

# Chapter 7

## Environmental Management Systems



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**Abstract** This chapter gives an overview of the history of the development of environmental management systems (EMS) and the purpose of an EMS. It expands on the description of the different steps of an EMS under the model Plan-Do-Check-Act and clarifies the use of concepts within EMS. Companies are motivated by external pressure from stakeholders, national and international authorities, customers demanding greener products etc., as well as the ability to attract new employees and avoid negative publicity. Standards belonging to the ISO 14000-family for environmental management include both product-related standards and audit and evaluation standards.

### 7.1 Introduction

An environmental management system (EMS) supports organizations in implementing their environmental policy. There are multiple reasons for an organization to recognize the need for an EMS. External pressure from stakeholders, national and international authorities, customers demanding greener products etc. motivate some companies, as well as the ability to attract new employees and avoid negative publicity (Sharma 2000; Epstein and Roy 2001; Mosgard et al. 2022). The implementation can also be the outcome of using methodologies presented in Chaps. 4–6. Starting with an intention to improve the processes and the value chains of their products, these tools will contribute to a better understanding of the environmental aspects of the organization. Through the implementation of cleaner production (CP) and design for environment (DfE) principles, the general environmental perfor-

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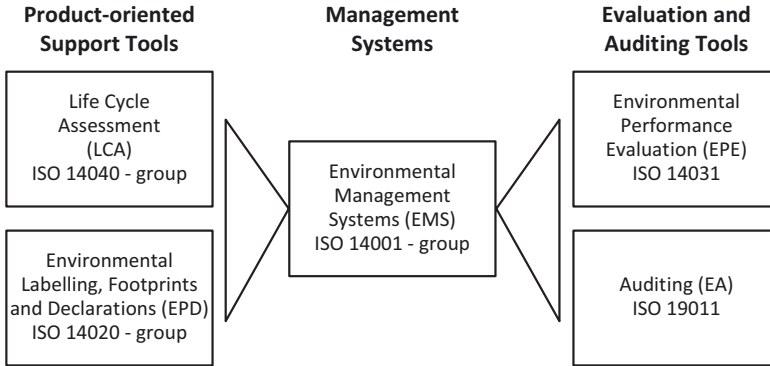
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**Fig. 7.1** Product-related standards and audit and evaluation standards underpinning environmental management. (Illustrated by examples from the ISO 14000-family)

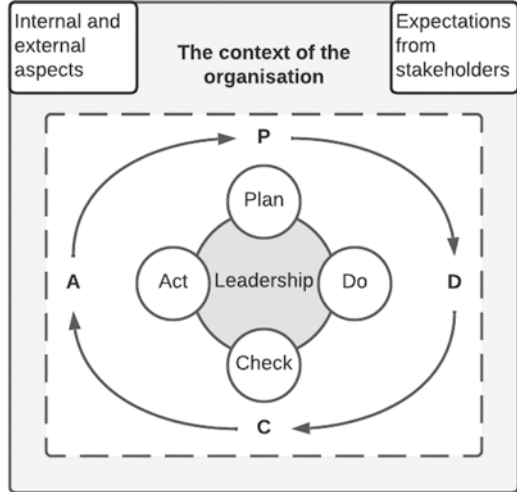
mance is improved by reduced material throughputs and lowered energy use (Eagan and Pferdehirt 1998). This will most often lead to upgrading management procedures, which further leads to the improvement of environmental policies, routines and strategies in the company. This, in turn, will contribute to a more comprehensive understanding of the benefits of a systematic approach toward the environmental challenges encountered by most organizations today. This is illustrated in Fig. 7.1, which shows a sampling of standards belonging to the ISO 14000-family for environmental management. Note that these include both product-related, and audit and evaluation, standards. A better insight into the performance of the processes often also results in improved business performance (Darnall et al. 2008; Mosgard et al. 2022).

