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**THE UPGRADE OF AN ENVIRONMENTAL MANAGEMENT SYSTEM IN A WIND ENERGY COMPANY**

Examiners: Professor, D.Sc. Lassi Linnanen  
Associate Professor, D.Sc. Mirja Mikkilä

## **ABSTRACT**

Lappeenranta University of Technology  
School of Energy Systems  
Degree Programme in Environmental Technology

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### **The upgrade of an environmental management system in a wind energy company**

Master's Thesis  
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Examiners: Professor, D.Sc. Lassi Linnanen  
Associate Professor, D.Sc. Mirja Mikkilä

This master's thesis studied the state of an ISO 14001:2004 standard certified environmental management system in a wind energy company. The objective of the study was to analyse the gaps in the management system to create a transition plan to the newest ISO 14001 standard. The plan was created by analysing the current system, determining gaps in the system and proposing changes to fulfil the gaps.

The results of the gap analysis revealed that the most significant necessities were mainly related to the clauses introduced in the new standard. The identified key gaps were related to life cycle thinking, context of the organisation, environmental performance and environmental objectives.

# TIIVISTELMÄ

Lappeenrannan teknillinen yliopisto  
School of Energy Systems  
Ympäristötekniikan koulutusohjelma

Malla Ranne

## **Ympäristöjohtamisjärjestelmän päivitys tuulivoimayrityksessä**

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Avainsanat: Tuulivoima, Ympäristöjohtaminen, ISO 14001, Johtamisstandardit

Tarkastajat: Professori, KTT Lassi Linnanen  
Tutkijaopettaja, MMT Mirja Mikkilä

Tässä diplomityössä tutkittiin ISO 14001:2004 standardin mukaisen ympäristöjohtamisjärjestelmän tilaa tuulivoimayrityksessä. Työn tavoitteena oli tunnistaa johtamisjärjestelmän puutteet ja luoda suunnitelma sen päivittämiseksi uusinta ISO 14001:2015 standardia vastaavaksi. Suunnitelma rakennettiin tunnistamalla nykyisen ympäristöjohtamisjärjestelmän puutteet gap-analyysin avulla ja kehittämällä ratkaisuja löytyneiden puutteiden korjaamiseksi.

Gap-analyysin tulosten mukaan nykyisen johtamisjärjestelmän suurimmat puutteet liittyivät suurimmaksi osaksi uuden standardin vaatimuksiin. Näistä merkittävimmät liittyivät elinkaariajatteluun, toimintaympäristön analysointiin, ympäristötavoitteiden asettamiseen ja ympäristövaikutusten seuraamiseen.

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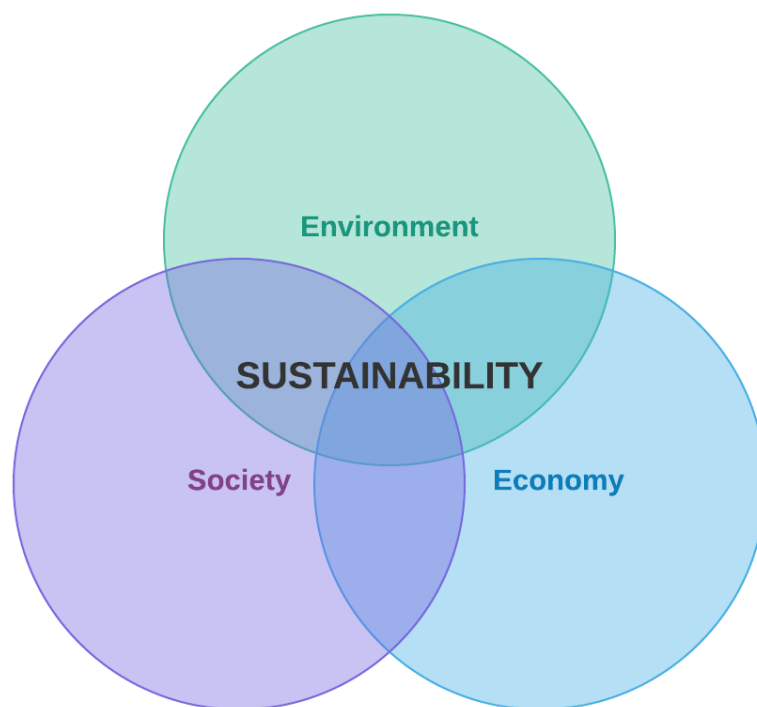
#### APPENDIX 1: Gap analysis between the current EMS and ISO 14001:2015

## **LIST OF ABBREVIATIONS**

|       |  |
|-------|--|
| BAT   | Best Available Techniques                        |
| CER   | Corporate Environmental Responsibility           |
| CSR   | Corporate Social Responsibility                  |
| ECI   | Environmental Condition Indicator                |
| EMS   | Environmental Management System                  |
| EPI   | Environmental Performance Indicator              |
| HLS   | High-Level Structure                             |
| HSE   | Health, Safety and Environment                   |
| ISO   | International Organization for Standardization   |
| KPI   | Key Performance Indicator                        |
| LCA   | Life Cycle Assessment                            |
| LCM   | Life Cycle Management                            |
| LCT   | Life Cycle Thinking                              |
| MPI   | Management Performance Indicator                 |
| NGO   | Non-Governmental Organisation                    |
| OHSAS | Occupational Health and Safety Assessment Series |
| OPI   | Operational Performance Indicator                |
| PDCA  | Plan, Do, Check, Act                             |

## 1 INTRODUCTION

The International Organization for Standardization (ISO) defines environment as: “Surroundings in which an organisation operates including air, water, land, natural resources, flora, fauna, humans and their inter-relationships.” It forms the three pillars of sustainability along with the economy and society (figure 1). Sustainable development aims to advance and strengthen the development of these three pillars at local, national, regional and global levels. The importance of sustainable development has increased due to a growing consumption of resources, which is a consequence of the population growth. (ISO 2017; Kates, Parris, Leiserowitz 2005, 10-12.)



**Figure 1.** Three pillars of sustainability

Environmental management system (EMS) means a system of administrative functions used to control direct and indirect impacts on the environment and improve environmental performance of organisations (ISO 2017). Environmental management systems can be in-house developed, but often they are based on standards that offer a framework to develop, implement and monitor the environmental strategy of a business. The most widely used standard for environmental management systems is 14001 by International Organization for

Standardization. Other popular frameworks include the EU Eco-Management and Audit Scheme (EMAS) and the British Standard BS 8555. (BSI 2015; WRAP 2015, 4).

Technology development and mass production of wind turbines have made wind energy a competitive option for energy production. From 2000 to 2015, worldwide cumulative wind capacity multiplied from 17 000 megawatts to more than 430 000 megawatts. One of the biggest reasons for the growth is climate change and the global efforts to prevent it. Climate strategies and targets all around the world favour energy alternatives with no water or air pollution. The growth of wind energy industry is predicted to continue and according to the forecast, one third of all electricity use will be produced by wind power by 2050. (National Geographic 2018.)

A certified environmental management system is a competitive advantage in wind energy industry. It offers a chance to distinguish positively from other operators in a highly competitive area of business. Demanding customer requirements, increasingly stringent environmental legislation as well as the political climate require wind energy organisations to pay more attention to their environmental performance and possible impacts on the environment.

## **1.1 Research questions and objectives of the study**

This study aims to answer the following research questions:

- What are the gaps in the environmental management system?
- How to fill the gaps to comply with the newest standard?

The research aim of this study is to find the gaps between the current environmental management system and the system proposed by the ISO 14001 standard by analysing and evaluating the system in the organisation. An improvement plan, which suggest changes in the current system, is created based on the findings of the gap analysis. The upgrade to the new standard version is required by the ISO organisation by September 2018.

The aim is not only to fulfil the minimum requirements of the standard but also develop the management system further to maximise the benefits. Some parts of the transition plan are

implemented during the study, but the full implementation is scheduled to take place after the thesis. Therefore, the implementation step is not included in the scope of this study.

## 1.2 Research method

### 1.2.1 Research design

Method designs refer to techniques and procedures to collect and analyse data (Saunders, Lewis, Thornhill 2016, 57). This thesis is separated into theoretical and empirical sections, where the theoretical section is a literature review with a focus on environmental management systems and the updated version of the international management standard ISO 14001:2015. The empirical section is a gap analysis, which is used to evaluate the gaps in the current environmental management system. The analysis evaluates the management system and its compliance with the new environmental management standard ISO 14001:2015. The research design overview of the study is shown in table 1.

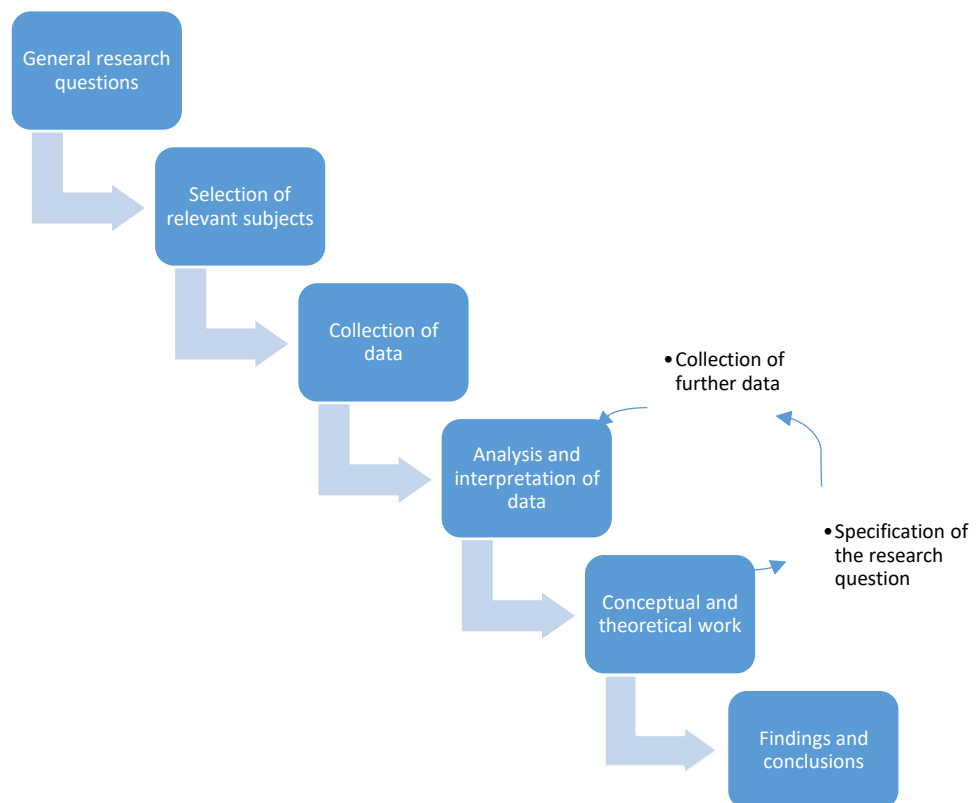
**Table 1.** Research design overview

| RESEARCH DESIGN OVERVIEW   |   |   |  |   |
|--|---|---|--|---|
| Context  | Methodology   | Data collection   | Data analysis  | Findings  |
| <ul style="list-style-type: none"> <li>• Background for the study</li> <li>• Research questions</li> </ul> | <ul style="list-style-type: none"> <li>• Selection of research methods</li> </ul> | <ul style="list-style-type: none"> <li>• Literature review to gain an understanding of the context</li> </ul> | <ul style="list-style-type: none"> <li>• Gap analysis</li> </ul> | <ul style="list-style-type: none"> <li>• Development of an improvement plan</li> <li>• Conclusions</li> </ul> |

The goal of this study is to examine, understand and describe a phenomenon in the organisation, why qualitative single case study was used as a research method. Qualitative research is a methodological approach that refers to a variety of research methods. Typically, qualitative research focuses thoroughly on a small number of samples instead of large samples. In these cases, the scientific criterion for material is quality instead of quantity. The importance of quality guides the creation of theoretical groundwork and collection of material. (Eskola, Suoranta 1998.)

There are a lot of different techniques for data generation in qualitative research, including for example development and practice, case studies and participant observation. A single case study strategy was chosen to get an in-depth inquiry of the phenomenon in a real-life context. The focus of the study is on an organisation, why a holistic case study was adopted. (Saunders et al 2016, 177-187.)

Research process is divided in 4 phases: data generation, analysis, interpretation and reportage. In qualitative research, interpretation is often part of the other phases, which makes it harder to divide the research process in different parts. Continuous interpretation can lead to revision of the research plan and question during the data generation process, and sometimes a return to the original data is needed to make the refined observations and adjustments (Figure 2). (Eskola, Suoranta 1998.)



**Figure 2.** Qualitative research process

### 1.2.2 Data collection and analysis

Data for the study is sourced using observation and literature review methods. This study was implemented in a work situation, where the researcher is part of the research setting. The objects of the observational data were operations and processes in the organisation that were related to the EMS. Literature refers to written material, which in this case was primarily sourced from the target organisation's databases including company publications, policies and procedures. This data was used to define the current state of the company EMS. Data for the description of environmental management and standards was mainly sourced from LUT Finna by the Lappeenranta academic Library. Types of literature included scientific journals, ISO publications, EMS handbooks and academic publications. The keywords used in searches included for example *environmental management*, *management system*, *management standard*, *sustainable management* and *life cycle management*.

The current environmental management system was reviewed and evaluated by answering questions based on the content of the system proposed by the standard. Relevant data for the gap analysis was processed using Excel, where the gaps were assessed and weighed to identify the most important focus areas in the EMS. The results were divided in three different groups depending on the level of conformance.

The study is limited to the environmental management standard ISO 14001 and does not include other management systems or standards. The focus of the study is on the significant changes included in the ISO 14001:2015 standard. The scope covers all activities of the target organisation.

