



DANTES

DEMONSTRATE AND ASSESS NEW TOOLS
FOR ENVIRONMENTAL SUSTAINABILITY

Manual on environmental decision making

Part II: Background report

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ABSTRACT

This report was made within the project DANTEs that is supported by the EU Life Environment Programme.

The focus of the DANTEs project has been to demonstrate how methods and tools for environmental sustainability such as Life Cycle Assessment (LCA), Environmental Risk Assessment (ERA) and Life Cycle Cost (LCC), are practically used within these companies. Integrated usage of methods and tools for estimating environmental load from products has been analysed and structured, based on practical experiences at the companies and knowledge about environmental informatics. The project has resulted in a set of strategies focusing on the communication of information required for environmentally related decisions. The strategies are describing how requested information is acquired using existing tools and methods, and how the resulting information is communicated to decision-makers in an understandable way. By using these strategies the environmental work and decision-making is made more cost-efficient in any company.

In this report the underlying principles and context to the development of strategies in DANTEs are described in detail. In addition, a description on how to develop new strategies is included as well as an example of a strategy published at the DANTEs web site (www.dantes.info).

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1. INTRODUCTION

The aim of this report is to describe the context and background to the structure and content of the DANTES web site, which contains information on how different companies are practically working with different tools for environmental sustainability. In particular this report provides the background to the strategy concept and on how to efficiently perform environmental decision making. The intended users of this report are persons working with environmental issues such as environmental support personnel, at companies and organizations, who have used the DANTES web site and want to read more about structured environmental work. Target groups for the manual (part 1 and 2) are also people responsible for implementing an environmental support function at a company or organisation.

The delivery “Final manual on environmental decision making” from the DANTES project is divided into two reports. The name of the first is “Manual on environmental decision making - What one can find on www.dantes.info. This report contains examples of environmental decision processes based on strategies and other content of the DANTES web site. The second report (this one) is written for people who want to read more about the methodology that resulted in the structure of the DANTES web site. This report especially enlightens the strategies published at DANTES web site and the strategy concept behind as well as information on how to work efficiently with environmental issues according to learnings from the DANTES project.

This report was made within the project DANTES that is supported by the EU Life Environment Programme.

2. RELEVANT AND COST-EFFICIENT ENVIRONMENTAL WORK

2.1 Why structured environmental work?

The environmental work performed in companies and organisations today does in many cases rather push information on the stakeholders than respond to pulls from decision-makers. The information that is communicated is moreover in some cases information which can be gathered with little effort from existing information sources using well-known tools, rather than information that really is required for specific decisions. There are evidently many exceptions from this as for example environmental information which also is requested for by authorities in regulations etc, but for the pro-active environmental work there is often not a clear stakeholder asking for the information. Within the project, a survey¹ has been performed to find different situations when environmental information is needed. The aim of the study was to identify

¹ Flemström, K., Definition of relevant environmental aspects, Chalmers university of technology, DANTES project, 2003

and define relevant environmental aspects in the participating companies. Based on the relevant questions and aspects identified in the survey, the focus of the DANTES project has been to describe how to find the needed information using existing tools and methods. To focus on the information need instead of the tool is important to perform structured and efficient environmental work.

The acquisition of data needed for environmental assessments is often a costly procedure. It is hence crucial that such gathering of information is performed in a structured way where a clear goal and scope is defined before the acquisition starts.² There are however many examples of performed data acquisitions that have been lacking a clear goal and scope. This has resulted in that there for example exist numerous LCA studies performed at companies where the results are not used for decision-making and the reports are only placed in the bookshelves.

In addition, there are many examples showing that it is costly to not work with environmental issues at companies and organisations. For example to use or produce substance with significant adverse impact on the environment or humans can e.g. affect a company's good name or lead to high juridical costs.

Some users need much and detailed environmental information, others need comparative information, while yet others need reliable statements or even labels.³ This illustrates some of the difficulties when producing environmental information that not exactly correspond to stakeholders needs. These needs vary between different companies, countries, and between different roles within organisations etc.

In this report the term environmental decisions is defined as a decision taken in the area of environmental issues at any type of organisation based on information such as process, product or material information. Results from environmental assessments such as LCA and ERA, studies on environmental impact from transports etc. described at www.dantes.info can be used as basis for an environmental decision. How this can be performed in a structured and cost-efficient way is exemplified in the report *Manual on environmental decision making, (part I)*.

² Pålsson, A-C., Enqvist, A., Karlsson, G., Loviken, G., Möller, Å., Nilseng, A B., Nilsson, C., Olsson, L., Svending, O., Methodology for handling forest industry environmental data, Method report, CPM report 2005:1

³ Carlson, R., Erixon, M., Erlandsson, M., Flemström, K., Håggström, S., Tivander, J., Establishing common primary data for environmental overview of product life cycles. Users, perspectives, methods, data and information systems, Naturvårdsverket, 2005

3. THE STRATEGY CONCEPT AND BACKGROUND

3.1 Structured environmental work in terms of strategies

In the beginning of the DANTES project the participants discussed how environmental aspects, indicators and methods, tools and basic data are connected which resulted in the definition of the strategy concept used in the project. One of the results from these discussions was figure 1 below illustrating the connection between any type of environmental decision-maker, environmental aspects, indicators, methods and tools and basic data. First, we have decision makers, the subjects, with environmental related requests and needs identified as problems to be solved or questions to be answered. These requests and needs can be seen as environmental concerns or environmental aspects which can be found in the policy of the company or organisation, aiming at covering their area of interest. The identified aspects can also be broken down to measurable indicators. Analysis tools and methods such as LCA, ERA and LCC, handle the requests and needs of the decision makers. In addition, different basic data is needed to produce input to analysis tools and methods. Tools for reporting and communication e.g. EPD and SDS are tools for technical dialogue and are used to make the results from the analysis methods and tools understandable to the decision makers. Many of the tools and methods for aggregation and assessment of basic data are using the same data as input or output. A general information model makes it possible to identify these common basic data which are used or produced by different tools and methods, and facilitates hence a structured, integrated and cost-efficient usage of data between different tools and methods. A general information model does also enable sharing of data between different companies and different parts of a company. The identification of the general information model has however not been a central part of the DANTES project as DANTES has been focused on demonstrating how the tools and methods meet the information needs of different types of decision-makers.