## 7.2 Environmental Management Systems Background

The world's first standard for environmental management was launched in 1992, namely the British Standard BS 7750, which was quickly followed by the European Eco Management and Audit Scheme (EMAS) in 1993, and later the International Organization of Standardization, the ISO 14001, standard on environmental management in 1996 (Delmas 2002). The British Standard BS 7750 has been withdrawn, but the others have been revised and the present version of ISO 14001 is from 2015 (ISO, 2015). EMAS has been updated with indicators set for different sectors and recommends ISO 14001. Even though there are differences, an EMS should include procedures for understanding the environmental aspects, setting objectives and targets, establishing programmes to achieve those objectives and targets, and reviewing performance against those objectives and targets.

An EMS is based on the environmental policy of the organization, with the EMS being the tool to bring this to life (Fet 2006; Fet and Knudson 2017; Johnstone 2020). An environmental policy is a written statement defining the company's aims

**Fig. 7.2** Methodology for Implementation of Environmental Management Systems with Leadership at the centre



and principles on managing the environmental effects and related aspects of the company. The policy should comply with national and international regulations and other obligations signed by the company as well as fulfill the ambitions of the company. A company should decide if they just want to use an EMS to ensure it avoids breaking any legal constraints, or if the ambition is to demonstrate its control of the environmental performance as a competitive advantage (Michelsen and Skaar 2021). In the latter case, an environmental policy should set the rules and guidelines for how a company should operate and shape its organization.

To be effective, an EMS should be integrated with the overall management system which includes the organizational structure, responsibilities, practice, procedures, processes and resources for determining and implementing the environmental policy. When an environmental policy is adopted, the programme should follow the plan-do-check-act-review cycle through continuous improvements as illustrated in Fig. 7.2. The context of the organization must be understood, the needs and expectations of those involved in the organization, including shareholders and the surrounding society as well as obligations in relation to compliance. Figure 7.2 makes the importance of leadership explicit and outlines the roles and responsibilities required for the management of a strong EMS.

### 7.2.1 The PLAN Stage in an EMS

The PLAN stage in an EMS is rooted in a description of the activities and processes of an organisation. It describes how its environmental policy is operationalized. An important part of this initial planning is to identify stakeholders and their requirements, to consider both environmental aspects and associated environmental impacts, and to understand the laws, regulations and standards with which the

organization must comply. An understanding of the context in which the organization operates is also of great importance in addressing management challenges.

### 7.2.1.1 Stakeholders

Stakeholders are individuals or groups who may gain or experience losses or harm as a result of company operations. Stakeholders can be employees, customers, suppliers, local communities, governments, nongovernmental organizations, or shareholders. Stakeholders can be engaged in a variety of ways, such as:

- focus groups meetings
- online discussions
- meetings in local communities (“Townhall” meetings)
- engaging a stakeholder panel, expert panel or external review panel
- involvement in partnerships

It is important to involve stakeholders who are directly affected by the environmental aspects of the company, both its activities and possible aspects of its products and services, with the possibilities of minimizing any negative impacts. A similar approach should be used for the social aspects (Edinger-Schons et al. 2020).

### 7.2.1.2 Environmental Aspects

Environmental aspects are defined as activities, products or services that might impact the environment (ISO 2015). When planning the implementation of an EMS, an overview of any potential environmental aspects that may occur as a consequence of the company’s activities and products should be created. By drawing maps and flow diagrams of all relevant activities and material flows, potential environmental aspects can be identified and listed. Documentation should include descriptions and flowcharts of existing processes, production data (e.g., raw materials consumption, production volume, emissions to air, water and soil, energy consumption, secondary products and waste, noise and vibration), transport, potentially also transport of employees, and storage of raw materials, products and waste. This should result in all environmental aspects being fully documented, and, as far as possible, an estimation of the amounts of resource usage, water consumption, and emissions and waste generated by the various processes involved. Initial surveys of environmental aspects are often qualitative and provide an opportunity for prioritizing areas needing attention. Material flow schemes and process flow diagrams, (see Chap. 4) can be useful for rendering a more quantitative overview. An important decision at this point is in designating appropriate limits for the EMS and identifying environmental aspects. Is the focus on internal processes only, or should aspects within the value chain which are upstream and downstream also be included? The answer to this depends on the type of company involved and the context of its operations, together with its environmental policy.