## 2 ENVIRONMENTAL MANAGEMENT

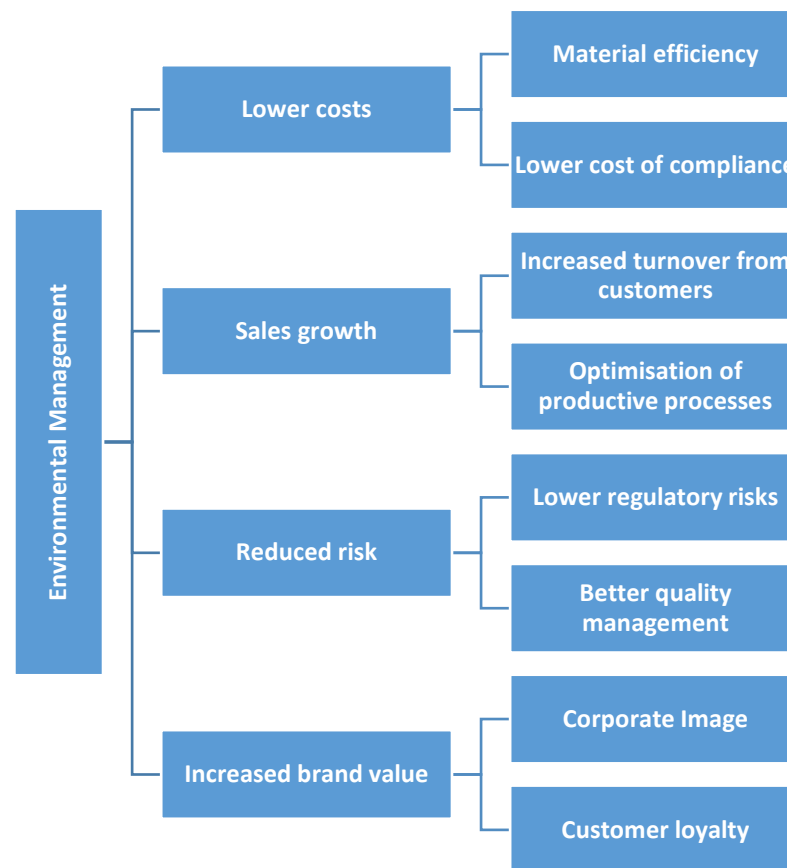
Environmental management means management of environmental aspects of an organisation. Environmental aspects are elements of products, activities or services that interact or can interact with the environment including air, water, land, natural resources, flora, fauna and humans. These aspects can cause an environmental impact or impacts in the surroundings that extend from the organisation to the local, regional and global system. Environmental, social and economic issues such as climate change, degradation of ecosystems and loss of biodiversity require preventive actions not only by nations but also by organisations. (SFS-EN ISO 14001 2015, 8-9.)

Organisational management systems establish policies, objectives and processes to achieve set objectives. As a part of the organisational management system, environmental management system is used to identify, measure and control environmental impacts of the organisation. Planned outcomes of an environmental management system include enhancement of environmental performance, fulfilment of compliance obligations and achievement of environmental objectives. These improvements provide value for the environment, organisation and stakeholders. (Ferron-Vilchez 2016, 883.) Stakeholders covers internal and external parties including customers, communities, suppliers, regulators, non-governmental organisations, investors and employees. Adopting and implementing an environmental management system is a voluntary act, as it is not regulated by national or international regulations or policies. (SFS-EN ISO 14001 2015, 8-9.)

Environmental management is sometimes equated with sustainability, but it does not consider the whole triple bottom line including social and economic aspects. The scope and concept of environmental management are more limited with the focus on tools, methods and policies. Environmental management is seen as a tool to achieve environmental sustainability, which with social and economic sustainability form the objective of sustainability. (Antweiler 2014, 4.)

## 2.1 Reasons for environmental management

The motives for environmental management can be categorised either in internal and external. The most important reasons for having an EMS are improvement of stakeholder relations, better company image, cost savings, better grip on environmental policy and reduction of environmental impacts and risks (figure 3). (Brouwer, Koppen 2008, 454.) Achieving strategic, tactical or operational objectives at different levels bring advantages to the organisation. These set targets can range from strategic and organisational goals to different products and services. (Ferron-Vilchez 2016, 883.)



**Figure 3.** Reasons for environmental management

The benefits from environmental management may improve the economic performance through competitiveness. The enhanced competitiveness derives from increased turnover from customers, lower cost of compliance with environmental regulations, efficient resource management and better total quality management covering the whole life cycle of products. (Masanet-Llodra 2012.) Avoiding material and energy flows avoids overall costs and is

therefore directly linked to improvements in the financial performance (Claver-Cortés, Molina-Azorín, Tarí-Guilló, López-Gamero 2005, 171-173).

A good corporate image may attract new customers, talented labour and increase the turnover from existing businesses. Corporate image can be defined as a current general impression that a company generates in external and internal stakeholder's minds. A green corporate image shows the public and the media that the organisation voluntarily adopts environmental improvements. Taking environmental concerns seriously can improve the corporate image and therefore attract more customers and investors. It can also build more effective and collaborative relationships between the organisation and its stakeholders. (Martin-de Castro, Amires-Salvado, Navas-Lopez 2015, 245; Antweiler 2014, 16.)

Corporate image is important particularly to companies with a high brand value and brand exposure. These companies are strongly exposed to consumer reactions and want to retain the corporate image and by avoiding any problems that could possibly lead to brand value losses. Decreased brand value and negative customer reactions influence the financial revenue. There can be also significant direct financial losses, if the environmental problem grows into an environmental disaster. Reputational damage from environmental issues can be difficult or even impossible to restore. (Krishna, Manickam 2017, 177; Antweiler 2014, 16.)

Environmental management system helps organisations to comply with increasing environmental legislation and application. It also makes it easier for government regulatory agencies and other institutions to assess the status of environmental performance and risk management. Communicating environmental information to relevant interested parties maintains good public and community relations. (Krishna, Manickam 2017, 177.)

Besides external reasons for environmental management, the optimisation of the productive processes is an important motive to implement environmental management. By implementing environmental management inside an organisation, companies improve the capacity of managing and controlling their environmental performance by monitoring and regularly checking their activities. Improved operational control in design, manufacture, distribution and disposal of products conserves input materials and energy that leads to increased operational efficiency and cost savings. Using a life cycle perspective in organisation processes

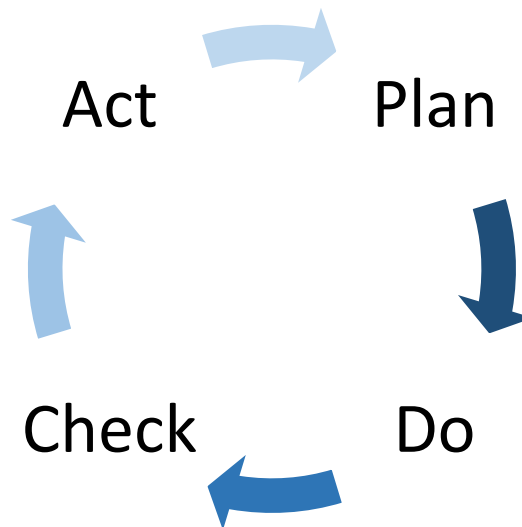
prevents shifting environmental impacts within the cycle. (Psomas, Fotopoulos, Kafetzopoulos 2010, 508; SFS-EN ISO 14004 2015, 6.)

Defining employees' responsibilities and tasks provides a basis for evaluating employee performance, identifying training needs and promoting employees. Integrating the management of quality and environmental issues in addition to other improvements provides credibility, reduced liability risk, increased productivity, cost saving and therefore profitability. (Psomas, Fotopoulos, Kafetzopoulos 2010, 508) Proactivity towards the environment also emerges unique and valuable capabilities in the organisation that help to achieve competitive advantages (Claver-Cortés et al 2005, 174).

## **2.2 The systems approach**

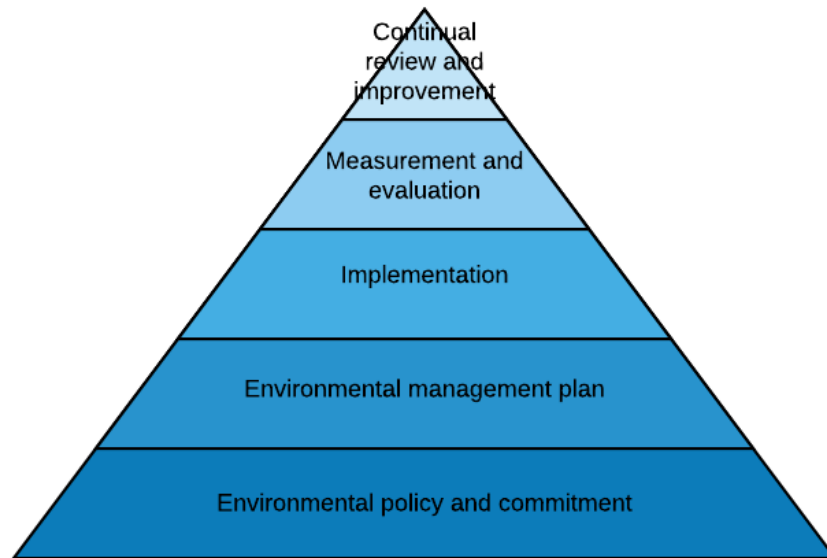
Environmental strategy includes environmental objectives, which aim to prevent, reduce, minimise or remedy environmental impacts caused by a business. Besides objectives, it defines procedures and techniques to achieve these objectives that can be for example methods or technology to reduce pollution. These procedures and techniques can go across organisational boundaries and include various stakeholders, including both internal and external parties. (Antweiler 1-2.)

Environmental management system ties together all functions that are used to develop, implement and monitor corporate environmental strategy. According to the systems approach, environmental strategy is a closed-loop process, where development of environmental objectives is followed by implementation through different techniques. Performance of the implementation is continuously monitored for the further development of the objectives. The design of the objectives is changed or adjusted to improve the performance of the implementation. Environmental management system is a continuous PDCA circle (plan, do, check, act), where development, implementation and monitoring alternate between the phases (figure 4). (Antweiler 1-2.)



**Figure 4.** Closed-loop process

Building an environmental management system can be broken into five phases as seen in figure 5. The foundation is an environmental policy and the commitment of the top management. The objectives of the environmental policy must be communicated through all levels of an organisation including employees and the public. The next step is to create an environmental management plan, which defines the objectives and goals of the environmental policy. It works as a bridge between the environmental objectives and their implementation. It does not require specific targets, as environmental management systems focus on the framework rather than measurable targets. (Antweiler 2014, 182.)



**Figure 5.** The Environmental Management System pyramid (Antweiler 2014)

The implementation phase takes place after creation of the environmental policy and management plan. Roles and responsibilities must be assigned, so the defined policies can be implemented in all levels of the organisation. In larger companies, there are usually environmental managers or equivalent managers, who are dedicated to carry out the objectives defined in the environmental management plan. They monitor and report on the environmental performance of the organisation and educate other employees about the environmental objectives. (Antweiler 2014, 182.)

Continual review and improvement of the environmental management stands on the top of the pyramid. This phase includes monitoring, measuring and evaluating relevant company operations and environmental performance. Continual improvement is a key element of ISO 14001 as it forms the basis for the plan-do-act-check principle. (Antweiler 2014, 182.)

### **2.3 International Organization for Standardization**

International Organization for Standardization (ISO) is an independent, non-governmental international organisation, which develops and publishes international standards. Since 1946, the organisation has published over 21991 International Standards making it the largest developer of international standards. (ISO 2017.) International standards provide technical

specifications and guidelines for the creation, interoperability and performance of products and processes. In principle, ISO standards are voluntary, but especially multinational companies often require their contractors along the supply chain to have the ISO certificate. The universal recognition of these standards allows compatibility between different operators. ISO's standards cover a wide variety of sectors, including for example agriculture, construction, manufacturing, healthcare, social responsibility and environmental management. (Heires 2008.)

ISO consists of groups called technical committees, which represent different sectors from all around the world forming a multinational network of standards committees. There are more than 250 technical committees ranging from information technology to food products and everything between. Technical committees are made up of experts from industries, consumer associations, academia, NGOs and governments. Co-operating with national governments and international organisation adds authority on the organisation and its standards. Governments use standards in creating public policy and hence incorporate them into public regulation. (Heires 2008; ISO 2017.)

ISO standards are based on a consensus approach, which means that comments from all stakeholders are considered in a decision-making process. There are 162 national members in ISO, each representing ISO in its country. Three categories divide these members in different levels of impact over the ISO. Only full member bodies have access to participate in ISO standard development and strategy by voting in ISO meetings. Correspondent members do not have their own standards organisation but can observe the development and strategy by attending the meetings as observers. Subscriber members cannot participate in work but can follow the development of standards and keep up to date. (ISO 2017.)

The consensus-based approach has received a lot of criticism due to its unevenly distributed capabilities to participate in ISO's work. Observer members do not have voting rights and hence cannot directly participate in the decision-making process. The important strategic decisions are made in the ISO Council and the Technical Management Board, which require member countries to be influential in economic size and involvement in standardisation. Developing countries do not meet the criteria to be accepted in these institutions, why the participation of NGOs and developing countries in the development work has been marginal

compared to industrialised countries. ISO standards have faced criticism for representing only interests of the industrial countries. Even if the standards are not equally relevant for all members, they still alter the global technological development in the future. (Heires 2008, 360-364.)

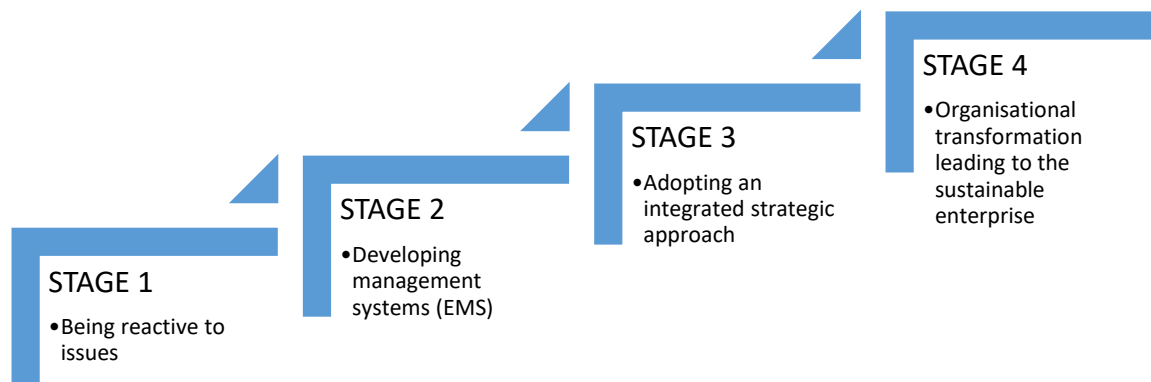
## **2.4 ISO Environmental Management System standards**

Environmental management systems often follow a standardised framework, the ISO 14001 being the most applied standard globally (Murmura, Liberatore, Bravi, Casolani 2018, 692). Environmental management system standards were introduced to improve sustainability, operational performance and environmental management in organisations through a framework, which can be audited by an independent third party. Environmental management system standards do not require companies to implement any technology or practise, but they encourage organisations to use the best available techniques (BAT). (SFS-EN ISO 14001 2015, 8-9.)

