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Integrating Environmental Management to Improve Strategic Decision-Making

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*Environmental System Analysis*

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## Summary

Today, many companies have identified the strategic importance of the environmental area but few have taken the consequences of this recognition. Driving forces for this development are, among others, legislation, customer demands and image but also the heavy environmental expenses that need to be managed.

A growing pressure from all stakeholders forces the companies to incorporate environmental responsibility in all activities, and there is the key to success: Only by understanding and managing environmental issues across the organization, as a normal everyday part of doing business, will companies ensure environmental excellence and long term profitability.

Following a model adopted from a new accountability approach (Epstein et al, 2000), four elements, essential to create an environmental management system that is fully integrated with the over-all management, are described and a generic model for implementing an environmental strategy is presented. Common pitfalls of the implementation process are pointed out and methods and concepts to facilitate the implementation are briefly described. The connection between economy and ecology is discussed and the importance of a balanced set of performance indicators is accentuated.

The integration and implementation of the environmental strategy is a far-reaching process that needs full support from the top-management level and sufficient resources, both personnel and equipment, to succeed. Along with this project a redesign of the information system needs to be done, in order to convey the information needed for distributed decision-making considering environmental aspects.

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- ABB AB
- Akzo Nobel AB
- Cementa AB
- Duni AB
- Electrolux Research and Innovation AB
- Telefon AB LM Ericsson
- Holmen AB
- SCA Hygiene Products
- Perstorp AB
- Saab Automobile AB
- Stora Corporate Research AB
- Vattenfall AB
- AB Volvo
- Volvo Car Corporation

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## **Preface**

This thesis is mainly addressed to managers that, irrespective of discipline, come across environmental issues in their day-to-day activities without seeing how these relate to other decision parameters.

It is to be seen as an introduction to integrated environmental management system from an industrial perspective. Today the environmental function, regarding responsibility as well as competence, in many cases, is isolated to one department, though the need of integrating environmental parameters into decision-making embrace the entire company. How this need could be satisfied, i.e. how the environmental responsibility could be integrated into all departments and activities, and the importance of doing that, are issues discussed in this thesis.

In chapter one a description of the task definition and approach is done and a short introduction to definitions regarding management and information is given. Chapter two gives an introduction to the industrial environmental issues. Next a survey of trends that pronounce the importance of including environmental parameters in the strategic decisions is made. In chapter four the connection between economy and ecology is discussed.

In chapter five a model, consisting of four pieces, which have to fit together in order to fully integrate the environmental responsibility into the organization, is presented. The next chapters discuss preconditions of a successful implementation of the environmental strategy and a plan for realization, a short survey of methods and concepts that can systematize and facilitate the implementation and maintenance of the system follows. After that the potential of integrating the environmental strategy in the daily routines is shown.

The following chapter concludes the master thesis and discusses advantages and disadvantages of the methodology used, and lastly, topics important for further work is presented.

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# 1 Disposition of master thesis

*Description of the work until the final task definition and a short introduction to definitions regarding management and information*

The task's primary formulation was to examine how an environmental information system should be organized to facilitate the strategic work. Further on a survey of the state-of-the-art should be carried out.

## 1.1 Introduction to the vocabulary of management and information

**Management system:** The last decades have put focus to an amount of different approaches to management, there is quality management, environmental management, risk management, just to mention some of them. What all these attempts have in common is that the determining factor for a successful implementation is the integration into the day-to-day operations. They all have the same purpose: guide the company in a complex reality. In this report I will concentrate on environmental management, but would like to point out that it is not to be seen as an isolated occurrence, but as part of an over-all management system.

**Environmental Management System:** the part of the overall management system that includes organizational structure, planing activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy [14]

Then who are the actors in this play and what are their roles? "A **manager** is a problem solver, and the fundamental activity in problem solving is decision-making. **Decision-making** is the process of identifying a problem, identifying alternative solutions, and choosing and implementing one of them." [13]

**Strategy** can according to Mintzberg be described as [6]:

... a pattern in a stream of decisions.

This indicates that the strategic work is a continual process, and the **strategic decision** can be recognized by three factors [6]:

1. They are unstructured and non-standardized
2. They are of vital importance to an organization
3. They are complex

This stresses the special need for strategic decision basis and the information system designed to handle it.

Next we need to define **information** and the interrelation with **data**. A broad definition says, "Data represent unstructured facts" and that "Information has a meaning...(it) comes from selecting data, summarize it and presenting it in such a way that it is useful to the recipient [13]. If an organizational aspect is added the definitions could be: "The raw material of organizational life; it consists of disconnected numbers, words, symbols and syllables relating to the events and processes of the business and continues information comes from data that has been processed to make it useful in management decision making." [13]

The development moves towards information-based organizations, where a number of experts are responsible for each competence area and are brought together in task forces that cut across the traditional departments [22]. This requires that the system technically, allow cross-functional information flow with community of data format and standard transfer protocols, and organizationally, clearly defined policy and objectives to ensure that the whole team struggles in the same direction.

This has led to an increasing amount of data that should be collected and transformed into information and distributed to various receivers inside and outside of the company. To organize the information handling there is a need for more or less formalized information system.

The PHASETS model describes how data is aggregated and transformed into information in a technical system and how a conceptual transfer can be done without a change of meaning, for further details I'll refer to CPM and papers describing this model [26].

An **information system** could be seen as [11]: *“an aggregation of equipment and procedures for the collection, storage, processing, and communication of information with the role of assisting and improving the decision making process.”*

This gives the information system three main functions [11]:

1. Facilitate the flow of information within the organization
2. Facilitate the flow of information into and out of the organization
3. Facilitate the management of information

## **1.2 Preliminary study to task precision**

As the master thesis is carried out in collaboration with the CPM industrial interest group, a screening was done to get a brief idea of how the environmental issues relate to information management today.

- Company presentation
  - CPM industrial interest group
- Educational visit
  - SCA Hygiene Products
  - Perstorp AB
- Telephone interview
  - ABB AB
- Survey of models and tools developed at CPM
  - RAVEL (RAil VEhicLe eco-efficient design)
  - PHASETS (PHASEs in the design of a model of a Technical System)
  - IBEIM (System for Integrated Business Environmental Information Management)
  - SPINE (Sustainable Product Information Network for the Environment), this is developed at ESA but maintained and further developed by CPM



And others

- Study of relevant literature  
Ref [3] and [11]  
Among others

### **1.3 Observations under the pre-study**

The most important observations under the preliminary study was, enumerated without priority:

1. There are tools and models to support an IEIS (Integrated Environmental Information System)
2. Data transferring between operational level and the environmental department is working
3. Information addressed to external organs, e.g. environmental reports and environmental product declarations (EPD), are continuously generated and processed
4. The information-flow to the top organization level is insufficient
5. Information supporting strategic decision-making is lacking
6. There is much implementation and integration of methods and tools left undone

### **1.4 Conclusions from the pre-study**

The problem areas found in the pre-study can roughly be summarized as:

*The top-level management often has difficulties receiving /comprehending addressed environmental information*

(Cf. 1.4.4. Lacking information-flow and 1.4.5 information is lacking)

*The implementation process is slow*

(Cf. 1.4.1 and 1.4.6. The tools available are not fully utilized)

The observations indicate that a superior problem conduces.

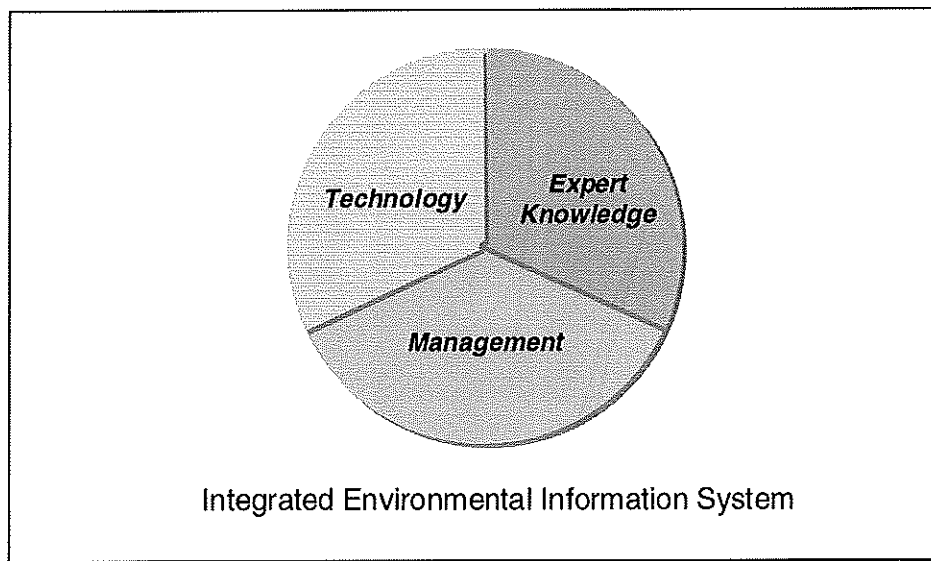


Figure 1 Three aspects of an Integrated Environmental Information System

One way to visualize the parts of an IEIS is shown in figure 1. The underlying problem can be derived from one of these components.

**1. *Technical problem?***

There are technical components to build an information system (Cf. 1.4.1, Tools available) that would satisfy the need for relevant information (Cf. 1.4.5, Strategic decision support)

Motivation:

If the benefits with environmental information to support strategic decision-making were fully recognized the development of data standards and interfaces would be an area of extensive experiment and not be seen as a dogged difficulty. Besides, this does not affect the other observations. (Cf. For example 1.4.5 or 1.4.6)

The components available are not compatible and the building of a complete information system means that these problems have to be solved.

**2. *Insufficient expertise?***

If there were a problem with insufficient environmental expertise the external communication and compliance with regulations would have been suffering and this is not, according to my observations, the case (Cf. 1.4.2 and 1.4.3).

**3. *Deficiency in the management system?***

There are indications that the environmental departments are alienated from the organization (Cf. 1.4.4 and 1.4.5, internal communication doesn't work). The information provided to the top management does not have the format needed to suit as strategic decision support.

If the top management had received relevant information, presented in a suitable form (Level of aggregation, periodicity, and time-perspective) the decision-making would have been gained and the further implementation prioritized.

In this perspective the observations made results in Hypothesis A

### **Hypothesis A**

*By giving the top-management more support from the EIS in the strategic work the issues will be prioritized and the implementation will be accelerated.*

### **1.5 Problems**

The problems that need to be dealt with according to hypothesis A are:

- How is the information-flow today, how could it be improved?

This is the theme in a parallel master thesis carried out by Annica Taprantzi at Stora Enso AB as final part of a master's degree at the University of Uppsala (Ref. 21).

- How can the top management be maximally gained by the EMS in the strategic work

This is the problem that will be tackled within the frames of this master thesis.

### **1.6 Solution approach**

- How can the top management be maximally gained by the EMS in the strategic work

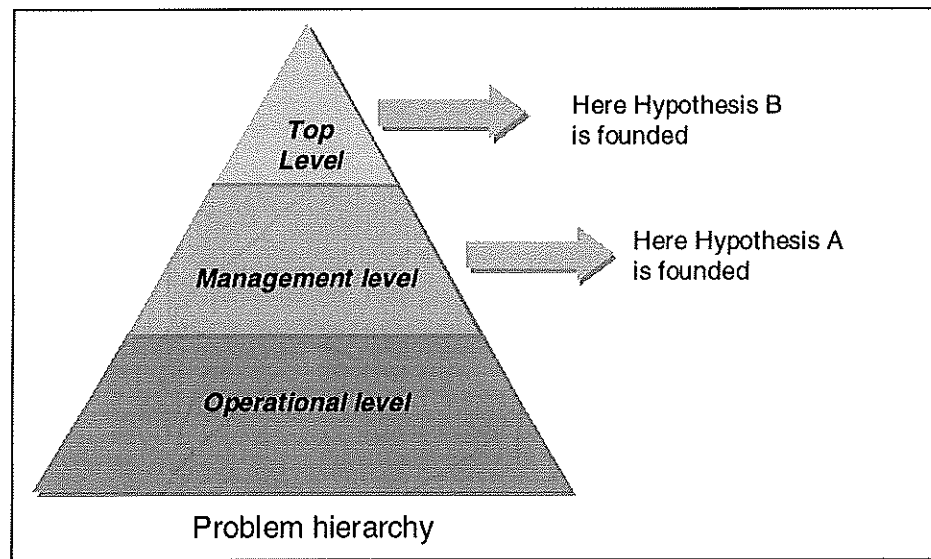


Figure 2 A visualization of the problem hierarchy

The obvious difficulty in gaining from a system yet not fully implemented demands a more theoretical approach and will be solved at top system level, see figure 2.

The approach is founded on the following hypothesis:

### **Hypothesis B**

*By integrating the environmental responsibility with the systems present and allocate the resources needed, the environmental strategy can be implemented and contribute to both improvements in the environmental performance and increasing long-term profitability.*

In this hypothesis, hypothesis A is included as a subset, which means that if B is proved so is A and thereby the task is solved.

I will prove B by first analyze the benefits that hypothesis B suggest and then show that they are reachable.

#### 1.6.1 Analysis of the benefits

- Examine the industrial environmental management issues from a strategic perspective.
- Make a survey of factors that forces environmental progress and analyze some of those that might have a restraining influence.
- Financial aspects of the environmental issue.
- Potential of the approach.
- A concluding evaluation of advantages and disadvantages of the methodology.

