of environment-oriented marketing opportunities (environment-friendly products, green labels, ads)				
The company has stated measurable targets concerning the protection of the environment				
The company develops programs to reach environmental goals				
The company has published public environmental reports				
The company has a training program for its employees in the area of environmental protection				
The company has an emergency plan				
The company applies procedures for the evaluation and management of environmental risks				

4. Familiarity with standards

4.1 Does the company plan to introduce ISO 14001?

1. unfamiliar with the standard
2. does not plan
3. is considering
4. is being implemented
5. the company has already implemented ISO 14001

4.2 Has the company implemented or is it in the process of implementing ISO 14001?

1. unfamiliar with the standard

2. does not plan implementation
3. is considering
4. is being implemented
5. the company has already implemented ISO 14001

5. Positioning

5.1 How does the quality and price level of the company's products compare to that of the competition?

	Low	Lower than average	Average	Higher than average	Exceptional
Quality					
Price level					

6. Risks

6.1 Evaluate environmental risks due to the nature of the company's business activities! (technology, skill of employees, etc.)

1 Small 2 Medium 3 Great

6.2 What is the degree of external pressures effecting the company?

(proximity to residential area, public building, sensitive natural area or water base; pressures from environmental organizations)

1 Minor 2 Medium 3 Great

7. Organization

7.1 At what level of the organization does the person (persons) responsible for environmental issues?

7.2 Please make an estimate what percentage of the company's registered capital was expended on investment/improvement in 1997? ……..

What portion of this was devoted to environmental investment/improvement?

……..

8. The following questions relate to concrete steps taken by the company.

8.1 Involving environmental projects, have decisions been made

(please list the measures adopted in detail)

(1) related to product development:

…….

(2) concerning purchase of materials

…….

(3) concerning production technology

…….

(4) concerning harmful emission

…….

(5) related to logistics activity

…….

(6) concerning waste management and/or recycling

…….

(7) related to equipment and/or infrastructure

…….

(8) related to management techniques

…….

(9) concerning resource reduction

…….

(10) concerning marketing activity (including consumer relations)

…….

9. Factors affecting the company

9.1 In the area of environmental protection, how strong do you think the following effects, threats and opportunities are?

	insignificant	**weak**	**average**	**strong**	**very strong**
Hungarian environmental regulations					
Environmental requirements of target markets (if the company sells abroad)					

	insignificant	**weak**	**average**	**strong**	**very strong**
EU environmental requirements					
Regulatory authority pressure (frequent inspections, tougher fines, etc.)					
Pressure from environmental organizations and the population					
Pressure from banks, insurance firms					
Consumer demands					
Attitude of top management					
Race to maintain market position					
Proximity of residential areas					
Proximity of school, hospital, other sensitive public building					
Proximity of sensitive areas (water base, natural resources)					
Tension due to technology- related environmental risks					
Hazard of environmental disaster					
Cost-saving opportunities as a result of conservation					
Opportunities for reducing fines					
Extra revenue from sale of new, environment-friendly product					

	insignificant	**weak**	**average**	**strong**	**very strong**
Chance to improve company image					

10. Data requested below is needed to compare the company's production volume and the degree to which production is responsive to the environment.

10.1 What percentage of total costs is spent on energy at the company:

……..%

10.2 What percentage of total costs is spent on base materials at the company:

……. %

10.3 What percentage of total costs is spent on waste disposal (hazardous and non-hazardous waste combined): ……. %

10. 4 What were the three most important air pollution particles discharged in 1997?

Name of particle	**Discharged volume (kg/h)**	**Production time (h)**
1.		
2.		
3.		

10.5 Company's total waste-water discharge in 1997: …… m^3

10.6 What were the three most important waste-water components discharge in 1997?

Name of component	**Average concentration g/m^3**	**No. of production days**
1.		
2.		
3.		

10.7 How much hazardous waste was produced at the company in 1997?

…….t

10.8 In what way has pollution emissions changed at the company compared to 5 years ago?

-decreased - in which area ? ……
- by what %: ……
- reason for decrease: ……..

- has not changed

- increased - in which area: …….

- by what %: ……
- reason for increase: ……..

10.9 Did the company pay any environmental fines in 1997. If so, how much?

- did not pay

- paid: HUF ……..

