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Sustainable Development as an Aspect of Improving Economic Performance of a Company

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1. Introduction

The contemporary world, especially its developed part, has been driven by consumerism that is apparent in both the consumption and production. Individual national economies and businesses are under ceaseless pressure for economic growth which goes hand in hand with many negative factors, environmental degradation being one of them.

Over the last twenty years, many of the world's developed economies, public and academic bodies, and industrial corporations, having become more conscious about the unsustainability of current development in terms of the physical capacity of our world, have conceived a range of concepts and models for the sustainable development.

Successful implementation of the sustainable development concept is, however, fundamentally dependent on individual companies. In business practice the concept of sustainable development is applied through **Corporate Social Responsibility** (CSR). The CSR concept is based on three interrelated pillars - economic, environmental, and social.

This chapter deals with the economic and environmental pillars of CSR, or more precisely it looks to examine the nexus between economic and environmental performance of a company. Both aspects of a company's performance intermingle in the **Eco-efficiency** concept applied in the business practice through **Voluntary Environmental Instruments**.

The Eco-efficiency concept and related voluntary environmental instruments (proactive strategy) go beyond the legal framework (reactive strategy) and fall fully within the competence of company management.

Needless to say, companies would only buy into the concept of sustainable development and the related environmental responsibility if they were cognisant of the economic benefits of such approach. It is therefore crucial to convince businesses of the advantages and benefits of proactive environmentally responsible behaviour and motivate them to adopt it.

A proactive approach to environmental protection, applied in practice through the voluntary environmental instruments, features not only the expected positive impact on the environment, but, as practice shows, results in a range of financial (reducing operating costs, increased revenues) and non-financial benefits contributing to business value creation.

2. Eco-efficiency

2.1 The eco-efficiency concept

Eco-efficiency is a management philosophy that challenges businesses to pursue environmental improvements yielding concurrently economic benefits (Lehni, 2009). This concept, entailing a change in production and consumption patterns, promotes innovation and leads therefore to economic growth and enhanced competitiveness. The term eco-efficiency was coined in 1992 by the **World Business Council for Sustainable Development** (WBCSD) in the 'Changing Course' publication. Eco-efficiency is based on the principle of generating larger amounts of products while consuming fewer resources and therefore creating less waste and pollution. (International Institute for Sustainable Development, 2007). In this context, the prefix eco stands for both environment and economics.

Eco-efficiency falls within a broader concept known as **Sustainable production and consumption** introducing change in production and consumption patterns, and leading therefore to sustainable consumption of natural resources. Businesses play an important role in this concept, both as consumers of raw materials and manufacturers of products. Eco-efficiency focuses on three broad sets of objectives (Lehni, 2009):

- Reducing consumption of resources
- Reducing impact on the environment
- Increasing product value

Opportunities for eco-efficiency

Eco-efficiency can be practically implemented into business processes mainly through search for innovation opportunities particularly in the following areas (Lehni, 2009):

- Re-engineering of processes
- Cooperation with other enterprises
- Redesign of products
- Searching for new ways to meet customer needs

2.2 Eco-efficiency indicators

Currently several approaches are known that enable measurement of eco-efficiency applied in production and business operations.

WBSCD

According to WBSCD, eco-efficiency can be formulated as a ratio of a product value (economic performance) to its environmental impact (environmental performance). WBSCD developed a framework for reporting company data relating to eco-efficiency that distinguishes three levels of information - Categories, Aspects and Indicators (Verfaillie & Bidwell, 2000).

UNCTAD / UN-ISAR

Unlike WBSCD, UNCTAD / UN-ISAR regards eco-efficiency as an environmental burden (environmental performance) per unit of economic value (economic performance). Similarly to WBSCD, UNCTAD/UN-ISAR proposed a framework for reporting company data relating to eco-efficiency consisting of three levels of information - Elements, Items and Indicators – as a performance measure of company specific aspects (Müller & Sturm, 2001).

At this point it might be useful to recall the key concepts of economic and environmental performance that will be encountered in the course of this paper.

2.3 Economic performance – BSC

Immense number of methods has been developed to measure economic performance of a company. Some of them focus purely on an assessment of company financial statements while others consider other aspects of a company's life. These multi-criteria methods analyse financial results in the context of wider non-financial achievements.

In our research, Balanced Scorecard (BSC), one of the models for multi-criteria decision making and valuation of economic performance, has been employed to represent the economic pillar of the eco-efficiency. BSC method was developed by Robert S. Kaplan and David P. Norton and published in 1992.

Within BSC, business objectives are classified into four perspectives - financial, customer, internal business processes, and learning and growth (potential) - that are intended for complex measurement and control of a company's performance. Objectives in these individual perspectives are interconnected with 'cause - effect' relations that are depicted by arrows (Kaplan & Norton, 2002).

2.4 Environmental performance

On the broad level, environmental performance (also profile) reflects the general achievement of a system (product, process, company) concerning cut-down on negative impact on the environment. ISO 14001 defines the environmental profile of a company as "*measurable results of the environmental management system, related to an organization's control of its environmental aspects, based upon its environmental policy, objective and targets.*" Similarly, ISO 14031 defines environmental performance as "*an organization's success in managing the relationships between its activities, products, or services, and the natural environment."*

To assess the environmental profile of a system, Environmental Performance Indicators (EPI) are used as measures for Environmental Performance Evaluation (EPE). Over the last twenty years, several concepts have been developed to evaluate the environmental performance of a company.

2.4.1 ISO 14031

ISO 14031 defines two general indicator categories for environmental performance evaluation:

- Environmental Performance Indicators (EPI) - which are further divided into:
  - Management Performance Indicators (MPI)
  - Operational Performance Indicators (OPI)
- Environmental Condition Indicators (ECI)

2.4.2 The Global Reporting Initiative

In 2000 the Global Reporting Initiative (GRI) issued its first guidelines on sustainability reporting. Environmental reporting is organized into nine groups called the evaluation criteria which are structured in such a fashion to ensure easy evaluation of inputs (Criteria:

energy, water, materials), outputs (Criteria: emissions, waste water and waste) and impacts on the environment (Criteria: e.g. Products and services, Transport) (GRI, 2006).

2.4.3 Research foundation of Norway (Oestdold Research Foundation)

In his work from 1999, Johan Thoresen, a member of the Norwegian Research Foundation Oestdold, developed three categories of EPI indicators (Thoresen, 1999):

- Category 1 - Performance of a product lifecycle
- Category 2 - Environmental performance of selected process technology
- Category 3 - Environmental performance of operations

3. Analysis of voluntary environmental instruments

3.1 Preventive vs. reactive strategy for environmental protection

A range of preventive and reactive strategies for the protection of the environment are used in the manufacturing. As the name indicates, preventive strategies aim to preclude origin of environmental damage through searching for and minimising sources of pollution and waste. Reactive strategies, on the contrary, do not anything that goes beyond what is necessary to comply with the environmental regulation. The reason why reactive strategies are not so effective and promising is the fact that they do not focus on the causes of environmental damage, they only try to mitigate the negative consequences of production. Among these "end-of-pipe" technologies are, for example, refuse compactors, collection containers and vehicles, waste heat recovery systems, air pollution filters, noise abatement investments and sewage treatment plants. As a result the quantity of toxic agents drops in one environmental domain, but rises in another one.