#### 1.6.2 How to achieve those benefits

- A presentation of a model that describes a holistic approach to change both culture and routines
- Sketch out an implementation plan, partly adopted from quality management were similar changes have been successful
- Common and useful methods to implement an environmental strategy and build an environmental management system
- A short introduction to system maintenance, continuous improvement and knowledge management.
- Point out where an integrated information system (IIS) is a particularly important success factor.

The difficulty to verify this reasoning will be dealt with by using references to similar procedures from quality management and best-practice examples from literature.

To solve the problems or at least treat the symptoms at lower system level is possible, but gives an inflexible system that cannot interact with a dynamic surrounding. This applies to both organizational and technical solutions, and has its base in the lack of integration between these low-level, sub-solutions, for example: one information sub-system to handle environmental design issues that is not connected to the system built for recognizing customers demands and priorities. This lead to design decisions made without correlation to customers' demands on environmental product performance.

The approach to solve the high-level problem leads to an integrated system that is holistic and flexible.

### **1.7 Delimitation**

A master thesis is a project that runs over 20 weeks, this sets the frames according to scope and depth. The main purpose is to provide a comprehensive picture of how an integrated environmental management system can serve in an industrial context. This implies that some parts will be cursory treated but still need to be mentioned for the comprehension of the system as a whole.

I see no clearly defined limitations between environmental management and accounting, in this report I will show some financial aspects of the environmental issue but it is beyond the scope to deal with business economics.

Within the limitations of this project I will not discuss the technical solutions needed for implementation and their integration into present systems.

## **2 Background**

*How has the attitude regarding industrial environmental issues changed and what are the consequences? What challenges do the companies face? The observations from the analysis are put in a larger context*

### **2.1 Short history of industrial environmental activities**

Environmental issues have been a matter of public concern for the last 25 years. Pressure groups and tightening regulations have forced the industry to examine their production according to environmental impact.

Early actions were often reactions to external pressure, mostly legal ones, and resulted principally in end-of-pipe solutions such as pollution treatment and safer handling of hazardous waste.

The next step in the development implied focus moving from end of pipe-solutions to process solutions, including the whole process and preventing problems instead of treating the effects. This often turned out to be a more remunerative way of dealing with the problems as the environmental expenses of necessary investments and legal fees suddenly increased to considerable amounts.

As the companies learned more about the causal connections within this area and the pressure of the market increased, the environmental issue became a parameter to consider by development of new productions. Different tools and methods were developed in order to facilitate the work. Standards of environmental management were developed and the companies begun to see market advantage in being able to prove that they could comply with the standards, both as supplier and manufacturer. With this the beginning of voluntary environmental reporting, aimed to a large public started.

Environmental consideration is no longer to be regarded as a temporary trend, but is today a part of industrial companies' everyday reality. The main point of companies' environmental work has during the past decades shifted from actions at operational level, as a reaction on regulative demands, to being regarded as an important instrument for decision-making on strategic level.

Today, lots of companies have identified the environmental area's strategic importance but few have taken a holistic approach, which is necessary to get full competitive advantage of it.

### **2.2 Description of the present situation**

A number of methods and tools have been developed to support and improve the companies' environmental performance. However, to a great extent there is a lack of holistic approach where environmental management is a natural part of the overall management system and despite of the fact that 80% of the Swedish top-managers consider the environment an important, strategic issue only 8% of them carry through environmental impact assessments of strategic decisions [6]. In contribution to this there is the lack of implemented and integrated systems on both technical and organizational level, which among other things become apparent as lack of quality in the information that is aimed as base of decision [6] and lack of follow-up in environmental-related expenses [2].

Many companies have the environmental departments subordinated directly under the top-management, which proves the high strategic priority that is given those issues [6].

What is needed to fully integrate the environmental function into the company is a more intimate cooperation between the environmental department, legal, accounting and operational managers [2], and a delegation of environmental responsibility to further anchor the environmental issues and facilitate communication of the company's environmental objective both internal and external [6].

The implementation of the environmental strategy and the technical solutions is often slow. This is more because of the lack of a goal-oriented action plan in order to transform visions to measurable results, than the lack of technical development.

The environmental departments are busy with generating material, e.g. reports and petitions for external purposes and the top management is not making use of the competence already present within the organization. There is also the lack of a common language, necessary for communication, as the information often contains complex physical and chemical conceptions, unknown outside the expertise sphere. The deficient adaptation to the receiver obstructs the use as decision base for strategic adjustments.

### **3 Driving forces for an environmental business approach**

*Why is it important to include environmental parameters in the strategic decisions? A number of different trends that speaks in favor of or against are briefly described.*

The environmental strategy is more and more integrated into the companies' core-business [18]. Following describes a selection of the most important driving forces in this process.

#### **3.1 Sustainable development**

The conception of Sustainable Development was popularized in 1987 when the Brundtland commission presented their UN-rapport "Our common future". In the rapport, the importance of a sustainable development was pointed out, defined as a strategy "that meets the need of the present generations without compromising the ability of the future generations to meet their own needs" [W3].

Different movements stress the importance of a change towards sustainability [15].

- A rapidly growing population, and an expansion of the proportion of the world's population that aspires to the prosperous, resource-intensive lifestyles of people in North America and Europe.
- The appropriate future pricing of resources that are now regarded as cheap or even free, resources as basic as water, soil, weather, and human health, as well as the future pricing of emissions.

Reactions are already noticeable; the late 1990s saw some dramatic moves in the direction of sustainable development [15]

- The growth of the World Business Council for Sustainable Development, with member companies drawn from the ranks of the world's biggest companies
- The public commitment of a growing number of firms (BP Amoco, DuPont, Interface, Monsanto, Motorola, Procter and Gamble, and Royal Dutch/Shell, among others) to the principles of sustainable development
- The establishment of financially credible environmental rating firms and successful investment funds focused on companies that meet investor criteria for social and environmental responsibility.
- The endorsement of sustainable development in the curricula of leading business schools.

#### **3.2 Customer focus**

- *Customers demands*

Customers will in the future have higher demands on the companies' environmental performances and the information concerning their environmental issues [6].

The prior opinion that green products were aimed only to a small market-segment of environmentalists has changed and today these products manage well at a larger market.



- *Environment as a quality-parameter*

Quality is a wide concept. One way of describing it is to identify eight different dimensions regarding the quality of the product [6].

1. Performance                      How well the product fulfills its main purpose
2. Secondary performance      Characteristics following the performance of the product
3. Reliability                        Likelihood of how long it will take before the product breaks
4. Conformity                        Accordance with the product specification
5. Durability                         How long the product will last
6. Level of service                 How fast and satisfactory the customer is served
7. Aesthetics                        What the product looks like, how it feels, smells or taste
8. Apprehended quality         How the customer apprehend the product

According to this definition, environmental influence can be assigned to the category of secondary performance. If one out of two otherwise equal products prove to be an environmental hazard and dangerous to peoples health, while the other is harmless, their performance is the same but the secondary performance, the "side effect", is different and gives consequently the second one higher quality.

One example of this is the chain of grocery stores, Hemköp, that have as core-strategy to keep high quality products and have hereby also an explicit environmental profile.

The information technical aspect of this is a need for information sharing across the disciplines and a possibility to compare environmental aspects to other aspects on equal conditions.

### **3.3 Heavy environmental expenses**

Environmental-related costs have grown very large, very fast, and most managers don't know how to deal with them [2].

An extensive framework forces companies to either make extensive investments in order to limit their pollution or be condemned to pay heavy fees. No matter if the strategy is to keep up a proactive environmental profile or just to be satisfied with compliance, the environmental-related expenses are inevitable.

One company that stated to measure their environmental-related expenses according to a narrow definition, expenses caused by pollution and waste control, proved that they amounted to approx. 2% of operating costs [4]. With improved management much of those expenses can be changed from being a heavy load to be a company asset. Cost-optimization does not always mean cost-minimization [19].

To be able to measure the environmental related costs, there must be a detailed knowledge about the environmental impact of all activities and an understanding of the structure of the own system.

### **3.4 Changed accounting methods**

- *Qualitative indicators*

Both companies and investors have begun to question how well a company's financial rapport indicates their performance. In the middle 90'th many of the companies listed on the stock exchange was valued three to eight times more than their book value [1]. This means that the balance sheet only reflected an average of 20% of the company's actual value. To be able to measure and influence the other 80% many companies try to broaden and nuance their indicators, and to rapport them parallel with the finical data.

This calls for a new way to manage information, which no longer consist of numbers with the same unity but is a mixture of qualitative and quantitative data.

- *Stakeholders demands for information*

The environment is a subject that engages more and more people and the companies need to inform many different pressure groups about their environmental activities. The local community wants information about risks and action programs concerning them. Consumers and consumer associations want products to be green labeled. Customers certificated according to an environmental management-standard are sending extensive questionnaires as basis for choice of suppliers. The list could be done longer. Of great importance is that if you want continuous confidence it is essential that the information: reaches the receiver, that it is adjusted to the receiver and that it is correct.

### **3.5 Image**

- *Corporate Social Responsibility*

Corporate social responsibility refers to how companies act towards their workforce and their families, local communities as well as society at large. It entails the establishment of sound ethics and core values in a company's relationship with its stakeholders. Issues to be dealt with include human rights, employee rights, supplier relations and community involvement. Corporate social responsibility is increasingly seen as a source of business opportunities. The identification of new markets, improving reputation and maintaining public support are examples for that. [W3]

- *Branding*

A quotation from Fortune Magazine says it all: "*A great brand relates to a strong financial position as the chicken to the egg: you can't tell what gives what but it's difficult to have one without the other*". The same Magazine has environment- and social responsibility as one out of eight criteria at the ranking of "Americas most admired companies" [18].

- *Ability to attract talent*

A good environmental reputation is a way to attract resources, both capital and talent [15]. With the harder competition about qualified manpower the soft values becomes more important as selection-factor in the choice of employer. The signification of environmental engagement in this context is shown in the fact that following the authorities the own personnel is the strongest pressure group when it comes to environmental issues [6].

### **3.6 Legislation**

- *Regulatory demands*

A political framework through laws and legal fees, but also subventions and tax deductions controls society's demands in companies' environmental issues. As expected, this is one of the strongest forces concerning environmental issues. The laws controlling the companies' activities have an increasing level of ecological aspects [24].

As the technical development is moving forward with more and more sophisticated measurement methods and better knowledge in different material's noxious effects an increasing number of material is restricted by the legalization. Many companies believe that they by being ahead, easier can adjust to new regulations and will not have to pay expensive rework, both in products and processes.

One of the current debates concerns the issue of emission trading. The fundamental idea is that each country should be given maximum quota of, first of all, greenhouse-gases and that those quotas could be sold to the highest bidder. There are many aspects, both moral and economical, of an arrangement like this, that I will not comment. But to be able to carry through this or similar projects it will take a much more detailed account of emissions than what is done today. If this is going to be realized a number of new regulations is to be expected.

- *Polluter pays principle*

Polluter Pays principle (PPP) is an important motive behind a statutory producers responsibility. According to this principle should the price of a product reflect all product-related expenses, also expenses connected to the final disposal of the product. The legalization elucidates the limits of the public engagement at the same time as it gives the producers the option to decide the more detailed forms of responsibility.

The recycling delegation's definition of the producer's responsibility is: *"the producer takes responsibility for that the by him manufactured or supplied product is as re-cycling-adjusted as possible. This means that the product causes minimum effect on the environment and claim as little resources as possible in the production and the preceding supply-chain, during use and disposal. By producers responsibility means also that a retailer take responsibility for that products with built-in environmental hazardous characteristics causes least possible damage on the environment."* [16]

Producers have a physical and economic responsibility for worn-out products. The physical responsibility means taking care of collecting, removing and the final disposal. By economic responsibility intends the fact that the producer should pay for responsible taking care of the material, whether the producer himself organizes the collection or if a contractor does the collection.

The recycling delegation suggests in a report that producers' responsibility should be extended to include all products [W4].

### **3.7 Environmental standards**

The development of the international environmental standards as EMAS and ISO 14000, brings a number of effects on the environmental issues. It is above all customers' demands that are the driving force behind certification as suppliers' classification is important components in both standards.

EMAS, and in some extent also ISO, lay stress on environmental reports, public announcements of environmental status and improvement-programs.

Another important effect from the standardization-program is the structure and conformity it offers. The companies get a common ground to stand on and homogeneous data-format and data-quality.

### **3.8 Improved IT-support**

- *Automated collection and processing of data*

The importance of the new information-technology for such a data-intense area as environmental issues is obvious. To be able to automatically collect data and aggregate by wanted field of application gives a flexibility that not many thought would be possible just decades ago. But with new prospects comes new demands, there are many stakeholders that wish to receive parts of the information, as mentioned above.

### **3.9 Restraining factors**

- *Short-term shareholders demand for profitability*

Investors can today, during a few hours buy and sell shares in companies that can bring fast return. An expensive and long-term investment can scare off those and hereby cause turbulence in the company. How a serious risk this is can be difficult to estimate as institutional administrators as pension- and mutual- funds often have large capital and encourage a long-term responsibility.