11. Company characteristics

Finally, we would like to have some general information on the company, which would make it possible to make statistical calculations for various types of companies (e.g., with different turnover, different ownership arrangements, etc.).

11.1 Characterize your company by the following criteria (fill out the space or mark with an 'x'):

11.2 When was the company established? ……

11.3 What was the company's total turnover in 1997: …….m HUF

11.4 How advanced is your production technology?

Completely outdated	Worse than the Hungarian average	Average by Hungarian standards	Better than Hungarian average	Modern by European standards
1	2	3	4	5

11.5 What is the company's line of business: …….

11.6 Principal forms of its activities:

- production of consumer goods
- production of semi-finished goods for further processing by other companies, institutions
- offering services
- other: ……..

Percentage of shares held by owners:

Privately owned by Hungarians: …. %

State or local government : ……. %

Foreign owned: ……%

Market share of company products by percentage:

domestic market: ……..%

EU market: ……..%

East-European market: ……%

Other markets:…….%

Number of employees: ……. People

Is the company part of a corporate group:

- yes (name of corporation): ……..
- no

What proportion of top management is:

Hungarian : ……

Foreign: …….

Size of the company:

- average age of production equipment

…….. years

- average age of environmental equipment

…….. years

What was the adjustment for the company's total assets in 1997 (compared to 1996): ……..

11.7 Please give respondent's name, position and telephone number:

11.8 I would like the company to be named and its environmental management system referred to as an example:

yes

no

11.9 Finally, please write below any reactions or comments you may have concerning the above questions:

……
……
……

Thank you kindly for having contributed to the success of my study with your responses. Please send the completed questionnaire to the following address:

BKE Környezetgazdaságtani és Technológiai Tanszék

1828. Budapest 5.

Pf. 489

15.6 Most important variables

Variable	Description	Scale
	Basic data	
ESTABLISHMENT	year of establishment of the plant	ratio
TURNOVER	turnover	ratio
EMPLOYEES	number of employees	ratio
OWNERSHIP	ownership (domestic, foreign, private or state owned)	nominal
MARKET(1-4)	how much of the production of the company goes to -domestic market -market of the EU -market of the CEEC -other market	ratio
GROUP	does the plant belong to a company group	nominal
MANAGEMENT	the top management is Hungarian or foreign one	nominal
EQUIPMEN TAGE	the average age of the manufacturing equipment	ratio
TECHNOLOGY	whether the technology used is state-of-the-art or not compared to the European standard	interval
CAPITAL CHANGE	the % change in the capital value	ratio
	strategic importance of the environment	
LONGTERM SURVIVAL	importance of environmental issues in the long run survival of the company	interval
PRESERVE MARKET	importance of environmental issues in staying on the market	interval
NEW MARKET	in what extent do you regard environment as a market opportunity?	interval
	EU accession	
ASSESSION	in what extent will the EU assessment influence the environmental requirements toward the company	interval
EUREQUIREMENTS	in what extent influence environmental requirements of the EU the market position of the company	interval
	the elements of an environmental management system	interval
ENVPOLICY	the company has a written policy statement on the environment	nominal
TOPMANAGER	there is a board member with specific responsibility for the environment	nominal
AUDITINTERNAL, AUDITEXTERNAL	the company has an audit system	nominal
COMMUNICATION	the company has a public communication program	nominal
SUPPLIERS	environmental performance evaluation of suppliers	nominal
ACQUISITION	environmental performance evaluation of acquisition candidates	nominal
MARKETING	environmental marketing program (e.g. green products, green labelling, special promotions, advertising)	nominal
OBJECTIVES	the company has environmental objectives	nominal
ENVPROGRAM	the company has environmental program including measurable objectives that helps in achieving its goals	nominal
ENVREPORT	the company has a published environmental report	nominal
ENVTRAINING	the company regularly organises environmental training for its employees	nominal
EMERGENCY	the company has a contingency plan	nominal