Research on environmental management system standards has mainly focused on the benefits of ISO 14001, while the criticism has been less discussed. One of the reasons for criticism has been the process-driven approach, which does not take performance achievements into account. Due to the process focused approach, there are significant differences in environmental performance between ISO 14001 certified organisations. (Ferron-Vilchez 2016, 883.) In some cases, the results of environmental management in company performance have been inconclusive, with no positive influence of environmental variables (Claver-Cortés et al 2005, 157).

Symbolic adopters are organisations that adopt ISO 14001 due to the achievement of institutional legality without interest in efficiency benefits or operational improvements. Adoption of the standard symbolically does not provide significant improvements in the organisation's environmental performance. (Ferron-Vilchez 2016, 883.) The ISO 14001:2015 standard emphasises improvement of environmental performance rather than improvement of the EMS itself. The transformation to the performance-driven approach allows an opportunity for symbolic adopters to achieve environmental improvements rather than just institutional legality.

ISO 14001 does not consider overall sustainable development including economic, social and environmental dimensions of business management. Therefore, using tools such as ISO 14001 does not assist an organization in real sustainable strategic planning. When considering sustainable development and its stages in an organisation, developing management systems in one of the first steps of involvement in sustainable development (figure 6). Developing management systems is a sign, that the organisation has started to consider environmental issues but does not necessarily mean that the organisation has adopted a strategic approach towards sustainability. The transition from stage two into stage three and further requires more generic understanding of the environmental impacts associated with an organisation's products, activities and process design. The key difference is fundamental and innovative change to the way the organisation operates. (Belcham 2014, 141).

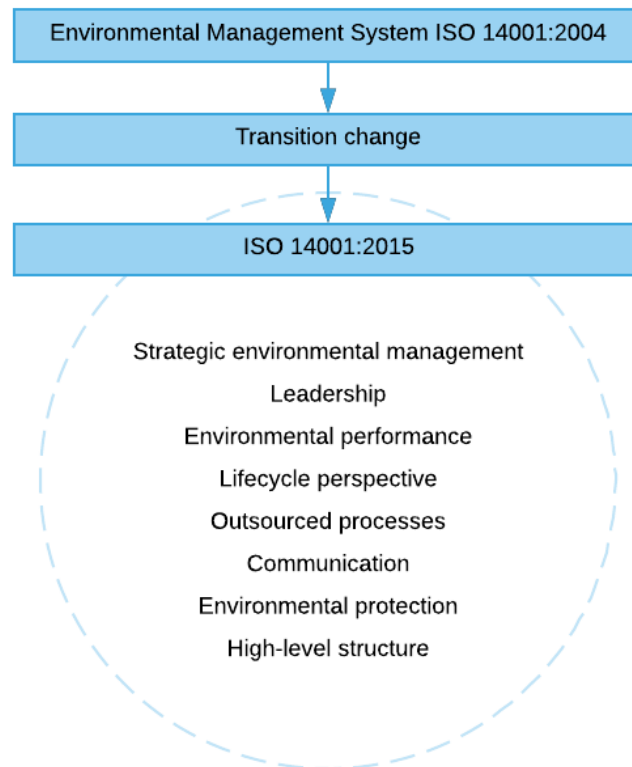


**Figure 6.** Evolving stages in environmental management and sustainable development (Belcham 2014, 141)

## 2.5 ISO 14001:2015

All ISO management system standards are regularly reviewed to maintain the relevance in today's markets and in the future. Standard updates are needed to answer the requirements of continuously changing working environment. (SFS-EN ISO 14001 2015, 8-9.) The new version of Environmental Management Standard was published in 2015 and the transition period from the old version lasts for three years until September 2018. The key improvements in the revised ISO 14001 are the importance of environmental management within strategic planning processes, greater commitment from the management, life-cycle

perspective on products and operations, stakeholder focused communication strategy and implementation of proactive initiatives to boost environmental performance. The new standard also follows Annex SL, a high-level structure for ISO management system standards. (BIS 2015.) The focus areas of the revised standard are seen in figure 7.



**Figure 7.** Key improvements in ISO 14001:2015

The Annex SL is a guideline, which provides the same structure and terminology for all management system standards. It is a set of 10 clauses that all ISO management system standards will follow in the future (figure 8). The similar structure allows system integration into other management systems, typically into a quality management system ISO 9001 and health and safety management system OHSAS 18001. Integrating management systems together has several benefits by reducing duplication and ensuring that all quality and environmental processes are integrated and aligned with the organisational strategy. (BSI 2015.)



**Figure 8.** High level structure of standards

### 2.5.1 Scope

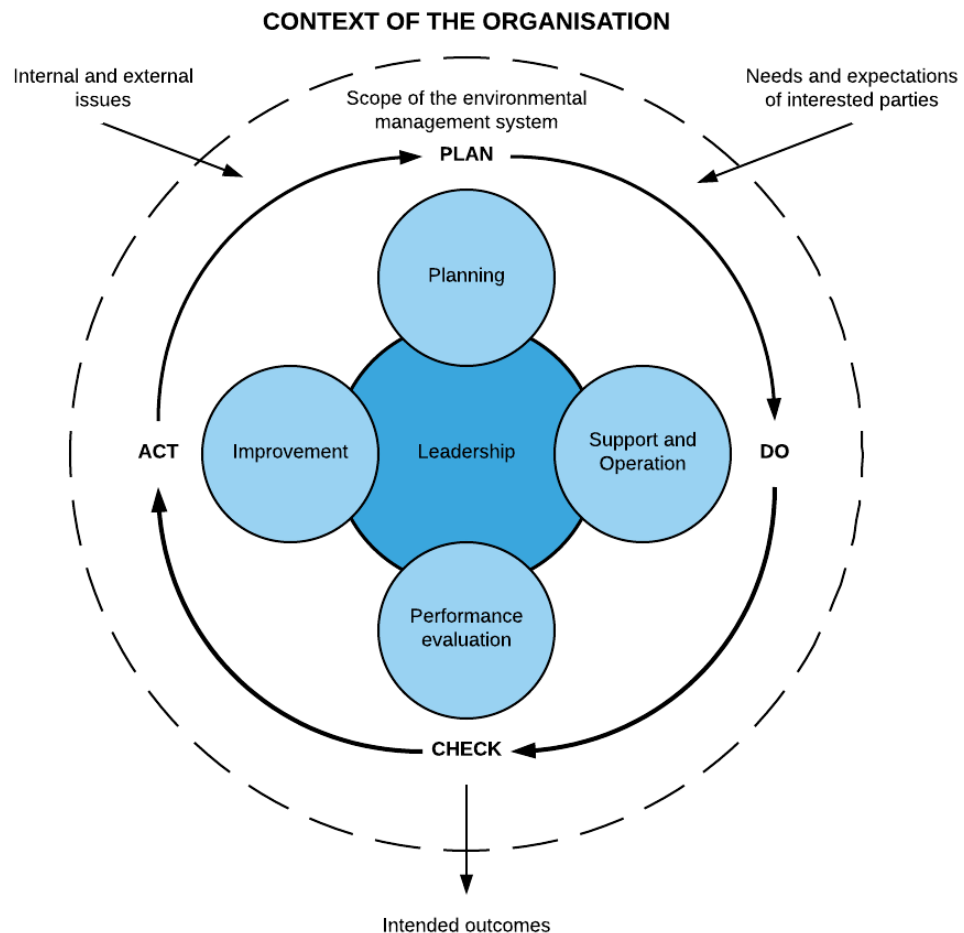
The scope refers to the scope of the ISO standard, not the actual management system. The scope differs between management standards; OHS standard is about people, quality standard is about the customer and environment is about the environmental impact. The scope also states that organisations will continually improve and follow statutory and regulatory requirements. It also states that all organisations regardless of size, type, products and services can follow the generic requirements. (PWC 2018.)

Normative references section keeps the numbering in alignment with other ISO standards, even if there are none planned for the upcoming revisions of ISO 14001. Terms and definitions include standard specific terms but also generic management system terms and definitions. (PWC 2018.)

### 2.5.2 Context of the organisation

Definition of the context represents the foundation of the Environmental Management System. The clause was added to the ISO 14001:2015 standard due to the increased prominence of environmental management in strategic planning processes. Defining the context will help the organisation to understand internal or external issues that can affect the organisation. External issues, such as legal, technological or cultural factors can exist on international,

national or local level. Issues inside the organisation contain things like values, culture and knowledge. Figure 9 shows the context of the organisation as described in ISO 14001:2015. (PWC 2018.)



**Figure 9.** Context of the organisation (ISO 2015)

The context of the organisation can include its complexity, structure, activities and locations of its functional units for the entire organisation or at a local level. Organisations should determine the context to establish, implement, maintain and improve their environmental management system. It includes environmental conditions that are relevant to its purpose and affect the results of the environmental management system. The intended core results include enhancement of environmental performance, fulfilment of compliance obligations and achievement of environmental objectives. Besides core outcomes, organisations can set

other voluntary targets beyond the requirements of the environmental management system. (SFS-EN ISO 14004 2016, 13.)

### 2.5.3 Leadership

ISO 14001:2015 introduces a new concept of leadership, where top management is directly responsible for the running of the environmental management system. Top management of the organisation should demonstrate leadership and commitment and ensure that policies, responsibilities and authorities are communicated and understood well through the organisation. (PWC 2018.) An active leadership was added to the standard, because top management has a final responsibility for the effective implementation of the environmental management system. Any changes in the leadership occur in other organisational structures, due to its central part in the context of the organisation. (Susanto, Mulyono 2017, 43.)

The environmental management system is more effective and enduring if it is integrated into other business processes and communicated across the business. Top management should ensure that the environmental system is not separate from the core strategy and is considered in strategic business decisions and objectives. The environmental management system should provide value to the organisation and stay successful and improve in the long term. An environmental policy should define a framework (figure 10) for establishing environmental objectives for the organisation. (SFS-EN ISO 14001 2015, 21.)



**Figure 10.** Environmental policy framework

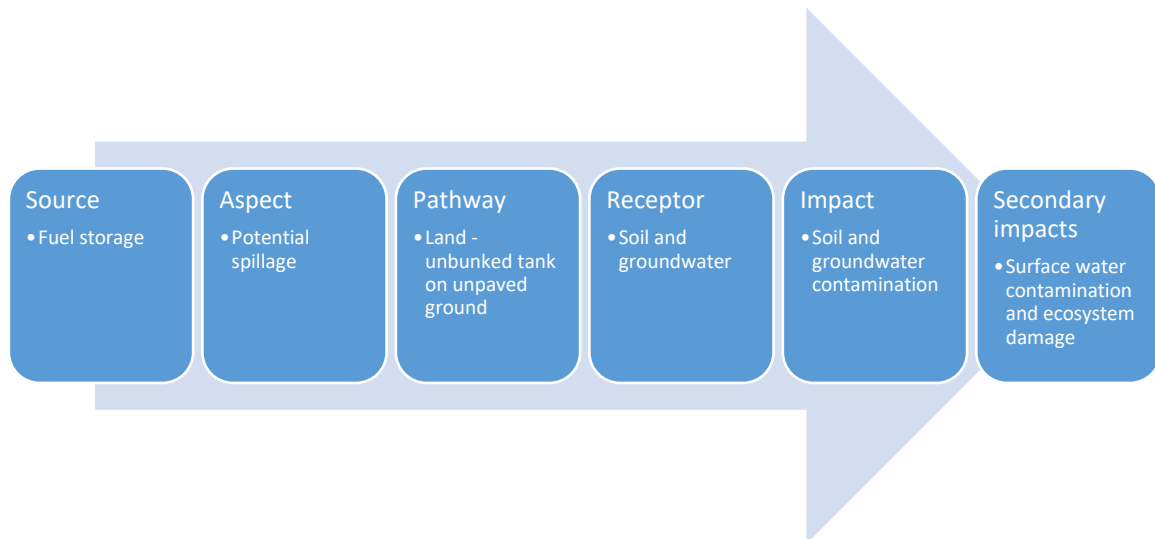
#### 2.5.4 Planning

The ISO 14001:2015 standard added a requirement to address both risks and opportunities related to environmental aspects, compliance obligations and other requirements. Organisations need to consider their environmental impacts but also impacts that the environment will have on them. For example, climate change, lack of resources or increasing energy prices are potential risks to many industries. Compliance obligations, for example national legislation or permits issued to the organisation, can result in risks and opportunities to the organisation. The compliance obligations change constantly, why there should have a documented process about who keeps track of changes in legislation and other requirements, which sources of information are used, how frequently it is evaluated and how is it recorded and communicated internally. (Martins, Fonseca 2018, 452; SCCM 2017.)

The ISO 14001:2015 standard considers the environmental impacts through the entire supply chain. One of the key changes is the introduction of life cycle thinking (LCT) and eco-design, which is a tool to integrate environmental aspects into product design and development. (Lewandowska, Matuszak-Flejsman 2014, 1795.) The key requirements referring to life cycle perspective in the standard are clauses “6.1.2 Environmental Aspects” and “8.1 Operational Planning and Control”. Clause 6.1.2 requires the organisation to consider a life cycle perspective when determining the environmental aspects of its activities, products and services that it can control and influence. According to clause 8.1, organisations should determine environmental requirements for procurement and create controls to ensure environmental requirements are addressed in development of products and services, considering life cycle perspective. Environmental requirements and life cycle related information should also be communicated to external stakeholders. (SFS-EN ISO 14001 2015, 15.)

The standard requires the organisation to keep a register of environmental aspects and establish environmental objectives based on them. Aspects, that can cause various types of high risk impacts, are classified as significant aspects. Direct environmental aspects are aspects related to operations, products and services of the organisation itself. The organisation has a direct management control over the direct aspects. Indirect aspects are not a direct result of the organisation itself but are still associated with the organisation. These include for example supply chain or customer-controlled aspects. (SCCM 2017.) The potential environmental

impacts should be identified in different operating conditions including normal, abnormal and emergency situations. The source-pathway-receptor model (figure 11) is used to recognise environmental aspects and their impact on the environment. (Belcham 2015, 188.)