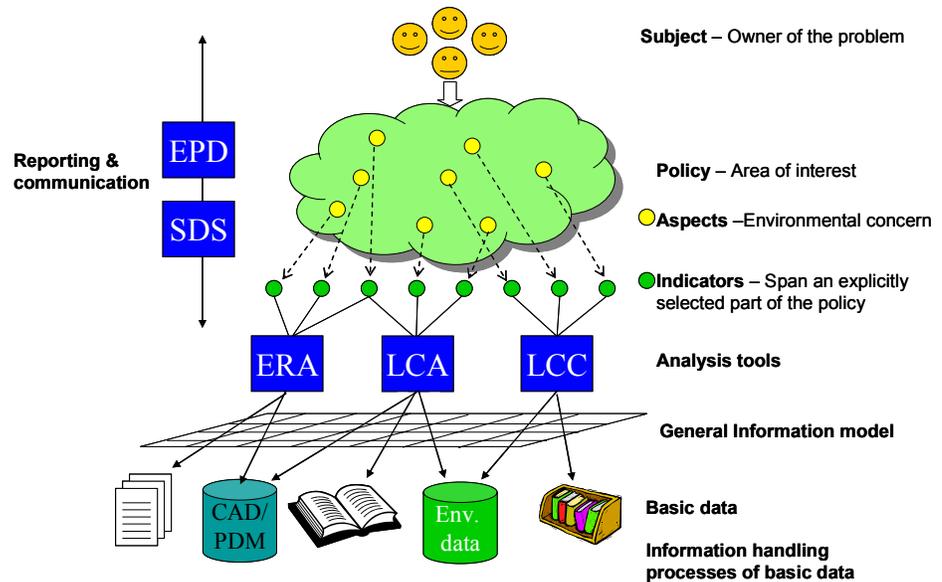


Figure 1: Grouping of tools and methods and the connection to the decision makers requests and needs

The wish to describe how different tools and methods for environmental assessments are practically used within the DANTEs companies, as described above, resulted in the definition of the strategy concept within DANTEs (see definition of a strategy in next section). The reason why the strategy work in DANTEs has been in focus is the need to provide right environmental information at the right moment and to the right stakeholders. By structuring the environmental work performed today the future work can be improved and we can demonstrate to other companies and organizations how a number of environmental related issues can be handled in a structured way. The strategies are meant to be understood and utilized by persons with environmental tasks as part of their assignments, or by persons responsible for implementing an environmental system in a company. Previous knowledge of basic environmental tools, methods and concepts can hence be assumed in the description of the strategies.

3.2 Definition of the strategy concept

The word strategy is used in a variety of different contexts. By strategy in DANTEs we mean a guideline on how the methods and tools described within DANTEs, can be used to find requested information needed for environmentally related decisions, and how the resulting information is communicated to the decision-makers in an understandable way, see the figure below. A strategy describes how to handle environmental issues in a company and to reach the overall environmental goals within the company. In addition, the strategies are examples of how tools and methods are integrated and practically used within the DANTEs companies.

A prerequisite to use or document a strategy is that the company or organization has decided to work towards sustainability. The key to sustainable development, as defined by The Bruntland Report⁴, is the coordination and balancing of environmental, social and economic issues, the so-called three pillars of sustainability. Even though DANTES is focused on the environmental pillar and development of general corporate strategies, social or financial sustainability issues are outside the scope, the resulting strategies for environmental sustainability are possible to combine with strategies for economic and social sustainability.

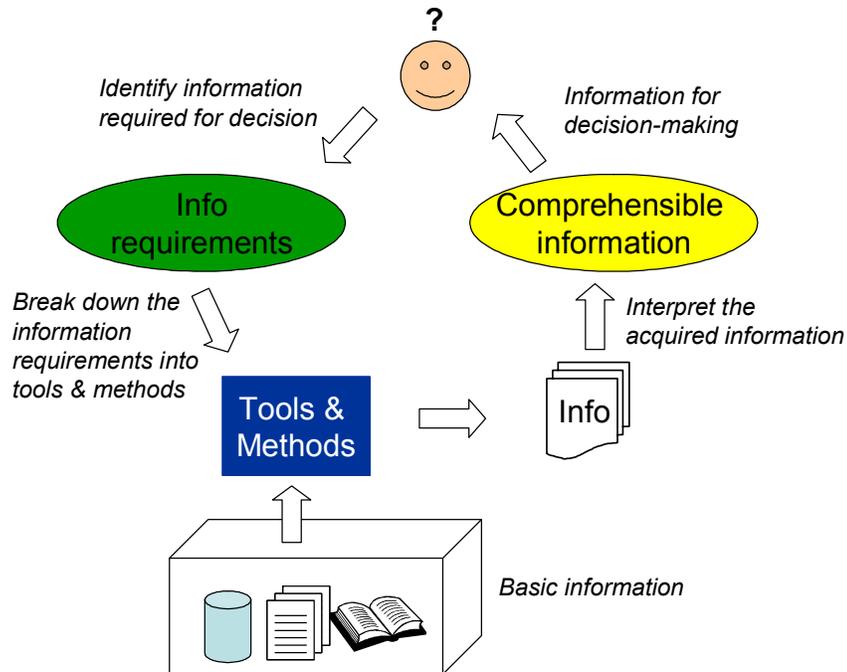


Figure 2: A strategy is a description of the journey from a question to the answer, where the required information is understood.

The purpose of structuring, documenting and publishing strategies within the DANTES project are to demonstrate how the tools and methods on www.dantes.info can be integrated and used to find answers on questions from stakeholders used in environmental decision-making, and how the resulting information is communicated back to the decision-makers in an understandable way.

Seeking information and communicating results may be carried out in very different ways depending on where these activities take place. Accordingly, the DANTES strategies are presented for different types of company functions. The strategies are divided into five groups based on which function within a company that benefit from the implementation of the strategy. The functions that hence are the target groups that can benefit

⁴ Bruntland, G. (ed.), "Our common future: The World Commission on Environment and Development", Oxford, Oxford University Press, 1987

from using the DANTES strategies are Marketing, Research and Development, Supply chain, Production, and Environmental support. For example a strategy about how to communicate a product’s environmental impact describes how an EPD can be used in market communication. The target group for this strategy could be environmental support at a company and marketing department if they need to know how to use environmental information in market communication. It was also discussed whether management should be a separate target group for the strategies. It was however decided that management is an integrated part of all the other target groups. A decision maker within any of the target groups needs environmentally related information to be delivered together with the more section specific information to make a decision (see figure 3 below). The DANTES strategies are describing how this practically is performed.