Variable	Description	Scale
RISKMANAGEMENT	the company has procedures to evaluate its environmental risks	nominal
EMS	*the number of EMSs element applied* *derived variable*	*ratio*
	standards	
ISO9000	ISO9000 adapted	ordinal
ISO14001	ISO4001 adapted	ordinal
	positioning	
QUALITY	products quality	interval
PRICE	price level	interval
	investments	
ENVIRONMENTAL INVESTMENTS	percentage of environmental investments	ratio
	environmental projects	
PRODUCT DEVELOPMENT	product development	nominal
PURCHASE OF MATERIALS	raw material related	nominal
PRODUCTION TECHNOLOGY	process modification	nominal
HARMFUL EMISSIONS	emission reduction	nominal
LOGISTICS	internal transport	nominal
WASTE MANAGEMENT	waste management	nominal
INFRASTRUCTURE	environmental equipment	nominal
MANAGEMTN TECHNIQUES	management related	nominal
RESOURCE REDUCTION	saving related project	nominal
MARKETING	marketing project	nominal
PROJEKTS	*number of projects* *derived variable*	*ratio*
	pressures	
EUpr	environmental requirements of the EU	
ENV.CHARGEpr	proposed environmental waste water charge	interval
TMARKETpr	environmental requirements of the target market	interval
CEOpr	top managers' pressure	interval
AUTHORITYpr	regulatory pressure	interval
NGOpr	NGOs pressure	interval
BANKSpr	banks and insurance companies	interval
CONSUMERpr	consumers` pressure	interval
ACCIDENTpr	environmental accidents	interval
COMPETpr	pressure from competition	interval
TECHNOLpr.	environmental risks from the technology	interval
RESID.AREApr	residential area nearby	interval
COSTpr	cost of raw materials	interval
FINESpr	cost pressure from environmental fines	interval
ECOCYSTEMpr	sensitive ecosystem nearby	interval
PUBL.BUIL.pr	School, hospital, etc. nearny	interval

Variable	Description	Scale
PRESSURES	*pressures on the company* *derived variable*	*ratio*
	change in the emission	
POLLUTION REDUCTION	decrease in the emission during the last 5 years	nominal
AMOUNT OF POLLUTION REDUCTION	decrease in the emission during the last 5 years	ratio
PRODUCTION REDUCTION	decrease of production during the last 5 years	nominal
POLLUTION INCREASE	increase in the emission during the last 5 years	nominal
	emissions	
HAZARDOUS WASTES	hazardous waste, kg	ratio
AIR POLLUTION	airborne emission, aggregate	ratio
WASTE WATER	waste water, aggregate	ratio
FINED	paid fine or not	nominal
	derived variables	
ELŐREJEL	*predicted management value based on environmental risks*	*ratio*
MAP	*strategic group membership*	*nominal*
PROPOLLUTION	*emission per sales ratio, pollution intensity*	*ratio*
CLEAN POLLUTION	*1/PROPOLLUTION*	*ratio*
EMS DEVIATION	*deviation from the predicted environmental management value*	*ratio*
INDEPENDENT EXTERNAL RISKS	*PRESSURES independent from the volume of pollution*	*ratio*
POLLUTION	*aggregated pollution*	*ratio*

16. References

1. Anderson, Dennis and William Cavendish. „Efficiency and Substitution in Pollution Abatement." The World Bank, Washington, D.C., 1992.
2. Attitudes Toward Environmental Management." Business Strategy and the Environment. 4:1 Jan, 1995., 40-41.p
3. Aupperle, Kenneth E. - Archie B. Caroll and John D. Hatfield. „An Empirical Examination of the Relationship Between Corporate Social Responsibility and Profitability." Academy of Management Journal. June, 1985. pp. 446-463.
4. Azzone, Giovanni and Raffaella Manzini. „Measuring Strategic Environmental Performance." Business Strategy and the Environment. 3:1 Spring 1994., 1-14.p.
5. Azzone, Giovanni -Bertelè, Umberto - Noci, Giuliano: „At last we are creating environmental strategies which work". Long Range Planning, Vol 30. No. 4, pp. 562-571, 1997.
6. Balaton, Károly – Bakacsi, Gyula –Dobák, Miklós – Máriás, Antal (szerk.): Vezetés-Szervezés, Aula, Budapest, 1991.
7. Bauer, András – Berács, József: Marketing, Aula, Budapest, 1992.
8. Bayer, József: Piac, verseny, stratégia, Vinton, Budapest, 1991.
9. Belz, Frank - Strannegard, Lards: *„International Business Environmental Barometer"*, Oslo1997
10. Bhargava, Sangeeta - Welford, Richard: „Corporate Strategy and the Environment.", in: Welford (1996), pp.13-34.
11. Boda, Zsolt - Pataki, György: „Versenyképesség és környezetügy", Working Paper, BKE Vállalatgazdaságtan Tanszék, 1997. 82 p.
12. Bulla, Miklós – Kerekes, Sándor – Kiss, Károly – Láng, István: "A hazai környezetvédelem", Ezredforduló, Budapest, 1998.