**Figure 11.** Source-pathway-receptor model (Belcham 2015)

The organisation should plan actions, how to integrate and implement the compliance obligations in the environmental management plan. The environmental objectives should be established so that the organisation can achieve the planned outcomes for the EMS. The plan should also include how to evaluate the effectiveness of the actions. The compliance obligations must be documented and considered when the environmental management system is established, implemented, maintained or improved. (SCCM 2017.)

### 2.5.5 Support

Immaterial and material resources such as skills, knowledge, tools and equipment, have to be determined for the efficiency of the EMS. Resources refer to ISO 14001:2015 requires organisations to demonstrate the competency of the employees, implementation of communication processes and the control of documented information. Attention should be paid to the competency of persons, whose work may have an impact on environmental performance of the organisation. Basic awareness of the EMS and how their work may have an impact on the environmental performance should be ensured in all employees. (Belcham 2015, 210.) The proof of monitoring the competence can be demonstrated for example by identifying the

required skills, providing training to fulfil these requirements and recording this information of competence. (Gardner 2018.)

Internal and external communication were added to the standard to develop a communications strategy in organisations. The strategy should cover all organisational levels and different departments and allow two-way communication for improving the EMS performance. (Gardner 2018.) Procedure for two-way communication means that the organisation can receive, record and respond to communications from different interested parties (Belcham 2015, 210). This includes not only employee and customer feedback, but also necessary dialog with public authorities such as emergency planning and communications. (Muralikrishna & Manickam 2017, 190.)

### **2.5.6 Operation**

Establishing and maintaining work procedures and controls over operations ensures that the environmental policy, objectives and goals are met. Work procedures should consider normal, abnormal and emergency conditions in operations. (Belcham 2015, 211.) Emergency plans and procedures should be in place to ensure effective response to incidents and accidents. Emergency responses should be frequently tested, where possible.

Operational procedures and controls can be divided in three categories (Muralikrishna & Manickam 2017, 190):

- Activities to prevent environmental impacts (pollution prevention, resource management)
- Daily management activities to comply with internal and external organisational requirements and to ensure their efficiency
- Strategic management activities to comply with changing environmental requirements

The requirement of outsourced processes was added to the ISO 14001:2015 standard to extend the control to outsourced functions or processes. This means controlling for example

contractor work, which could cause significant environmental impacts. (Muralikrishna & Manickam 2017, 190.)

### **2.5.7 Performance evaluation**

Organisations should have a documented procedure on how to monitor key performance criteria. Environmental indicators are simple measures that show the status of an environmental system. They are used to monitor and evaluate effectiveness and performance of sustainable targets, to communicate to various stakeholders and to compare the environmental performance of companies. Indicators express the status of an environmental system in different forms, including for example qualitative, quantitative, specific and general forms. Quantitative indicators express for example the total amount of air emissions or total volume of hazardous waste while qualitative indicators express for example changes in cultural values. ISO has developed a various set of indicators to measure environmental performance of businesses. (Bae, Smardon 2011.)

The organisation should determine when and how it evaluates its compliance. It can be conducted as part of the internal audits, which are used to review the current state of the management system and its possible nonconformities by the organisation itself. The evaluation determines whether the environmental management system has been properly implemented and maintained. The results of the audit are reported to the relevant management. Audit frequency should consider findings of the previous audits and focus on areas with the most significant environmental aspects. (Belcham 2015, 195.)

### **2.5.8 Improvement**

The previous versions of the ISO 14001 standard emphasised the continual improvement of the management system, but the ISO 14001:2015 standard has shifted the focus on the improvement of environmental performance. The organisation should include the basic elements of correcting non-conformances (Muralikrishna & Manickam 2017, 191):

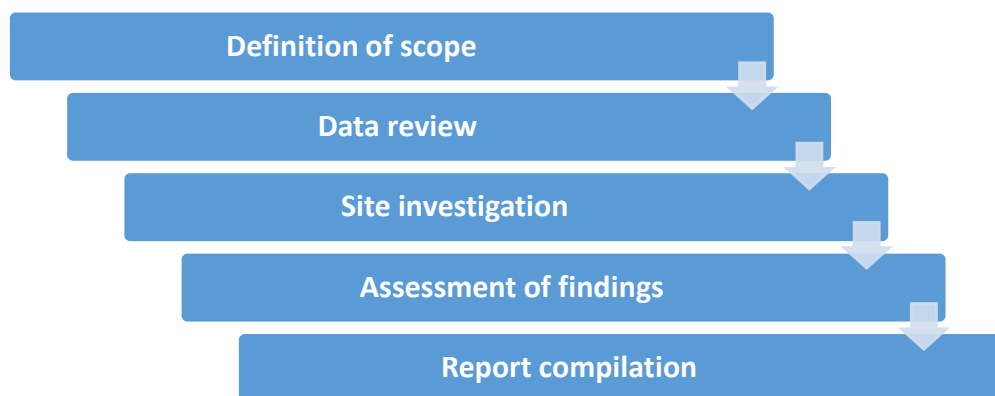
- Correction to the non-conformance
- Identifying the root cause

- Identifying and implementing corrective action
- Implement controls to avoid the non-conformance
- Monitor the results of actions taken

The organisation should review and determine the causes to eliminate the root cause of non-conformances. If necessary, the organisations should make changes in the environmental management system to avoid these nonconformances in the future. The effectiveness of the changes should be monitored and documented.

## 2.6 EMS certification audit

Environmental management systems can be standardised to be comparable between organisations. Audit is a systematic, independent and documented process to evaluate the management system and its compliance with the management standard. To verify the compliance with the ISO standards, organisation must pass a certification procedure. The verification process must be done by an independent accredited third party to ensure transparency and credibility. (Antweiler 2014, 182; Dogui, Boiral, Heras-Saizarbitoria 2014, 14.) Both internal and external audits include some common elements as presented in figure 12.



**Figure 12.** Audit elements (Belcham 2015, 196)

When an organisation is seeking for a certification, the certification body sends its auditors to audit the organisation's EMS. If the results of the audit confirm that the EMS complies with the requirements proposed by ISO 14001, the organisation obtains the certification for a period of three years. Accredited certification to ISO 14001 is not a requirement and the organisation can benefit from the standard without the certificate. However, certified

management standard is a proof to external stakeholders that the organisation has an environmental management system that has been properly implemented and maintained. The certificate also helps to show authorities and other stakeholders that the organisation meets the certain environmental requirements. (Dogui et al 2014, 14.)

The effectiveness of ISO audits has been criticised due to different requirements for certifications between auditors and certification bodies. The audit process addresses highly complex issues, but the sources of information on which the certification is based are unreliable. Size and resources of the organisations differ, which leads to auditors adopting a consulting approach rather than a conformance perspective and treating organisations heterogeneously. There is also a difference between the auditors and their clients, as clients require more compliance focused auditing than auditors. This supports the theory of symbolic adoption of the standard rather than being an actual tool to improve environmental performance. (Heras-Saizarbitoria, Dogui, Boiral 2013, 90-91.)

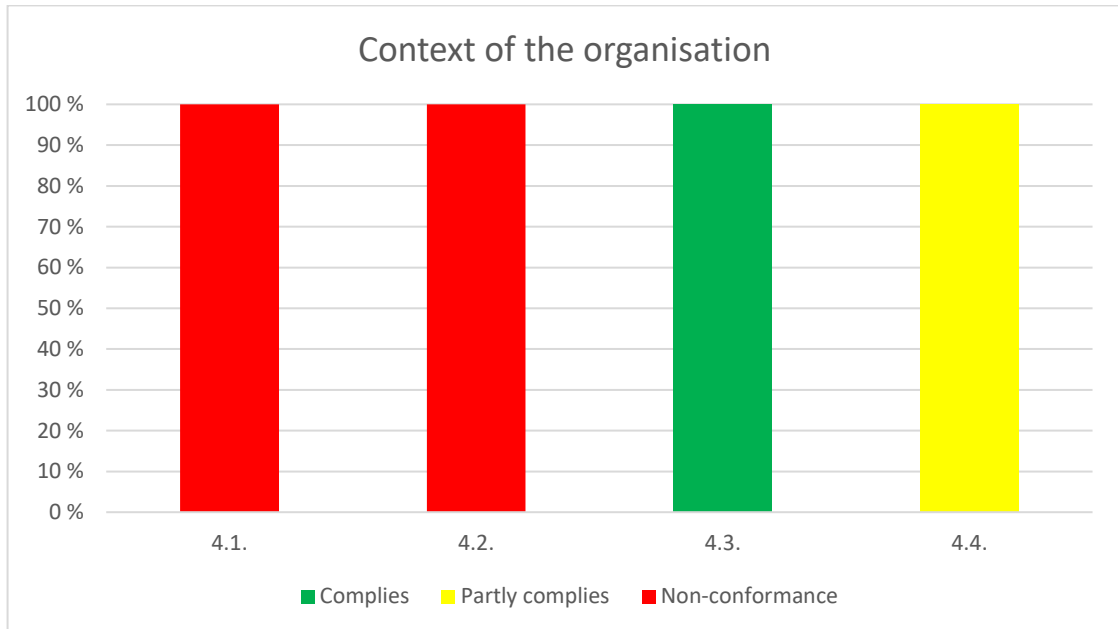
### 3 ENVIRONMENTAL MANAGEMENT REVIEW – QUALITATIVE ANALYSIS

The environmental management system was reviewed and evaluated by answering questions based on the content of the ISO 14001 standard. The analysis and its questions were divided in clauses and sub clauses as presented in the standard. The EMS was compared to each requirement of the standard and scored with 3 possible results, that ranged from fully compliant to partly compliant and non-conformance (figure 13). Traffic light rating system was used to indicate the status of each requirement. The percentage of non-conformances, partly compliant and compliant clauses are shown in results, while the complete gap analysis can be found in Appendix 1.

| Complies with the requirement   | Partly complies with the requirement  | Non-conformance   |
|---|---|---|
| <ul style="list-style-type: none"> <li>• There is evidence to support the question</li> <li>• There is a written procedure (if needed)</li> </ul> | <ul style="list-style-type: none"> <li>• There is evidence to support the question but the procedure needs to be improved to be fully compliant</li> <li>• There is evidence to support the question but no written procedure</li> <li>• There is a written procedure, but not enough evidence to support the question</li> </ul> | <ul style="list-style-type: none"> <li>• There is no evidence to support the question</li> <li>• There is no written procedure</li> </ul> |

**Figure 13.** Scoring the conformance to the requirements

### 3.1 Context of the organisation

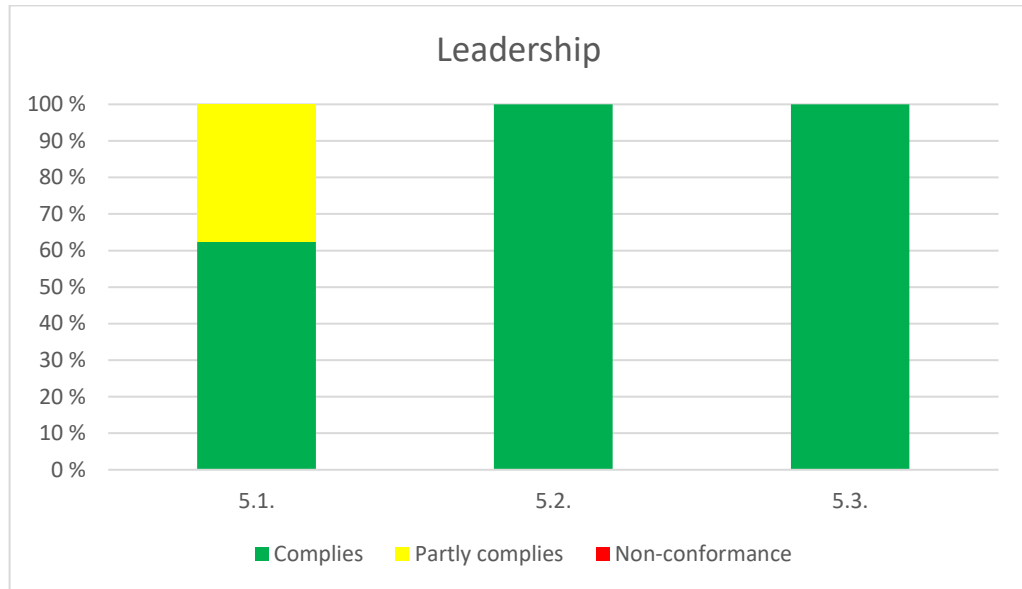


**Figure 14.** Gap analysis - context of the organisation

As seen in figure 14, the target organisation does not comply with the requirement to understand the context of the organisation. Clauses 4.1 and 4.2 focus on determining external issues, internal issues and interested parties relevant to the organisation. The target organisation has not determined these issues, interested parties or their needs and expectations. Therefore, it has neither recognised the compliance obligations arising from the requirements.

The scope of the EMS has been determined and documented, as required in clause 4.3. The EMS includes all the activities, products and services within the scope. The requirement to establish, implement, maintain and continually improve and EMS (clause 4.4) has been partly fulfilled. There is an established environmental management system, but there are no established processes to continually improve it.

## 3.2 Leadership



**Figure 15.** Gap analysis - leadership

Clause 5.1 focuses on leadership and commitment. Top management has taken accountability for the effectiveness of the EMS. The environmental policy and objectives lack compatibility with the strategy and the context of the organisation, as the context has not been determined. The target organisation has neither established clear environmental objectives for the organisation. The requirements have been poorly integrated to the business processes, as some of the requirements (e.g. environmental aspects or impacts) have not been considered in all business processes.

Top management has ensured resources and directed persons to ensure the effectiveness and communication of the EMS. Top management has also supported other relevant management roles to demonstrate their leadership in EMS related matters, as required in 5.1.

As seen in figure 15, the established environmental policy is fully compliant with clause 5.2 – it provides a framework for setting environmental objectives, commitment to protect the environment, to fulfil its compliance obligations and to improve the EMS to enhance environmental performance. The policy is documented and available internally and externally to interested parties. The roles, responsibilities and authorities to ensure the EMS conformity and reporting have been assigned as required in clause 5.3.