A fundamental disadvantage of the reactive type of control strategy is that the end-of-pipe technology can never reach 100 % efficiency. Then obviously despite taking corrective measures, that are often very expensive, with an increasing number of pollution sources environmental degradation rises concurrently. Another problem is that the stated emission limits may not be sufficient given the fate of substances in the environment - all forms in which a substance released into the environment can convert and through subsequent reactions, the so-called secondary effects, impact on humans and ecosystems - cannot be confidently determined (Czech Ministry of Environment, 2003).

Freons (CFCs) eroding the ozone layer represent a classic example of ignorance of the fate of substances in the environment. These materials were originally considered to be almost perfectly non-reactive gases, and therefore used as a carrier gas in spray cans and refrigerators.

All these above mentioned flaws of reactive strategies clearly demonstrate that the only solution to sustain a healthy environment is to focus on preventive elimination of damage sources rather than addressing problems already arisen.

As practice has shown, the preventive strategy has a positive impact on the environment and leads to financial savings, economic profit, cost reductions and enhancement of the competitive advantage at the same time. Preventive strategy is therefore considered a double profit strategy: environmental and economic – a 'win-win' strategy. The preventive strategy to the environmental protection can be practically applied through a range of voluntary environmental instruments.

3.2 Eco-efficiency tools

The following text gives overview of selected management tools - voluntary environmental instruments - that help companies maximize their efficiency, product quality and profit through improved corporate environmental profile.

Environmental management systems (EMS) - EMS represent a systematic management and control of particular business areas that are posing risk to the environment. Within EMS companies set environmental goals to ensure continuous improvement of corporate environmental profile in the future. Currently, there are two commonly used standards for implementing an EMS:

- Technical standards of ISO 14001
- EU regulation Eco-Management and Audit Scheme (EMAS)

Environmental management accountancy (EMA) - EMA allows a company to identify and manage its environmental costs and achieve therefore a reduction in total company costs. Within EMA both financial and material information is tracked and analysed.

Cleaner Production - The concept of cleaner production is being connected with the integral preventive strategy which is applied especially to the sector of production (Remtová, 2003a). The aim of this strategy is to eliminate or reduce sources of environmental degradation with the use of technical and nontechnical solutions (e.g. more efficient use of raw materials and energy, elimination or reduction of toxic and hazardous materials, prevention of waste and pollution at source). Within cleaner production all material and energy flows in a company are monitored in order to identify the sources of undesirable waste.

Ecodesign - Ecodesign incorporates requirements for environmental protection into product design and development. Currently there is no unified definition of ecodesign. In general, ecodesign can be defined as a systematic process of product design and development which puts emphasis not only on common product features like economics, safety, ergonomics, technical feasibility, aesthetics, but that also pursues a minimum negative impact on the environment (e.g. reducing quantity and toxicity of materials, product demountability for easier reuse and/or recycling at the end of its useful life) (Remtová, 2003b).

Life Cycle Assessment (LCA) - LCA is a tool for assessing the overall environmental impact of a product in its entire life cycle. Withing LCA all material and energy flows relating to any life phase of a particular product are analysed. This tool is widely used during a product design (see Ecodesign).

Eco-labeling - Eco-labelling is a certification system for products and services that are friendlier to the environment than substitute products. This system is directed by a third party that has to be independent. Currently there are three different Eco-labeling systems that a company can opt for:

- Ecolabeling - Environmental Declaration (Type I)
- Self-declared Environmental Claim (Type II)
- Environmental Product Declaration (Type III)

3.3 Comparison of voluntary environmental instruments

Comparison of voluntary environmental instruments is not a straightforward and simple task to do. On the contrary, even when comparing the benefits and implementation

requirements for the same instrument the final conclusions can differ immensely due to the specific situation of investigated companies. Period of return on investment as well as the subsequent financial benefits of the individual voluntary environmental instruments can be significantly different when compared among companies.

Voluntary environmental instruments can be compared from different perspectives (see Table 1). While some instruments are focused on product environmental performance, others help streamline business processes or influence the management and operation of a company as a whole, i.e. the entire corporate system.

Voluntary environmental instruments also vary in terms of so-called external collaboration. Some instruments can only be used if an appropriate background has been created for them

Comparison criterion	Voluntary methods and instruments						
	EMAS	**EMS/ ISO 14001**	**EMA**	**Ecodesign**	**LCA**	**Cleaner Production**	**Eco-labelling**
Purpose	Regula-tive	Regulative Educative	Informative	Regula-tive	Informa-tive	Informa-tive	Regula-tive
Focus	Systems	Systems	Processes	Products	Products	Processes	Products
Normalization	Yes	Yes	No	No	Yes	No	Yes
Necessary external collaboration	Yes	Yes	No	No	No	No	Yes
Preventive strategy	Yes	Yes	No	Yes	Yes	Yes	can be
Financial requirements associated with an implementation	Yes	Yes	No	Yes, conside - rable	Yes, conside - rable	No	Yes
Labour input intensity	No	No	Yes	Yes, conside - rable	Yes, conside - rable	Yes	No
Economic benefits	Yes, partly	Yes, partly	informative benefits more likely	Yes	No	Yes – conside - rable	uncertain
Intended for	All company types	All company types	All company types	Manufac - turing compa - nies	All company types	All company types	Company with products/ services included in existing product categories
Logo/ certificate	Yes	Yes	No	No	No	No	Yes

Table 1. Comparison of a selection of voluntary environmental instruments, Source: authors

to be implemented. Among the key activities that cannot be carried out by a company itself and are compounding this background are inspection, certification and registration. These activities need to be provided by another entity (e.g. an independent third party, a state body). There are of course financial expenses related to the necessary external collaboration (e.g. costs associated with consultations, advisory on EMS or application fee for eco-labeling) that distinguish significantly from one instrument to another. Voluntary instruments differ also hugely regarding benefits for a company and costs required for their application. While some of the voluntary environmental instruments are generally considerably beneficial in terms of operation costs reduction (e.g. Cleaner production) the contribution of other instruments is mainly informative (e.g. LCA).

Table 1 provides an overview and comparison of a selection of voluntary environmental instruments with regard to different perspectives.