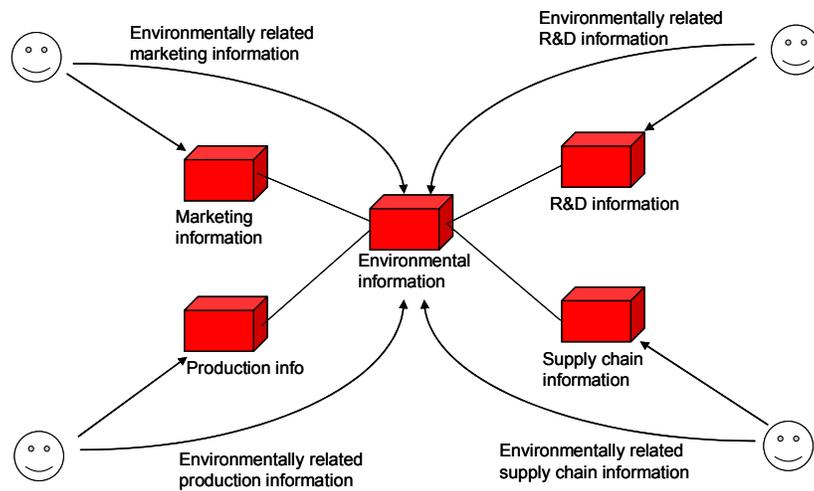


Figure 3: Different type of information (red boxes) for environmental decision making in a company and the information flow in a company illustrated by the arrows.

Based on the target group and their identified question, a work procedure is presented demonstrating an example of a step by step work procedure together with experiences and recommendations.

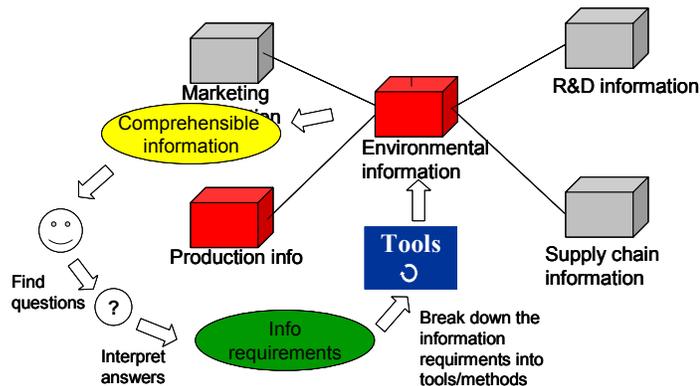


Figure 4: Relation between question, environmental related product information, tool and answer for a function within a company. The user will start with finding questions and then interpreting answers etc. and finally reaching comprehensible information (compare with figure 2).

To be able to reach an environmental target, a systematic work using the right tools and methods is necessary. The DANTES strategies describe and illustrate how this work can be performed efficiently and they are also important when putting environmental work into operation in European companies. In addition, there was an internal need within the project team to describe and document how we are working so that this can be used for internal training as well as to get internal support.

3.2.1 Template for documentation of strategies

To make the DANTES strategies more homogeneous and structured, a template for documentation of strategies was developed. According to this template the following information should be included when documenting a strategy.

Title:

The name of the strategy should describe the content of the strategy as far as possible and should be written on the format “Strategy for *Name*”, where *Name* is the title of the strategy.

Short description / sub-title:

As a complement to the title of a strategy all strategies shall have a short description where the aim for using the strategy is clearly defined and also which company’s or organisation’s experiences the strategy is based on e.g. “The aim of this strategy is to give practical advice on how to conduct an LCA study. The strategy is based on experiences from ABB” or “The aim of this strategy is to enhance communication of environmental requirements and performance in the supply chain. The strategy is based on an example from the railway industry and it is documented by

Industrial Environmental Informatics at Chalmers University of Technology”.

Background:

Description of the question or problem the working procedure described in the strategy aims at answer or solve.

- Separate clear definition of the question
- Background information including why this question is relevant e.g. Laws, requirements from customers, policy, risks – increased knowledge, public acceptance etc.

Who owns the question?

- Who is the stakeholder asking the question?
- Who benefits from the solution of the question?

Description:

Description of the work procedure

- What method/tool(s) is used to find the required information?
- How is the method/tool(s) used to answer the question(s)?
- How is the answer(s) reported and how is feedback retrieved?

Experiences:

Description of experiences from working according to the strategy including an approximation of the resources or total time (effective time and calendar time) needed to perform the strategy. In addition, potential risks, ways to eliminate these risks and business value shall be described.

3.2.2 Example of a strategy

Name: Analyzing and reducing energy use

The aim of this strategy is to illustrate how it is possible to study the energy situation at a chemical industry site and propose measures for reducing the energy use and the environmental impact. The strategy is based on experiences from Akzo Nobel.

Background

Optimizing and reducing the use of energy are always important tasks for process engineers in the chemical industries for different reasons. Traditionally, the focused benefits of energy savings are financial. The competition is continuously growing keener, especially for businesses of which the products are already balancing on the margin. During the recent decades, the focus has widened to also comprise the environmental benefits of energy savings. With support from the [Environmental Code](#) in Sweden, authorities have begun to make demands on companies to better and more thoroughly monitor, follow up and decrease their use of energy.

The purpose of this particular study was to illustrate the total energy situation at a certain production site and identify areas where it might be possible to

save energy and reduce the environmental impact. Following are examples on some issues that were addressed:

- The possibility to utilize more of the excess hydrogen gas formed as a by-product in the production process as fuel for steam generation
- The possibility of cleaning, compressing and selling hydrogen gas
- The possibility of exchanging energy with nearby industries
- The possibility of using more of the energy content in the feed water
- The possibility of controlling the process to a higher extent with respect to energy use, for example by using pump speed control or installing more flow meters

Project managers who co-ordinate the technical competence, collect data and put together a complete picture of the energy situation might benefit and get ideas from this strategy. In the described example, personnel from a central environmental staff coordinated the project and assisted the local environmental department in reporting the result to local authorities.