13. Cairncross, Frances. „Costing the Earth. The Challange for Governement, the Opportunity for Business.” Harvard Business School Press, Boston 1991.

14. Cairncross, Frances. „Green, Inc. A Guide to Business and the Environment.” Island Press, Washington D.C. and Covelo, California, 1995.

15. Cairncross, Frances. „How Europe’s Companies Reposition to Recycle.” Harvard Business Review, March - April, 1992.

16. Carroll. A.B. (1979) „A Three-Dimensional Model of Corporate Performance. „Academy of Management Review.”28:3, 133-141.p.

17. Cebon, Peter B. „The Myth of Best Practices. „The Context Dependence of Two High-Performing Waste Reduction Programs.” in: Fisher and Schot (1993), pp. 167-197.

18. Chikán, Attila: “Vállalatgazdaságtan”, KJK. Budapest, 1992.

19. Christensen, Per & Eskild Holm Nielsen. „Implementing Environmental Management Systems in the Danish Industry.” The 1995 Business Strategy and the Environment Conference. Leeds, September 20-21, 1995.

20. Clarke, Robert J. and David W. Ewing. „New Approach to Employee Health programs.” Harvard Business Review, XXVIII:4, July, 1950.

21. Cleaner Industrial Production” , UNIDO, 1995.

22. Company Environmental Reporting. A Measure of the Progress of Business & Industry Towards Sustainable Development”, UNEP, Technical Report No24, 1994

23. Conrad, Jobst. „Development and Results of Research on Environmental Management in Germany.” Business Strategy and the Environment. 4:1 1994. Apr-Jun .

24. Corbett, Charles J. and Luk. N. Van Wassenhove. „The Geen Fee: Internalizing and Operationalizing Environmental Issues.” California Management Review. Fall, 1993. pp. 116-135.

25. Crombez, Evelyne and Caroline Gallez. „The Environmental Pressures Evaluation in Relation to the Enterprises` Profile: The Case of Wallonia and Water." The 1995 Business Strategy and the Environment Conference. Leeds, September 20-21, 1995

26. Csutora, Mária: Environmental strategies of Hungarian companies, Proceedings of the European Business Strategy Conference, Leeds, 1997.

27. Daly, Herman. E.: The Economic Growth Debate: What Some Economists Have Learned, but Many Have Not, Journal of Environmental Economics and Management, Dec, 1987.

28. Denton, D. Keith: „Enviro-Mangement: How smart companies turn environmental costs into profits". Prentice Hall, Englewood Clifts, New Yersey, 1994.

29. Dieleman, Hans and Sybren de Hoo. „Toward a Tailor-made Process of Pollution Prevention and Cleaner Production: Results and the Implication of the PRISMA Project." in: Fisher and Schot (1993), pp. 245-275.

30. Dodge, John and Richard Welford. „An In-depth Look at One Organisation`s Functional Environmental Strategies and Performance." The 1995 Business Strategy and the Environment Conference." Leeds, September 20-21, 1995.

31. Edwards, Felicity N. (ed.): "Environmental Auditing: The Challenge of the 1990`s", University of Calgary Press, 1992.

32. Ellingstad, Marc - Csaba, Makó: Environmental Attitudes and Policies among Firms in the Székesfehérvár Region, Budapest, BUES, 1998., 51 p.

33. Florida, Richard: „Lean and Green: The Move to Environmentally Conscious Manufacturing". California Managemnt Review, Vol. 39 Fall 1991 p. 80-105.

34. Forgácsné, dr. Kovács Erzsébet – Törökné, dr. Matits Ágnes: "A gazdasági elemzések sztochasztikus múdszerei II., Kézirat, Tankönyvkiadó, Budapest, 1991.