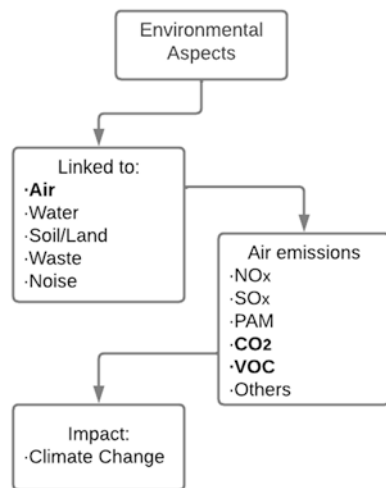
### 7.2.1.3 Environmental Impacts

Based on the list of environmental aspects drawn up, the next step is to understand their severity by analyzing any potential impact on the environment. Impact on the environment can be local, regional and/or global. In order to understand the consequences, one must know the cause – effect response of the different emissions and their impact on the environment and eventually on human health. Figure 7.3 illustrates the pathway for determining environmental impacts caused by an aspect which is, *the use of fossil fuel in transportation*. The burning of fossil fuel causes a number of emissions into the air, e.g., NO<sub>x</sub>, SO<sub>x</sub>, particulate matters (PAM), CO<sub>2</sub>, VOC and others. Each of these has a distinct impact on the environment. If we look closer at the CO<sub>2</sub> and VOC, they are categorized as greenhouse gases with an impact on global warming followed by a potential impact on climate change. The impact that NO<sub>x</sub> and Sox have on acidification could be illustrated in a similar manner and analyses could be completed for each identified aspect.

There are no standardized methods for assessing environmental impacts, so organizations are encouraged to establish procedures for determining which aspects have the most significant impact on the environment. It is important to have in mind that environmental impacts are not limited only to emissions. Impacts caused by land use, land transformation and resource extraction and potentially depletion should also be included. Normally, data achieved from input-output (I/O) analyses, material flow analyses (MFA) and life cycle assessment (LCA) information form the basis of the registration of environmental aspects and related impacts caused by the company’s activities, products and services.

For smaller firms with limited resources for a full assessment, a simplified impact assessment can be conducted where the company identifies a priority list of what is regarded the most important aspects. For the example of emissions above (Fig. 7.3), CO<sub>2</sub>-emissions will have global impact through global warming, while SO<sub>x</sub> may

**Fig. 7.3** Illustration of pathway from aspects to impacts: emissions from *the use of fossil fuel in transportation* to the impact on climate change caused by CO<sub>2</sub> and VOC-emissions. (Modified from Winther and Fet 2016)



cause acidification with a regional impact. Similarly, particulate matters may cause bad air quality, and thereby have local impact. As for other activities land use and potential impacts on biodiversity could be the most relevant aspect. As part of the management system, the company should implement procedures for how to evaluate and take action for the most significant aspects for their company. Chapters 8 and 9 on indicators and reporting practices provide a more in-depth analysis of environmental impact assessments (EIA).

#### **7.2.1.4 Environmental Improvement Programmes**

The planning stage should also include consideration of environmental improvement objectives, and furthermore, how to achieve them. This should include objectives related to activities, processes and products, which in the next turn involve operations as well as value chain control, emergency preparedness, monitoring and measurements. Proposals for environmental improvements may refer to:

- Product and process changes
- Changes in raw materials and auxiliaries
- Changes in technology and practices
- Alternative measures for waste reduction
- Reuse or recycling
- Energy conservation
- Land restoration and/or biodiversity precautionary actions
- The possibilities for environmental improvements can be considered in different ways. Based upon the list of identified environmental aspects, a priority-list for improvements should be made. The next step should then be to select the measures for improvements. The action plan should specify:
  - the schedule for implementation of measures
  - assignment of responsibility
  - training plan for employees, introduction of new equipment, new operating instructions, etc.
  - documentation of the effectiveness of the chosen measures.