Working procedure

1. Define scope and limitations of the study. Is the study conducted for a part of the industrial site or for a whole site? What parts are possible to affect and what parts are not? Who can provide information?

2. Conduct an initial meeting with the involved personnel and brain-storm on the possibilities of energy saving measures.

What studies have been carried out with respect to this issue in the past?

What types of fuels are used? Are there any alternatives?

Are steam and electricity consumptions monitored in detail, i.e. is it possible to identify the “hot spots”?

Is it possible to re-circulate and heat exchange to a greater extent?

Is it possible to cooperate with nearby industries in energy issues?

3. Make a preliminary outline for a project report and communicate it with personnel involved.

4. If authorities have made demands on the study, make sure to communicate the outline and the contents of the report with them before proceeding to a more in-depth level.

5. Collect figures on annual energy use as much in detail as possible. Account for the situation from a life-cycle perspective; describe the environmental impacts in the life-cycles of the different fuels and electricity.

6. Identify where measures for improvement should be taken according to these descriptions.
7. Describe potential energy saving measures in the specific plant. Account for the magnitude of the potential improvements with respect to energy savings, potential decrease of environmental impact, investment costs, pay-back periods and other factors that might be influenced.
8. Identify measures that can be realized in a short-term and a long-term perspective respectively. An example of short-term measure is to install more flow meters, while a long-term measure might be to invest in a new steam boiler. Naturally, the short-term measures also tend to be the least expensive ones as opposed to long-term and more expensive measures that need further investigations.
9. Propose [EPIs](#) related to energy. Account for possible interrelations and incompatibilities of different EPIs. [See examples of EPIs](#), where this is further described.
10. Propose follow-up procedures and environmental goals with respect to energy.
11. Present the study to decisions makers.
12. When decisions on measures, EPIs and follow-up procedures are taken, finalize the report and present it to the parties concerned. [See example of report](#).
13. Keep up a close dialogue with interested parties like authorities and nearby industries. Good relations are likely to lead to environmental improvements due to efficient cooperation in the long run.

Experiences

For the successful completion of this study it was of crucial importance to always remember who the commissioner of the study was. This is probably true for any study of this type. No matter if the commissioner is an authority, a corporate function or somebody else, the results must be presented so that the commissioner understands the results and receives answers to the questions that made him/her order the study in the first place. Keeping up an open and unbiased dialogue with the commissioner to make sure all are on the same track is necessary.

When proposing energy saving measures, it was important to recognize that many measures turned out to be of an investigate-further character. If data are not available and no monitoring routines exist for a certain part of a process, the measure could be to further investigate how monitoring may be carried out.

Since many different operational functions were involved, it was also important to present the results to these people at short intervals. This may be a very general piece of advice for project management, but it cannot be

stressed enough. The quality of the facts and figures must be reviewed by those closest to the production. However, it was favorable to also involve some external resources in the project. Some issues may be put aside by tradition and it is often easier for someone from the outside to discover such issues.

On a practical level, it was favorable to write the report from the study in parallel to collecting information and interviewing people. This provided the writer with a better overview and it diminished the risk of missing important aspects.

3.3 Problem or question

To explicitly define the question to be answered or problem to be solved is important as discussed earlier in this report.

Environmental aspects of an organisation represent their environmental concerns that should be in focus. In DANTES we regard both environmental aspect in ISO 14001 and Impact category in ISO 14042 as environmental aspects. From the ISO 14001 perspective the impact categories are relevant issues for the environmental management system, and from the ISO 14042 perspective, they may be associated with both a characterising description of how the environment is impacted, as well as with a causal description of how e.g. a product or process gives rise to this impact.

The first step is to identify, name and define the list of aspects. There should be no unclearness about what an aspect includes. After prioritisation of the aspects, a list of significant aspects is obtained and the environmental work within a company or organisation could therefore focus on these aspects. With help from the philosophy of the ISO 14042 framework, a cause-effect chain (characterisation method) is used to trace the relationship between an environmental impact and an aspect of e.g. an organisational behaviour or a product. For example, avoidance of killing fish, might imply avoidance of emitting cadmium from a production facility, and especially from the unit where batteries are installed in machines. The simple logic of this reasoning is in fact a *backtracking* of the methods described in the framework of ISO 14042, and it results in a logic description, and an understanding of the company's potential environmental cause-effect chains. The second step is to quantify the aspects into measurable environmental indicators e.g. the aspect Energy use could be quantified into the indicator Amount of CO₂ emissions (in e.g. kg/product).

3.4 Stakeholder

A sector independent categorisation of users of environmental information to overview product life cycles is presented in the report Carlson et al, 2005. These user categories are:

1. Science and expertise with deep interest in and understanding of many aspects of environmental information

2. Setting rules, policy, legislation etc. Generalist experts who define and decide e.g. acceptable behaviour and artifacts for businesses, consumers etc.
3. Professional decisions, using environmental information as a professional tool as a purchasing and/or technical expert
4. Everyday actions, facing environmental information as layman concerning technicalities of the decision.

User category 2 and 3 are the one in focus for DANTES methods and tools, and also category 1 and 4 to some extent. Stakeholders of DANTES tools and methods who are willing to pay for the information and/or tools and/or methods, was identified. First, a list of all types of conceivable stakeholders was identified and then as a next step a selection of stakeholders to focus on was made based on the criterion “to be willing to spend money and time to apply the methods and tools included in the project”. The master list of conceivable stakeholders includes e.g. society, local, regional and national governmental organisations, trade organisations, customers and suppliers to DANTES companies etc.⁵ The more project focused list of DANTES stakeholders who are willing to spend time and money to apply the methods and tools included in the project and therefore also the DANTES strategies contains the DANTES partners, the CPM member companies, customers and suppliers to the DANTES partners and the EU (financer of the project). The DANTES partners consist of the following sub stakeholders, in terms of functions and persons:

- Environmental specialists, want detailed information, methods and tools in environmental area
- Managers, want to know if the product generate money and if it is good from a sustainability perspective
- Product managers, want to know if the product generate money and if it is good from a sustainability perspective
- Process and product developers, want support and advise when evaluating different designs or process alternatives
- Marketing and sales persons, want marketing arguments and marketing information
- Supply management, want to evaluate environmental aspects of suppliers and supplied components
- Logistics, want to evaluate environmental impact from transports

The list above has been further described in the report Requirement analysis report.