- *Conflicting expert-verdicts*

There are many opinions when it comes to the major environmental issues. The debate has been going on for a long time and still it is difficult to, with scientific certainty establish what environmental effects the human activity causes and which of them that can be explained by natural fluctuations.

- *Intangible political debate*

The political debate has been even more changing than the scientific debate, which aggravates the possibility of predict future legal alterations and action-priorities. Instead of making an extensive investment that soon could prove to affect the wrong areas or not give enough effect, a common reaction is to wait until the change is a fact.

- *Non-established methods to economical assessment of environmental investments*

The lack of standardized methods to lead an economic environmental accountancy and to make investment-calculations has limited the usefulness of the environmental management-system and aggravated internal communication of issues, which has given the issue lower priority in many companies.

- *Customers are not ready to pay for environmental adjusted products*

Studies show that top-managers don't think that their customers are willing to pay 10-20 % more for environmental friendly products [6]. This excludes an environmental approach built on higher price.

## 4 From a business-economic perspective

*The connection between economy and ecology is important. A growing number see this as a win-win situation where ecological and economical development is not in opposition, and the risk lays in not taking advantage of this synergy.*

Business theory has by definition the effective use of scanty resources as basis [6]. Therefore it shouldn't be surprising that a positive financial result is achieved, as focusing on use of raw material, energy, and waste control activities [4]. Much more difficult is it when trying to assess other environmental actions or the lack of action.

One thing is certain; the environmental problems in the industry have a huge turnover. This has often been regarded as forced costs beyond management control, but this view is rapidly changing.

To refrain following up these expenditures in a systematical manner and thereby being prepared to legal fees that previous actions may cause, disclose sub optimization and make fact-based investment calculation, involves a great risk.

So far the economical aspect, studies in the US shows that 30% of all environmental project are interrupted due to lacking economical connection [18]. This stresses that all parties involved are served by a more extended interaction between the disciplines.

### 4.1 Environmental-related costs

Uncovering and recognizing environmental-related costs is important for good management decisions in many different areas, for example, product design, purchasing, product pricing and performance evaluations [4], [2].

When the environmental related costs are specified they often shows to be 4-5 times higher then the first estimation indicated [18], the figures comes from American industry but should be relevant for the entire Western World.

#### 4.1.1 An example

As environmental related costs can occur far from its primer cause and the issue is restricted by rigid regulations, general investment calculations are insufficient.

If a facility replaced trichloroethylene with soapy water as a degreaser, it would be able to show only part of the return on this investment (i.e. Lower raw material cost and lower hazardous waste disposal cost). The reduced training, personal equipment, and record-keeping costs would not be captured as part of the return. Incomplete measures can lead managers to make poor decisions [5].

### 4.2 Classification of environmental-related costs

There are many ways to classify environmental-related costs. One, known as full-cost accounting derive in four categories:

- **Direct costs** (capital expenditure, waste disposal, maintenance, etc.)
- **Indirect costs** (administrative costs, training, monitoring, etc.)
- **Potential liabilities** (contingent liabilities, potential fees, fines, taxes, etc.)
- **Less tangible costs** (image, moral, absent workers, etc.)

Yet another, primary developed to follow-up quality related costs, distinguish three types of cost:

- **Failure:** the cost of putting right or otherwise dealing with defects, arising through either internal failure or external failure (i.e. those defects that occur in use by customers)
- **Monitoring:** inspections and other costs to ensure that defects are eliminated or detected
- **Prevention:** costs of avoiding defects

Which method that is suitable depends, among others, on the purpose of the information generated and the compatibility with existing routines.

### **4.3 Eco-Efficiency**

Eco-efficiency is the efficiency with which environmental resources are used to satisfy human needs. Reducing material and energy input and cutting back emissions per economic value is widely recognized as an important strategy to meet the environmental challenges ahead. It is also seen as an opportunity to reduce economic costs and thus improve corporate profitability. Consequently, an increasing number of firms is integrating eco-efficiency measures into their innovatory activities. [W3]

### **4.4 Pricing**

Without knowing the real costs associated with a product or process a correct pricing is difficult. History shows that companies further on can be held responsible for its former environmental damaging activities, activities they no longer profit from, this results in a cost allocation dilemma. Three different approaches can be identified:

- Current costs for past sins
- Current costs for current sins
- Future cost for current sins

**Current costs for past sins.** Heavy expenses for cleaning up former activities are harassing many companies, depending on new regulations. How these costs should be allocated without deceptive influence on performance results regarding a certain product or facility is not obvious. One party is claiming that they should be treated as overheads and yet another is of the opinion that today's products gain from the preceding development and should therefore bear the costs.

**Current costs for current sins.** Including current operating costs that relate to current production in product cost is not controversial, the problem is how to do it. Unless environmental costs are adequately tracked and estimated some products will be overcosted and others undercosted.

**Future costs for current sins.** The question is the same as in case one, the difference is that today there are methods for better estimation available. This information is a valuable management tool for which products that bring long-term value and which don't.

Improved costing systems must be installed to facilitate a proper allocation of environmental-related costs.

#### 4.4.1 Externalities

Externalities is a term used for side effects of an economic activity, when the side effect (which can be negative and/or positive) is not reflected in the price of the goods or services produced by the economic activity. Environmental pollution is an example of a negative externality. Because the prices paid by consumers do not include these external costs, they give incorrect market signals encouraging demand and hence supply (i.e. production) beyond the level of economic efficiency for the economy as a whole. The consequence of this "market failure" is that activities that may be of substantial private benefit but costly to society, e.g. car driving, is encouraged. The effort to bring these external costs into prices (i.e. *internalizing* the externalities) or in other words making private costs better reflect the social costs, is called *Full Cost Accounting* (FCA). One way of applying FCA is by taxing. Environmental taxes also offer means of implementing the so-called *Polluter Pays Principle*. The tax raises prices to the consumer, providing an incentive to use less of the taxed product or service. But to make the tax reflect the monetary value of externalities is difficult, since there are little or no agreed data on their actual economic costs.

#### 4.5 Evaluation of non-financial factors

*"Financial accounting, balance sheets profit and loss statements, allocating of costs, etc, are an x-ray of the enterprise's skeleton. But much as the diseases we most commonly die from –heart disease, cancer, Parkinson's- do not show up in a skeletal x-ray, a loss of market standing or a failure to innovate do not register in the accountant's figures until the damage is done."* [1]

The budgeting, investment and performance appraisal systems have remained largely untouched by the changing environmental agenda. Until they do develop in this way, organizations will face conflicts between environmental and conventional financial factors. [9]

As a sign of this can Dow Jones Sustainability Index be seen. It is a stock index aimed to provide a benchmark for financial products based on the concept of corporate sustainability [W1]. This business approach creates long-term shareholder value by embracing opportunities and managing risks deriving from economic, environmental and social developments. Sustainability leaders can be identified and ranked for investment purposes according to their management of sustainability opportunities and risks. The ranking is founded on the performance within three areas, important to a long-term competitiveness.

*Innovation:* Investing in product and service innovation that focus on technologies and systems that use financial, natural and social resources in an efficient, effective and economic manner over the long-term.

*Governance:* Setting the highest standards of corporate governance, including management quality and responsibility, organizational capability and corporate culture.

*Shareholders:* Meeting shareholders' demands for sound financial returns, long-term economic growth, long term productivity increases, sharpened global competitiveness and contributions to intellectual capital.

*Leadership:* Leading the industry toward sustainability by setting standards for best practice and maintaining superior performance.

*Society*: Encouraging long lasting social well being in communities where they operate, interacting with different stakeholders (e.g. clients, suppliers, employees, government, local communities and NGOs) and responding to their specific and evolving needs thereby securing a long term "license to operate", superior customer and employee loyalty and ultimately superiors financial returns. [W1]

Corporate sustainability is a wide concept that integrates economic, environmental and social criteria into strategy and management.

To evaluate, on equal conditions, financial figures with environmental ones are today rather controversial and may suggest that the solution not necessary means to monetarize the environmental accountancy but to allow qualitative indicators compare with financials. Experimentation in this direction has begun in connection with the advance of the concept balanced scorecard (Ref. 6.4.4.) [2]

#### **4.6 Are environmental activities profitable?**

*"We have identified clear sustainable-development premiums that go beyond returns on standard business management"*.

The statement comes from a study performed by the management-consulting firm, Arthur D Little that during 10years worked with these issues, and proves in many examples that environmental responsibility pay-off both in short-, medium, and long-term.

Oil companies in the petroleum subset of an investment rating, which factors in historical liability risk, operating factors, eco-efficiency and sustainability risk factors, risk management capacity, and strategic profit opportunities, outperformed other oil companies by more than 17 percent in 1998. Other industry sectors have comparable stories.

The five-year backcasted performance of the recently launched Dow Jones Sustainability Group Index was an average 36.1 percent better than that of the Dow Jones Global Index [15].

Other economical effects of a good environmental record are the possibility to get a better lending rate and lower insurance premium, the reason is the assumed connection between a good environmental management and a qualitative over-all management [4].

The exact results are depending on the calculation methods used, and the lack of a common standard makes comparison difficult. The major problem is to assess soft values and intangible costs depending on future regulations. This causes a great deal of uncertainty in the calculations. To be able to make these assessments, there need to be a cross-functional teamwork between the accounting- and the environmental-department and also a technical system that allows integration of different disciplines and managing of both qualitative and quantitative information.



## 5 Elements of an integrated environmental strategy

*These driving forces show that a new way of thinking and doing business will be necessary. Here is a model, consisting of four pieces that have to fit together in order to fully integrate the environmental responsibility into the organization.*

There are, as previous chapters have shown, consequently a number of reasons to reevaluate the attitude toward environmental issues in order to, in the best way possibly, meet the demands from a changed world.

The company should first of all go through and elucidate the values, and frame of references that exists and then change these, if they do not match the direction of the company. The company's philosophy is the basis of how the co-workers act and the intent is to create the right culture, a kind of personal leadership where everyone takes own responsibility.

But a strong company-culture is not enough; it has to be institutionalized into the organization-structure [2]. There has to be systems that unite disciplines and follow-up-routines to encourage constant improvements.

This is not impossible. The Japanese quality-concept has similar fundamental ideas, new accountability management suggests it and progressing companies are "living their brand", with a strong company-culture and vision as a base for all activities.

To make it easier to discuss the elements that found the basis of a successful implementation of a proactive environmental policy, I have borrowed and partly modified a model developed by Epstein and Brichard [1], originally to describe accountability for corporate advantage.

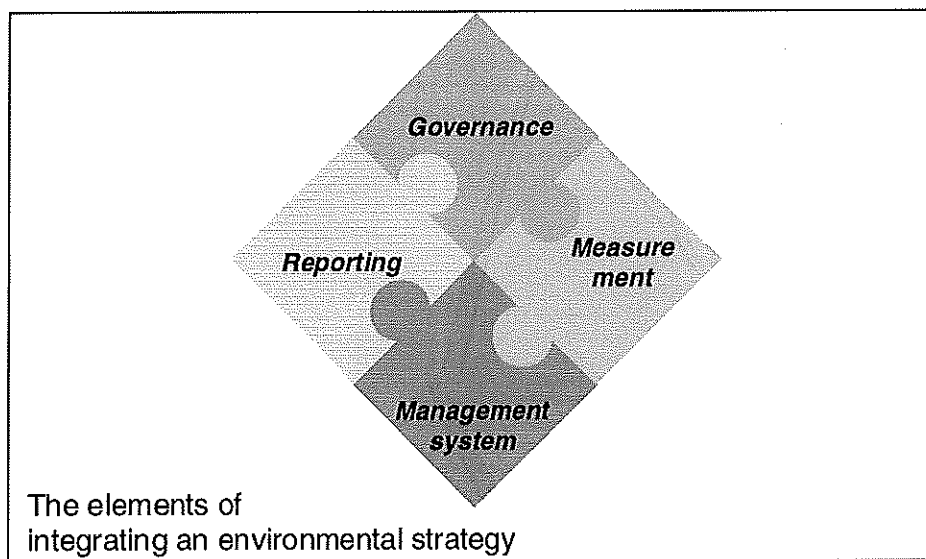


Figure 3 The elements of integrating Environmental Strategy (after Epstein et al, 2000)

The four corner-stones in this process is; an active governance that sets the tone at the top, a balanced financial and non-financial systems of measurements, to follow up the process; integrated planning, budgeting and feedback systems, that implement the strategy bottom up; and a two-way communication channel with stakeholders, for a mutual collaboration. Together, the entirety becomes more than the total of the detailed parts.

## 5.1 Governance

It is the top management that is responsible for a winning strategy and its implementation. It is the top executives who must set a new cultural tone; stressing fair appraisals, open disclosure, and continuous learning. They must dedicate the people and money to build the information systems that support qualitative measurement and reliable reporting.

### 5.1.1 Strategic leadership

In today's uncertain and rapidly changing environment, characterized by rapid communication and an abundance of information, the strategic leader is faced with a daunting challenge. He must ensure that the organization consistently, efficiently and effectively accomplishes the vital tasks and functions that encompass its mission while simultaneously promoting innovation and embracing change. He must accomplish this within a system too large and complex for him to regularly observe and influence the majority of the personnel and operational processes, and where information reaching him is "filtered" as it passes through various levels of management. This environment requires a different approach to evaluation and control. Successful leaders today have a vision of where they are leading their organization and energize their workforce towards achieving it. They are able to foster a joint sense of commitment to the organization and its mission. We use the term strategic leadership to describe this type of approach.