35. Forschungsgruppe Umweltorientierte Unternehmensführung (FUUF). „Möglichkeiten zur Kostensenkung und Erlössteigerung", in Umwetbudesamt. Umweltorientierte Unternehmehmensführung. Erich Schidt Verlag, Berlin, 1991.

36. Gamble, George O. - Kathy Hsu - Deraum Kite and Robin R. Radtke. „Environmental Disclosures in Annual Reports and 10Ks: An Examination." Accounting Horizons. September, 1995.

37. Goldmann, Bernhard: "Betriebliche Umweltkennzahlen", BJU-Umweltschutz-Berater, 44. Erg.-Lfg. September, 1997.

38. Gottlieb, Gerhard.: „Környezet-menedzsment", Kézirat, 1992. 82 p.

39. Gray, Rob - Reza Kouhy and Simon Lavers. „Corporate Social and Environmental Reporting: a Review of the Literature and a Longitudinal Study of UK Disclosure." Accounting, Auditing & Accountibility Journal. November, 1995.

40. Greene, William H.: Econometric Analysis, Prentice Hall, Englewood Cliffs, NJ 07632

41. Guimaraes, Tor and Kevin Liska. „Exploring the Business Benefits of Environmental Stewardship." Business Strategy and the Environment. 4:1 Jan-Mar, 1995., 9-22.p

42. Hajdu, Ottó-Hunyadi László-Vita László: "Statisztikai Elemzések", BKE, Budapest, 1998.

43. Hart, Stuart L.: „Beyond Greening: Strategies for a Sustainable World". Harvard Business Review, January- February, 1997.

44. Hirschorn, Joel S. „Business and the Environment." in: Rao V. Kolluru (ed.): Environmental Startegies Handbook. Mc Graw-Hill, Inc., New York, 1993. 1030. p.

45. Hopfenbeck, Waldemar. „The Green Management Revolution. Lessons in Environmental Excellence." Prentice Hall, New York, 1993.

46. http://www.ecology.or.jp/isoworld

47. Hunt, Christopher B. and Ellen R. Auster. „Proactive Environmental Management: Avoiding the Toxic Trap." Sloan Management Review. Winter, 1990.

48. Hunyadi, László – Mundruczó, György – Vita, László: "Statisztika", Aula, Budapest, 1996.

49. Hutchinson, Andrew. „Environmental Management in Devon and Cornwall`s Small and Medium Sized Enterprise Sector." Business Strategy and the Environment. 3:1 Spring 1994., 15-22.p.

50. Ipari és Építőipari Statisztikai Évkönyv, 1996, KSH 1997.

51. James, Peter. „Business Environmental performance Measurement." Business Strategy and the Environment. 3:2 Summer, 1994., 59-67.p

52. Kennedy, Peter: "A Guide to Econometrics", Third Edition, Blackwell, Oxford, 1994.

53. Kerekes, Sándor - Kiss, Károly: EU-csatlakozásunk környezeti szempontú vizsgálata, Kutatási beszámoló, BKE Környezetgz1997.

54. Kerekes, Sándor – Szlávik, János: "A környezeti menedzsment közgazdasági eszközei", KJK Budapest, 1996.

55. Kerekes, Sándor - Szlávik, János: „Gazdasági útkeresés - környezeti stratégiák," KJK. Budapest, 1991.

56. Kerekes, Sándor, Gyula Vastag and Dennis A. Rondelli. „Evaluation of Corporate Environmental Managament Strategies: A framework and Application." Kenan-Flagler Business School, Chapel Hill, 1995.

57. Kerekes, Sándor – Zilahy, Gyula: Environmental Business Management in Hungary, Proceedings of the IGWT Conference, Budapest, 1993.

58. Kerékgyártó, Györgyné – Mundruczó, György: Statisztikai módszerek a gazdasági elemzésben, AULA, Bp. 1995.

59. Kindler, József – Kerekes, Sándor: „Vállalati környezetmenedzsment”, AULA, Budapest, 1997.

60. Kindler, József. „Döntéselméleti elõfeltevések kritikája”, Akadémiai doktori értekezés, 1988.

61. Kindler, József: „Fejezetek a döntéselméletbõl”. Aula Kiadó, Budapest, 1991

62. Klassen, Robert D. -Whybark, D. Clay. „Plant-level Choices of Environmental Technologies. The Influence of Environmental Management Strategy”. October, 1995. Western Business School, The University of Ontario, London, Canada

63. Kovács Sándor: Szöveggyűjtemény a szervezetelmélet történetének tanulmányozásához, Bp., Tankönyv, 1990.

64. “Környezetstatisztikai Adatok”, 1996. KSH, Budapest, 1998.