In addition, authorities, customers, management/owners, NGOs and employees are stakeholders of environmental information, methods and tools according to interviews at the participating companies.⁶

⁵ Karlson, L., Widheden, J., Requirement analysis, DANTES report, task 7, 2002

⁶ Arnell, S., Manuilova, A., User requirements, DANTES project report, task 5, 2003

When developing a strategy it is of high importance to identify the user of the strategy i.e. the user of the information. The person who owns the question or problem identified earlier, needs to be addressed when using environmental assessment tools or methods.

3.5 Methods and tools

3.5.1 Definition of tools

A tool can be anything that from a user perspective adds value to some provided input data. The added value can for example be in terms of structure, aggregation of data, or lower complexity of the data. From a user perspective the structure and internal operations performed by a tool is practically irrelevant. The important parts in the description of a tool are instead a definition of all inputs and outputs required for using the tool as well as a description of the function the tool provides that transfers the input data into the output data. A clear definition of a tool in terms of goal and scope, boundaries and function, can help the user to choose the right tool for the given situation. The input effort e.g. number of data, required by a tool should by definition be lower than the output effort, since a tool should have a leverage effect. In addition, all input information required for using the tool need to be explicitly defined as well as the output information.

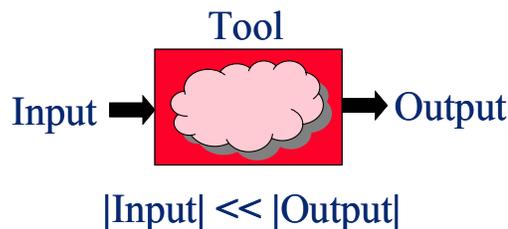


Figure 5: A picture of a tool in terms of inputs, outputs and leverage effect.

The need for a leverage effect of a tool does not imply that the total number of input values has to be smaller than the total number of resulting output values, since the structuring and documentation of the input highly contributes to the value of the output produced by a tool. The leverage effect is actually often larger for a tool that requires a lot of input values and delivers a few outputs, compared to a tool that only requires a few input values. There is a trade-off situation when choosing tools. Tools with a small scope are often easy to use and do only require a few input values, but the results are often hard to interpret, not possible to review and not re-usable. Tools with larger requirements on the documentation require more work to retrieve a result, but the study is on the other hand possible to interpret, reviewable and re-usable.

3.5.2 The tools on DANTES web site

There are many reason why LCA, LCC and (E)RA are the tools highlighted in the DANTES project. Firstly, these tools are commonly used within the participating companies during the last ten years and secondly, there exists a lot of knowledge in these areas in the project

group. In addition, LCA, LCC, (E)RA, together with Environmental impact assessment (EIA) and scenario modeling, covers the assessment and analysis tools often used today.⁷ The communication tools EPD, SDS and SPI have also been in focus since these are used at the participating companies.

3.5.3 Integration of tools

3.5.3.1 The DANTES integration platform

In the project an integration platform has been developed aiming at demonstrating an integrated usage of many different tools based on identified environmental aspects. A user can starting from a question find alternative ways of gathering the information needed for a decision, by using different tools or by using the same tools in a different order. The solution of a problem can be presented both as a logical structure, and as process structure.



Figure 6: Any task can be broken down in a logical structure and a number of process structures.

The *logical structure* breaks down a task into a number of conditions or subtasks that have to be fulfilled in order to complete the task. The logical structure does not define any specific order in which the subtasks have to be performed. For that reason, the logical structures for a specific task does often look very similar for different users. The order in which the different subtasks are performed is instead clarified using a *process structure*. The process structure describes the actual way of working to perform a task and to find an answer to a question. The order in which users prefer to perform different activities to fulfill a task often varies a lot from user to user. For that reason the process structures for the same task are often very different between different companies and users. By using logical structures and process structures, ways of finding answers on different questions can be documented both as a logical structure of subtasks that have to be performed, as well as different alternative working procedures.

The platform does also provide information on individual tools. A tool is something that requires input and delivers output as a result (see section 3.5.1). When integrating different tools to perform a task, each tool has to be defined with a clear scope and boundaries. The exact definition of how

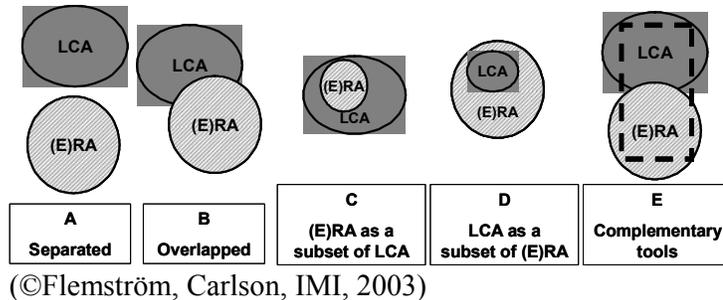
⁷ Carlson, R., Erixon, E., Erlandsson, E., Flemström, K., Häggström, S., Tivander, J., Establishing common primary data for environmental overview of product life cycles - Users, perspectives, methods, data, and information systems, Naturvårdsverket, 2005

a tool performs a subtask is irrelevant. The integration platform does hence require each tool to be defined with a clear scope and boundaries.

It was decided that the integration of tools would be achieved by developing strategies that describes the interrelation of tools. The work in software integration platform was hence cancelled.