The primary function of the leader is to gather and disseminate relevant information among groups within the organization. Another key function of leaders is to create internal organization and coordination. [16]

A comparison can be made between the structures of a smart organization with that of a cell membrane, where information, ideas, and insights flow readily from one part of the organism to another. Two important concepts to implement a radical change is *flexibility*, the ability to meet new challenges with new ways of thinking, and *permeability*, the ability to enable the flow and sharing of information, experience, and values [W5].

To transform an organization, the strategic leader must fundamentally change the way in which the people of the organization function, behave and communicate. This is an important aspect of leadership [W5]. All of the people and various functions must communicate, interrelate, and interact effectively not only amongst themselves in the internal environment, but also in response to the challenges and pressures for change originating from the external environment in order for the organization to succeed. Organizational learning is the ability of an organization to gain insight and understanding from experience. For real learning to occur, managers must *unlearn* old ways of thinking about structure and internal coordination to perform needed processes within the organization. [W5]

Accomplishing today's mission, while leading towards tomorrow's vision, is the essence of strategic leadership in an environmental proactive organization.

### 5.1.2 Policy

The environmental policy should define how the companies relate to its surroundings in environmental issues, commitment to environmental improvements and form a

basis for setting corporate objectives. It should be clearly defined and easy to communicate both inside and outside the company. The policy is an understandable summary of the company's visions and as it should be well established throughout the organization it forms a frame for actions. Before each decision the question is (implicitly) asked: "is this aligned with our policy?" In that way the company's actions becomes clear and consequent.

The policy shall be supported at the top management level to point out that environmental responsibility is an important aspect of doing business [19].

As stated in ISO 14001: "The environmental policy is the driver for implementing and improving the organization's environmental management system so that it can maintain and potentially improve its environmental performance..."[14].

## **5.2 Measurement**

*"What gets measured gets done"*. To power the performance of the organization, there need to be a balanced set of indicators, financial and non-financial. Those companies that wish to broaden and modulate their set of measures will encounter both operational and managerial difficulties. They need to find a way to integrate the new measures with the old systems for accounting, management control, and financial reporting.

Many of these ideas are derived from quality management where a range of performance indicators measures both strategic and operative activities.

### **5.2.1 Environmental Performance Indicators**

Environmental Performance Indicators (EPI) are becoming increasingly important at the company level. This is in part due to stakeholders demanding environmental improvements and proof that these have been made. EPIs can facilitate the environmental management through:

- the adoption of the most appropriate measures of environmental protection in terms of effectiveness and efficiency;
- the empowerment of environmental policy by a better definition and monitoring of environmental objectives;
- an effective definition of responsibilities and an aid for the implementation of the environmental management systems; and
- the improvement of external and internal communication on environmental achievements and programs.

One definition of an indicator is *"A number, absolute or relative, that facilitates management, communication and follow-up of an organizations performance"*[9].

ISO/DIS 14031 states: "*Indicators for Environmental Performance Evaluation (EPE) are selected by organizations as a mean of presenting quantitative or qualitative data or information in a more understandable and useful form. They help to convert relevant data into concise information about management's efforts to influence the organization's environmental performance, the environmental performance of the organization's operations, or the condition of the environment. An organization should select a sufficient number of relevant and understandable indicators to assess its environmental performance.*" [9]

In the financial field, performance indicators (ratios) are well established. They have been used in financial markets to describe for example the value of stocks in relationship to price in various ways. Today, performance indicators are used to describe productivity, quality and other important factors for an enterprise. In the same way, performance indicators could be, and in some cases have already been, developed for various objectives that may be relevant to the environmental management of a company.

An indicator doesn't need to be specific for environmental evaluation, e.g. the quality parameter yield (efficiency in an operation, 1-defect products/ total products) could be seen as a measure of resource efficiency, and thereby be an important environmental parameter.

There is currently no consistent, established way of measuring environmental performance and improvements achieved. There is no consistent basis for choosing indicators; the number of indicators; or measuring techniques and definition of standards.

EPIs can be:

- Absolute - basic data e.g. total CO<sub>2</sub> emitted in this year
- Relative - quota of parameters e.g. energy consumption per unit of output
- Compound - combining data from absolute and relative categories, e.g. total CO<sub>2</sub> emitted per unit of production in this year
- Group - data for related factors, e.g. waste: total solid, hazardous waste, waste incinerated, waste recycled etc
- Indices - constructed to produce a number by using a baseline year, factoring equivalents on a scientific basis or through the use of factors and weighting to produce a number



*Comparability* is the central issue. There are several levels of comparability:

- Comparability with an earlier time period
- Comparability with other sites in the same company
- Comparability with other companies in the same line of business
- Comparability with all other companies.

Any system of comparisons will also have winners and losers, which mean that the losers can be expected to put up a fight against any system that is suggested. They will always have ammunition for that battle, since an indicator never can be an accurate reflection or reality. The problems with indicators are thus forbidding. In that context it is helpful to lower ambitions so that the goal of an indicator is to be useful, not to be absolutely correct. This would seem to imply that they need not be long lived. An indicator could be very useful for a limited time period.

Two principles for developing performance indicators are especially interesting and concern the way indicators describe performance [9]. They are the on-the-board principle and the cluster principle.

*On the board principle:* Approximate and useful is better than exact and impracticable. *Cluster principle:* Several indicators that approximately describe a phenomenon can, if the indicators are independent, together give a more exact picture than a single one.

Environmental performance measurement is not an objective process but a communication tool.

### **5.3 Integrated Management System**

Integration of environmental matters with the overall management systems can contribute to the effective implementation of the environmental management system, as well as to efficiency and to clarity of roles. [14]

What here desired is a system that converts strategic planning into frontline action, some sort of organizational nervous system that ensures that signals given at the head of the company, flow to each extremity and back again.

#### **5.3.1 Planning and Control**

The task of management is mainly about planning activities and controlling the results. The word control might seem frightening to many, but without some kind of follow-up and evaluation is there no guarantee that the company stays on track. However, the control doesn't necessary have to contain rigorous supervising-systems, which other than undermines the motivation and creates a scapegoat mentality, also are inefficient and resource demanding.

A parallel to quality management shows two different ways of attaching the problem; either you have frequently tests and inspections to sort out defect products or you delegate responsibility and authority while supporting with relevant training in order to prevent defects instead of having to deal with them. Naturally, the zero-defects approach is no 100%-guarantee to avoid defects and it will be necessary to partly continue the quality controls. However, the most important thing, when a deficiency occurs is not to ask whose fault it is but how to avoid it henceforth. This way a

management system is created that to great extent is self-controlling and in addition generate valuable feedback.

To support this management activity there need to be an information system to keep record of the results and the targets to facilitate a follow-up and gain improvement.

### 5.3.2 Environmental Performance Evaluation

To be able to estimate if there is a continuous improvement of the environmental management system and the environmental performance, managers can use an Environmental Performance Evaluation (EPE).

Environmental Performance Evaluation (EPE) is defined by ISO/DIS 14031 as a *"process to facilitate management decisions regarding an organization's environmental performance by selecting indicators, collecting and analyzing data, assessing information against environmental performance criteria, reporting and communicating, and periodic review and improvement of this"*.

For companies that want to improve their environmental performance, the development of incentives is important. Performance evaluation of all employees, teams, facilities, and business units must include an environmental component. If the reward system is based strictly on short-term financial indicators it is hard to achieve real environmental improvements.

Another important part of the management system is to handle feedback and take advantage of the knowledge captured. I discuss knowledge management in chapter 6 (Ref. 6.5.2.).

### 5.3.3 Information management

Without the rich inventory of data that computers can collect, process and disseminate, this fact-based management system would not be possible at all. One of the reasons that management planning and control systems have long focused solely on financials is that they just couldn't handle anything more. These information systems creating a digital nervous system that facilitate for managers to expand measurement and control to many more categories of performance. They can increase real-time monitoring of business initiatives and strategy. In fact we are only beginning to see the innovations possible with the new capabilities available.

There are at the market a number of complete information systems concerning strategic information, monitoring, assessment and feedback online. Such a system can essentially shorten the lag time between field experiences and management action and in that way create a base for capturing and sharing knowledge.

But the new technology also put pressure on companies; data-hungry outsiders such as financial analysts and interest groups want more and more facts, preferably in disaggregated form for their own analyses. In the same way as customers today can check in the companies data-bases to see how their orders are advancing Epstein et.al [1] predict that analysts in the future will be able to obtain the updated data and analyze it. To make this possible and to keep down the expenses, the companies have to deal with problems such as inconsistency in the systems and try to standardize accounting system and information problems worldwide.

Easy-to-use computer systems, network and applications creates a base for an efficient infrastructure that support the management system and helps the company to broadly disseminate the information needed for decision making, empower people to independently act in accordance with overall objectives and use experience to make improvements, which will lead to a workforce aligned with and committed to the strategy and a strategy executed with speed and precision.

#### 5.3.4 Problems with lacking integration

Environmental management is still considered a distinct function in many organizations. The staff members are often isolated from the critical decision-makers, with little opportunity to share and apply their specialized knowledge and expertise across the organization [5]. Only by understanding and managing environmental issues across the organization, as a normal everyday part of doing business, will companies ensure environmental excellence [5].

### 5.4 Reporting

Looking at information from a marketing perspective, the information is like any other product and the receiver is a customer, then the same market sense, product innovation, standardization, and just-in-time delivery has to be obtained as for other products. The information has to satisfy the needs of the user of the information, not the producer.

The development of new corporate communication strategies is increasingly based on increased transparency [1].

#### 5.4.1 Internal Reporting

Environmental data should be communicated across functional and business lines in ways that highlight possible opportunities for business process improvement [5].

To make fact-based decisions, many kinds of information are needed. From an environmental perspective it implies that a lot of data, both physical and abstract, qualitative and quantitative, internal and external, factual and estimated, must be collected, aggregated, synthesized and distributed.

To be useful, the information must be adjusted to the purpose and to the receiver. Generally could be said that the higher in the organization the receiver is, the more abstract information is needed for long-term strategic planning, while the operational levels needs concrete information for day-to-day tactics [21].

It is important to maximize the flow of information throughout and between the various boundaries of the substructures within the overall organization [W5].

As mentioned, the internal communication is a key factor in the implementation and integration of the environmental management system in the overall management system. I leave this issue with reference to a parallel master thesis that addresses this topic (Ref. 1.4). Some of the questions that are discussed in this report are [21]:

1. What are the needs for information?
2. What type of information/data is distributed?
3. What is the origin of the information and what kind of source produces it?



4. What is the destination of the information and how far away from the source is it?
5. What paths of distribution does the information follow on its way to the destination?
6. To what degree is the information processed and what is its retention time in the system before reaching its destination?
7. Who bears the responsibility for analyzing, assessing and distributing information?

#### 5.4.2 External Reporting

The traditional attitude to consider all information as company secrets has begun to meet resistance. Many managers are of the opinion that they get an advantage through an open disclosure [1].

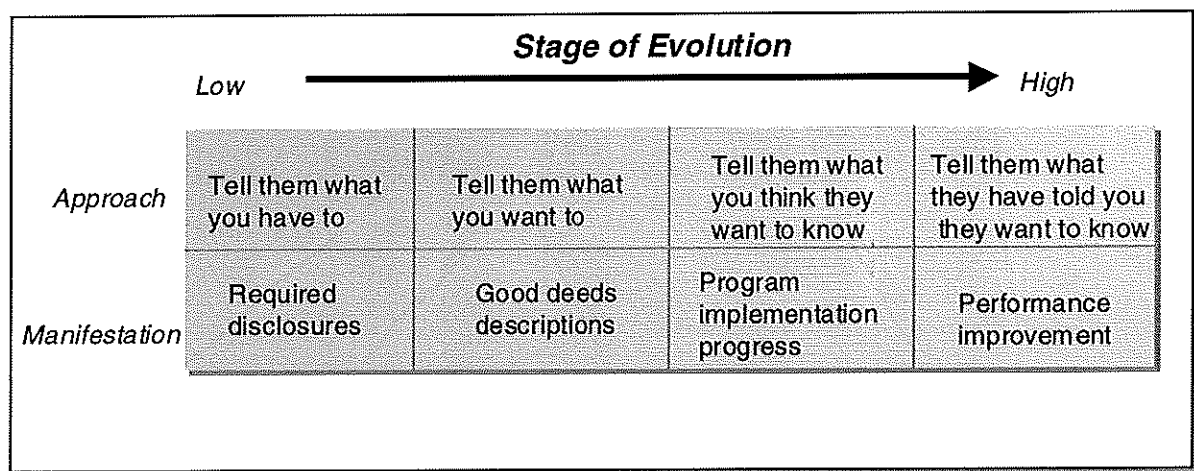


Figure 4 The evolution of reporting (from Prism, Artur D Little, 1996, [5] )

##### 5.4.2.1 Environmental Reports

*"Corporate environment reports have quickly become the key channel for companies to communicate their environmental performance and, just as important, have become an effective tool to demonstrate company-wide integrated environmental management systems, corporate responsibility and the implementation of industry voluntary codes of conduct" (UNEP, 1994).*

The action plan for sustainable development *Agenda 21*, which was adopted at the United Nations Conference on Environment and Development in Rio de Janeiro in June 1992, demands that: *"The business community, including transnational corporations, should recognize that environmental management is one of the highest priorities and a decisive factor in sustainable development"*. It encourages business and industry to communicate their environmental performance and to report *"annually on their environmental records, as well as on their use of energy and natural resources"* and *"on the implementation of codes of conduct promoting best environmental practice"*.