3.4 Classification of environmental benefits of voluntary instruments

On the basis of a thorough analysis of the individual voluntary environmental instruments, a generic classification of their benefits was created. These benefits were divided into two major groups, financial and non-financial. Within our research we then elaborated a catalogue with benefits for each one of the voluntary environmental instruments.

a) Financial benefits

The financial benefits stemming from implementation of the voluntary environmental instruments in a company consist mainly in:

- Operating costs savings as a result of energy saving measures , water and materials efficiency programmes, and a decline in fees and taxes related to environmental damage
- Increased revenue as a consequence of access to new markets, increased demand of existing customers or sale of a new product, e.g. waste materials
- Obtaining state aid or subsidies

b) Non-financial benefits

Similarly, application of the voluntary environmental instruments is associated with a number of non-financial benefits that however ultimately affect the financial benefits for a company. We have proposed the following eight groups to which the non-financial benefits can be allocated:

- Business benefits - improved corporate image, growth of "brand equity" and related customers satisfaction
- Employee relations - increasing morale and involvement of employees as a result of increased employee satisfaction and related retention of key employees
- Public relations – enhanced corporate credibility and overall public functioning, improved position of in negotiations with public authorities
- Risk management - emergency preparedness and reducing the likelihood of environmental accidents;
- Compliance with environmental, health and safety legislation and standards - regular monitoring of legislation ensuing in ability to predict possible legislative changes and prepare for them

- Company management - establishment of order in company operations and documentation, improved internal communications, streamlined production processes and increased product quality
- R & D - stimulating innovative thinking
- Environment, Health & Safety (EHS) - Improved quality of working environment and related betterment of safety and health conditions for employees resulting in decreased absenteeism and increased employee productivity

4. Corporate environmental profile index

Corporate Environmental Profile Index (CEPI) was designed for internal business purposes for the multi-criteria analysis and assessment of a company's environmental performance. CEPI is composed of four broad set of categories that are further divided into a number of criteria. The four categories are as follows:

- RC - Resource Consumption
- ERL - Environmental Releases
- ER - Environmental Remediation
- CO - Compliance (with environmental legislation)

The four index categories were deliberately defined broadly to cover all potential environmental aspects of business operations. For each category neither specific criteria nor their number were determined for the general model (see chapter 5).

The importance of the index categories and criteria, in terms of their contribution to the overall environmental profile of a company, is expressed by weights (v_i for each criterion and V for a given category). The weights can take values from 1 to 5 with the following meaning:

1. Very low importance
2. Low importance
3. Intermediate importance
4. High importance
5. Very high importance

As a result, the importance of an individual criterion in terms of the final index value is not only given by their own weight but also by weight of the category to which they belong.

Each criterion within those four categories is further evaluated with a score (s_i) which expresses the qualitative criteria evaluation in the range:

1. Very good
2. Good
3. Average
4. Bad
5. Very bad

The score represents a formal quantification of the performance evaluation, where each criterion is objectively assigned a score value according to the interval that corresponds with its specific criteria performance.

In general, scores can be determined:

a. With regard to a specific target for individual criteria
b. With regard to a trend of development of individual criteria

Mathematical expression of CEPI

When employing the input parameters described earlier the CEPI can be calculated as follows: For each category a category score is computed according to the equation (1) shown below, which mathematically represents a weighted average of individual scores of all criteria in the particular category.

$$\bar{w} = \frac{\sum_{i=1}^{n} s_i v_i}{\sum_{i=1}^{n} v_i} \tag{1}$$

Where

$\bar{w}$ Category score

s Criterion score, for which $s \in S, S = \{1,2,3,4,5\}$

v Criterion weight, for which $v \in V, V = \{1,2,3,4,5\}$

As a next step, each category score needs to be multiplied with a specific category weight, see the equation (2).

$$W = \bar{w}V \tag{2}$$

The final CEPI value then corresponds to a weighted average of scores for all categories, as calculated in the formula (3).

$$CEPI = \frac{W_{RC}+W_{ERL}+W_{ER}+W_{CO}}{V_{RC}+V_{ERL}+V_{ER}+V_{CO}} \tag{3}$$

Where

W_{RC}, W_{ERL}, W_{ER}, W_{CO} Weighted score of each category

V_{RC}, V_{ERL}, V_{ER}, V_{CO} Weight of each category

Using the input parameters of this method the formula for determining the CEPI is as follows:

$$CEPI = \frac{\left(\frac{\sum_{i=1}^{n} s_{RCi} v_{RCi}}{\sum_{i=1}^{n} v_{RCi}} V_{RC}\right) + \left(\frac{\sum_{i=1}^{m} s_{ERLi} v_{ERLi}}{\sum_{i=1}^{n} v_{ERLi}} V_{ERL}\right) + \left(\frac{\sum_{i=1}^{o} s_{ERi} v_{ERi}}{\sum_{i=1}^{n} v_{ERi}} V_{ER}\right) + \left(\frac{\sum_{i=1}^{p} s_{COi} v_{COi}}{\sum_{i=1}^{n} v_{COi}} V_{CO}\right)}{V_{RC} + V_{ERL} + V_{ER} + V_{CO}} \tag{4}$$

Given the specified range of weights and scores the final CEPI can take any value in the range of <1,5>. The resulting CEPI value can be therefore classified into one of the four below intervals assessing the level of company environmental performance:

1. <1, 2) excellent environmental performance

2. <2, 3) good environmental performance
3. <3, 4) poor environmental performance
4. <4, 5> unsatisfactory environmental performance

5. B2En Performance Development model

5.1 Introduction

In chapter 2, dealing with the Eco-efficiency concept, the interconnection was highlighted between economic and environmental performance or more specifically between environmental and economic results of a company. Selected voluntary environmental instruments have been characterized in chapter 3 as specific examples of application of the eco-efficiency principles in business practice. From chapter 3 it is obvious that implementing eco-efficiency principles in a company not only results in costs savings and increased sales; but that environmentally proactive behaviour, closely associated with innovative thinking, drives a range of non-financial benefits which in the end contribute significantly to the financial bottom line. In our research we went even further and created a conceptual model integrating environmental and economic performance as two interrelated aspects of business activities, enabling effective management and control of both performance areas.

To put it in a different way, the model shows the interdependence between environmental prevention and protection actions on one side, and achievement of business economic objectives on the other side. The name B2En Performance Development indicates that a proactive behaviour in terms of environmental responsibility has a direct impact on improving a company's economic performance. The main aim of the B2En model was to identify interrelations between environmental and economic performance of a company. For the economic component of our model it was necessary to select a suitable method for measuring and managing economic performance.

For the purposes of the model, it was essential to choose such management method that would:

- consider financial as well as non-financial factors (see the nature of the voluntary environmental instruments benefits)
- allow for integration of the environmental perspective
- enable identification of cause-effect relations between environmental and economic performance

Model Balanced Scorecard (BSC), as a comprehensive management method cutting across the entire business, meets all three above conditions and was therefore selected as an economic component of the conceptual B2En model.

As already mentioned, the B2En model is based on the eco-efficiency concept that lies around the principle of generating more products while consuming less resources and therefore producing less waste and pollution. As described in chapter 2, this is achieved especially through innovation in terms of new production and consumption patterns leading to separation (decoupling) of economic growth from resource consumption.

According to the eco-efficiency principle, environment and economics are two interrelated and therefore interacting aspects of a business. For this reason B2En model was designed in

such a way that the environmental perspective is integrated into all four original perspectives of BSC (Fig. 2), forming so the interaction between environmental and economic performance of a company.