3.5.3.2 LCA and ERA

The similarities, differences and interfaces between the two methods or tools LCA and ERA have also been studied and there are more complicated questions than what may intuitively be apprehended. For example there are similarities between LCA and environmental risk assessment (E)RA as described in the report “Relationships between Life Cycle Assessment and Risk Assessment – Potentials and Obstacles”⁸. Both life cycle assessment and risk assessment provide ways for structuring, evaluating and presenting environmental information relevant for different types of environmental decision making. However, in spite of the fact that the methods address neighbouring problem domains and provide complementary information, the two methodologies are not yet easy to combine. In figure 7 below alternative approaches of viewing the tools in terms of simplified Venn diagrams is presented. Different methodological approaches, different scientific view-points, and different disciplinary traditions need to be bridged. To be effective and efficient tools the approaches of LCA and RA needs to be harmonised in some way. The issues dealt with both tools are very complex and it is not uncomplicated to explicitly explain all the aspects of the information provided by the tools. The study indicates that the knowledge about integration of the tools regarding technical feasibility, potential advantages and obstacles are not yet sufficiently examined, and that e.g. the different attempts to integrate LCA and RA that has actually been made have resulted in contradictory results. Both purpose and perspective of the two methods are often different and the connections between them are not fully investigated in literature to date.



⁸ Flemström, K. et al, Relationships between Life Cycle Assessment and Risk Assessment – Potentials and Obstacles, Naturvårdsverket, 2004

Figure 7: Alternative approaches of viewing the tools LCA and risk assessment in terms of simplified Venn diagrams.⁹

3.5.3.3 LCA and LCC

LCC can be used together with LCA to internalize external costs. One attempt to do this is described in the report “External environmental costs in LCC”¹⁰.

Integrated tools for LCA and LCC exist today e.g. the LCC/LCA tool “Wet fermentation.xls”¹¹ developed by ABB. The purpose of the tool is to allow designers to evaluate the costs and environmental impact of a potential biogas plant designs and do parameter studies. The evaluation results can be used for design optimisation, in market communication, sales support etc. the scope of the tool is to evaluate the environmental impacts of different materials in a plant, emitted CO₂, saving of resources and use of electricity and fuels. In addition, the tool can calculate the cash flow of the plant.

3.6 Basic information

Basic information is needed when performing LCA, LCC and ERA studies. In the report “Knowledge about the environmental impact of products: availability, needs and build-up of life cycle data”¹², the authors phrase this as that “environmental information” is “all thinkable and needed environmental information relevant for products in a life cycle perspective.” In the report “Establishing common primary data for environmental overview of product life cycles Users, perspectives, methods, data, and information systems”¹³, this wide scope is limited to that ‘environmental data are such data that is used for defined environmental decisions or assessments’, and the authors mean that environmental data need to be defined by its users and their applications. In this report and in the strategy work within the project we use the latter definition of basic data or primary data.

3.7 Communication of understandable environmental information

3.7.1 Informatics viewpoints

Communication of understandable environmental information is a crucial step in the environmental work at companies and organisations. Understandable information is whether the information is documented so that it can be interpreted by the user. The data need to be available in a language and terminology that the users can appreciate. When

⁹ Flemström, K. et al, Relationships between Life Cycle Assessment and Risk Assessment – Potentials and Obstacles, Naturvårdsverket, 2004

¹⁰ Steen, B., External environmental costs in LCC, Chalmers University of Technology, DAN TES report, 2003

¹¹ Ravemark, D., LCC/LCA Tools, Wet fermentation.xls – for wet fermentation to biogas, ABB, DAN TES report, 2004

¹² Naturvårdsverket (2002), *Kunskap om produktiers miljöpåverkan: tillgång, behov och uppbyggnad av livscykeldata*, Swedish EPA Report 5229, p25.

¹³ Carlson, R., Erixon, E., Erlandsson, E., Flemström, K., Häggström, S., Tivander, J., Establishing common primary data for environmental overview of product life cycles - Users, perspectives, methods, data, and information systems, Naturvårdsverket, 2005

communicating information both the sender and receiver of the information need to have a common agreement on the concepts communicated to avoid misunderstanding and misuse. In addition, the sender has not fully communicated the information until the receiver has understood the information and how he/she shall act based on this. The quality is of high importance for the communication of information e.g. the quality of the information needs to be explicitly defined so that the user can evaluate if the quality of the data is acceptable for his/her purposes.

3.7.2 Communication of environmental information in practice

There are several examples demonstrating how different tools and methods are used to communicate measurable goals and environmental performance at the DANTEs web site.

Methods and tools that can be used to facilitate handling and communication of environmental information in the participating companies are EPD, SDS, LCA and LCI, SPIs, EPIs and Product Stewardship.¹⁴ Stakeholders' perception of environmental communication tools such as SDS, EPI/SPI and EPD have been studied in detail to better understand the environmental skills among companies and find out specific needs for the environmental communication tools.¹⁵

To develop long-term strategy for market communication of sustainability information is one of the conclusions from the report *Environmental Product Declarations in market communication – the ABB experience*¹⁶. The reasons for this are e.g. the complexity to describe and communicate the sustainability performance of a products life cycle and the importance to not underestimate the time perspective of implementing EPDs. Further, employees working with and communicating using EPDs need detailed information and thorough training in LCA and EPD. Supply management, marketing and sales personnel and have so far been little involved in environmental information. Only few customers ask for EPDs but they value the information positively when they receive it. Regarding communication to customers, interviews have shown that EPDs are difficult to interpret and use, therefore interpretation keys have been developed. It is important that the information in any communication tool is easy to use, interpret and understand for the customer. In addition, training and education of employees and customers is necessary to succeed with the communication as well as an “environmental culture” within the management group and in the company as a whole.¹⁷

¹⁴ Imrell, A-M. et al, Stakeholders perception on environmental tools, DANTEs report, 2004

¹⁵ Stakeholders' perception of environmental communication tools (EPD, SPI , SDS). Overview of previous studies. DANTEs internal study within task 6 - Document reactions from stakeholders, 2004

¹⁶ Imrell, A-M., Karlson, L., Environmental Product Declarations in market communication – the ABB experience, DANTEs, 2003

¹⁷ Imrell, A-M. et al, Stakeholders perception on environmental tools, DANTEs report, 2004

SPIs are tools for information of specific indicators and could be one way to facilitate handling and communication of e.g. environmental information.¹⁸

SDSs are legally required tools which answer the questions from customers about classification and labeling of chemicals, product properties and impact of products on the environment.¹⁷

The way different stakeholders perceive environmental information i.e. environmental communication tools depends on the awareness of environmental issues in the field they work in as well as their role in the organisation.¹⁹

3.8 How to make new strategies- description on how to proceed

When developing and/or documenting new strategies it is important to regard the strategy from information needs. First, the strategy developer needs to identify a stakeholder and ask (or guess based on earlier experiences) what type of environmental information the stakeholder requires for a specific environmental decision or for solving an environmental related problem. Then, these answers are interpreted and the information requirements are identified and explicitly described. In addition, the requirements are broken down to existing and available tools and methods, both expert tools and methods e.g. LCA, ERA, support tools e.g. data input tool, material inventory and databases, and communication tools e.g. EPI result, EPD etc. The next step is to find the information required (to find the answer on the stakeholders question to be used in the environmental decision) by using a tool or method for aggregation of basic data. Finally, the results are communicated to the stakeholder in a comprehensible way.

