CHALMERS

Manual for Policy Controlled Environmental Management Work

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1 Introduction

This manual describes a methodology for policy controlled environmental management work.

The purpose of the methodology is to:

- enable communication of quantitative environmental information in the EMS
- enhance the controllability of the EMS
- quality assure environmental data management
- enable an identical impact assessment at different sub-units of a company

The methodology was developed in the CPM project A20 "Policy controlled environmental management work" during CPM's third phase. The development process is described in *"Policy Controlled Environmental Management Work - Final Report"* CPM Report 2004:10.

2 The methodology in brief

The methodology consists of eight steps (see figure 2.1). In each step, a specific task in policy controlled environmental management work is performed. Each step can be performed independently of the other steps. The lines in figure 2.1 indicate how the different steps are related to each other and the arrows indicate that the different steps may be performed in any direction.

The eight steps in the methodology are briefly described below:

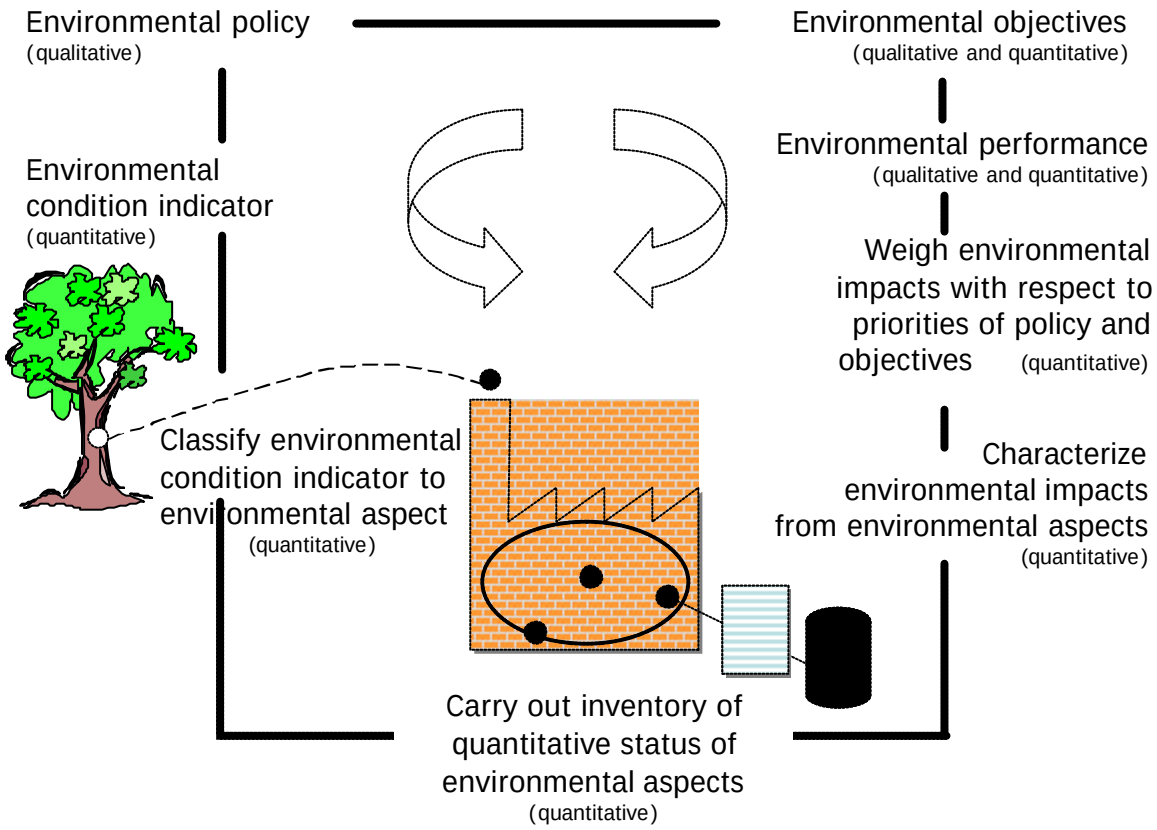

Figure 2.1. Policy controlled environmental management system.

Environmental policy

The environmental policy is formulated. The policy expresses the company's viewpoint and aim with its environmental work.