Corporate environmental reporting has known an almost explosive growth over the past years, as various stakeholders have begun to take a greater interest in the environmental performance of the companies.

Environmental reports are now well known as an important instrument in company environmental management and are widely used, especially by large companies in the industrial sector in Europe and North America. In the short period since the first report appeared the progress has been astonishing. However, only a relatively small number of large companies produce corporate environmental reports (CERs), but the quality of disclosure in the reports that are produced has improved considerably.

There has also been speculation on the advent of new laws and regulations that will force companies to report. Environmental reporting is also a key requirement for industrial sites wishing to be registered under the voluntary EU Eco-Management and Auditing Scheme (EMAS). By reporting voluntarily a company can build up expertise in advance of the expected regulation. Also, there are internal benefits of environmental reporting, since the reporting process helps the company to pinpoint problems and inefficiencies of its operations.

However, it is important to remember that the corporate environmental report is only one of many tools that can be used for communicating with the stakeholders. All companies must start by identifying the key stakeholders and their needs and formulate an environmental communication strategy based on this. Within this environmental communication strategy the format of environmental reporting should be determined.

#### *5.4.2.2 An example*

An example that shows an interesting development of public communication comes from the American health-care industry and could illustrate a possible development of environmental communication between the companies and their stakeholders [1].

Chief executive at one of the largest managed-care companies in USA, United HealthCare, gave 1993 his managers instructions to publicize the quality report card. United uncloaked vital data on customer satisfaction, quality of care, administrative efficiency and cost reduction. Many competitors followed. This new approach was outstanding when first appeared, but is to many health-care companies today status quo. This extensive disclosure is considered so important to the companies that U.S Healthcare, another large managed-care company, 1996 bought a full two-page spread in Wall Street Journal to show their performance compared to the branch average.

Even if those initiatives were voluntary, one of the driving forces were the political debate considering a new disclosure regulation at the time. Through being active at an early stage the company could influence the regulation to their advantage.

The report cards marked the first step of the evolution. They required companies to develop wholly new systems and measures internally to drive improvement. They required new strategies and methods for reporting externally. They demanded new means to handle the tide of data that external feedback provided.

The second step in the evolution was standardization. A non-profit managed-care accreditation organization, National Committee for Quality Assurance (NCQA) produced the Health Plan Employer Data and Information Set (HEDIS) today, nearly every managed-care company follows the HEDIS standard.

The third step in the evolution was when the NCQA standards were broadly accepted. Then NCQA announced that it would begin to require compliance with the standards. Starting in July 1999, any managed-care organization that wants accreditation by NCQA must supply audited data on key measures, at that time fifty-three measures.

## 6 Implementation of environmental strategy

*Preconditions of a successful implementation, a plan for realization and a short survey of methods and concepts that can systematize and facilitate the implementation and maintenance of the system*

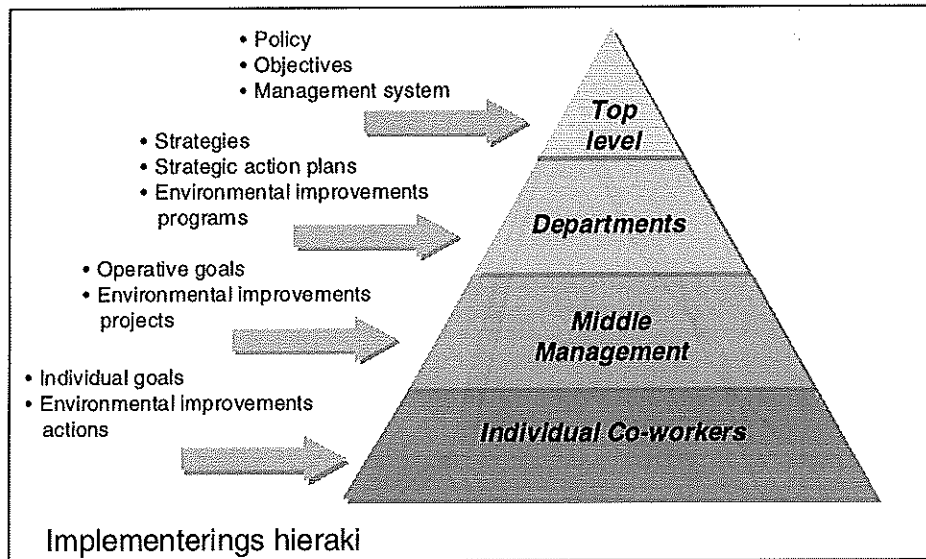


Figure 5. A visualisation of the implementation hieraki (after DGQ, 1995, [19] )

Figure 5 shows a general organization structure to illustrate where in the organization different activities should take place and be supported.

### 6.1 Preconditions of implementing environmental strategy

#### 6.1.1 Change management

Implementing change within a complex organization can take many approaches: enacting internal processes to improve competencies, reacting to external pressure which threatens the organization's fundamental purpose, or responding to opportunities that are recognized as being beneficial to the organization. The result of all these approaches is that there is always a successive and overlapping change going on [W5]. Acquiring sophistication in the various approaches to implementing change is an executive competency in developing as a flexible and continuous improving organization.

A strong and broad support of the vision behind the change is important, each and everyone has to know that they can contribute in a desirable direction [5].

To work through a radical change, and to success, it is necessary not only to rewrite the formal rules but also to change the unwritten rules that influence a lot of the company culture and can be an effective obstruction even to the best intentions [5]. An overhaul of the reward- and promotion-systems, to ensure that they are compatible with the prescribed policy and that the evaluation in the end not only bases on financial measures but also has an environmental aspect, can be the incentive necessary to succeed.

Here a lesson can be learned from successful quality management, where quality parameters have been built into performance evaluation systems and influence all parts of the company, from the bonuses of individual co-workers to the evaluation of company sites.

Develop the agenda top-down, design the changes bottom-up [5], this approach is involving the persons set to implement the changes which makes it easier to motivate them and will probably lead to better solutions, as the ones dealing daily with the problems have a better understanding of the situation. Studies show that the three most important factors to motivate the co-workers at a change are [19]: information about the project according to purpose and content, an active involvement in the process and training.

The integration of the environmental responsibility is a cross-functional issue and one problem can be teambuilding and information sharing across the disciplines. The “not-invented here” syndrome can cause that valuable information is not taken into consideration by decision-makers, just because of insufficient acceptance of others expertise.

### 6.1.2 Connection between organizational- and information-system

Information is essential for an organization, and to create a cross-functional organization there has to be a cross-functional information flow. Along with every organization-chart there could be drawn a parallel information-chart, but that is rarely done.

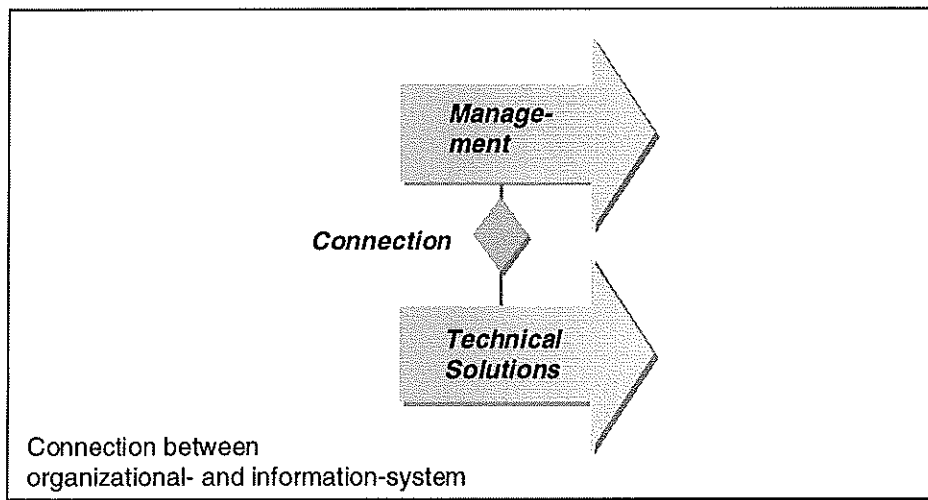


Figure 6 The connection between organizational and information systems

As mentioned, one of management’s most important tasks is to provide adequate and timely information, and with a lack of connection between the management system and the technical system that facilitates this information handling this task is unlikely to be well executed. When it comes to environmental management this information handling is complicated. As proposed in this report, environmental activities should embrace the whole organization and thereby environmental information is generated and used in all parts of the company.

This necessitates redesign or at least rethinking of the information system. Today, as observed in the pre-study, the information systems consist of separated components, aim for specific purposes, with little or no comparability. When developing new

systems the integration aspect need to be considers and the gaps between the existing components have to be reconciled. Interfaces are a difficult area both technically and organizationally but also the key in an integrated approach to an environmental responsible way of doing business.

Not only the technology needs to be compatible, the information too. To facilitate decision-making the information has to be comparable regardless of unit, for example when choosing between different design alternatives environmental impact has to be compared to cost or functionality. To assess the environmental impact a LCA could be made but guidelines how to compare this to other parameters are seldom specified. In this kind of decisions less tangible aspects are important, such as core-values, image, and company-culture. Unless a clear-cut decision base could be formed out of these fuzzy aspects the decision-maker has to be very well informed of the effects of the decision and in more crucial cases a sensitivity analysis could be undertaken.

## 6.2 Implementation plan for environmental strategy

This implementation plan does not follow the implementation plans for environmental management standards, i.e. EMAS or ISO 14000, in order to be generic.

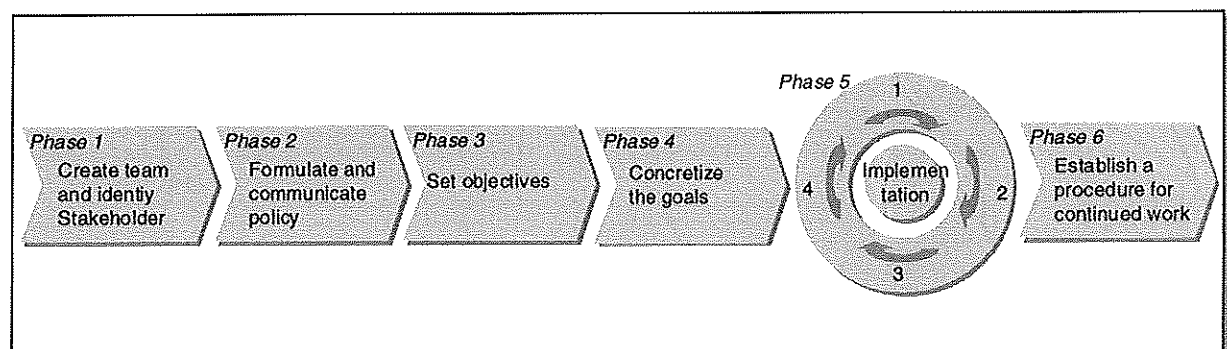


Figure 7 A generic implementation plan

Phase 1: Create team and identify stakeholders

- *Create team*

The first step is to create a cross-functional team that will have the responsibility for the project. In the team, members from all departments should take part. An advisory board with members from the top management is in charge of the work.

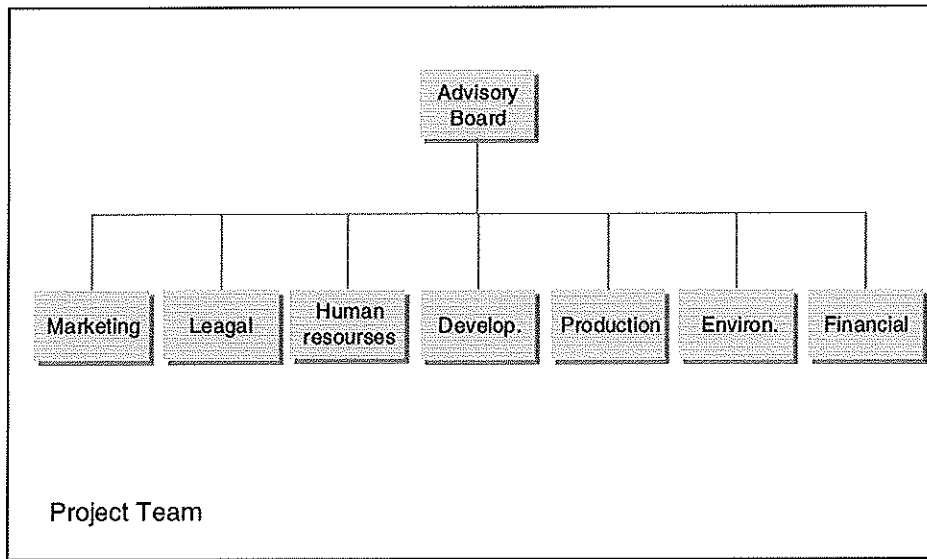


Figure 8 Functions represented in the project team

- *Find key stakeholders*

To meet stakeholders' demands is the overall purpose of a company. Environmental strategy, like any strategy, can succeed only if it meets the needs of the company's stakeholders' [5].