65. Lenaghan, Collin, Dominic Elliott and Dean Patton. „Environment and Business: A Study of East Midlands Firms.

66. Leonard, Suzanne Barbara. „An Empirical Analysis of the Adoption of Energy Conservation Measures in Developing Countries” Doctoral Thesis, Tufts, Fletcher School of Law and Diplomacy, August 1993.

67. Makower, Joel. „The E-factor: The Bottom-Line Approach to Environmentally Responsible Business.” Times Books, New York, 1993.

68. Marguglio, B.W.: „Environmental Management Systems.” Marcel Dekker Inc and ASQC Quality Press, New York, 1991.

69. Martinuzzi, André: „Environmental Consulting in Austria”. Viennas University of Environmental Economics and Management, 1996.

70. Maucher, Helmut. „Industry and the Environment.” Columbia Journal of World Business. XXVIII:2 Summer 1993. 6-1.p.

71. McKinsey&Company. „The Corporate Response to the Environmental Challange. Summary Report” Amsterdam, 1991.

72. Meredith, Sandra and Teun Wolters. „Environmental Strategies in the Paint and Coatings Industry.” Business Strategy and the Environment. 4:1 Jan-Mar, 1995., 1-8.p.

73. MSZ 21854: 1990 1M “A környezeti levegő tisztasági követelményei”

74. North, Klaus: “Environmental Business Management.” International Labour Organisation, Geneva, 1992.

75. OCDE/GD(94)30: „Accelerating Corporate Investment in Cleaner Technologies through Enhanced Managerial Accounting Systems”. OECD, Paris, 1994.

76. OCDE/GD(95)21: „Policies to promote Technologies for Cleaner Production and Products: Guide for Government Self-Assessment”, OECD, Paria, 1995.

77. Palmer, Karen and Wallace E. Oates and Paul R. Portney. „Tightening Environmental Standards: The Benefit-Cost or the No-Cost Paradigm?” Journal of Economic Perspectives, Fall, 1995.

78. Parker, Jeffrey N. „Profits and Ethics in Environmental Investments.” Management Accounting. Ocotber, 1995.

79. Pearce, David-Turner, R. : “Economics of Natural Resources and the Environment” The Johns Hopkins University Press, Baltomore, 199ö.

80. Peattie, Ken and Anja Ringler. „Responding to the Green Challange: A Manufacturing/Service Sector Comparison.” The 1995 Business Strategy and the Environment Conference.” Leeds, September 20-21, 1995

81. Porter, Michael E. and Claas van der Linde. „Green and Competitive: Ending the Stalemate.” Harvard Business Review, September - October, 1995.a.

82. Porter, Michael E. and Claas van der Linde. „Toward a New Conception of the Environment - Competitiveness Relationship.” Journal of economic Perspectives, Fall, 1995.b

83. Porter, Micheal E. „America’s Green Strategy.” Scientific American, April, 1991.

84. Rappaport, Ann and Margaret Fresher Flaherty. „Corporate Responses to Environmental Challanges. Initiatives by Multinational Management." Quorum Books, New York, 1992.

85. Report on the WTO Committee on Trade and Environment". PRESS/TE 014 , WTO, 1996

86. Report on Trade and Environment to the OECD Council at Ministerial Level". OECD, 1995.

87. Rikhardsson, Pall. „The Evolution of Environmental Accounting Systems: A Research Note." The 1995 Business Strategy and the Environment Conference. Leeds, September 20-21, 1995.

88. Rosenblum, John – Nazer, Mazen – Orrett, Ned.: "Pollution Prevention in Practice: Organising, Auditing and Financing".Strategic Planning for Energy and the Environment, 1993 Summer

89. Rutledge, Gary L. and Christine R. Vogan. „Pollution Abatement and Control Expenditures." Survey of Current Businesses. May, 1995.

90. Schmidheiny, Stephan: "Changing Course: A Global Business Perspective on Development and the Environment", Cambridge, MA: The MIT Press, 1992.