Environmental condition indicator

A conceptual analysis is made of the policy to find the established responsibilities of the company. Environmental condition indicators are extracted as the consequences of the

statements of the environmental policy. These indicators are measures of the state of the environment and should be quantitative and relevant for the company.

Classify environmental condition indicator to environmental aspect

The environmental condition indicators are translated into environmental aspects. This step is compatible with the classification step in the ISO 14042 standard.

Carry out inventory of quantitative status of environmental aspects

This step involves acquisition, processing and reporting of numerical environmental data and modeling of the production system based on the environmental aspects of interest. The list of environmental aspects from the last step may be complemented with aspects that are not covered by the policy but are still needed because of laws and regulations, customer/supplier demands, internal use etc. This step corresponds to the environmental review and the general measuring and monitoring according to ISO 14001. Allocation is also made at this step.

Characterize environmental impacts from environmental aspects

The environmental effects of all the aspects of the company are quantified with characterization methods. In this step the characterization methods that link all aspects with the environmental condition indicators are prepared. There is a choice of using existing methods, creating new ones, or adapting existing methods to the company's needs.

Weigh environmental impacts with respect to priorities of policy and objectives

A quantitative subjective prioritization is made of the effects on the environmental condition indicators. The method with which this will be made is chosen in this step. The priorities shall be based on the policy and can also be used to identify the company's significant aspects. The company can choose to develop company specific priorities instead of using the weighting methods of existing impact assessment methods such as EPS 2000, Eco Indicator 99 or EDIP.

Environmental performance

In this step, the actual calculations are performed. The current status of the environmental performance of the company is measured in terms of impact on the environmental condition indicators from the activities performed by the company. The characterization factors and the priorities from the two previous steps are used.

Environmental objectives

The results from the calculation of the environmental performance are used to set environmental objectives and targets. The environmental objectives are set at company level to avoid sub-optimizations at individual sub-units.

3 Explanation of concepts used in the manual

In the following, the concepts and terms that have been used in the project and in this report are explained. The explanations are based on the report *"Documentation of environmental impact assessment, compatible with SPINE and ISO/TS 14048"*[1], the ISO 14000 series of standards, SPINE and discussions at workshops.

Impact Indication Principle

The choice of how to express or indicate environmental impact is subjective and depends on the viewpoint of an "observer". This viewpoint may be expressed as a "principle", the impact indication principle. The environmental policy of a company is one example on such a principle. Other examples can be the system conditions[2] or the 15 objectives of the Swedish EPA. Based on an impact indication principle, different impact categories can be chosen, as well as different category indicators.

Impact Category

Impact categories are names of classes of environmental impacts and are represented by one or several category indicators. The impact categories are chosen to reflect the impact indication principle in question.

Category Indicator

Category indicators are names of quantifiable environmental condition indicators belonging to impact categories. The category indicators are chosen to reflect the impact indication principle in question.

Environmental Condition Indicator

The environmental condition indicator (ECI) is defined in ISO 14031[3] as a "specific expression that provides information about the local, regional, national or global condition of the environment". The environmental condition indicators can be grouped into different impact categories (global warming, acidification, ozone depletion etc), and the environmental condition indicator representing that group is then called category indicator.

Environmental Aspect

An environmental aspect is an "element of an organization's activities, products or services that can interact with the environment" according to ISO 14001. The environmental performance indicator of ISO 14031 is an environmental aspect that is a "specific expression that provides

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[1] Carlson R., Pålsson A-C. "*Documentation of environmental impact assessment, compatible with SPINE and ISO/TS 14048*" IMI Report 2002:1

[2] 1) Holmberg, J., 1995. *Socio-Ecological Principles and Indicators for Sustainability*, Ph.D. Thesis, Institute of Physical Resource Theory, Chalmers University of Technology and Göteborg University, Göteborg, Sweden.
2) Holmberg, J. 1998. *Backcasting — a natural step when operationalising sustainable development.* Greener Management International. — the Journal of Corporate Environmental Strategy and Practice. Issue 23: 30-51. (Autumn 1998)

[3] ISO 14031:1999 (1999): Environmental management – Environmental Performance Evaluation – Guidelines

information about an organization's environmental performance". In this project it is implied that the environmental aspect is quantified.