### 3.3 Planning



**Figure 16.** Gap analysis - planning

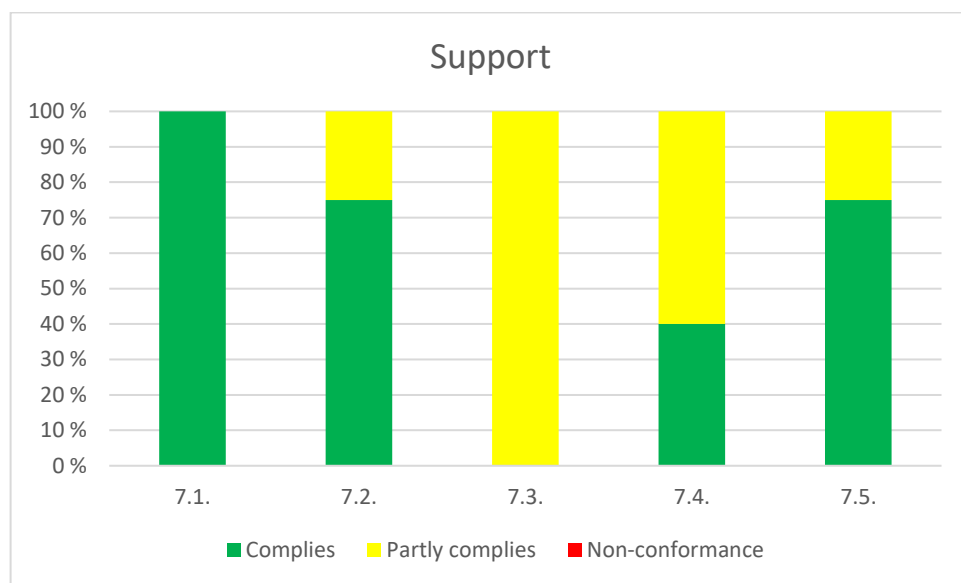
The biggest non-conformances revealed in the gap analysis are related to planning, as seen in figure 16. This is partly due to the new requirements introduced in ISO 14001:2015, but also due to old requirements of ISO 14001:2004, that have not been fully implemented.

Clause 6.1, the requirement to address risks and opportunities related to environmental aspects, compliance obligations and other issues has been partly fulfilled. The target organisation has defined risks thoroughly but has not considered opportunities related to these issues. The target organisation has determined the environmental aspects of its activities, products and services, as well in emergency situations or under abnormal conditions. The organisation has also established criteria to rate the most significant environmental impacts of these aspects.

The only non-conformance under clause 6.1 is the requirement to consider life-cycle perspective when determining the associated environmental impacts. The organisation has not considered life cycle of its products or services and therefore has not recognised the associated environmental impacts.

As seen in figure 16, the organisation does not comply with clause 6.2, which is environmental objectives and achieving them. There are no established environmental objectives at all, even if there is an environmental policy in place that provides a framework for setting objectives. Due to the lack of environmental objectives, there is no planning action on how to achieve them or how to integrate them into other business processes.

### 3.4 Support



**Figure 17.** Gap analysis - support

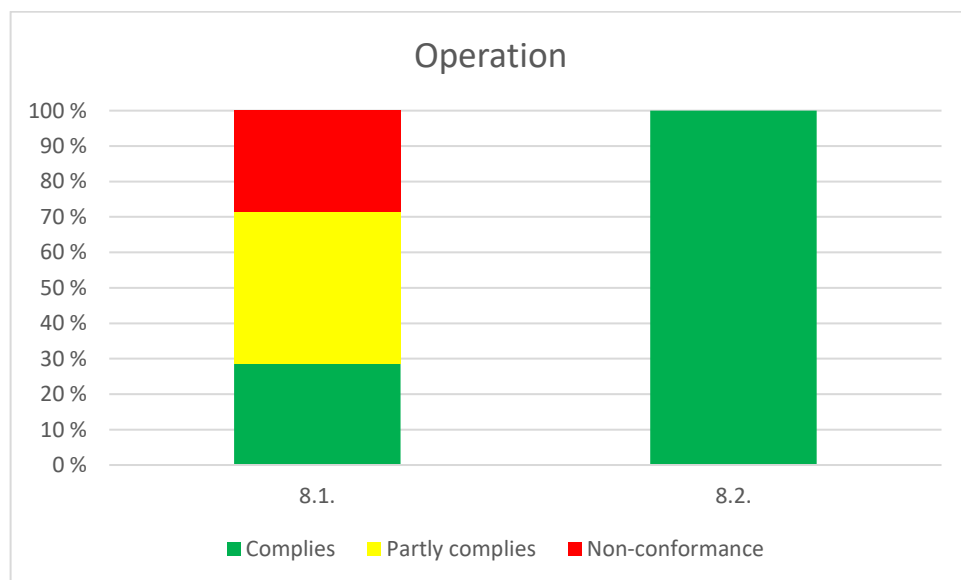
The organisation has determined and provided resources for the implementation, maintenance and continual improvement of the EMS, as required in clause 7.1. The necessary competency of these people has been determined and ensured, and there is documented information of trainings and other competencies as required in clause 7.2. The organisation does provide training on EMS related issues, but it has not fully recognised possible training needs associated with its environmental aspects.

The organisation is partly compliant with clause 7.3, which is about the EMS awareness of its employees, as seen in figure 17. The environmental policy, significant environmental aspects and environmental issues are communicated for example during the planning and operation phases, but the organisation has not ensured the awareness of employees who do not participate for example in projects.

In general, the target organisation has partly established and implemented communication processes as required in clause 7.4. The organisation has focused on internal communication relevant to the EMS, and this information has been communicated among the various levels and functions of the organisation. The organisation does not fully comply with the requirements of external communication, as it has not communicated EMS related information as established by the communication processes.

The organisation mainly complies with clause 7.5 on documented information, as its EMS includes documented information required by the standard. This documentation is also available and appropriately protected. There is also a process for appropriate format of the documented information, but it has not been fully implemented among all functions of the organisation.

### 3.5 Operation



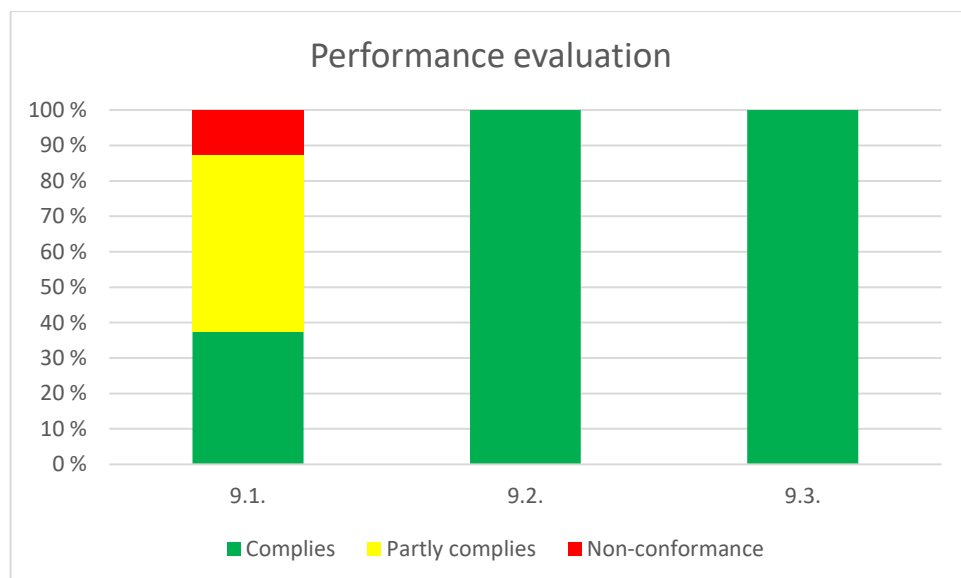
**Figure 18.** Gap analysis - operation

There are multiple non-conformances related to clause 8.1, operational planning and control, the most significant being the life-cycle perspective. The organisation has not considered the life-cycle perspective in the design of its products or services. Due to the lack of life-cycle thinking, it has not determined the potential environmental impacts associated with its supply

chain and other stakeholders. Therefore, the organisation has not communicated life-cycle related information to external stakeholders, including for example customers and contractors. Other environmental requirements, excluding the life-cycle related information, have been communicated to relevant stakeholders. The organisation has ensured the influence and control of outsourced processes, but the type and extent of control has not been defined within the EMS.

There are established, implemented and maintained processes for possible emergencies as required in clause 8.2. There are planned actions for preventing and mitigating environmental impacts from emergencies, and these actions are reviewed and revised, if needed after trainings or emergency situations. All employees are also trained to prepare and response to emergency situations, and these competencies are documented.

### 3.6 Performance evaluation



**Figure 19.** Gap analysis - performance evaluation

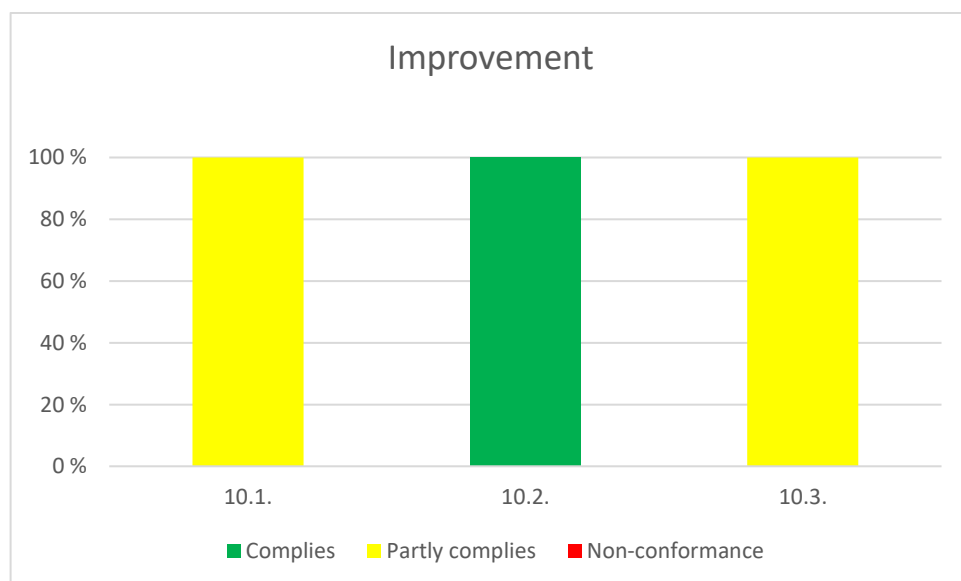
In general, the organisation has not determined methods, criteria, indicators or schedule for evaluation of its environmental performance as required in clause 9.1 (figure 19). This is a significant non-conformance, as top management has evaluated the environmental performance and effectiveness of the EMS, but there are no established methods, criteria or

indicators for this. The communication relevant to the environmental performance has been insufficient, as it is focused only on the environmental emergencies and abnormal conditions.

The organisation has established, implemented and maintained processes to evaluate its compliance obligations and their fulfilment. There is also documented information of the compliance evaluation results.

There is an internal audit programme in place, that includes frequency, methods, responsibilities, planning requirements and reporting as required in clause 9.2. The implementation and results of audits have been documented. In addition to internal audits, top management reviews the EMS regularly according to the requirements of the standard. The reviews and their outputs are documented as evidence of the results.

### 3.7 Improvement



**Figure 20.** Gap analysis - improvement

In general, the organisation has determined opportunities for improvements to achieve the intended outcomes of the EMS. The clause 10.1 is only partly compliant, because the organisation has not implemented necessary actions to achieve all the possible improvements.

The organisation has well prepared for nonconformities, as required in clause 10.2. The organisation has reacted to possible nonconformities by controlling them and by mitigating adverse environmental impacts. After nonconformities, the organisation has reviewed and determined the causes and other possible nonconformities to eliminate the root cause. The organisation has acted to correct the nonconformities and followed the effectiveness of these actions. The nonconformities, actions and results are documented, and the management system is changed, if necessary.

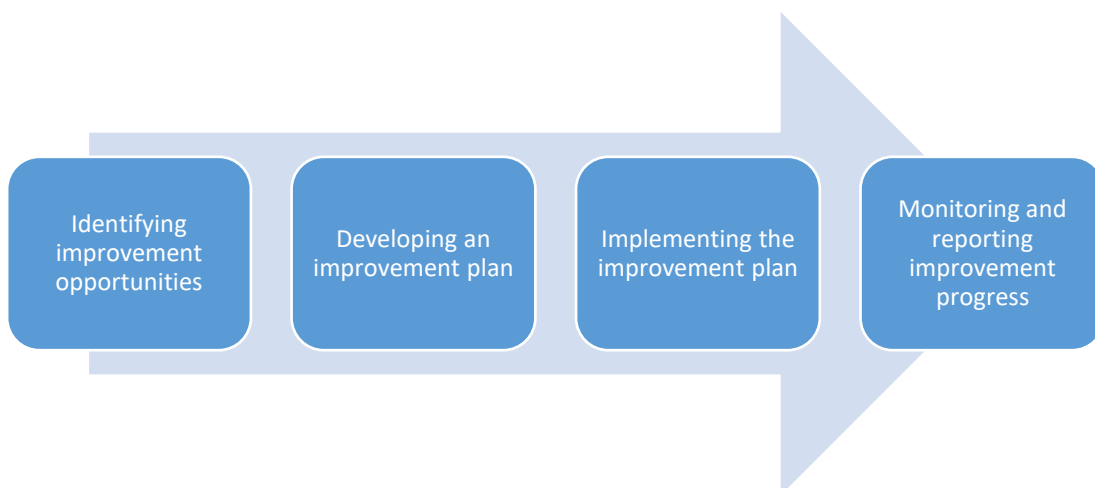
## 4 RESULTS

### 4.1 Gap analysis

A gap analysis is a tool used to identify differences between the current environmental management system and what is required by the standard. The information provided by the gap analysis is used to develop an improvement plan, which is part of implementation of an environmental improvement programme (figure 21). The current EMS complied or partly complied with clauses of the previous standard version. All non-conformances found were new requirements of the ISO 14001:2015 standard. The improvement plan focuses on the non-conformities, which were:

- Context of the organisation
- Life cycle perspective
- Environmental objectives
- Environmental performance

The improvement plan suggests corrective actions to comply with the new requirements.