An analysis, i.e. brainstorming, in the team is undertaken to find the stakeholders of importance. The completeness of this analysis is guaranteed by the fact that the team has representation from all parts of the company.

- *Analyze the stakeholders' needs according to the environmental issues*

There are many different methods to systematically analyze what effect the company's activities, products and services have to different stakeholders' [2]. To get this information the already established channels can be used and new can be created, i.e. mobile opinion, internet surveys, employees surveys, customers' spoken and unspoken demands, dialog with local NGOs or even a strategic alliance to share knowledge.

A general disposition of the different stakeholders' demands for corporate environmental performance can be as follows:

<b>Stakeholder Group</b>	<b>Environmental needs</b>
Owners	No acceptable risks or liabilities
	Capitalize on competitive environmental opportunities
Customers	Product information
	Environmentally responsible products
Community	Safe and healthy environment
	Openness to risk concerns
Employees	Safe and healthy workplace
	Pride in company

Figure 9 Tabel of stakeholders and their needs (from Prism, Arthur D Little, 1996, [5])

- *Create an information base for the project*

To ensure that all knowledge captured and channels established are documented and maintained, an information base or system has to be created, reachable for everyone that needs the information, or at least for the team members who then can distribute the information within their departments. A well-defined site on the Intranet that regularly is updated with project information, responsibilities and project structure, and where the progress can be observed, is one alternative. Along with the project the information system has to be developed.

### 6.2.1 Phase 2: Formulate and communicate the policy

- *Formulate the corporate environmental policy.*

With this stakeholder perspective as a base, the corporate environmental policy is formulated, a formal established way to relate to the environmental issue in the sphere where the company is active. Here legislation and regulation that affect the company is taken into consideration. The policy has to be supported of the board of directors.

- *Communicate the policy to all stakeholders*

It is important to communicate the policy and establish it at all levels of the organization. Both ISO and EMAS standards point out the significance of this and provides that the environmental policy shall be familiar and binding for everyone. The communication can be verbal as well as written, on the black board, Intranet, and as an explicit point at personnel meetings.

The communication with the external stakeholders can be instituted through environmental information included in the annual report or public meetings in order to establish a dialog with the community and local NGOs.

A person answerable for public relations is given the responsibility for public environmental information. More detailed information can be received from each team members within their range of competence, or forwarded trough the team to the right specialist. These responsibilities are defined and documented in the project description, i.e. project site on the Intranet.

The definition and communication of the policy is only the beginning. If the company can't show that real improvements are done, it is nothing but empty words. Throughout the process it is important with a frank and open dialog. Confidence is not created through presenting impressing figures but through showing what actions have been taken and what the results are, and if the results are not good enough, why and how will it be corrected.

### 6.2.2 Phase 3: Set objectives according to the policy

A key factor in successfully leading a large, complex organization is the development of a strategic plan – a road map that will transform the company's policy into environmental performance improvements. [W5]

The strategic plan describes “*how a company will adapt to and take advantage of opportunities in a constantly changing environment, thereby maintaining a strategic fit between the organization’s goals and capabilities and its changing market opportunities*” [27]. Two main activities can be identified, an internal and external corporate assessment and the setting of objectives.

- *Make a internal and external organization assessment with focus on improvement potential*

This focuses on one of the key steps in the process, assessment of the organization. An assessment should answer the question: “Where Are We?” The team must assess the organization’s mission, its present status and its normal operating procedures. Identifying an organization’s cultures, climate, key values and past performance are critical assessment issues. An assessment of the internal and external environments facing the organization will be a major factor in determining its future direction. Assessment is an iterative process and cyclically revisited by the strategic team.

This assessment needs to be documented to make a follow-up on the results possible.

- *Set objectives*

At this point the long-term goals, the policy, and the present situation, the organization assessment, are identified. Now the short-term objectives need to be set, those will be areas for the improvement activities under approx. the following year.

The objectives can be reduced use of resources or amount of waste but also less tangible, as improved public relations or employee satisfaction. Also internal objectives should be set, e.g. integrating environmental information into business objectives.

The important thing is that the result can be followed-up, to evaluate the project and ensure that corrective steps are taken unless the project is on track.

### 6.2.3 Phase 4: Concretize the goals

Next phase translates the objectives into specific goals and target dates and defines responsibilities, accountabilities, and incentives for reaching goals.



<b>Setting goals</b>	
• <b>What?</b>	- What is the objective?
• <b>How?</b>	- What resources are available?
• <b>Where?</b>	- Where shall it be realized?
• <b>When?</b>	- When shall it be realized?
• <b>Who?</b>	- Who is responsible for reaching it?
• <b>Why?</b>	- What is the purpose?

Figure 10 Questions to consider at goal setting

- *Derive operational goals from the strategic objectives*

The strategic objectives don't cover how and when the alterations shall take place. A strategic objective can be; decrease emissions to air with 20% per year, without in detail say what emissions and through what actions it should be realized and that is why the goals has to be made detailed and concrete. In those areas that have shown the greatest potential the present situation is more closely analyzed and quantified goals are set.

- *Define success criteria to follow-up goals*

Which measures are necessary to check whether the goal is reached or not? Within what interval is the result regarded to be sufficient, where is the limit where corrective actions have to be undertaken, how can the process be supervised? There are many questions that need to be considered. It can be advisable to use both in-process and end-of-process measures, the former to get indications about the ongoing work and the latter to make a follow-up.

The success criteria can be e.g. improvement of quantitative measures, like decreasing waste amounts, or improvement of qualitative measures, like better customer information.

Understanding the potential benefits and pitfalls of measurement systems is an important step in developing the sound evaluation systems necessary to achieve effective control [W5].

- *Derive intermediate goals from the operational goals and define success criteria for these*

This iterative process to concretize the goals through the organization structure from top-level to individuals guarantee that each strategic goal has it's correspondence at operational level and that each goal can be followed-up according to well-defined success criteria.

This process and the results should be documented in the project database.

To facilitate improvement of the goal setting process the feedback should also be documented, which routines were good, were the initial goals unambiguous, and so on.

## 6.2.4 Phase 5: Implement actions

This procedure is following the TQM concept, P-D-C-A-cycle (Ref. 6.4.3)

### 1. Plan:

- *Measure and document baseline*

The basis for a follow-up is a well-documented starting-point, a baseline. In this the status of all aspects that are likely to change is documented and kept in the project-database for later evaluation of the improvements.

- *Prepare solution scheme and action plan*

Then solutions to realize the desired improvements are found and an action plan to implement them is prepared. An estimation of the resources necessary to the implementation, e.g. personnel, equipment and education, is made. If the implementation starts without adequate resources allocated, the process, if it can be completed at all, will be protracted and a strain on all parties involved.

The measures are already defined, left to decide is how to measure, considering technical solutions and routines. Documentation of the routines to maintain the data and the measure procedures, is necessary to secure the data quality.

- *Preconditions of the implementation of the action plan and the success factors are examined.*

One way to do this is to carry through a Helpers and Hinders analysis (Ref. 6.4.7) where organizational or technological preconditions as well as external factors can be considered. Above all should critical success factors be identified, and the likelihood for those to fail estimated. If appropriate an alternative plan may be worked out. An example can be a new measure system that uses untested technology, if it is identified as a critical success factor it could be a good idea to keep the old system stand-by until the new one is working correctly.

- *Communication within the company*

A careful communication of the solution schemes and the action plan will win support and minimize misunderstandings. Everyone involved has a chance to give his opinion and doesn't feel disregarded. Sub-optimization and adverse scheduling can be attended to at an early stage.

### 2. Do:

- *Allocate necessary resources and hold training*

According to the results from the key success factor analysis preconditions are created. One precondition of importance is sufficient knowledge to implement the actions but also to understand the whole concept. Therefore the training not only need to convey the expertise knowledge but also show the purpose with the project and thereby increase the motivation. New routines and methods need to be established in the whole organization. As Kaplan says of frontline workers armed with measures they understand: "you transform them into people who really deliver the strategy day to day"[1].

- *Implement actions*

The planned actions are implemented and measure systems are installed, if not already in use. Especially if the goals are of organizational character the implementation requires large personnel resources and can cause a loss of work capacity and disturb the daily routines. One way to minimize these effects is to test the new methods on a pilot group to ensure that the procedure is optimized when it is introduced in full-scale.

3. Check:

- *Observe the effects*

The indicators are observed. The automatically collected data, e.g. process data, is transferred to a database. Manually collected data, e.g. questionnaires, is well documented, not necessary in electronic form, but in a way that ensures quality and maintenance.

- *Analyze the data*

The data collected is analyzed, e.g. with statistic methods, and compared with baseline according to the established success criteria.

4. Act:

- *Study the results*

Evaluate the results from the check step. Even if the goals are formally reached it is not necessary that the results are sufficient, the goals were maybe too easy to reach and left-unutilized potential or the requirements or competitive situation has changed. If there is a need for corrective actions the P-D-C-A cycle is repeated.

- *Give feedback, Find best practices*

The feedback to the origin of the change is important. The operative group needs to evaluate their processes, but the feedback is also a part of the overall evaluation of the project. This experience, both negative and positive, is analyzed and documented to build a base for later projects.

- *Communicate the results*

Everyone that has contributed or been affected of the change needs to be informed about the outcome, but other parts of the organization and the external stakeholders that have an interest in the advances on the environmental frontier also need information to follow the progress of the project.

The channels established at the beginning of the project can be used. To get a firm structure of the communication it is important with frequent reports even when no revolutionary results have been achieved.

### 6.2.5 Phase 6: Establish procedures for continued work

- *Establish procedures*

The experience drawn from the implementation will be the basis for the procedures for continued work. The responsibility for following and updating those documented procedures is also assigned.

- *Secure continuous improvements*

Through feedback and analysis of the strength and weakness of the process a base for improvements is built. The TQEM concept (Ref. 6.4.3) can be helpful to secure that continual improvements are a part of the maintenance procedure (Ref. 6.5.1.)

- *Build a knowledge management system*

The building of an effective and systematic knowledge management system is a further step towards an information-based (Ref. 1.1) and learning organization (Ref.6.5.1) and an important part of the continual work.

### **6.3 Common pitfalls of the implementation process**

Here follows a few common pitfalls that can determine the implementation process and are worth considering [24]:

- Wrong hierarchical level

If the project doesn't have full support from the top management it will most likely fail. As pointed out, it is necessary to change old patterns and integrate disciplines that today are totally separated. This demands that the issues are given a high priority and sufficient resources, means that it needs top-level commitment.

- Lacking knowledge about the internal situation

Without a realistic apprehension of the initial position, the baseline that all results are compared to, all improvement actions will be based on false information.

- Lacking knowledge about the external situation

The natural and social systems that the company interacts with form the frames of the environmental responsibility. A proactive approach requires that external signals are perceived and correctly interpreted.

- Indistinct goal setting

As pointed out clear and documented objectives at highest level and their iterative derivation through the organization hierarchy are of vital importance for the realization of the environmental strategy.

- Conflict repression

When involved in a change process many people react defensive. This reaction must be provided through extensive information and training or else it can interfere with the adoption of new routines and cross-functional team building.

- Concentration on short-term solutions

If the pressure of short-term results is too high the long-term improvements get out of focus. This causes solutions that are not compatible with the over-all system and except from inefficient use of resources the loss of holistic

approach jeopardize the integration of the environmental responsibility, which is the aim of the project.

- Limitation to cold figures

To concentrate only on cold figures cases loss of valuable dimensions of the environmental issue. In a complex environment it takes a balanced set of measures to follow-up the work and keep the project on track.

## **6.4 Methods and Standards**

### **6.4.1 European Eco-Management and Audit Scheme (EMAS)**

#### *Environmental management standard within the European Community*

Having been open for participation since 1995, the European Eco-Management and Audit Scheme (EMAS) was the first internationally recognized environmental management system. By June 2000 over 3,400 European companies had been certified in line with EMAS. EMAS is a voluntary initiative that sets standardized guidelines for managing a company site's environmental impact and reporting on environmental achievements. It seeks to support continuous improvement by obliging participating company sites to define environmental policies and objectives, to systematically and regularly measure their environmental performance and to report the results to the public [W3].

### **6.4.2 ISO 14000**

#### *International standard for environmental management*

ISO 14000 is the most widely applied environmental management system. Launched in 1996 by the International Organization for Standardization (ISO), the number of ISO 14000 certificates has grown rapidly. By the end of 1999, more than 14,000 company sites had been certified according to this norm. Similar to the European Eco-Management and Audit Scheme, ISO 14000 sets standards with regard to environmental policy, environmental objectives, implementation, control and continuous improvement [W3].

ISO has been criticized for promoting the continual improvement of the management system, not of environmental performance, as required under EMAS [W7].

### **6.4.3 TQEM**

#### *Framework for environmental management with a pronounced customer/stakeholder focus*

Total Quality Environmental Management (TQEM) is based on the concept Total Quality Management (TQM) that were developed by Deming after world war 2 and focuses on continuous improvements to better meet customer demands. The Global Environmental Management Initiative (GEMI) it is an association with 27 companies working with environmental management and sustainable development. They have adopted the TQM approach and applied it to environmental management to get a systematic procedure to continuously improve the environmental performance [2].