Classification

Classification assigns environmental aspects to environmental condition indicators or impact categories, which means that the practitioner makes a number of implicit choices. In this methodology it is called "Classify environmental condition indicators to environmental aspects". The classification are in some cases seen as a special case of the characterization, where it is decided if the characterization factor is 0 or ? 0 for a certain category indicator.

Characterization

The list of environmental aspects and the life cycle inventory (LCI) have both the form of a list of inputs and outputs. The characterization links the inputs and outputs with their impact on the environmental condition indicators quantitatively. The characterization method is the method used to model the relation between the environmental aspect and the environmental condition indicator (see below).

Characterization Method

The characterization method relates the environmental aspect quantitatively to an environmental condition indicator. The environmental impact is modeled with a certain method that can be used for one relation or several. Depending on level of detail of the modeling of the environmental impact, different information about the inputs and outputs is needed, e.g. name of substance, amount, environmental conditions and geographical location. The numerical expression of the relation between an environmental aspect and an environmental condition indicator is called Characterization Factor (CF). An example is shown below:

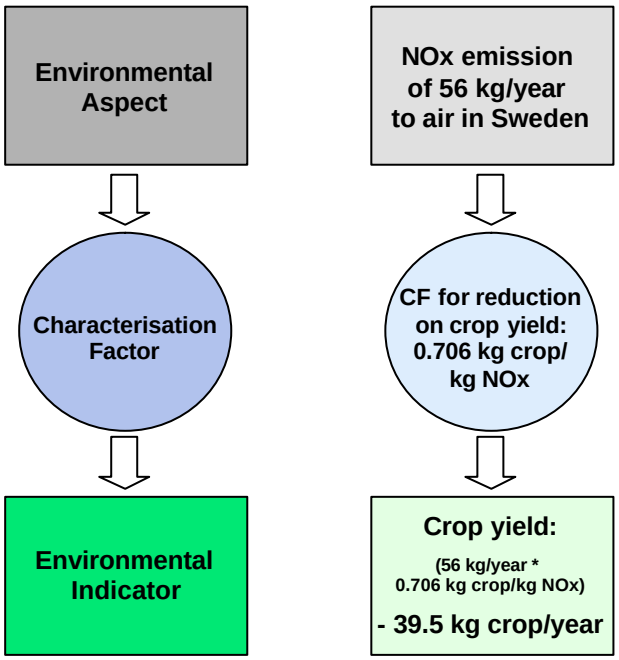

Figure 3.1. The relation between an environmental aspect and an environmental condition indicator.

Prioritization

Prioritization is a subjective and quantitative measure of the relative importance between different environmental impacts. In LCA, this prioritization is called weighting. Different weighting methods can be used to compile and calculate the relative weights of indicators, and each different method results in different sets of relative Weighting Factors (WF).

A prioritization method is associated with a set of category indicators. Each indicator is associated with a weighting factor, expressing this indicators relative significance to the other indicators in that set. The aim is to get one single score for a studied object instead of one score for each category indicator.

It is important to distinguish between weighting, which is made between category indicators, and identification of significant environmental aspects, where the prioritization is made between environmental aspects. The selection of significant environmental aspects can be based on the prioritization between category indicators.

Impact Assessment

A full impact assessment includes the three concepts classification, characterization and prioritization, in a logical sequential order and together with a definition of the impact indication principle and the scope of the intended application of the impact assessment. The scope typically encompasses several complementary category indicators, a geographical area, and the consideration of many different stakeholders. When creating an impact assessment method, the environmental policy can be used as guidance to select a set of suitable category indicators and to prioritize between those category indicators in different trade-off situations. One must also have a clear opinion of the natural environment included in the scope, and of which inputs and outputs that are implied by the scope. The impact assessment method describes how impact indication principles, classification methods, characterization methods, and prioritization methods have been selected and combined.

Technical System, Environmental System, Social System

The technical system contains the human activities producing services or goods and impacting the environment. It can be companies, manufacturing sites, production lines or life cycle scenarios for products. The environmental system is the resources, animals, plants, climate etc. The social system consists of people; customers, neighbors, environmental experts, employees, managers etc. and provides the values or rather attitudes against various changes in the environment.