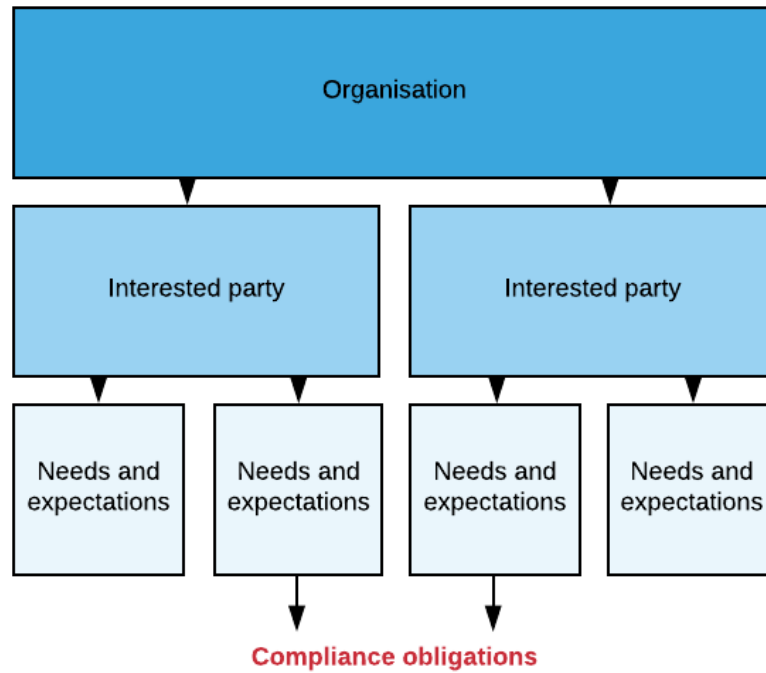
**Figure 21.** Implementation of an environmental improvement programme (Belcham 2015, 307)

## 4.2 Context of the organisation

There are three parts in the context of the organisation: understanding the organisation and its context, understanding the needs and expectations of interested parties, determining the scope of the environmental management system and establishing and maintaining the environmental management system. According to the ISO 14001:2015, determining the context includes 5 steps:

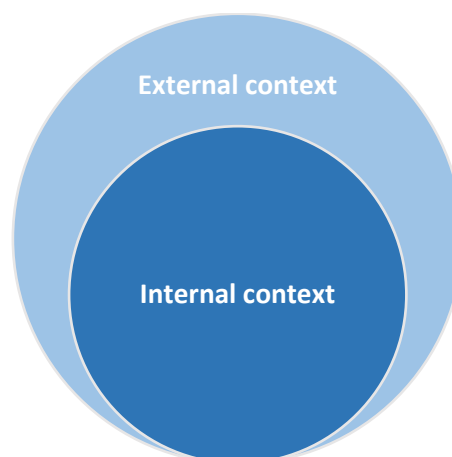
1. Identify all internal issues
2. Identify the external issues
3. Identify the interested parties
4. Define the scope of the EMS
5. Establish and maintain the EMS

The first step is to determine all relevant external and internal issues that can possibly affect the intended goals of the environmental management system. To find out the compliance obligations of the organisation, interested parties such as regulators and suppliers, should be determined. After the most important stakeholders are found, their need and expectations should be determined. Some of these needs and expectations become organisation's compliance obligations (figure 22) (SFS-EN ISO 14001 2015, 13.).



**Figure 22.** Determining the needs and expectations of interested parties

Changes in the other parts of the context of the organisation can result to changes in interested parties over time, therefore the interested parties should be reviewed on a regular basis. The organisation should consider the scope, nature and scale of the organisation when determining needs and expectations of the relevant interested parties. The approach should be suitable in terms of details, complexity, time, cost and availability of reliable data. (SFS-EN ISO 14001 2015, 17-18.)



**Figure 23.** Context of an organisation

Internal context of the organisation includes internal stakeholders, vision, mission, objectives, resources, capabilities and culture. External context of the organisation includes macro-economic factors such as legal, social or political regulatory. It includes also factors which affect internal context through other requirements such as trade union regulations (figure 23). (Nolan 2018.)

**Table 2.** Example of interested parties

| RELATIONSHIP             | INTERESTED PARTY        | NEEDS AND EXPECTATIONS                |
|--------------------------|-------------------------|---------------------------------------|
| <b>Authority</b>         | Regulatory agency       | Legal compliance                      |
| <b>Dependency</b>        | Employees               | Safe and healthy working environment  |
| <b>By representation</b> | Membership organisation | Collaboration on environmental issues |

Stakeholders are interested in the EMS for different reasons (table 3), what should be kept in mind while identifying the interested parties. ISO 14001:2015 does not provide methods to determine the context of the organisation, but there are different business tools developed for analysing the business environment. PEST analysis (table 2) can be used to analyse the macro-environmental factors that have an impact on an organisation. Factors recognised in PEST analysis can be classified using SWOT analysis, which categorises them in strengths, weaknesses, opportunities and threats. (Martins, Fonseca 2018, 451.)

**Table 3.** PEST analysis

| Political  | Economic  | Social   | Technology   |
|--|---|--|--|
| <ul style="list-style-type: none"> <li>•Legislation</li> <li>•Regulatory agency</li> <li>•Government policy</li> <li>•Lobbying groups</li> </ul> | <ul style="list-style-type: none"> <li>•Economic policies</li> <li>•Taxation</li> <li>•Specific sector conditions</li> <li>•Interest rates</li> </ul> | <ul style="list-style-type: none"> <li>•Attitudes and opinions</li> <li>•Media</li> <li>•Publicity</li> <li>•Image of the organisation</li> <li>•Major events</li> </ul> | <ul style="list-style-type: none"> <li>•Competing technology</li> <li>•Replacement solutions</li> <li>•Technology legislation</li> </ul> |

The scope of the environmental management system requires the organisation to determine the boundaries and applicability of the environmental system. Organisational structure, activities, products, services and ability to control in addition to parts determined in previous steps are considered when determining the scope. When the scope is defined, all the activities, products and services of the organisation within the scope should be included in the environmental management system. The scope should be documented and available to interested parties. Once the environmental management system is set, the organisation should establish, implement, maintain and continuously improve it in accordance with the standard. (SFS-EN ISO 14001 2015, 13.)

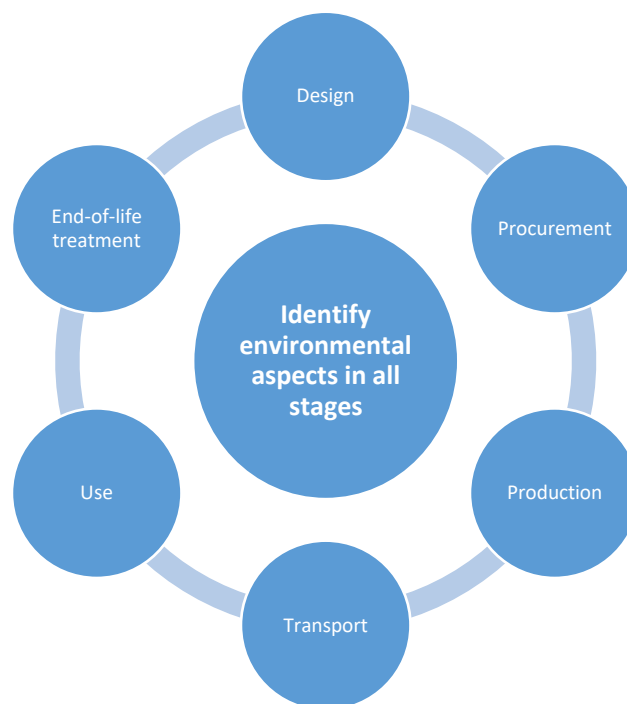
### **4.3 Life cycle perspective and eco-design**

#### **4.3.1 Life cycle management**

The approach to cover the entire product chain from cradle to grave to reduce environmental impacts is referred as environmental Life Cycle Management (LCM) (Nilsson-Linden, Baumann, Rosen, Diedrich 2018, 1369). LCM is an integrated framework of concepts, techniques and procedures that aims to improve the overall sustainability performance of company's value chain and business. This means expanding the traditional view in environmental management to upstream and downstream activities, taking social and economic aspects throughout the life cycle in account and linking sustainability management to business value and value creation. (Rebitzer 2015, 5.) Considering social and economic aspects along a product life cycle is in line with the recent evolution of life cycle assessment (LCA), which has progressed from a calculation method to an overview of the issues related to the life cycle (Nilsson-Linden et al 2018, 1373).

Application of LCM may vary in organisation due to different product systems, aspects of sustainability, specific environmental issues, scope, and value chain complexity and so on. Reviewing the organisation's products should be the first step when applying LCM. Gathering information of a product life cycle, market situation and external stakeholders helps to get an overview of the sustainability status of the organisation. (Gemechu, Sonnemann, Remmen, Frydendal, Jensen 2015, 37.)

The life cycle of a product covers multiple stages including design, manufacturing, distribution, consuming, recycling, reuse and disposal (figure 24). Organisations should be aware of environmental impacts of their products and services and have control or influence throughout this life cycle. Assessing the whole life cycle of products or services can provide reliable information on environmental impacts of the organisation. This information helps organisations to recognise the influence of its choices. (Sonnemann, Gemechu, Remmen, Frydendal, Jensen 2015, 11-12.)



**Figure 24.** The life cycle of products and services

The standard requires organisations to consider the environmental aspects or impacts of the life cycle of products but does not propose a single method for determining the aspects. According to the standard, the organisation should consider inputs and outputs regarding products, services and activities. These inputs and outputs include for example raw materials, resources, energy, emissions, waste and use of space. (Rybackowska-Bladejowska 2017.)

When considering the life cycle of a product, the organisation should study at least the following:

- the stage of the life cycle, where the product or service is in

- the amount of control over the life cycle
- the amount of influence over the life cycle
- the length of the supply chain
- the technological complexity of the product

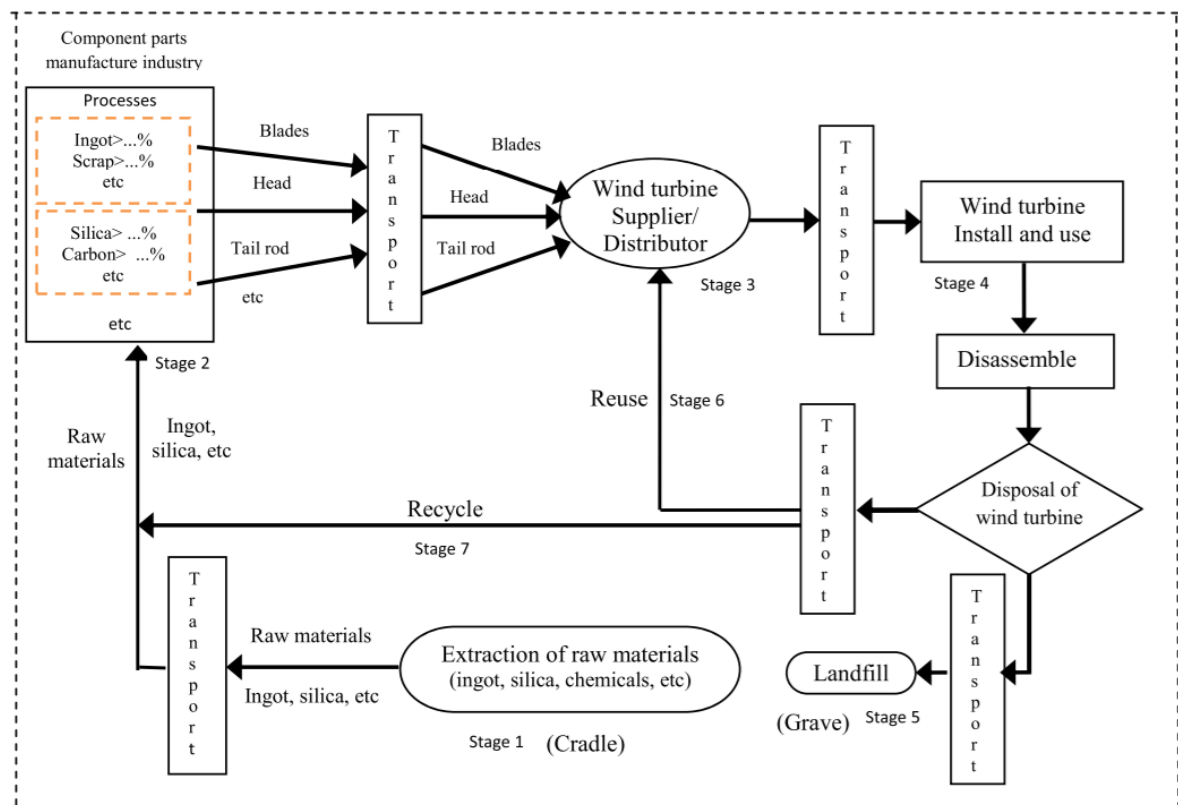
Considering the above requires strong co-operation across the organisation and includes suppliers, manufacturers, contractors and customers within different stages of the life cycle (Lewandowska, Matuszak-Flejszman 2014, 1797.) Stages, where the organisation has the greatest control or influence over, are usually the greatest opportunities to reduce the environmental impacts for example by minimising the use of resources or generation of waste. Revealing the most significant impacts in each life cycle stage also avoids transferring environmental impacts from one stage to another. (Rybczewska-Bladejowska 2017.) When the organisation has performed the status overview of its products and services, the next step is to set objectives and targets for improvement. When choosing prioritising areas of concern for LCM, the following aspects are usually considered (Gemechu et al 2017, 44):

- Relevance
  - Where are the significant environmental impacts along the life cycle?
- Potential
  - Where is the biggest opportunity for environmental improvement?
- Influence
  - Where is the greatest opportunity to make a concrete difference?

The organisation should communicate its environment-related demands to the end users to prevent environmental impacts across the value chain. Creating value can relate for example to improved environmental life cycle of products. Even if the organisation does not have direct control over the stage, it can positively impact on the activities related to its suppliers and contractors. Disposal of products can cause the most significant environmental impacts, even if the organisation is not responsible for removing the product from use. (Rybczewska-Bladejowska 2017.)

Across the life cycle of the product (figure 25), most of the environmental impacts of a wind farm are caused by the extraction and production of materials, while the share of

transportation is relatively low. Recovering valuable components at disposal minimises inefficiencies in the whole value chain. In life cycle studies of wind turbines, the recycling of materials reduced the total environmental impacts of the wind farm significantly (Uddin, Kumar 2014, 154; Bono, Laurent, Olsen 2016, 331-332). From the LCA point of view, re-powering old wind farms is a considerable option, when the wind turbines reach the end of their lifetime. Repowering old wind turbines extends the lifetime of turbines and increases the capacity of the wind farm. (Martinez, Latorre-Biel, Jimenez, Sanz, Blanco 2018, 268-270.)