Category	Criteria				Weight (V)	Weighted Category Score (W)
	Name	Score (s_i)	Weight (v_i)	Weighted Score (w_i)		
Resource Consumption RC	Criterion 1				V_{RC}	W_{RC}
	Criterion 2					
	Criterion 3					
	⋮					
	Criterion n					
	Total					
	Category Score $\overline{w}_{RC}$					
Environ-mental Releases ERL	Criterion 1				V_{ERL}	W_{ERL}
	Criterion 2					
	Criterion 3					
	⋮					
	Criterion n					
	Total					
	Category Score $\overline{w}_{ERL}$					
Environ-mental Remediation ER	Criterion 1				V_{ER}	W_{ER}
	Criterion 2					
	Criterion 3					
	⋮					
	Criterion n					
	Total					
	Category Score $\overline{w}_{ER}$					
Compliance CO	Criterion 1				V_{CO}	W_{CO}
	Criterion 2					
	Criterion 3					
	⋮					
	Criterion n					
	Total					
	Category Score $\overline{w}_{CO}$					
			Total			
			CEPI			

Table 2. Corporate Environmental Performance Index

5.2 Model structure

For the B2En model three different diagrams were created that represent different levels of approximation:

a. Level 1 (Fig. 1) - General concept – displays the very essence of the B2En model consisting in integration of the environmental perspective into the original four perspectives of BSC model (economic perspective);
b. Level 2 (Fig. 2) - Structure of the model - provides more detailed information on individual components of the model and mutual relations between them;
c. Level 3 (Fig. 3) - Identification of relations - offers a detailed look at the cause-effect relation between environmental and economic perspectives.

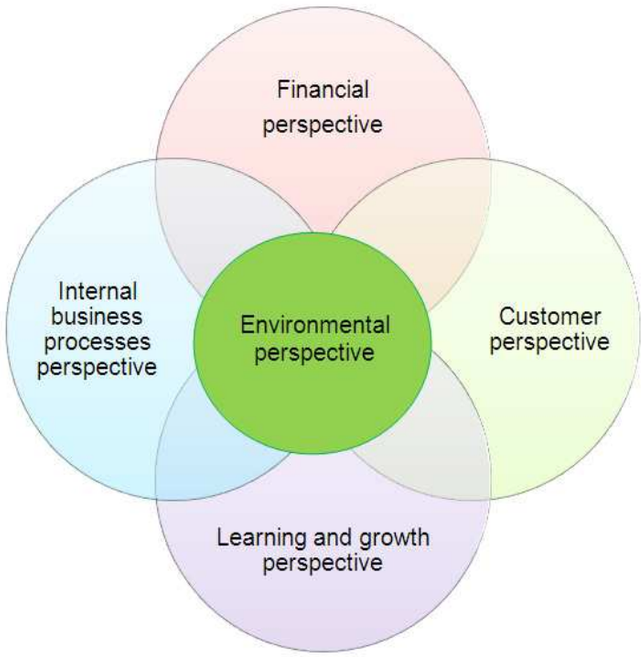

Fig. 1. General Concept of the B2En Performance Development model

When looking closer, B2En model consists of three components: Environmental Perspective (I.), Balanced Scorecard (Economic Perspective) (II.), and Eco-efficiency indicators (III.), which are interconnected by logical links (see Fig. 2). Environmental Perspective of the B2En model comprises the following three components:

1. Environmental performance - presents four broad categories of environmental objectives: resource use, environmental releases, environmental remediation, compliance with environmental legislation;
2. Environmental Performance Indicators (EPI) – these are used as metrics for environmental objectives evaluating a company's environmental performance.
3. Voluntary environmental instruments - enable application of the eco-efficiency concept in business practice. In B2En model voluntary environmental instruments are divided into four groups representing a management level to which they relate: products, processes, systems and strategies.

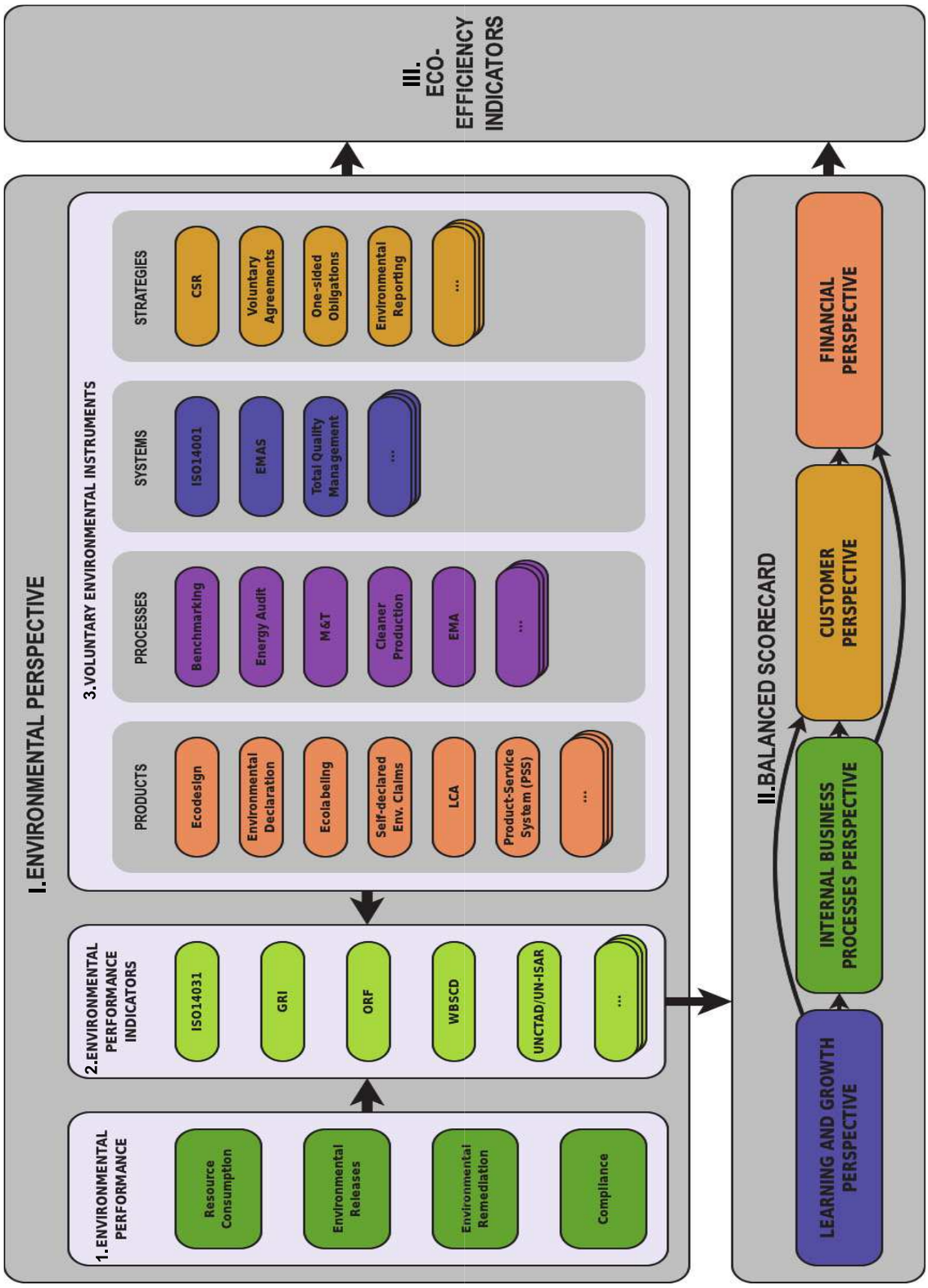

Fig. 2. Components of the B2En Performance Development model

Links and connections between the respective components of the model are expressed by arrows and the principle of the scheme is as follows. A company sets environmental objectives and priorities within the four categories in order to improve its own environmental performance. Once the objectives are set appropriate metrics (EPI) need to be identified and allocated to each of them to measure achievement of these objectives. Voluntary environmental instruments serve as means to influence a specific EPI and achieve those environmental objectives.