In the interface between the social and the technical system, people appreciate the value of the good produced by the technical system. In the interface between the social and the environmental system, on the other hand, people react to the consequences in the environment caused by the activities in the technical system. The indication of an environmental problem and the prioritization between different environmental problems occur in the interface between the social and the environmental system.

There is also an interface between the technical and the environmental system in which there is a continuous exchange of energy and matter. The use of renewable and non-renewable resources, emissions and occupation of land are examples of activities that occur in this interface. The environmental impact is estimated in terms of the negative change implied by the technical system upon the environmental system, as evaluated by the social system.

4 Full description of the methodology

Environmental policy

Work description

The environmental policy is formulated. The policy is a mean to create a common shape and focus of the daily work in an organization, which will help the different parts to move in the same direction.

Procedures

The environmental policy should be formulated in an operative way. The company can develop one external policy and one internal that is more operatively formulated or use other complementary documents, like guidelines or strategies that provide the operative support.

The value documents designed for the environmental department need a higher resolution than those designed for the top management or other purposes. The environmental department gives the operative message to the production units of which measures to take.

The following questions may be asked:

- Who is the policy directed to?
- Which societal or customer groups are included?

The policy can be adapted to a sub-unit by adding local issues.

Environmental condition indicator

Work description

The environmental condition indicators are extracted as the consequences of the statements of the policy.

Procedures

A conceptual analysis of the environmental policy is made to investigate the established responsibility of the company. The following questions are asked:

- What does the policy express that it protects?
- Which environmental condition indicators measure this?

The environmental condition indicators are measures of the state of the environment and should be quantitative and relevant for the company. The real environment is thus modeled with the environmental condition indicators. This work can be transparently performed if it is documented, e.g. by underlining phrases in the policy that point out specific indicators and explaining the choices and interpretations that have been made.

When possible, the work is simplified if the environmental condition indicators are chosen among the indicators of existing impact assessment methods that have documentation and ready-made characterization methods. This choice does however demand an interpretation of the environmental impact assessment method to make sure that the values in the method are in line with the general policy of the company.

Classify environmental condition indicator to environmental aspect

Work description

The environmental condition indicators are translated into environmental aspects. This step is compatible with the classification step of LCIA in the ISO 14042 standard.

Procedures

The effect on the environmental condition indicators from the environmental aspects at the company is investigated. Characterization models are cause-effect models that can be used to find the links between indicators and aspects. They are generally very expensive to develop and existing models as the EPS 2000, Eco Indicator 99 and EDIP can be used, if the indicators of the method are interpreted in a similar way to the company's environmental condition indicators. The environmental aspects are assigned to one or more environmental condition indicator.

The identification of the environmental aspects is a process that demands a certain competence (of the activity, environmental science, legislation etc). The ISO 14001 definition of environmental aspects can be used as support when compiling the list of aspects. The aspects are usually divided into groups of aspects. This division can be made in different ways e.g. the type of aspect where the GRI indicators or the ISO 14031 EPIs[4] can be used as support. Another possible division of the aspects could be according to their origin; historical/present, raw material/processes/transports etc. This would enable different types of aspects to be considered, and not only the present aspects.

Carry out inventory of quantitative status of environmental aspects

Work description

This step involves acquisition, processing and reporting of numerical environmental data for the production plant, business unit or entire company and also modeling of the production system based on the environmental aspects of interest. This corresponds to the environmental review and the general measuring and monitoring according to ISO 14001. This part of the methodology has not been developed in the project. The result from a previous CPM project, the CPM/SSVL[5] methodology, was considered as sufficient to fill the needs.

Procedures

Survey the plant's need for environmental data

Identify and survey the plants' needs of environmental data to satisfy different stakeholders. The list of environmental aspects from the last step may be complemented with aspects that are not covered by the policy but are still needed because of laws and regulations, customer/supplier demands, internal use etc. Environmental aspects that are not covered by the policy may be found in the environmental review according to ISO 14001.

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[4] The Environmental Performance Indicators of GRI are further described in *"Policy Controlled Environmental Management Work-Final Report"*, CPM Report 2004:10

[5] The CPM/SSVL methodology is based on PHASETS [Carlson R, Pålsson A-C (2001): "*Industrial environmental information management for technical systems*", Journal of Cleaner Production, 9 (5): 429-435, Elsevier Science Ltd] and SPINE [Carlson R, Löfgren G, Steen B (1995): "*SPINE – A Relational Database Structure for Life Cycle Assessment*", Report B1227, Swedish Environmental Research Institute, Göteborg].