When documenting the strategy the defined problem or question that needed to be solved as well as the target group should be detailed described. It is furthermore important that the language and level of detail of the strategy description is adapted to the target group of the strategy. The structure of the DANTEs strategies i.e. the documentation format, contains of a background, working structure and experience part, see section 3.2.1 for more details, and this should be used when writing the strategy. Using the common documentation format facilitates and improves the use of the DANTEs strategies. Before describing the step by step procedure on how tools and methods are used and examples of results are illustrated, the goal and scope, target group and explicit question to be answered need to be described in detail.

¹⁸ Flemström, K., Imrell, A-M. Palm, A-L., Communication of environmental tools, DANTEs report, 2005

¹⁹ Imrell, A-M. et al, Stakeholders perception on environmental tools, DANTEs report, 2004

In the working procedure section it is important to describe the use of different tools and methods and also the outcome (output data) of the tools or methods and how this information is used. The strategy writer and also the strategy reader will then easier understand the importance of using tools for a specific purpose etc.

In the DANTES project a review procedure has been implemented in the development process of strategies. A review team has reviewed the developed strategies before publication focusing on the usage of the common format, understandability of and language in the strategies. This procedure has improved the quality of the published strategies and also made them more homogenous.

4. THE DANTESTRATEGIES

4.1 Introduction

A set of strategies developed within the DANTESTRATEGIES project are presented on a common presentation format at the public web site. These strategies are grouped according to the company functions that can benefit from them and the target users of each strategy are explicitly described in the text. To facilitate the user to find a strategy suiting his/her needs it is possible to search for a strategy by using a list of keywords.

The developed strategies may be apprehended as ad hoc but they have been chosen by the strategy writers based on their knowledge and shall also cover the significant sustainability work closely related to the assessment tools in focus for the project i.e. LCA, ERA and LCC. In addition, the target groups of the project web site i.e. marketing, management and research and development are also in focus. However, strategies can be developed on different levels (also illustrated in the picture below) such as:

- **Strategy for environmental communication** – Describes how environmental information is communicated between different users. The DANTESTRATEGIES web site contains many examples of this kind of strategy.
- **Strategy for information planning** – Describes how basic environmental information is aggregated into more comprehensible information for decisions, based on identified needs. This kind of strategies that describes how different tools for environmental sustainability can be used in a cost-efficient way has previously been poorly documented, and has thus been the focus for the DANTESTRATEGIES strategies.
- **Strategy for basic data** – Describes how basic data used in different tools and methods are related to a common general information model, and how basic data should be managed in a cost-efficient way. This question is too complex to be generally solved in the DANTESTRATEGIES project. In some areas we have though reached very far e.g. in the LCA and DfE areas.

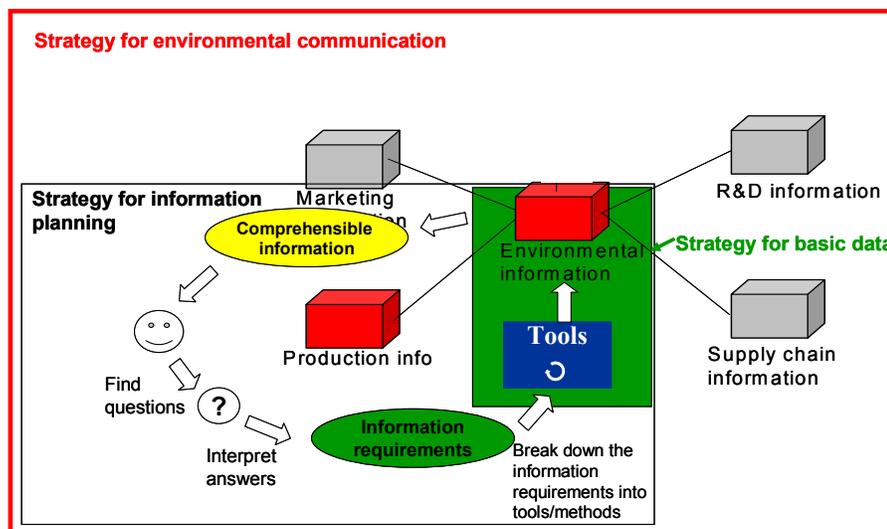


Figure 8: Strategies on different levels (can also be compared with figure 4).

4.2 List of DANTEs strategies

When developing the strategies it was intended that the strategies should support use of tools and methods, and environmental decisions in product development, manufacturing as well as marketing. 23 strategies have been developed within the DANTEs project in the area of environmental support, marketing, production, supply chain and research and development representing company function that can benefit from using the strategies. These strategies are documented on a common format and described in the report “*Manual on environmental decision making – part I*” to facilitate the understanding and usage of the strategies.

The list of strategies published to date at the DANTEs public web site is presented below by name of each strategy and grouped by company function;

Research and development:

1. Sustainability aspects in product development
2. Design for Environment
3. Environmental aspects in a gate model for the chemical industry

Marketing:

4. Use of EPD in marketing
5. Use of sustainability tools to answer questions from customers
6. SPI in market communication
7. Marketing tools for products

Supply chain:

8. Supply management
9. Analysis of the environmental impact from transportation
10. Use of EPIs in supply chain communication

Production:

11. Implementing an Environmental Management System, EMS
12. Analyzing and reducing energy use
13. Greenhouse gas emission trading

Environmental support:

14. How to perform an LCA
15. How to perform an EPD
16. Material declaration and recycling description
17. Handling and reporting environmental information
18. Policy controlled environmental management
19. Product stewardship implementation
20. How to perform application specific Environmental Risk Assessment, ERA
21. Eco-efficiency analysis of products or processes
22. How to perform an LCC
23. Comprehensive environmental assessment of a chemical product

All these strategies can be found at the DANTEs web site www.dantes.info.