Given the nature of the voluntary environmental instruments based on the elimination of waste and pollution prevention at source, achievement of the environmental objectives has a positive effect on one or more perspectives of the BSC. Voluntary environmental instruments hereby ultimately impact on the financial perspective of the BSC model and therefore contribute to the financial performance of a company. Achieving environmental objectives is therefore positively reflected in the economic perspective of business performance which refers to a win-win or a double victory situation.

Fig. 3. provides a detailed look at the cause - effect relationship which interconnects the environmental and economic perspective (representing four original perspectives of BSC) at the level of an individual environmental objective of a company. As the arrows indicate, achievement of an environmental objective has a positive impact on the key economic performance indicators (KPIs).

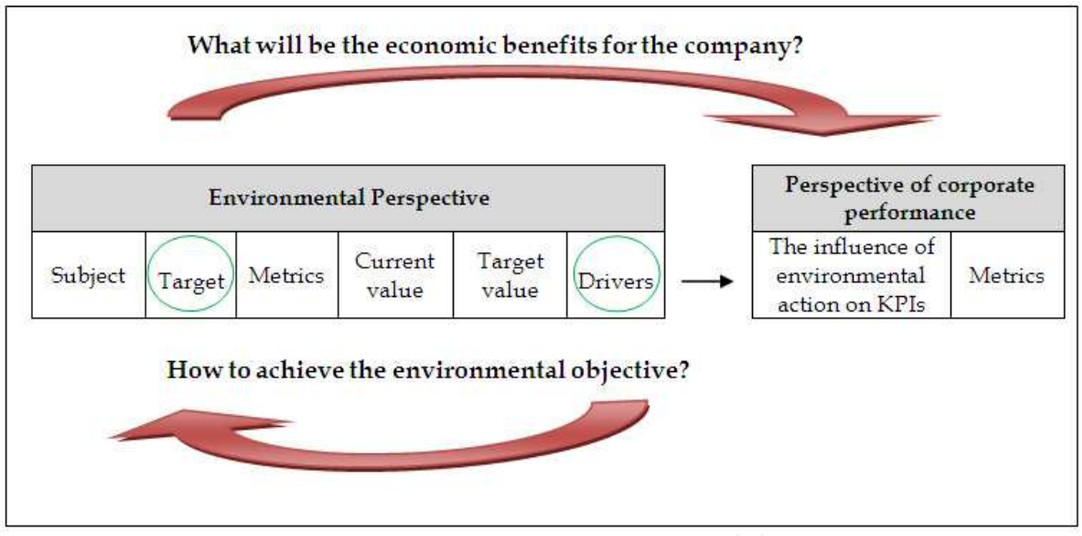

Fig. 3. Cause-effect relationship between environmental and economic perspectives

For each environmental objective, not only the way (drivers – voluntary environmental instruments) to its achievement needs to be identified, but also economic consequences resulting from this accomplishment. Managing eco-efficiency is therefore a two-fold task consisting in reaching the stated environmental objective and achieving the greatest economic benefits, both financial and non-financial. Mutual relationship and linkages between the environmental perspective and individual perspectives of the BSC will be addressed in the following text and the diagram in Fig. 3 will be elaborated for the individual perspectives in greater detail (see table 3).

BSC perspective	Environmental perspective: Subject	Target	Metrics	Current value	Target value	Drivers	→	Economic perspective: Impact of the environmental action on KPIs	Metrics
Financial Perspective	**GHG emissions**	Reduction of GHG emissions in the process / product or for the company as a whole	Tons of CO_2 equivalent per 1 million sales Energy consumed (EUR/GJ) per number of employees			Energy efficiency programmes (CP, EMS) Using renewable energy	→	Cost savings on emissions charges Saving energy costs Revenues from sales of surplus emission allowances	Operating costs (EUR) Turnover (EUR)
Customer perspective	**Eco-label**	Over the next 12 months an eco-label for two key products to obtained	Eco-label certificate			Environmental specialists to be involved in the technical development teams	→	Product features and image | Acquiring new customers in the European market	% contracts from new customers in targeted EU segments
Internal business processes perspective	**Waste**	Reduction of solid waste in the process / product or for the company as a whole	Disposed waste (volume, weight, or EUR) per added value			Waste prevention programs (CP, EMS) Programmes to increase material efficiency Reuse of waste	→	Cost savings associated with the efficient handling of production materials	Operating cost efficiency
Learning and growth perspective	**Consum-ption of toxic substances**	Cut down on the volume of toxic substances in the process / product or for the company as a whole	The volume of toxic substances (l) per number of products The volume of toxic substances per added value			Change in Technology Change of major raw materials Change in consumables	→	Reduced absenteeism due to workplace accidents and illness	Average absenteeism measured as missed working days per 1 employee

Table 3. Links between environmental and BSC perspectives

For whom is the B2En model intended?

The B2En model was designed mainly for internal business purposes to enable efficient management and control of environmental and economic performance with the aim to achieve a win-win situation. In principle, the B2En model can be implemented in all businesses regardless of size and industrial sector. However, for the B2En model to be implemented, the BSC model needs to be applied to certain extent in business practice. Due to this fact and the potential scale, the model is envisaged to be implemented particularly in medium and large companies, whether at the corporate level, individual departments or for a specific product. The win-win principle resulting from a proactive business approach to environmental protection - basic idea of the B2En Performance Development model - is of course essential for the change in general attitude of business community towards environmental responsibility and relating rethinking of the consumption and production patterns. The proposed model is therefore clearly important even for small businesses, although it will not be applied in the proposed form.

5.3 Relationship and interdependencies between the economic and environmental perspective of the B2En model

5.3.1 Financial perspective vs. environmental perspective

In this chapter-part, relationship and interconnection will be scrutinised between the environmental perspective and the individual BSC perspectives. Environmental activities applied in a company through respective voluntary environmental instruments have a wide scope to all levels of business. In the following text, specific areas will be identified in which environmental activities are directly impacting on long-term financial objectives of a company.

a) Increased sales

The increase in business turnover is influenced, among others, by introduction of a new product, new customer acquisition and new market penetration. Many voluntary environmental instruments have the potential to positively affect the growth in turnover of a company through searching for new opportunities, as they offer a different perspective for business decision making.