Prepare draft models of production systems

Based on the identified needs of environmental data, draft models of the production units are designed, which can be simple or aggregated. In the work the scope and the boundaries of the production system are defined, i.e. the processes that shall be included within the system, and the processes that can be excluded are selected.

Process numerical data for the environmental aspects

Establish routines needed for the processing of numerical data. Data processing includes identification of measurement systems, acquisition and compilation of measurement values. Both physical measurements and calculation models can be used.

Documentation of how data has been collected is needed for quality assurance of data. The documentation facilitates the work of following up and updating.

Make the final compilation of the models

Do the final compilation of the models, including any final changes, using the information prepared in the previous stages. Allocation is also done at this point. The information produced can e.g. be aggregated to an environmental report in accordance with ISO 14001.

Reporting

Establish routines for reporting and communication of data and results from each of the previous stages, to support the environmental data handling. For example, routines for how to generate an environmental report should be established.

Characterize environmental impacts from environmental aspects

Work description

This step involves selecting or developing characterization factors for all relations between aspects and indicators. The characterization factors are used in the calculations that are performed in the step "Environmental performance". Characterization factors are obtained by a characterization method.

Procedures

The environmental effects of each aspect of the activities of a company are investigated scientifically with a characterization method. This generally leads to a paradox problem: the existing methods are judged as too ill-fitting for the company but it is too expensive to consult environmental expertise and create new ones. A compromise could be to start with a ready-made method and have the internal competence adapt it to the company in a transparent way.

The options for characterization methods are:

1. Develop new characterization methods from scratch.

   When a new characterization method is created, there is a choice to either follow the aspects to a selected end-point or as far as it is economically justifiable. The former way is more correct but can be very expensive.

2. Adapt existing characterization methods.

   An existing characterization method can be an approximation for the effect on an indicator from an aspect. The impact indication principle with which the characterization method is produced is analyzed. The reasons for the choice are documented.

3. Use existing characterization methods as they are.

   The impact assessment methods EPS 2000, EDIP and Eco-indicator 99 have characterization methods for the most common environmental aspects. The characterisation factors and the end-points vary between them. Document the reasons for the choice of impact assessment method and note the deficiencies with the characterization method.

The characterization is supposed to be an objective assessment of the environmental consequences of the different environmental aspects of the company. The subjective evaluation is not part of this step but is done in the next step – weighting.

Weigh environmental impacts with respect to priorities of policy and objectives

Work description

This step involves setting priorities by selecting or developing a prioritization method. Prioritization is a subjective ranking of the (adverse) environmental impacts from the company's activities. The prioritization method can be used both to prioritize between environmental condition indicators and to identify significant environmental aspects. There is currently no guidance in the ISO 14001 standard on how to perform prioritization. The company can develop company specific priorities or use ready-made weighting methods.

Procedures

The policy controlled environmental management methodology is based on that the priorities should be extractable from the policy. In the development of the methodology for prioritization, the system conditions[6] were used as the common basis as they were found to summarize the different investigated approaches, see *"Policy Controlled Environmental Management Work - Final Report"*[7]. Using a common basis gives compatibility between businesses.

The prioritization can be made less person independent if it is made by an interdisciplinary panel and this method is therefore chosen in the project. The alternatives to a panel procedure are e.g. to use some kind of checklist, have an environmental expert make the prioritization or use the weighting methods of EPS 2000, EDIP and Eco-indicator 99. The impact indication principles of such ready-made prioritization methods however, will probably differ from the company's environmental policy.