The aim for TQEM is to create a company climate where continuous improvements are norm and a system that strives to fulfil the demands of present and future customers. Customers is here a term that includes all the stakeholders of the company.

The TQEM concept has borrowed many components from quality management that are generic as they focus on structuring the change process more than on the objective for the change.

The classic TQM Cycle works equally well with TQEM:

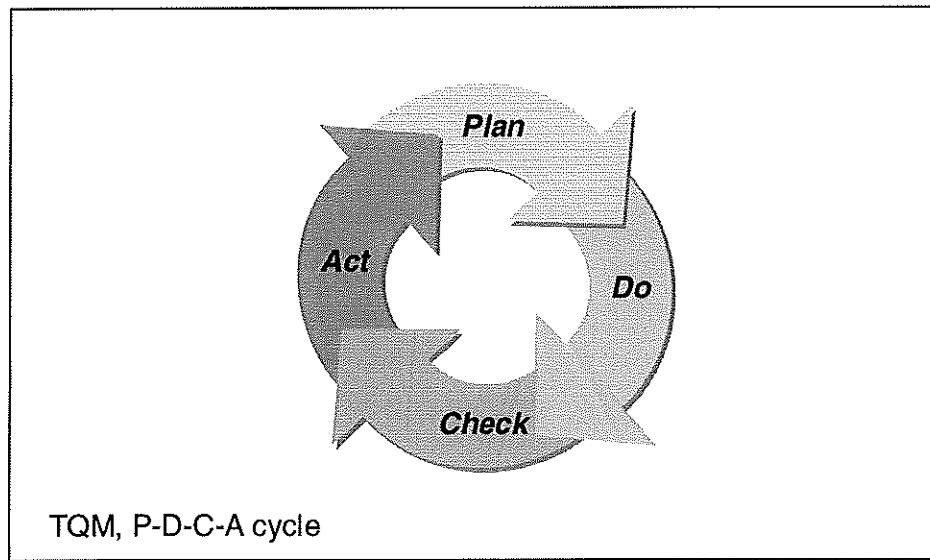


Figure 11 The TQM Plan-Do-Check-Act cycle

- **Plan.** Understand the gaps between present state and desired state, set priorities, and develop an action plan.
- **Do.** Implement the changes, and collect data on actual results.
- **Check.** Observe the effects, analyze the data, pinpoint problems.
- **Act.** Study the results, redesign systems, change standards, communicate broadly and retrain. And repeat the cycle continually.

According to GEMI's TQEM Primer, there are four basic elements of TQEM that provide guidelines for planning in business:

- *Customer Identification* - In TQEM, environmental quality is determined by customer preferences. Buyers, community, environmental groups and the general public are considered external customers, while a company's employees represent the internal customer group.
- *Continuous Improvement* - A company's management and employees should work systematically and progressively toward the improvement of environmental performance. Company-wide employee involvement in TQEM is one of the key success factors of this concept.
- *Doing the job right the first time* - TQEM supports the prevention of environmental risks. Employees should seek to identify and eliminate potential causes of environmental problems.

- *Taking a System approach* - It is important to design all components of the TQEM system so that they function together, and support each other in achieving desired goals.

A well designed and implemented TQEM system turns information into action.

#### 6.4.4 Balanced Scorecard

*Framework to evaluate the performance of the company from both a financial and non-financial perspective*

Since its introduction in 1992, the balanced scorecard has rapidly gained in importance on a worldwide scale. Harvard Business Review even selected it as one of the most important management tool of the past 75 years. The balanced scorecard is a multidimensional framework integrating financial data with other key performance indicators. It helps companies to translate their mission and strategies into measurable objectives that go beyond a narrow focus on financial figures. [W3]

Balanced scorecard has no environmental dimension in its original form. Depending on the interpretation environmental responsibility can be included, and if seen as a stakeholder concern it should be integrated.

Norton and Kaplan compare the balanced scorecard with the dials in an airplane cockpit: it gives complex information at a glance [10].

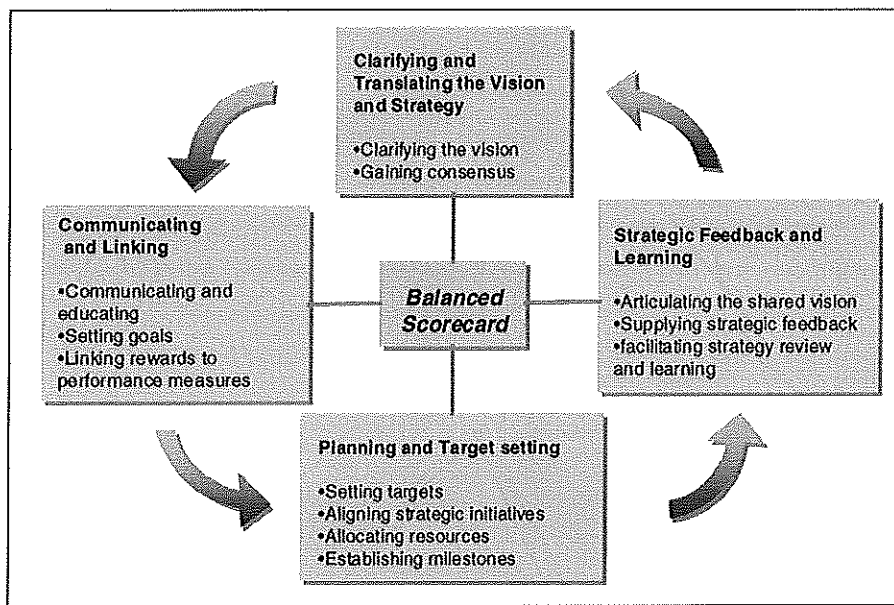


Figure 12 Balance scorecard as a strategic framework for action (from Kaplan et al., 1996, [10])

#### 6.4.5 DfE

- *Concept to integrate environmental aspects in the design phase decisions*

The real revolution must occur in the design phase: the companies know that end-of-the-pipeline emission controls and cleanup are costly and inefficient, and that what is needed instead are product and process designs for environmental performance.

Eco-design or Design for Environment, incorporates environmental considerations into the design of new products and services. Assessing the environmental impact over the whole life cycle at this early development stage helps companies reduce material and energy intensity as well as emissions and waste. [W3]

DfE includes several tools that together facilitate the effect analysis of different design alternatives. DfE tools range from simple checklists, qualitative and quantitative matrix analysis, to complete life cycle assessments (LCA's) and the number available tool grow constantly [8].

Most design and manufacturing engineers have had little formal, environmental education [8]. To get the full leverage of using DfE, a cooperation between the environmental- and the design department, along with other disciplines, e.g. production, marketing and so on, is necessary.

#### 6.4.6 LCA

*Method to systematically assess environmental effects and facilitate the decision making*

Life cycle assessments (LCAs) are used to evaluate the environmental impacts of products from cradle-to-grave. With ISO 14040, 14041, 14042, and 14043 the International Organization for Standardization (ISO) has developed a set of guidelines, which divide an LCA into four phases [W3]. According to these norms an LCA must start with a clear definition of its goals and scope. In a second phase a Life Cycle Inventory quantifies the use of resources as well as the amount of waste and emissions created by the product over its entire life cycle - from the extraction of raw materials to its disposal. The inventory is the basis for a Life Cycle Impact Assessment that evaluates the impact a product has with regard to ecological systems, human health and resource depletion [12]. The final part is a Life Cycle Interpretation in which the results of the Impact Assessment are interpreted in light of the goals of the assessment.

LCA does not address economic effects but can be used together with Life Cycle Costing (LCC), to add a monetary component.

LCA is one of the tools used in DfE but carried out by the book it is time- and data-demanding which limits the use of it [5].



## 6.4.7 Helpers and Hinders analysis

*A tool to analyze driving and restraining forces at the prospect of a change process*

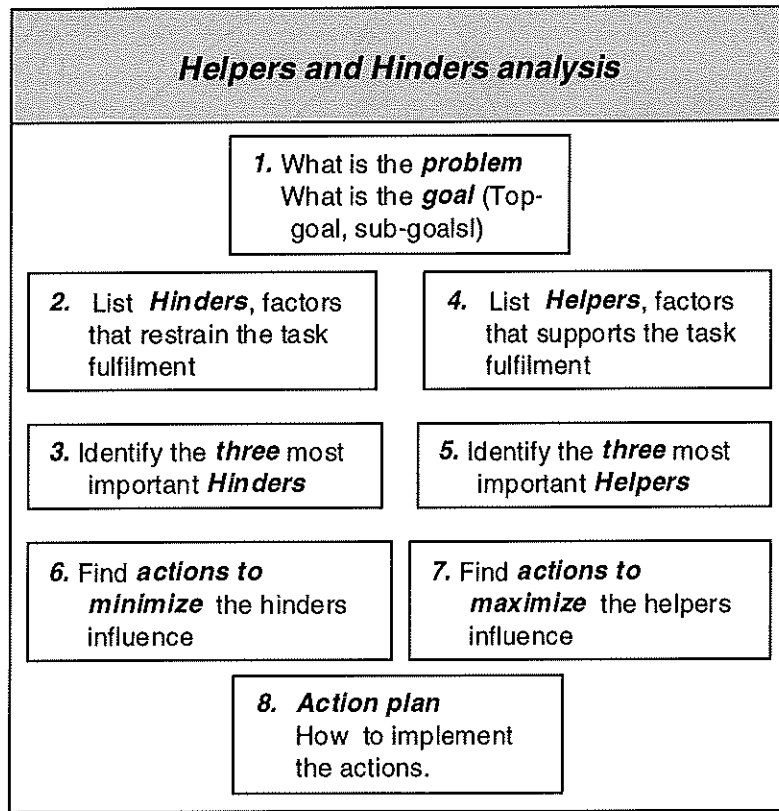


Figure 13 Steps in a systematic Helpers and Hinders analysis (after DGQ, 1997, [19] )

This is a tool used in quality management and can elucidate different aspects affecting the process, e.g. technical factors, organizational factors or external factors. Correctly carried out it can give a good indication of the preconditions and how to utilize them.

## 6.5 Maintaining the system

*After the implementation the real challenge comes, to maintain the system and continuously improve personnel, processes and results. To illustrate this a short introduction to the concepts continuous improvement and knowledge management is given*

Some twenty-three centuries ago, Aristotle observed, "*Excellence is an art won by training and habituation. We do not act rightly because we have virtue or excellence, but we rather have those because we have acted rightly. We are what we repeatedly do. Excellence, then, is not an act but a habit.*"

### 6.5.1 Continuous improvement

To continuously improve and develop the systems is a necessity to stay competitive today, when the pace of change is even higher than before. To improve, two things are important: identifying new opportunities and using old experience along with new knowledge in those new situations. This put together gives a flexible learning organization.

A definition of a learning organization is [22]:

*“A learning organization is an organization skilled at creating, acquiring and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights.”*

This is a change process, to modify behavior. In this case it isn't revolutionary it's a continual process that needs to be managed along with the day-to-day operations.

Three steps in this cycle can be identified: improving the ability to learn, improving the processes and improving the results.

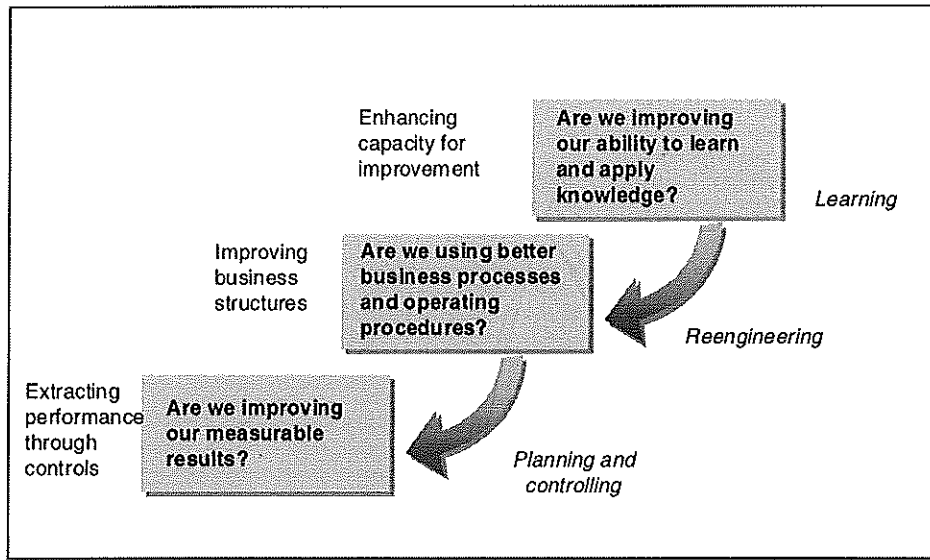


Figure 14 Three steps in the improvement process ( from Prism, Arthur D little, 1996, [5] )

To create a lasting change there are seldom short cuts, a radical transformation is often needed to establish new behaviors and approaches, but in the long run the successive improvements are the desirable state to establish a learning process. The TQM concept has as explicit purpose to support the continuous process of improvement (Ref. 6.4.3).

It seems that to support continues improvement, learning and knowledge are essential as well as sharing of information.