New Customers - Many enterprises confirm increased sales as a result of implementing EMS - a systematic approach to environmental protection in all aspects of business. An environmentally responsible company with an EMS certification gets new opportunities in commercial sector.

New Product – Waste represents another field of opportunities for further growth in sales. Selling waste as a secondary resource or for recycling, rather than landfilling, constitutes another source of sales. Also, environmental instruments (e.g. Ecodesign, LCA and Eco-labelling) may positively affect the marketability of products.

New markets - Environmentally responsible behaviour improves overall corporate reputation and positively impacts on public perception of a company. This is very important nowadays, especially if a company aims to penetrate or retain foreign markets. An EMS certification or a product eco-label is often an entrance card for companies to export their products to foreign markets.

b) Cost reductions / productivity improvements

Prevention of waste - Environmentally responsible behaviour is primarily associated with savings in operating costs. Preventive voluntary instruments, such as cleaner production, EMS, and Ecodesign seek to minimize waste as a non-product output with a negative or zero market value.

Compliance - A company that comply with environmental legislative requirements is spared fines, fees, denials of permits, closures and other unpleasant consequences of contravening applicable laws. Within EMS, a company is obliged to monitor current environmental laws and regulations on a regular basis to stay ahead of them.

Environmental Risk Management - Through proactive management of environmental risks the likelihood of environmental accidents, leakages, and oil stains can be minimized. Preventive measures, applied through e.g. cleaner production or EMS, can reduce costs associated with repairing damages and penalties for failure to comply with legislation.

5.3.2 Customer perspective vs. environmental perspective

Within the customer perspective, companies in particular strive for growth in the market share and sales in targeted customer segments. These objectives are closely linked to retaining existing and acquiring new customers, and increasing their satisfaction. Among the many aspects influencing customer satisfaction are product features, good relations with customers, and business image.

Product Features - Products manufactured in accordance with the eco-design principles or eco-labelling criteria are easy to disassemble, provide greater security, and can be sometimes purchased at lower prices as a result of recycling some sub-components. Voluntary environmental instruments enable improved product quality in terms of reliability, longevity and ease of maintenance and repair.

Customer Relations – Many customers nowadays aim to improve their own environmental performance and require therefore environmentally friendly products from environmentally responsible suppliers. Voluntary instruments enable inter-company cooperation focused on reducing negative environmental impact across respective supply chains. Industrial symbioses represent another example of such cooperation. Within these clusters, waste of one company becomes raw material input for another one and a closed/ continuous loop is achieved.

Business image and reputation - Environmentally responsible behaviour enhances corporate reputation, positively affects public perception of a company and increases business credibility which is essential when dealing with banks, insurance companies, municipalities and other public institutions.

5.3.3 Internal business processes perspective vs. environmental perspective

An internal value chain consists of three different levels - innovation processes, operational processes and after-sale services (Kaplan & Norton, 2002). Voluntary environmental instruments not only significantly impact on innovative solutions aiming to manage environmental and economic performance at the same time, but they also contribute to streamlining business processes.

Innovation Processes

The Eco-efficiency concept boosts innovativeness through challenging companies to find creative solutions leading to enhanced environmental and economic results. Companies have a plethora of opportunities to innovate, among the most obvious being

- New markets or new customers in existing markets (e.g. Industrial Symbiosis)
- Products innovations (e.g. Eco-design)
- Technological innovations focused on energy and material efficiency

Business Processes

At an operational level, a company should look to 'do more with less', as explained in chapter 2 on eco-efficiency. This does not relate only to economic efficiency, rather the aim is to mitigate harm (emissions, waste, leakages, consumption of material and energy) to the environment when generating more products and services and improving economic benefits. As to resource consumption, eco-efficiency is focused mainly on:

- Streamlining production processes
- Cutting down on resource consumption
- Restriction of hazardous materials
- Reducing unwanted by-products

5.3.4 Learning and growth perspective vs. environmental perspective

Intangible assets of a company represent a prerequisite for flexible and efficient internal processes oriented on achieving objectives of the customer and financial perspectives. A company should also strive to nurture its employees' satisfaction as this is an essential factor in securing customer satisfaction.

Competence of staff

A company can only achieve outstanding results in mitigating negative environmental impact of its business processes, if necessary competence and skills are secured for its employees. However, the excellent performance of employees is not only given by their knowledge and skills, but is significantly influenced by such soft factors as motivation and work attitudes.

Employee Satisfaction

As a result of improved working environment, stemming from an environmentally responsible behaviour of a company, a drop in absenteeism due to illness, fewer workplace accidents, and increased productivity can be expected.

Company image constitutes another factor affecting job satisfaction. A company characterized by environmental responsibility and safe working environment is likely to be more successful in attracting and retaining good employees with a positive environmental attitude.

5.3.5 Colligation of environmental perspective with individual perspectives of BSC

From the above text a clear relationship between environmental management and economic benefits, whether it be financial or non-financial, is obvious. As explained, voluntary

preventive environmental approach not only benefits the environment but is connected with a range of positive impacts on all levels of business.

Table 3 was designed as a template for examining the interrelationship between environmental actions and economic performance of a company as a direct consequence of these actions. In the original research, these interrelationships were scrutinised for each BSC perspective in greater detail. Within this chapter only one example is presented for each BSC perspective. These examples are illustrative only; each company will choose its own objectives, metrics and KPIs according to its individual needs.

6. Eco-efficiency Statement

The Eco-efficiency Statement was developed by the authors to assess the impact of a company's environmental activities, more precisely its environmental profile, on its economic performance. The Statement enables evaluation of the relationship between the environmental and economic results achieved within a specific time period.

As displayed in table 4, information included in the proposed Eco-efficiency Statement is classified into three groups:

- Under the **Key economic performance indicators** key items are shown from the profit and loss statement and financial analysis, that get most affected by the environmental profile of a company. The economic indicators include:
  a) Key indicators of Profit and loss statement
     - Indicators relating to business operation: e.g. Sales, Operating income, Operating expenses, Gross profit, Value added
     - Key profit categories: e.g. EBITDA, EBIT, Profit after tax
  b) Key indicators of financial analysis: e.g. ROCE, ROE, ROI; EVA, CFROI

- **Key environmental performance indicators** give an overview of core indicators identified in the GRI guidelines that have the greatest impact on the environmental profile of a company. However, it is necessary to add that the Eco-efficiency Statement is by no means meant to replace the full environmental performance reporting, that is far more comprehensive and gives thorough overview of the total environmental profile of a company. The environmental indicators include:
  a) Input indicators: e.g. Materials or energy used
  b) Output indicators: e.g. Emissions released, water discharge
  c) Impact indicators: e.g. Fines and sanctions

- **Eco-efficiency indicators** represent the third group of indicators included in the Eco-efficiency Statement. These indicators are particularly important as they document the performance of a company and its trend, help identify and prioritise improvement opportunities, and identify cost savings and other eco-efficiency related benefits. Eco-efficiency indicators can also testify that, in a specific business area, there are only limited opportunities for improvement and requirements posed by stakeholders are impossible to achieve. In this Statement, the UNCTAD's approach to eco-efficiency (see chapter 2.2) was applied.