Constructing a person independent panel

The person independency is secured if the panel is populated with personnel representing specified functions within the company. The panel participants will get a common frame of reference from education in ISO 14001 and the system conditions (the impact indication principle). The goal is not that the group will reach understanding; the different functions are appointed to continually guard their own interests. It is important that the persons in the panel use their actual competence and not personal viewpoints to keep the transparency. It must also be

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[6] 1) Holmberg J., 1995. *Socio-Ecological Principles and Indicators for Sustainability*, Ph.D. Thesis, Institute of Physical Resource Theory, Chalmers University of Technology and Göteborg University, Göteborg, Sweden.
2) Holmberg J., 1998. *Backcasting — a natural step when operationalising sustainable development.* Greener Management International. — the Journal of Corporate Environmental Strategy and Practice. Issue 23: 30-51. (Autumn 1998)

[7] Carlson R., Pålsson A-C., Häggström S.; *Policy Controlled Environmental Management Work - Final Report*; CPM Report 2004:10

considered that a company will only have certain people available to participate in the group. There should however be minimum requirements to be fulfilled in order to consider the panel person independent. The person independent panel will need support via systemizing and documentation. If the results from the panel procedure are going to be used to control the environmental work, the panel needs to have real influence in the company.

It could be useful to have two panels. One with environmental personnel that only consider the environmental issues and one mixed panel that also considers the economical, technical, legislation and business aspects. This would give the advantage that, in a first step, the environmental consequences can be described without negotiation with other factors, and the prioritization of the environmental condition indicators and the environmental aspects can be made from a pure scientific view. This will make it easier to compare long term effects with short term effects and may possibly lead to environmentally sounder decisions.

The subjectivity of the prioritization is inevitable. Formalization and systematization can make the prioritization person independent, i.e. help to avoid the problem with dependency on individuals and uniform the prioritization method in companies with many sub-units.

Prioritization of environmental condition indicators and/or environmental aspects

The environmental policy is the basis for the priorities that the interdisciplinary panel makes. From the analysis of the policy can be understood which environmental condition indicators are the most critical. For example, the panel might prioritize an indicator that is not considered urgent from the environmental perspective but is enhanced by the policy.

The controllability and efficiency is enhanced if all units have the same instructions on how to perform the prioritization of environmental condition indicators and environmental aspects, instead of using different methods at different business units. The local panels will be supported by systemizing and documentation. This includes creating a common frame of reference for the involved people, through education in ISO 14001 and the system conditions. Another supportive tool that can be used is a common identification model.

The identification model

The identification model is created based on available models, knowledge of the activity and support for classification, characterization and weighting. It can be described as a filter that the environmental condition indicators and environmental aspects pass through.

The *classification support* is used in the classification step and provides support for which environmental aspects that affect which environmental condition indicators. The system conditions are one example of a classification support. The *characterization support* is used in the characterization step and provides a qualitative and quantitative description of how the environmental aspect affects the environmental condition indicator. The EPS, EDIP and Eco-indicator 99 can provide characterization support (and also classification support). The *prioritization support* provides support for the prioritization of the environmental problems.

A model for the choice of identification model process can be seen below:

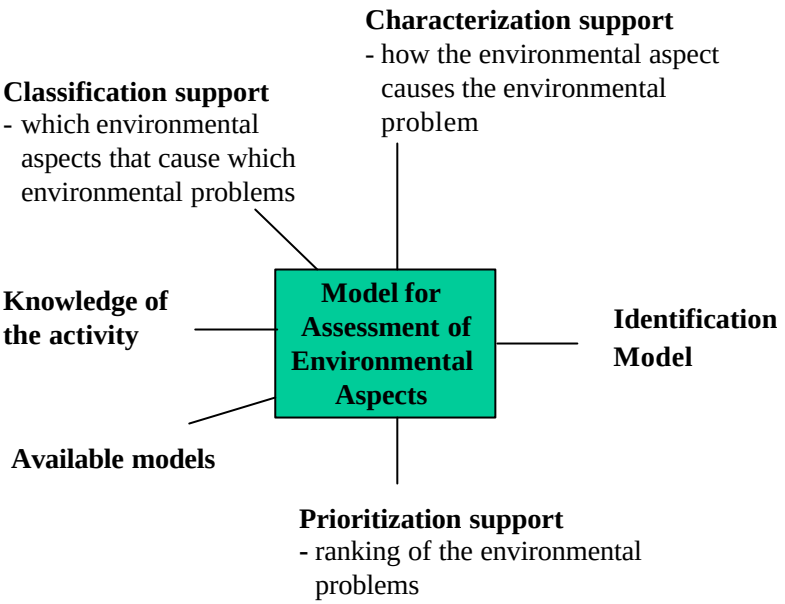

Figure 4.1. The identification model.