91. Sells, Bill. What Asbestos Taught Me About Managing Risk. „What Asbestos Taught Me About Managing Risk." Harvard Business Review, March - April, 1994.

92. Smart, Bruce (ed.): "Beyond Compliance: A New Industry View of the Environment" (Washington, D.C.: World Resources Institute, 1992.

93. Smith, Denis (ed.). „Business and the Environment. Implications of the New Environmentalism." St. Matins's Press, New York, 1993.

94. Stavins, Robert - Adam Jaffe - Steve Peterson and Paul Portney. Environmental Regulation and the Competitveness of U.S. Manufacturing: What does the Evidence Tell Us? CSIA Discussion Paper 94-06, Kennedy School of Government, Harvard University, August, 1994.

95. Stead, W. Edward and Jean Garner Stead. „Management for a Small Planet. Strategic Decision Making and the Environment." Sage Publications Inc. Newbury Park, 1992., 212. p.

96. Steger, Ulrich. „The Greening of the Board Room: How German Companies Are Dealing with Environmental Issues." in: Kurt Fisher and Johan Schot: Environmental Startegies for Industries (International Perspectives on Research Needs and Policy Implications). Island Press, Whashington, D.C.and Covelo, California , 1993.

97. Sustainable Production and Consumption, in Industry and the Environment, September, 1996.

98. The Challange of Going Green." ." Harvard Business Review, July - August, 1994.

99. *The Survey Kit"*, SAGE Publications, London, 1995.

100. Tibbs, Hardin. „Industrial Ecology. An Environmental Agenda for Industry." Arthur D Little Inc, 1991.

101. Turchany, Guy: Környezeti auditálás, KTM-MKM-BME Környezetgazdálkodási Osztály, Budapest-Genf, 1994.

102. United Nations. Environmental Management in transnational Corporations. Report on the Benchmark Corporate Environmental Survey. UN, New York, 1993.

103. Vastag, Gyula - Rondinelli, Denis - Kerekes, Sándor: „How Corporate Executives Perceive Environmental Issues". Kenan-Flagler Business School, 1994., 30 p.

104. Vaughan, Dion-Micke, Craig: „Environmental profiles of European Business", Earthscan Publications Ltd., London, 1993.

105. Visser, Peter: "Integrating Industrial and Environmental Concerns Through Innovative Approaches to Policy Implementation", European Environment, Vol. 7. Pp 92-96., 1997.

106. Vogel, David. „National Styles of Regulations: Environmental Policy in

Great Britain and the United States." Cornell University Press, London, 1986.

107. Walley, Noah and Bradley Whitehead. „It's Not Easy Being Green." Harvard Business Review, May – June, 1994.

108. Wehrmeyer, Walter and Kevin T. Porter. „Identification, Analysis and Relevance of Environmental Corporate Cultures." Business Strategy and the Environment. 4:3 Jul-Sep 1995., 145-153.p

109. Welford, Richard – Gouldson, Andrew: "Environmental Management and Business Strategy", London, Pitman Publishing, 1993.

110. Welford, Richard: „Corporate Environmental Management. Systems and Strategies", Earthscan, London, 1996.

111. White, Allen L. and Deborah E. Savage. „Budgeting for Environmental Project: A Survey." Management Accounting, October, 1995.

112. White, Mark. „Does it Pay to be Green?" The 1995 Business Strategy and the Environment Conference." Leeds, September 20-21, 1995

113. Williams, Hugh E. - James Medhurst and Kirstina Drew. „Corporate Strategies for a Sustainable Future." In: Kurt Fisher and Johan Schot: Environmental Strategies for Industries (International Perspectives on Research Needs and Policy Implications). Island Press, Whashington, D.C.and Covelo, California , 1993.

114. Wubben, Emiel : „Economic Development, Trade and the Environment". , Manuscript, 7th Annual European Environmental Conference, 1997.

115. Young, C. William: „Measuring Environmental Performance." in: Welford (1996), pp. 150-176.

116. Ziegler, Andreas R.: "The Common Market and the Environment: Striking a Balance", Dissertation der Hochschule St. Gallen, 1995.

117. 3/1984 (II.7.) OVH rendelet: "A vizeket szennyező anyagok határértékei és az egységnyi bírságtételek"