Eco-efficiency Statement								
Key indicators of economic performance	**Unit**	**I.**	**%**	**II.**	**%**	**III.**	**%**	**IV.**
Key indicators of profit and loss statement								
Sales	thousand EUR							
Operating income								
Operating expenses								
Gross profit								
Value added								
EBITDA								
EBIT								
Profit after tax								
Key indicators of financial analysis								
ROCE	%							
ROE	%							
ROI	%							
Dividend per share (gross)	EUR/share							
Operational CF	thousand EUR							
EVA	thousand EUR							
CFROI	%							
Key indicators of environmental performance according to GRI								
EN1: Materials used by weight or volume	thousand tons							
EN3: Direct energy consumption by primary energy source	GWh							
EN8: Total water withdrawal by source	thousand m3							
EN16: Total direct and indirect greenhouse gas emissions by weigh	CO_2 tons equivalent							
EN19: Emissions of ozone-depleting substances by weight	CFC-11 tons equivalent							
EN20: Nox, SOx, and other significant air emissions by type and weight	tons							
EN21: Total water discharge by quality and destination	thousand m3							
EN22: Total weight of waste by type and disposal method	thousand tons							
EN24: The amount of hazardous waste	thousand tons							
EN28: Monetary value of significant fines and total number of non-monetary sanctions for noncompliance with environmental laws and regulation	EUR							
Key eco-efficiency indicators	**Calculation**							
Energy efficiency (energy consumption / sales)	GWh/sales							
Consumption of water in relation to added value	m3/value added							
Waste in relation to the added value	tons/value added							
CO_2 emissions in relation to sales	tons/sales							
Leakage of toxic substances into the atmosphere in relation to sales	tons/sales							

Table 4. Eco-efficiency Statement

Eco-efficiency Statement enables an assessment of correlation between environmental results (e.g. energy consumption) and economic outcomes (e.g. operating expenses, EBIT). For achieved results to be interpreted, it is especially important to consider time series data and indexes (increase / decrease compared to last year). Again, the content of the Eco-efficiency Statement was not meant to be fixed. Companies will need to adhere to the proposed structure but should include such key indicators that are essential for their specific business situation and accounting standards. An example of the Eco-efficiency Statement is introduced in the table 4.

7. Methodology for B2En performance development model implementation

Phase 1 – Setting objectives for improving environmental profile

Internal analysis

Identification of current and potential business impacts on the environment should be the starting point for any environmental action and effort for improving environmental performance. The multi-criteria index CEPI (see section 4) is a useful tool for identifying problem areas of the environmental profile of a company.

Feedback from external and internal stakeholders

Over and above the results gained during the internal analysis, a company should also consider views of its external and internal stakeholders, as this can be an invaluable source of information. A company should not rely solely on the results obtained from the internal analysis. It is always invaluable to consider opinions of a company's external and internal stakeholders. Through e.g. regular questionnaire surveys, a company should identify and assess business environmental issues important for its stakeholders. Based on the results from internal analysis, opinion polls and analysis of stakeholders' views, an environmental manager sets targets and objectives for improving company's environmental performance.

Phase 2 – Identification of eco-efficiency opportunities

Once a company has a good understanding of its business actions and production processes and their impact on the environment, it can start identifying the eco-efficiency opportunities leading to enhanced business value through an improved environmental profile. It is crucial that each environmental objective is attained with the best economic outcome. The scheme outlined in table 5 can be used as a selection mechanism for business priorities considering both, their environmental and economic importance. Once respective areas for environmental improvements and value creation opportunities are identified, they need to undergo a prioritization process and be allocated into the following groups:

- High priority issues (H)
- Medium priority issues (M)
- Low priority issues (L)

Phase 3 - Application of voluntary environmental instruments

After goals for improving environmental performance have been set and links to the various perspectives of economic performance have been identified, chosen voluntary environmental instruments can be rolled out.

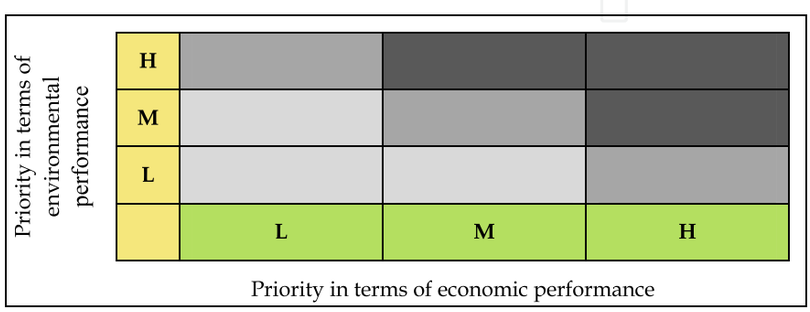

Table 5. Prioritization of proposed actions

Phase 4 - Objectives assessment

During the application of voluntary environmental instruments all results need to be constantly monitored, not only at the end of the project but throughout the entire implementation process. All significant deviations from forecast need to be thoroughly analysed and appropriate corrective actions need to be implemented. The Eco-efficiency Statement (see chapter 6) can be used to evaluate the overall success of the voluntary environmental instruments application.

Phases 5 - Demonstration and communication of results

Demonstration and communication of results achieved through application of selected voluntary environmental instruments follows as the final phase of deployment of the B2En Performance Development model. The economic and environmental benefits ensuing from implementation of individual voluntary instruments shall be communicated to various interest groups in different ways. This process comprises both, internal and external communications.

8. Case study - 3M Corporation

At the end of our research we undertook a case study to verify the functionality of the proposed B2En Performance Development model and its implementation methodology.

The model was applied, in line with the proposed methodology, on real environmental and economic data and targets of 3M Corporation[1] (3M). For the purposes of this paper only a summary of the full case study is introduced.

8.1 Definition of goals for improving environmental performance

3M is characterized by its proactive approach to environmental issues and implementation of preventive solutions. Based on thorough analysis 3M set and prioritised the following goals for the period 2005 and 2010:

- Energy efficiency improved by 20%
- Production of waste materials reduced by 20%
- 800 projects of pollution prevention completed
- Emissions of volatile compounds reduced by 25%

8.2 Application of voluntary environmental instruments

3M apply their responsibility towards the environment mainly through

- Use of Environment, Health and Safety (EHS) management systems (e.g. EMS, Cleaner production)
- Application of product life cycle management systems for permanent protection of the environment, health and safety (e.g. LCA, Ecodesign, Eco-labeling)
- Prevention of environmental pollution through development of new technologies and products.

[1] http://solutions.3m.com/wps/portal/3M/en_US/3M-Sustainability/Global/

8.3 Evaluation of achieving stated objectives

8.3.1 Environmental results

Energy - Since 2005, 3M has achieved energy savings to the tune of 37 million USD, especially through implementation of 1400 projects proposed by its staff.