**Figure 25.** Wind turbine LCA system boundary (Uddin, Kumar 2014, 156)

### 4.3.2 Life cycle assessment

For more detailed information about the life cycle, there is a wide range of tools to assess environmental impacts on the organisational level from qualitative life cycle approach (life cycle thinking) to quantitative approaches (life cycle assessment studies). Organisations may choose the best solution by considering their strategy, products and resources. In view of the various requirements, LCA is a considerable option for identifying life cycle related

problems and issues of products in an organisation. It considers both direct impacts from manufacturing and indirect impacts from resource use, product distribution, consumer use and disposal (figure 26). (Antweiler 2014, 103, Nilsson-Linden et al 2018, 1373.) LCA offers a repeatable, quantitative way to realise eco-design in organisations (Lewandowska, Matuszak-Flejszman 2014, 1797).



**Figure 26.** Overall environmental impacts of an organisation (Belcham 2014, 137)

#### 4.4 Environmental objectives

Environmental objectives are used to identify, track and inform stakeholders about the future improvements of the EMS. They should be consistent with the environmental policy, which offers a framework for setting the objectives. Being relevant through the organisation, environmental objectives should be communicated to employees at all levels of the organisation. When establishing environmental objectives, compliance obligations, risks, opportunities and significant environmental aspects should be considered. Identification of business risks and opportunities can be done using a management tool such as SWOT analysis. (Hammar,

2018.) Environmental objectives should be created using S.M.A.R.T. principle, which means the objectives are:

- Specific
- Measurable
- Achievable
- Realistic
- Time-based

The ISO 14001:2015 standard discusses environmental objectives and targets in the same clause, because targets are an integral part of the objective. Setting an environmental objective is not sufficient without setting a target, which defines the desirable state of the environmental performance. If the environmental policy obligates to save resources, the environmental objective derived from the commitment could be for example reducing the use of energy on sites. (Hammar, 2018.)

Setting specific objectives and targets help to guide the persons implementing the plan. In the first place, the objectives should be agreed with the persons working on them to ensure the efficiency of implementation and distribution of these targets at all levels of the organisation. (Edvardsson 2004, 176.) Generic objectives, such as “balanced environment”, are difficult to evaluate and can be understood differently depending on the person. Effective actions towards the desired results require common understanding of the objectives.

Objectives should be time-based and measurable where practicable, so the progress towards the goal can be estimated in the given schedule (Hammar 2018). Being measurable means that the extent, to which the target has been achieved, can be evaluated. Evaluation of the progress is crucial also for revision of the implemented actions. If there are only minor results towards the objective, the course of action should be sustained, changed or abandoned. The specificity of the objectives makes it easier to monitor and evaluate the progress. (Edvardsson 2004, 177.) If the objective is to reduce energy use, the more specific target could be for example reducing electricity use on sites by 20 % by the year 2020 (figure 27).

| Policy commitments                                | Objectives   | Targets  |
|---|--|--|
| <input type="checkbox"/> Save resources           | <input type="checkbox"/> Reduce energy use                                   | <input type="checkbox"/> Reduce electricity use by 20 % by 2020                        |
| <input type="checkbox"/> Avoid waste              | <input type="checkbox"/> Minimise quantity of waste sent to landfill         | <input type="checkbox"/> Waste to landfill   |
| <input type="checkbox"/> Environmental protection | <input type="checkbox"/> Avoid any environmental incidents (e.g. oil spills) | <input type="checkbox"/> Reduce number of oil spills by 50 % by 2020                   |
| <input type="checkbox"/> Environmental awareness  | <input type="checkbox"/> Improve employee awareness                          | <input type="checkbox"/> All employees have received an environmental training by 2019 |

**Figure 27.** Example of objectives and targets derived from the policy commitments

The plan to achieve the targets should not be treated as a separate section from the objectives. The plan should determine what will be done, resources, responsibilities, completion and how the results will be evaluated to achieve the objective and target. The organisation can either create a plan for all objectives or divide plans for each objective. (Hammar, 2018.) Having a clear target ensures that everyone in the organisation knows, what is the direction and goals of the EMS.

## 4.5 Environmental performance

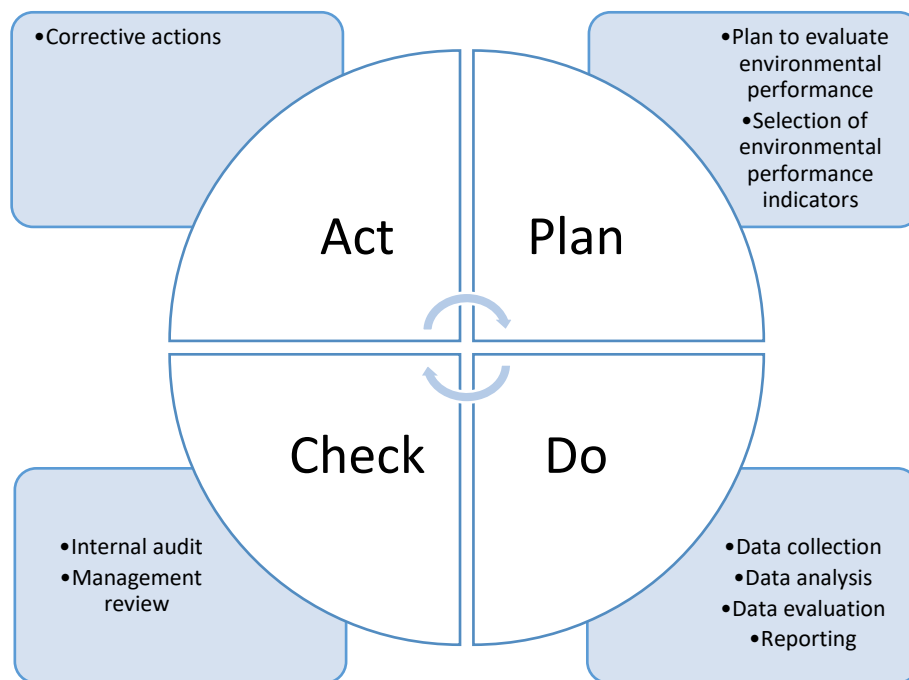
### 4.5.1 Environmental performance indicators

Environmental performance can be divided in four conceptual dimensions (Del Brio, Fernandez, Junquera 2005, 187), which are:

- Organisational systems
- Stakeholder relations
- Regulatory compliance
- Environmental impact and efficiency

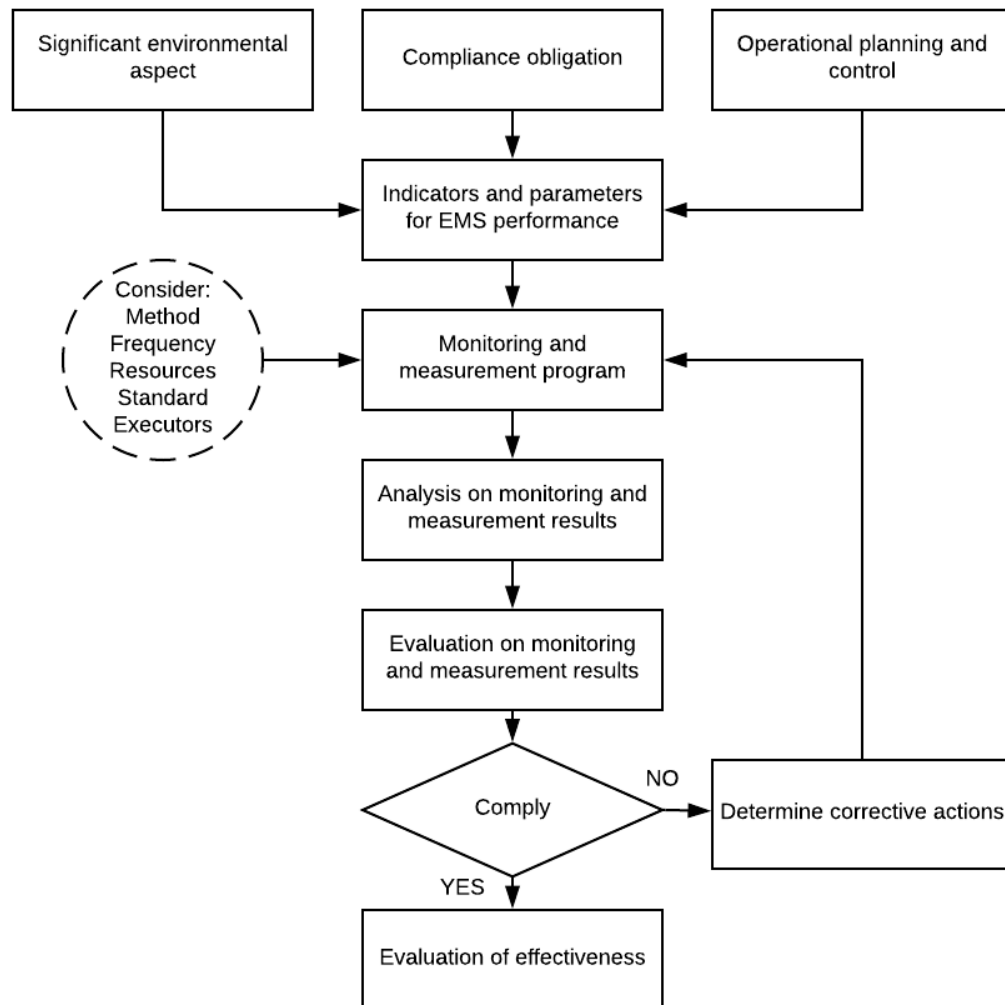
Environmental performance evaluation is an on-going process (figure 28), where data is collected, analysed, reported, communicated and reviewed to improve the conceptual dimensions of environmental performance in an organisation. Indicators help to convert data into

information about the condition of the environmental and actions to improve the environmental performance. This information can help the organisation for example to identify environmental aspects and opportunities to set detailed objectives and targets for improvements. (SFS-EN ISO 14031 2013, 2; Del Brio, Fernandez, Junquera 2005, 187.) Data on key environmental issues is required also to track these performance improvements and to guide decisions about environmental priorities (Belcham 2014).



**Figure 28.** Plan-Do-Check-Act model for environmental performance evaluation (SFS-EN ISO 14031 2013, 4)

Once an organisation has defined its environmental priorities and objectives, indicators are needed to monitor improvement progress (figure 29) (Belcham 2014, 154). Performance indicators demonstrate the effectiveness of achieving set objectives (Edvardsson 2004, 178). They help to improve organisational performance by providing data about the performance of resources to achieve its environmental performance objectives and targets. Besides evaluation and monitoring, indicators are used to simplify the performance information and communicate it to external and internal stakeholders. (Medel-Gonzalez, Garcia-Avila, Acosta-Beltran, Hernandez 2013, 37.)

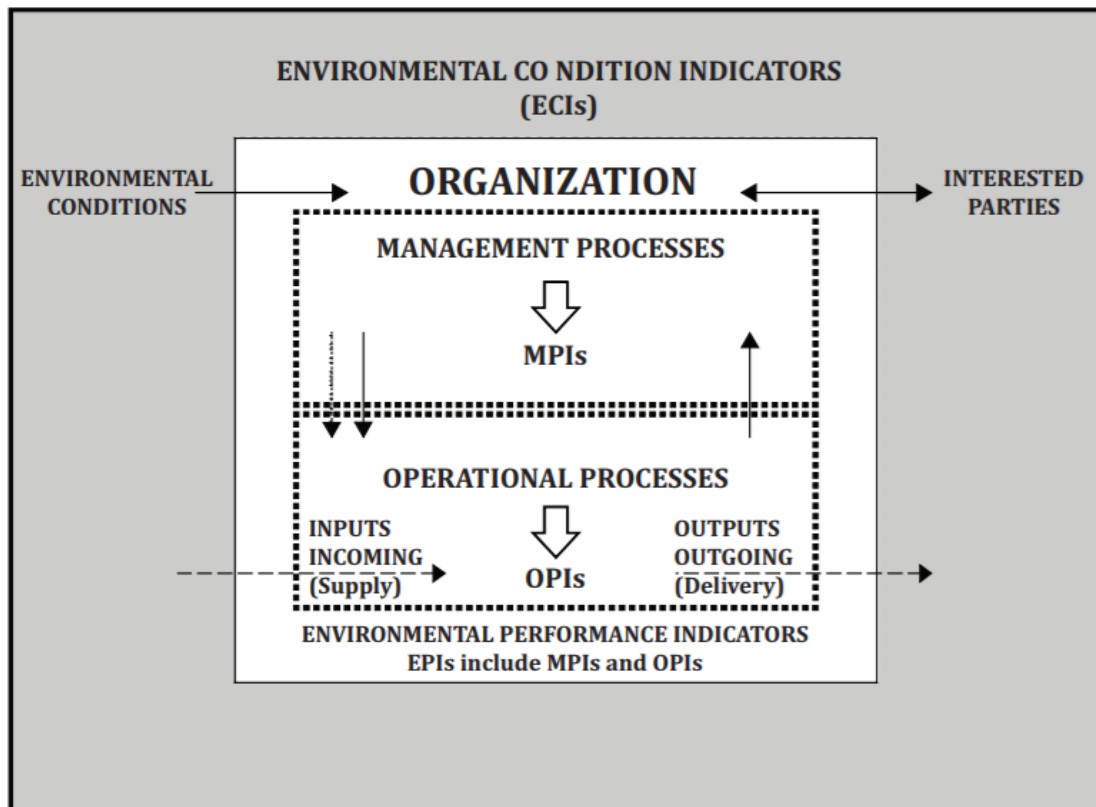


**Figure 29.** Indicators and performance of EMS (Susanto, Mulyono 2017)

#### 4.5.2 Defining indicators

Choosing indicators for environmental performance can be challenging, because there are no internationally agreed sustainable development indicators (Medel-Gonzalez, Garcia-Avila, Acosta-Beltran, Hernandez 2013, 37). There is no single way determining the extent to which the environmental objectives have been achieved. For example, if the objective is maintaining the landscape, the progress can be hard to assess and evaluate. (Edvardsson 2004, 178.) ISO 14031 standard has been developed to guide organisations on environmental performance evaluation. It introduces a performance evaluation process, which can be used as a part of an EMS (Belcham 2014, 154). ISO 14031 divides environmental performance indicators in two categories and subcategories (figure 30), which are:

- Environmental condition indicators (ECIs)
- Environmental performance indicators (EPIs)
  - Management performance indicators (MPIs)
  - Operational performance indicators (OPIs)



**Figure 30.** ECIs in the context of the organisation (SFS-EN ISO 14031 2013, 6)

ECIs provide data about environmental conditions to better understand the actual or potential impact of environmental aspects (Medel-Gonzalez, Garcia-Avila, Acosta-Beltran, Hernandez 2013, 38; Belcham 2014, 156). Condition indicators can be used to provide information on a local, regional, national or global level of environmental quality. (Campos, de Melo Heizen, Verdinelli, Cauchick Miguel 2015, 288.) ECIs are developed and applied mainly for scientific and governmental purposes in government agencies, non-governmental agencies and institutions rather than in individual organisations (Belcham 2014, 156). Even if ECIs are hard to link to organisational operations, the information provided by them can help to understand for example the environmental impact of air emissions (SFS-EN ISO 14031 2013, 5).