A set of environmental goals and agreed-upon programmes ready for implementation, signify the shift from the PLAN to the DO-stage.

#### **7.2.2 *The DO Stage: Implementation***

This part of the management system focuses on implementation of measures for improving environmental performance. Procedures for implementation, monitoring, control and documentation of the progress should be established. In case of emergency situations, the organization must plan and implement a process to determine preventive actions to minimize the risk for accidents that can result in negative impacts on the environment.

The DO stage further requires that the organization shall determine and provide the resources and competence needed for the implementation of programmes and procedures, ensuring continual improvement of the environmental performance. Environmental statements form the basis for determining new objectives and related action plans or environmental programmes. The organization shall further plan how to respond to external interested parties as required by its compliance obligations.

### **7.2.3 *The CHECK Stage: Monitoring, Verification and Auditing***

The objective of the CHECK stage is to ensure the project sits within rules and regulations and company policies, and that the plans are appropriate to meet the environmental objectives set.

The *monitoring* activity should concentrate on following up on the environmental improvement objectives and programmes, thereby *verifying* whether the environmental performance is improved according to the plan.

The purpose of an *audit* is to uncover weaknesses or discrepancies and to examine whether the systems and procedures are adopted and work as intended. This is done by obtaining audit evidence and judging it objectively to determine the extent to which the audit criteria are fulfilled. The audit is completed when all activities set out in the audit plan have been completed. Follow-up measures should be listed in the audit report. ISO 19011 (ISO 2018) provides guidance on how to carry out audits, and the audit programme shall include procedures for the audit and the follow-up of the audit, and reporting to management.

Another purpose of an audit is to begin a dialogue in relation to any potential challenges the company might encounter due to an increasing focus on sustainability relating to activities, products, and services. Checklists for future scenarios could therefore support companies wishing to be at the forefront of developments, and thereby turn such challenges into opportunities.

A final part of the CHECK stage is the management review. The organization must evaluate environmental performance and provide input to management for review of the effectiveness of the EMS. The audit report is one of the underlying documents for the management review.

### **7.2.4 *The ACT Stage: Action for Improvement***

The last stage in the PDCA-circle is ACT. This means that the organization should react to any non-conformity and take action to eliminate the causes of these and implement corrective actions. An important part of this is also an evaluation of the company's environmental policy to determine if it should be revised. This is a task for top management.

### 7.3 Conclusion

According to the principles presented in this chapter, an EMS is the tool for bringing the environmental policy of the organization to life. EMS is also a tool that helps organizations reach and document their compliance regarding laws, regulations and own targets and ambitions. The target for the EMS is therefore to establish procedures and good practice to achieve the objectives given in the policy. EMS should support strategic business management: strengthening the relationship between environmental management and the core business of organizations.

According to the ISO 14001 standard (ISO 2015), an organization must accept responsibility for the impact caused by its activities, products and services. Due to the increased sustainability challenges the world is facing, the attention given to an organization's performance is also increasing. The discussion is how far reaching such responsibility should be. As a result of the UN Sustainability Development Goals (SDG) (United Nations 2015), especially SDG 12 on responsible consumption and production, the responsibility should address the entire value chain of a product, that involves sustainability aspects both upstream and downstream in the chain (Michelsen and Skaar 2021). Aspects related to end-of-life treatment of the products should be included and possibilities to circulate materials into new products, should be identified. This requires that the EMS has procedures for analyzing the impact outside the factory gate, which means an increased focus on life cycle thinking (Mosgaard et al. 2022). This should be visible in the environmental policy as well as in the procedures to be used for the understanding of the most significant environmental aspects and impacts.

An EMS is designed to mainly address environmental aspects. It can be extended to a management system to also include social and economic aspects. The structure could be the same, but the written material should then include procedures for identifying these aspects, and also criteria for carrying out an audit connected to economic and social performance. With an increased focus on holistic and life cycle thinking, new standards for sustainability management systems are expected to appear in the future (Nawaz and Koç 2018).

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