Waste - In 2008, 616 pollution prevention projects were completed, which prevented 55.5 thousand tonnes of waste representing savings of nearly 91 million USD.

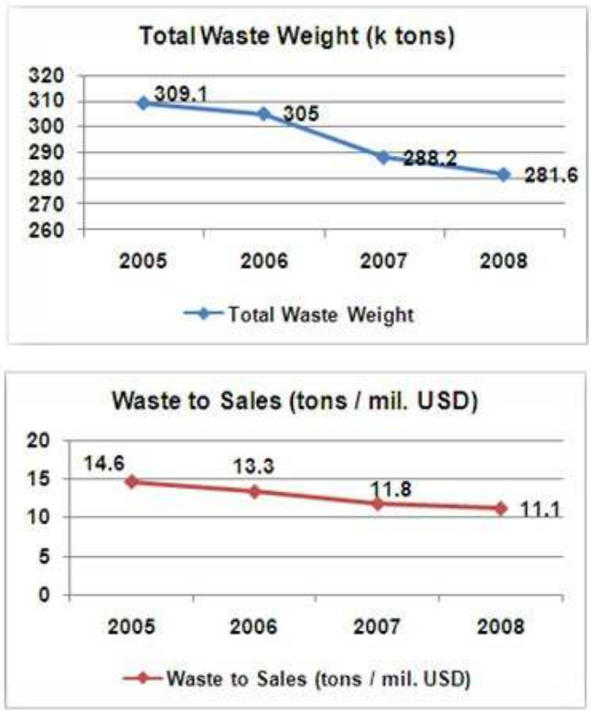

Fig. 4. Total waste production and waste production in relation to sales in years 2005-2008

Emissions – Through a range of energy efficiency programmes, 3M managed to reduce emissions of greenhouse gases by 16% in 2008 compared to 2006 and 69% compared to 1990.

Water - Total water withdrawal, similarly as total water use in relation to sales, showed a negative trend between 2005 to 2008. This was mainly due to introduction of a programme for monitoring and controlling water consumption in 2005 at the corporate level.

8.3.2 Economic results

Operations (See Fig.5.) - Long-term application of programmes for energy efficiency and waste prevention has proved to be particularly important in conditions of surging and fluctuating prices of raw materials. Other positive consequences of these programmes included a decline in recorded work accidents by 7% compared to 2007, with the associated 3.8% decrease in time loss.

Employees – There are many non-financial aspects having direct impact on 3M's employee satisfaction, among the most significant being improved workplace safety, internal

communication, motivation, and the overall business image. These factors have been therefore closely linked with the lower turnover of 3M employees.

Customers (See Fig.5.) - 3M's economic success is mainly based on building long-term business relationships with customers who appreciate the world-famous brand of 3M products representing quality, innovation, reliability and sensitivity towards the environment. Since 2003, demand for 3M's products has been growing, with an average growth rate of 6.1% from 2005 to 2008.

Financial results (See Fig.5.) – Due to controlled growth of operating costs and the positive trend in sales, there was a positive trend in 3M's profit in the period from 2005 to 2007. The decline occurred in 2008 due to global economic crisis. This decrease, however, was not so devastating for 3M, again thanks to implemented programmes for energy efficiency and waste prevention. 3M's business results are also translated into interesting gains for investors. In years 2003-2008, the net profit per share rose by 69.8% with an average growth of dividends per share of 51.5%.

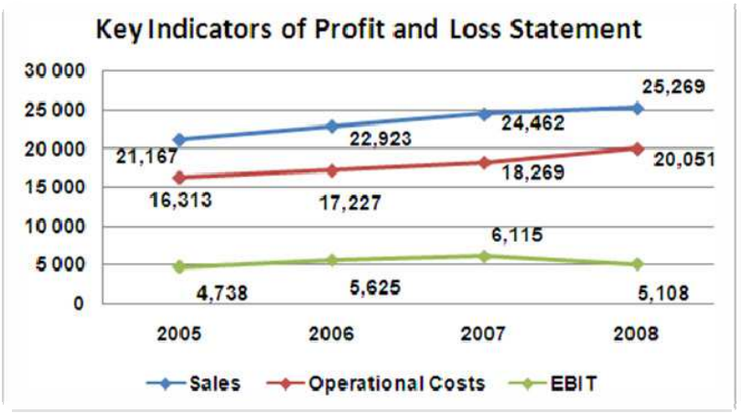

Fig. 5. Trend of key operational business indicators in years 2005-2008

Indicators of eco-efficiency

3M has been successful in improving its eco-efficiency, respectively in reducing the ratio of resource consumption / production of waste and achieved sales.

9. Conclusions

In the current business environment, there is still plethora of companies spurning their environmental responsibility that, as they believe, only represents another financial burden and is in contradiction with economic profit. Therefore, the aim of our research was to testify and demonstrate the positive impact of environmentally responsible behaviour on economic performance of a company. Within our research we undertook a questionnaire survey of some 200 companies in the Czech Republic, carried out an inventory of current environmental performance concepts and tools, and analysed benefits stemming from voluntary environmental instruments applied in business and production processes. Having been cognisant of the contemporary situation, we started developing a conceptual model to

illustrate the interrelation between environmental and economic performance of a company. The B2En Performance Development model proposed by the authors, as presented in this book chapter, links the Balanced Scorecard model with the Eco-efficiency concept. The proposed model, comprising multi-criteria index CEPI , Eco-efficiency Statement, and a spread sheet based software tool, enables identification of relations between environmental objectives and KPI of individual BSC perspectives and demonstrates so a positive impact of proactive environmental actions on business performance. The developed model is essential for a complete attitude change of business-community towards environmental responsibility and re-thinking production and consumption patterns, playing therefore an important role in theory and practice of economic performance.

Given the breadth and depth of this topic, however, there are still significant research gaps that need to be addressed, e.g. modification of the B2En model for application in small companies, application of the model on a specific process or product, or detailed look at correlation of links between the environmental and economic perspective at the level of a specific environmental objective.

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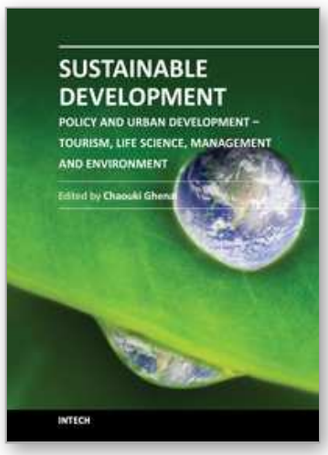

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The technological advancement of our civilization has created a consumer society expanding faster than the planet's resources allow, with our resource and energy needs rising exponentially in the past century. Securing the future of the human race will require an improved understanding of the environment as well as of technological solutions, mindsets and behaviors in line with modes of development that the ecosphere of our planet can support. Sustainable development offers an approach that would be practical to fuse with the managerial strategies and assessment tools for policy and decision makers at the regional planning level.

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