### 6.5.2 Knowledge Management

Since the beginning of the 1990s, knowledge management has been the subject of growing attention in management theory and business practice. Knowledge is increasingly seen as the critical factor for long-term economic success and, thus, the economic sustainability of companies. Rapid and discontinuous changes call for a strong commitment to organizational learning. Consequently, a rising number of companies engage in proactive management of their intellectual capital. Mapping sources of knowledge, managing the processes for knowledge creation, dissemination and storage, and raising awareness of the important role of tacit knowledge are among the measures taken to remain competitive in a knowledge economy. [W3]

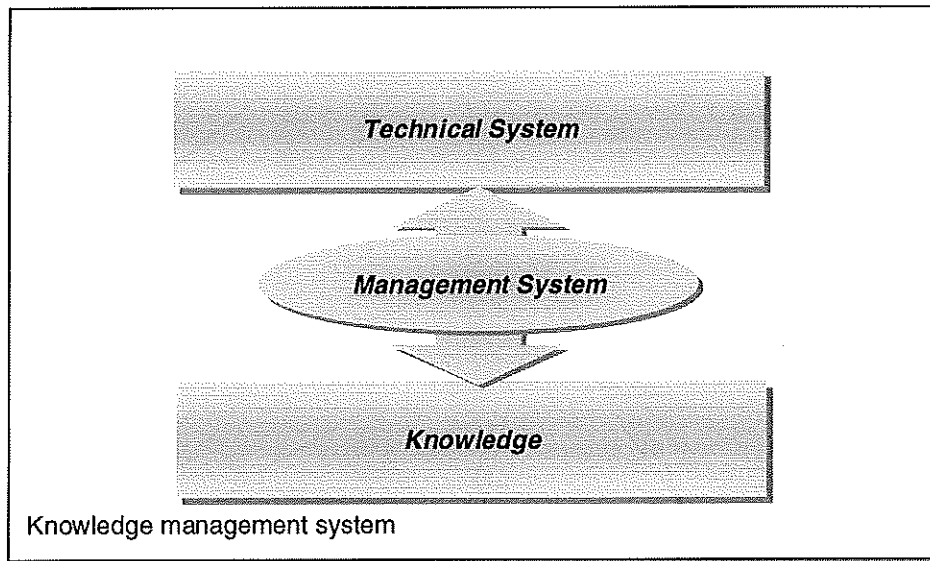


Figure 15 The knowledge management system

To get the full leverage of the company's knowledge you need to have a technical system (e.g. Intranet solution, software etc.) for the sharing and capturing of information. The management system has to guide and support the knowledge transaction to ensure efficiency, performance and quality of information.

Although technology is a critical component when establishing a knowledge management system, it is only 20% of the challenge [25]. The greatest challenge is to change culture and procedures to incorporate the captured experience with the day-to-day work.

When introducing a knowledge management system it is important to question what information it should include. It is easier to capture than it is to reuse and maintain. If the system gets unstructured and inconsistent the risk for redundancy and not updated information increases and the reuse is obstructed [22].

A knowledge management system needs to be continually developed and updated, to serve its purpose.

## 7 The potential of integrating environmental strategy

### *The potential of integrating the environmental strategy in the daily routines*

But what are the advantages of having an IEMS in place? Among the benefits for enterprises of introducing an environmental management system is [W7], [24], [1]:

- Improved decision-making – e.g. a wealth of performance information is generated and informs decision-makers with facts;
- Management focus on key activities - e.g. increased knowledge of the organization's significant environmental effects and how to prioritize dealing with these;
- Facilitates change - e.g. through greater commitment and a detailed, systematic approach;
- Improved information system – e.g. cross-disciplinary information sharing and development of key indicators;
- Potential cost savings - e.g. through the control and reduction of resource use (i.e. water, energy, consumables, waste, etc.);
- Minimization of potential liabilities - e.g. identification of environmental risks and the setting of objectives to reduce these;
- Responds to stakeholder concerns - e.g. addresses major issues and enhances corporate profile both among employees and external interested parties;
- Financial support - e.g. subsidy from government, EU and funds to specified project;
- Market benefits - e.g. the opportunity to gain competitive advantage through environmental achievements;
- And lastly - but most importantly real environmental improvement - e.g. reduced environmental impact of products and processes.

What is characteristic for companies that achieves these benefits? Studies shows that the key is integration [5], [2].

- Integration of environmental policy into the business goals
- Integration of environmental information into financial and managerial information system
- Integration of environmental considerations into all product- and process- designs
- Integration of environmental performance in performance evaluation systems

## **8 Conclusions and discussion**

*Conclusions drawn from the master thesis. Advantages and disadvantages of the methodology used*

### **8.1 Conclusions**

A system engineering approach bases on extensive system knowledge and a good understanding of the complex problem situation to analyze the cause and effect patterns [29].

In an issue as complex as the environmental this system description can be both complicated and time demanding, but still I consider it vital to facilitate the prioritization between the action, and the mapping of their effects.

To attack low-level problems (C.f.1.6) can appear as a pragmatic as well as an economically favorable solution, as the top-level problems are much more extensive and often don't get solved with less than a rework of the whole system. What then is disregarded is the number of sub-problems that one main-problem can cause and the fact that new sub-problems are constantly generated. To create a dynamic and lasting system the cause has to be treated, and it is my opinion that the cause, in most cases, is unfitting system architecture, both technological and organizational.

As more experiments are done and many of them show great potentials, the ideological motive becomes less important and the business aspect is taking over as the primer driving force. This is, from my point of view, an evolution that ensures that these issues are taken seriously and that the practical problems are attended to. To get the full leverage of this opportunity it takes a well-informed top-management to integrate the environmental responsibility with the present technological- and organizational- systems and allocate adequate resources to this.

Every company has its own story to tell, but as a synthesis of my observations from interviews, educational visits, and study of literature, it can be concluded that one of the greatest challenges the next years is to compete in a complex world where the focus has changed from financial figures to a multidimensional performance evaluation. A growing pressure from all stakeholders forces the companies to incorporate environmental responsibility in all their activities, and there is the key to success: Only by understanding and managing environmental issues across the organization, as a normal everyday part of doing business, will companies ensure environmental excellence and long term profitability.

### **8.2 Discussion**

The environmental issue is an extremely complex topic because it involves not only a technical system, i.e. the organization, but also a social system, i.e. the society, and a natural system, i.e. the global environment, which all interact. This brings an abundance of variables in causal relations. In chapter 1, I give my interpretation.

What I identify as one of the greatest uncertainties is the time perspective. In papers from the late 80'th the environmental development was predicted to culminate in the next ten years but more recent studies shows that the climax yet not is reached, among others depending on an unpredicted inertia in the ability to adopt a new way of thinking.

The restraining factors (Ref 3.9) are, as far as I can see, not strong enough to stop the evolution but could cause considerable delays.

Another area of pronounced importance that could jeopardize an effective adoption of environmental business values is the lack of data standards and formal information systems, to provide decision-makers with suitable information.

To examine those risks and evaluate the alleged potential, further work has to be done both in the form of practical experiments and of academic research.

### ***8.3 Evaluation of the methodology***

The methodology is fully based on a system engineering approach. This demands that an extensive structuring is accomplished before the final problem definition can be done. By identifying problem hierarchies it is secured that it is the main problem that is attacked and short-term symptom treatment is avoided. This approach to solve the high-level problem leads to an integrated system that is holistic and flexible.

To be able to evaluate whether the interpretation of the pre-study observations is relevant, a much more careful assessment of the present situation has to be done, this is out of the scope of this master thesis.

As pointed out I don't treat all the components in an integrated environmental management system, my focus is the organizational preconditions for a successful implementation. Under further work (Ref. 9) I will address some of the issues suitable for deeper studies.

One arrangement that could have been taken under consideration is a group of students writing their master thesis in cooperation with separated focuses but with compatible frames. This would give a deeper study of each field and additionally an analysis of the interaction and synergies between those fields.

## 9 Further work

*This work has a cross-disciplinary approach and to deepen this study several topics need to be analyzed. The topics I find important for special attentions are listed below.*

### 9.1 Further academic research

I have identified the areas that need more comprehensive analysis and further academic research. After each section I'll give a suggestion on literature that can give an introduction to each field.

#### 9.1.1 Technical solutions

I have in this study not investigated what technical solutions that are necessary and how to integrate them in the present system.

Some question to base a further study on could be:

*Information system:*

- What are the demands on an information system?
- How is the present situation?
- State of the art
- Fitting system architecture
- What information is needed internal/external?

*Data standard:*

- What are the demands on a data standard?
- How is the present situation?
- State of the art, survey: SPINE, ISO 14048

*Integrating into present systems:*

- Experience from other disciplines, e.g. quality information
- How can it be done for environmental information?

Literature that I recommend:

- Information, Systems and Information Systems; Checkland
- Establishment of CPM's LCA database; Carlson R., Pålsson A-C

#### 9.1.2 Environmental accounting

My opinion is that vital for the integration of the environmental responsibility is the possibility to make correct investment calculations and from a business-economical viewpoint prioritize action programs and objectives.

The experiments with non-financial parameters in accounting (Ref. 4.5) have hopefully opened the door for introducing environmental aspects in the economical sphere, though the need for a cross-disciplinary cooperation can delay the process.

Interesting literature for introduction in the field:

- Counting what counts; Epstein
- The green bottom line; Bennett
- Balanced Scorecard; Kaplan; Norton
- Realizing the Sustainable Development Premium; Hedstrom, Shopley, LeDuc (ADL)
- <http://www.sustainability-index.com>

### 9.1.3 Key indicators

A third area, where I see a lack today is the development of key indicators. Both considering the theoretical base and the development and follow-up, this has connection with both topics described above. As pointed out in the report the success is depending on the possibility to evaluate the results and identify improvement potential for further actions.

The literature that I can recommend is:

- Counting what counts; Epstein
- Continuity, Credibility and Comparability; Skillius
- Balanced Scorecard, Kaplan; Norton
- Measuring corporate environmental performance; Epstein



## **9.2 Further practical work,**

Though there is a need for further research a lot practical work can be done in the companies.

As proposed in the implementation plan a pilot project can be a way to make efficient use of limited resources.

As pointed out the integration is the key, both organizational and technical, and is today, often the weakest point. The most important area to focus on is therefor to prepare the technical and organizational systems for integration. This requires a detailed system analysis to find the connections and where the need for interfaces is most crucial. Then the information needs to be adjusted to the receiver. This could be done iterative as long as the holistic perspective doesn't get lost. The risk is, that even with a good approach, the implementation doesn't manage to build a fully integrated system, and the result is LCAs that are not based on production data and performance evaluation and reward system that don't include environmental aspects, i.e. management level and operational level steer after different parameters.

Another area is to benchmark the environmental work and environmental management system against others to identify strength and weaknesses. Question what the key success factors are and learn from instructive failures, why did those projects fail or succeed, how can we adopt this experience? Here a cooperation of industrial groups and/or NGOs and universities is favorable for sharing of ideas and costs.

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## 11 Definitions, Glossary

### 11.1 Acronyms

CPM	Competence Center for Environmental Assessment of Product and Material Systems
ESA	Environmental System Analysis
LCA	Life Cycle Assessment
ISO	International Standardization Organization
NGO	Non-governmental organization
IS	Information System
IEIS	Integrated Environmental IS
EMS	Environmental Management System
IEMS	Integrated EMS
TQM	Total Quality Management
TQEM	Total Quality Environmental Management
EPI	Environmental Performance Indicators

### 11.2 Definitions

Those definitions have I partly adopted from two different references [12], [W6]

#### **System**

A complete set of activities, needed to fulfill a given function

#### **Function**

The service or benefit that system provides

#### **Policy**

A formal established way to relate to the environmental issue in the sphere where the company is active

#### **Benchmarking**

The process of identifying areas for improvement by comparing one's own organization with another, which is deemed to be better at a particular activity. The firm you benchmark against doesn't have to be in the same industry, simply performing the same function.

#### **Core competence**

A particular group of skills and technologies, which enable a firm to provide those benefits to customers, which constitute its competitive advantage.

#### **Corporate Social Responsibility (CSR)**

An approach to managing organizations which takes account not only of the profit and cost *objectives* of business, but of the *processes* by which they are achieved. Specifically, CSR is concerned with the ethical and ecological dimensions of business

practice and argues for a pluralist view of business in which social as well as financial objectives are pursued - the two being viewed as compatible rather than mutually exclusive.

### **Culture (Organizational)**

Organizational culture is a broad concept that consequently defies easy definition. Most definitions refer to values, beliefs and taken-for-granted assumptions which order the way people behave and interact in organizations and which consequently affect how organizations interact with their environments.

### **Knowledge Management (KM)**

KM is most commonly viewed as an attempt to capture the knowledge of workers in databases so that others can access it and benefit from this experience based knowledge. KM specialist often distinguishes between "tacit" and "explicit" knowledge. The former is knowledge that we normally refer to as someone's expertise (it derives from experience, is second nature, intuitive, and difficult to explain in words) while the latter is the kind of knowledge we find in technical manuals, instruction booklets, documents and databases.

### **Key Success Factor (KSF)**

Also known as a critical success factor, KSFs are those resources, skills and processes that a firm must do well to compete effectively in a given competitive arena. KSFs differ from one competitive situation to another.

### **Learning organization**

The "learning organization" is a term to describe an organization, which is continuously adjusting its way of operating in response to changing conditions. A learning organization is one which does this better than most in its industry - faster learning is seen a spotting significant change sooner and developing the skills and knowledge top deal with it faster than rivals