The input to the prioritization process is thus competence from the person independent panel, an identification model and a list of quantified impacts on the environmental indicators. The output is a ranking of which environmental indicators that are most important for the company to protect. The equivalence when it comes to identification of significant environmental aspects is seen below:

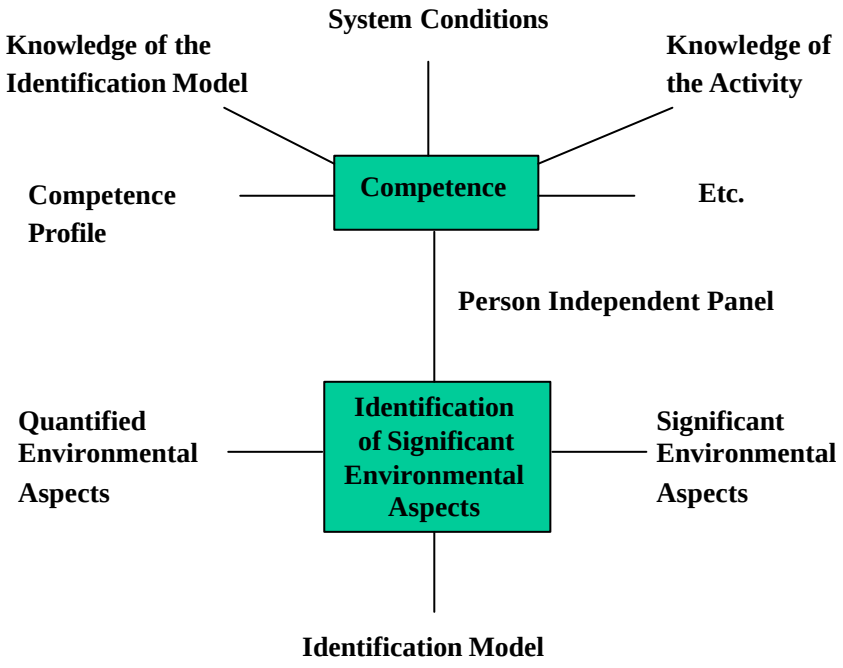

Figure 4.2. Identification of significant aspects.

Environmental performance

Work description

The current status of the environmental performance of the company is measured in terms of impact on the environmental condition indicators. The characterization and the prioritization methods from the previous steps are used to calculate the impact on the environmental condition indicators from the activities performed by the company.

Procedures

The impact on each environmental condition indicator is calculated by using the results from the inventory together with the chosen characterization and prioritization methods in the two previous steps.

The result from the characterization is a list with all the chosen environmental condition indicators, and a quantitative value together with the unit for the impact on them. The units can be different for each indicator. The result from the weighting is a list with the chosen environmental condition indicators together with a quantitative value, all with the same unit.

Further information that can be produced in the calculations is for example:

- The company's significant environmental aspects
- The products with most detrimental environmental impact
- The environmental performance of the company compared to previous years

The ISO 14001 standard implies that the company should be aware of which aspects that have significant environmental impact[8]. The standard does not, however, give any guidance on how to identify which aspects are significant. The standard does not either demand that all significant environmental aspects must have objectives set on them and the company can choose which significant aspects to work with, and which to disregard by themselves. The company cannot however choose which aspects that are the significant. This is calculated by using the results from inventory together with prioritization factors for environmental aspects.

Environmental objectives

Work description

The results from the measurement of the environmental performance are used to set environmental objectives and targets.

Procedures

The environmental performances of each unit are communicated and aggregated. The objectives are set at company level to avoid that the individual units set objectives that will sub-optimize the environmental performance of the company as a whole. It is difficult for a single production unit to take responsibility for the whole life cycle of the products; it can generally only focus on environmental issues that its production causes, like waste, noise, energy consumption, dust etc. The objectives are communicated to the production sites and will later be followed-up at group level.

The ISO 14001 standard implies that the significant environmental aspects are considered when setting the environmental objectives. However, as said above, the standard does not demand that all significant environmental aspects must have objectives set on them.

[8] ISO 14001:1996; Environmental management systems – Specification with guidance for use