4.3 Analysis of DANTEs strategies

When analysing the DANTEs strategies the first question has been; do the strategies handle the identified relevant environmental aspects and user requirements identified earlier in the project? The list of identified relevant environmental aspects is presented in the DANTEs report Definition of relevant environmental aspects.²⁰ The study presented in that report has been conducted as interviews at the participating companies as well as a literature study. Aspects such as emissions to air and water, use of raw material, energy use, transportation, environmental impacts from products, greenhouse gas emissions and materials' toxic properties have been handled in the strategies. However some of the identified aspects have not been included in the set of strategies and these are for example spill prevention, access to fresh water, oil leakage, use of batteries and energy as losses during usage phase or decrease of energy consumption for the customers.

The intended users of the developed strategies are marketing and sales personnel, management personnel at companies (e.g. decision-makers at different levels), environmental personnel such as environmental coordinators, environmental support and environmental information management personnel, logistic personnel, customers, suppliers and product developers. This list of intended users is very similar to the list identified as the target group of the DANTEs project, (see section 3.4), and these groups are to some extent handled in the strategies. Groups such

²⁰ Definition of relevant environmental aspects, Flemström, K., DANTEs project, 2003

as authorities, NGOs and employees are not the direct target group of the developed strategies but could however benefit from them. One remark is that the target groups of the strategies are often very broad and it could be easier to find a suitable strategy for one's needs if each strategy's target group is more detailed defined.

The level of detail in the developed strategies differs and in some cases it can be hard to follow the described working procedure in practice. A more detailed description of the working procedure would be preferred in these cases. The different examples of sub-results are however useful. Which tools to use in the strategies are not always clear and the connection between tool and output from the tool is not satisfactory described in the strategies from an informatics point of view.

The strategies under the *R&D* area are Sustainability aspects in product development, Design for Environment and Environmental aspects in a gate model for the chemical industry. These three describe how environmental aspects can be integrated into product developers and designers every day work at different companies. All three are design for environment (DfE) methods and the user of the strategies needs to regard the target group and detailed purpose of each strategy to be able to choose a strategy suiting his/her specific purpose.

There are 7 strategies under the *Environmental support* area. Three of these are closely connected to an environmental assessment tool i.e. *How to perform a LCA*, *How to perform an EPD* and *How to perform application specific ERA*. These strategies describe a working procedure in short to be used when making these assessments based on the company's experiences. The focus for e.g. the LCA strategy is on the practical experiences and the reader is referred to the LCA standards for more information about the working procedure. On the contrary, the ERA strategy is more focused on the step wise working procedure based on standards in the ERA area. The two strategies describing a method for handling environmental information and a method for policy controlled environmental work are in contrary to the environmental assessment methods strategies more focusing on the actual environmental information and on how to structure and use this information to obtain controllability within a company.

There are three strategies under the *Production* area at the web site. These are handling three different areas such as EMS in a company, energy use of a manufacturing unit and CO₂ emission trading according to the EU regulations in this area.

Under the *Supply chain* area how to handle supply management, how to analyse environmental impact from transportation and how to use EPIs in supply chain communication is in focus. There are of course many other environmental issues that can be handled and methods to be used in supply chains like in the other areas and therefore these are only some examples.

The strategies for the *marketing* area more or less cover the project group's experiences in the area on using environmental tools in market communication. The tools EPD, SDS and SPI are all handled in these strategies to different extent.

As discussed above the strategies published at the DANTES web site are heterogeneous which also is one of the ideas behind them. Environmental work within companies often differs a great deal, different departments can be involved, environmental assessments such as LCA or ERA studies, measurement emissions of CO₂ can be performed etc, and the results of the environmental work performed need to be communicated to different types of stakeholders etc. However, among a set of strategies it should be easy to find a strategy suiting the user's specific need. To facilitate this, the common documentation format has been developed and used in the project.

At the DANTES workshop, 10th of March 2005 at Chalmers over 40 persons from industry, organisations, authorities and academia participated. The strategy area at the web site was overall apprehended as a useful part full of company experience and detailed information. Current strategies did however seem to be ad hoc and the reason why exactly these were developed was not understood. In addition, some specific areas such as REACH system, cement production and education were mentioned as suggestions of new strategies to be developed as well as more integrated strategies and examples where environment does not stand alone. Further information of stakeholders view on the published strategies is described in the report "*Evaluation report*", developed within task 2, in the DANTES project.

5. STRUCTURE AT WWW.DANTES.INFO

The aim of developing the site www.dantes.info was to demonstrate the environmental work performed at the participating companies Akzo Nobel, ABB, Stora Enso and also at the competence centre CPM and the department of Industrial environmental informatics (IMI) at Chalmers. The academic partners in the project have focused on structuring the companies experiences in a strategic way on the DANTES web site. Important to know is that the strategies have not been developed within the DANTES project, but they have been strategically selected and documented within DANTES.

The basis and also the focus of the project have been to demonstrate methods and tools used for environmental assessments, communication and environmental decision making. The methods LCA, ERA, LCC, EPD, product stewardship, Design for Environment, EMS etc has been described in detail focusing on the goal, scope and step by step working procedure. Examples of studies performed at the participating companies

can also be found in reports e.g. LCA reports and certified EPDs on ABB and Akzo Nobel products.

6. CONCLUSIONS

By working with strategies within the DANTE project the participants have documented chosen parts of their successful environmental work in a structured way. Agreeing on how to demonstrate i.e. the documentation format and content of the strategies has been a time consuming task within the project but the common agreement has been a crucial step in the project results. The large number of published strategies can be seen as a proof that the work to demonstrate performed environmental work in a structured way has succeeded.

Developing new strategies will be useful for both the strategy writer and the strategy reader. With knowledge about the definition of the strategy concept within DANTE developing and/or using a strategy the advantages will be greater than the costs for doing this. By working in a structured way with environmental issues at different companies and organizations and also by communicating the results of environmental work to customers and suppliers could give a significant business value for the companies, see examples at the published strategies.