EPIs deliver data about the environmental performance of an organisation and can be further divided in two different types: managerial and operational indicators. MPIs present information about management efforts for the environmental performance development, for example the number of audits or cost savings due to improved environmental performance per year. OPIs provide information on the environmental performance of operations, for example on the quantity of waste and emissions generated on site (table 4). (Campos et al 2015, 288; Belcham 2014, 156-157.)

**Table 4.** Environmental performance indicator examples

| Indicator category                               | Issue areas                                | Indicator examples  |
|--|--|---|
| <b>Management performance indicators (MPIs)</b>  | Implementation of environmental programmes | <ul style="list-style-type: none"> <li>• Number of achieved objectives and targets</li> <li>• Degree of implementation of operating practice</li> </ul>                                     |
|  | Financial performance                      | <ul style="list-style-type: none"> <li>• Cost of waste management</li> <li>• Savings achieved from decreased energy use</li> </ul>  |
|  | Conformance                                | <ul style="list-style-type: none"> <li>• Degree of compliance with legislation</li> <li>• Number of audits per year</li> <li>• Number of audit findings per audit</li> </ul>                |
| <b>Operational performance indicators (OPIs)</b> | Waste                                      | <ul style="list-style-type: none"> <li>• Total quantity of waste generated</li> <li>• Quantity of waste stored on site</li> <li>• Quantity of hazardous waste generated per year</li> </ul> |
|  | Service                                    | <ul style="list-style-type: none"> <li>• Quantity of hazardous materials used per wind turbine</li> <li>• Quantity of emergency events per year</li> </ul>                                  |
|  | Energy                                     | <ul style="list-style-type: none"> <li>• Quantity of energy used per site</li> <li>• Quantity of energy from each energy source used</li> </ul>   |
|  | Contractors                                | <ul style="list-style-type: none"> <li>• Quantity of hazardous materials used by contractors</li> <li>• Amount of contractor incidents per year</li> </ul>                                  |
|  | Transport                                  | <ul style="list-style-type: none"> <li>• Average fuel consumption of company cars per year</li> </ul>   |

|  |           |   |
|--|-----------|---|
|  |           | <ul style="list-style-type: none"> <li>• CO2 emissions from business traveling per employee</li> </ul>                                    |
|  | Product   | <ul style="list-style-type: none"> <li>• Percentage of recyclable materials in a product</li> <li>• Rate of defective products</li> </ul> |
|  | Emissions | <ul style="list-style-type: none"> <li>• Quantity of emission to land</li> <li>• Quantity of total emissions per year</li> </ul>          |

Indicators, that are used to evaluate the most critical factors influencing the organisational goals are called key performance indicators (KPIs) (Lo-Iacono-Ferreira, Capuz-Rizo, Torregosa-Lopez 2018, 847-850). For example, if an organisation has set a zero-waste strategy, then total quantity of waste generated would be an environmental KPI to measure the progress against the target. KPIs can be defined by:

1. Finding the operational critical success factors
2. Determining measures
3. Getting the measures to drive performances.

Defining KPIs should be an ongoing process to ensure that the KPIs adapt to possible changes in the scope and goals of the organisation. (Lo-Iacono-Ferreira, Capuz-Rizo, Torregosa-Lopez 2018, 847-850.) The choice of indicators determines the type of data used for environmental performance evaluation. Indicators should describe the environmental performance against environmental policy, objectives, targets and compliance. Performance information should be relevant and cover all environmental aspects that the organisation wants to manage. According to the ISO 14031:2013 standard, information from the environmental performance evaluation should be:

- Relevant
- Complete
- Consistent and accurate
- Transparent

It is recommended to use quantitative data over qualitative data due to the better comparability and consistency to previous measurements, permitted levels and standards. Quantitative data is also clearer for all parties, especially for intended users, to understand. (Belcham 2014, 157).

## 5 DISCUSSION

The objective of this study was to analyse the current environmental management system of the target organisation to find the gaps compared to the environmental management standard. After the gaps were found, the study created a transition plan to comply with the newest environmental management standard.

### 5.1 Reliability and validity of the study

Reliability and validity measure the quality of the completed research. Reliability of the study refers to the applicability of the research in a different setting. The research is reliable, if the obtained results from the research setting can be replicated by using the same research design. Validity refers to the accuracy of the analysis, suitability of the used measurements and generalizability of the achieved findings. (Sanders et al 2016, 202.)

Case study research and qualitative research generally has been criticised due to poor reliability and generalisability. Adopting a single case study strategy decreases the number of samples and therefore the applicability of the research findings in other research settings. (Saunders et al 2016, 185.) The results of this study can be utilised especially in the operational area of the case organisation but also in other locations of the corporation.

Another challenge using a case study strategy is the in-depth nature of the study. To gain a full understanding of the case and its context, the researcher must identify, define and gain access to the research setting. (Saunders et al 2016, 185.) Therefore, limited publicity of company material and the structure of the organisation may affect the validity of the study.

The participation as an internal researcher in an organisation may pose a threat to the reliability of the research. Personal involvement may bias observations and therefore influence the research results. This may lead to differences in studies between observers, and hence decrease the validity of the study. Validity could have been improved by observing from different locations including sites and other offices. Interviewing employees and subcontractors would have increased the variety of observations and therefore improved the validity.

This was not possible due to limited amount of time and resources. Because of this, observations were made mainly from the country office and limited to the observer.

## **5.2 Applicability of the study**

The target organisation of this study has a ISO 14001:2008 compliant environmental management system, which builds a framework for the implementation of the planned changes. The results of this study help the target organisation to develop and implement processes to fill the gaps in their current management system. Some of the changes suggested by the study can be applied also in other parts of the organisations besides the target organisation, as the changes in ISO 14001 standard affect the organisation globally.

The results of this study are in line with the results from external audits, which were carried out after the qualitative analysis of this study. Further external and internal audits are required to ensure the conformity after the organisation has implemented the changes required by the ISO 14001:2015 standard.

## 6 CONCLUSIONS

The gap analysis revealed gaps mainly related to the clauses brought by the new standard. This was expected, as the organisation already held the ISO 14001:2004 certificate. Some of the new clauses had already been partially implemented, so the number of non-conformances was relatively low. The most significant necessities were related to life cycle thinking, context of the organisation, environmental performance and environmental objectives.

Context of the organisation requires the organisation to identify its stakeholders and their relevant needs and expectations. This information forms a basis for later clauses that are relevant to the external or internal stakeholders. The requirements of this clause are relatively easy to fulfil and do not require any additional processes in place.

Environmental objectives set in the central corporate have focused mainly on the production of wind turbines, because the most significant environmental impacts come from the beginning of the life cycle. The local organisation should set environmental objectives relevant to its scope, which excludes manufacturing. Setting environmental objectives requires knowledge of the most significant environmental aspects and impacts. Once they have been found, the organisation should prioritise them and set specific, realistic objectives with deadlines. Setting environmental objectives and targets itself is not enough, if there is no plan to achieve them. The organisation should choose indicators to measure the progress towards these goals. Indicators should preferably be quantitative to have data, which is comparable with previous results. Comparing results allows the organisation to estimate the level to which the targets have been achieved.

Defining the current supply chain and its inputs and outputs in different stages is the first step of taking life cycle perspective into account. After the overall picture has been defined, the organisation can start defining the environmental aspects related to these stages. Considering all environmental aspects throughout the supply chain might reveal information that has not been measured before. Recognising environmental aspects related to external stakeholders required strong cooperation with contractors, customers and other significant parties throughout the supply chain. When different stages and their environmental aspects have been considered, the organisation should weight its control and influence over these stages.

The stages with the biggest control and influence are usually the greatest opportunities to improve environmental performance. Potential life cycle studies in the future would reveal valuable information about the environmental aspects of wind farms, such as whether to dispose or repower the turbines in the end of their lifetime.

Standardised environmental management systems are increasingly popular in today's business, but their part in environmental improvements in organisations is biased. If the organisation is engaged to environmental values and adopts an EMS to improve their environmental performance, it usually results in more efficient environmental management. The issue with certified management system is their symbolic adoption with no meaning to improve environmental performance. This leads to significant differences in the level of environmental performance between certified organisations. Therefore, the certificate itself does not reveal much information about the status of environmental management in an organisation. It signs, that the organisation has created procedures and has certain processes in place.

On the other hand, customers and other stakeholders are more aware of environmental issues and value efficient environmental management. Organisations, that have adopted and implemented efficient environmental management, gain competitive advantage compared to organisations without EMS or real implementation of the EMS. Increased legal and other requirements will increase the need for efficient environmental management, and standardised environmental management systems will have a significant role in this progress. Even if them alone are not enough to achieve sustainability, they are a great start towards this target.

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**Appendix 1: Gap analysis between the current EMS and ISO 14001:2015**

| <b>4 Context of the organisation</b>  |  |                                      |
|---|--|--------------------------------------|
| <b>4.1 Understanding the organization and its context</b>   |  |                                      |
| a) Has the organisation determined external and internal issues that are relevant to its purpose and that affect its ability to achieve the intended outcomes of the EMS? |  | Non-conformance                      |
| <b>4.2 Understanding the needs and expectations of interested parties</b>   |  |                                      |
| a) Has the organisation determined the interested parties that are relevant to the EMS?   |  | Non-conformance                      |
| b) Has the organisation determined the relevant needs and expectations of these interested parties?   |  | Non-conformance                      |
| c) Has the organisation determined which of these needs and expectation its compliance obligations become?  |  | Non-conformance                      |
| <b>4.3 Determining the scope of the environmental management system</b>   |  |                                      |
| a) Has the organisation determined the boundaries and applicability of the EMS to establish its scope?  |  | Complies with the requirement        |
| b) Does the EMS include all the activities, products and services of the organisation within that scope?  |  | Complies with the requirement        |
| c) Has the organisation documented the scope and made it available to interested parties?   |  | Complies with the requirement        |
| <b>4.4 Environmental management system</b>  |  |                                      |
| a) Has the organisation established, implemented, maintained and continually improved an EMS in accordance with the requirements of ISO 14001?                            |  | Partly complies with the requirement |

| <b>5 Leadership</b>   |  |                                      |
|---|--|--------------------------------------|
| <b>5.1 Leadership and commitment</b>  |  |                                      |
| <b>a)</b> Has top management taken accountability for the effectiveness of the EMS?   |  | Complies with the requirement        |
| <b>b)</b> Has top management ensured that the environmental policy and environmental objectives are established and compatible with the strategy and the context of the organisation? |  | Partly complies with the requirement |
| <b>c)</b> Has top management ensured the integration of the EMS requirements into the business processes?   |  | Partly complies with the requirement |
| <b>d)</b> Has top management ensured resources needed for the EMS?  |  | Complies with the requirement        |
| <b>e)</b> Has top management ensured communication of the importance of effective environmental management and conformance to the EMS requirements?                                   |  | Complies with the requirement        |
| <b>f)</b> Has top management directed and supported persons to contribute to the effectiveness of the EMS?  |  | Complies with the requirement        |
| <b>g)</b> Has top management promoted continual improvement?  |  | Partly complies with the requirement |
| <b>h)</b> Has top management supported other relevant management roles to demonstrate their leadership as it applies to their areas of responsibility?                                |  | Complies with the requirement        |
| <b>5.2 Environmental policy</b>   |  |                                      |
| <b>a)</b> Does the environmental policy provide a framework for setting environmental objectives?   |  | Complies with the requirement        |
| <b>b)</b> Does the environmental policy include a commitment to the protection of the environment, including prevention of pollution and other specific commitments?                  |  | Complies with the requirement        |

|   |  |  |                               |
|---|--|--|-------------------------------|
| c)  | Does the environmental policy include a commitment to fulfil its compliance obligations?   |  | Complies with the requirement |
| d)  | Does the environmental policy include a commitment to continual improvement of the EMS to enhance environmental performance?               |  | Complies with the requirement |
| e)  | Is the environmental policy documented, communicated within the organisation and available to interested parties?                          |  | Complies with the requirement |
| <b>5.3 Organizational roles, responsibilities and authorities</b> |  |  |                               |
| a)  | Has top management assigned the responsibility and authority for ensuring that the EMS conforms to the requirements of the ISO 14001:2015? |  | Complies with the requirement |
| b)  | Has top management assigned the responsibility and authority for reporting on the performance of the EMS to top management?                |  | Complies with the requirement |

|   |   |  |                                      |
|---|---|--|--------------------------------------|
| <b>6 Planning</b>                                     |   |  |                                      |
| <b>6.1 Actions to address risks and opportunities</b> |   |  |                                      |
| <b>6.1.1 General</b>                                  |   |  |                                      |
| a)  | Has the organisation established, implemented and maintained the processes needed to meet the requirements in 6.1.1 to 6.1.4?                               |  | Partly complies with the requirement |
| b)  | Has the organisation determined the risks and opportunities related to its environmental aspects, compliance obligations and other issues and requirements? |  | Partly complies with the requirement |
| c)  | Has the organisation maintained documented information of its risks and opportunities that need to be addresses and processes needed in 6.1.1 to 6.1.4?     |  | Partly complies with the requirement |
| <b>6.1.2 Environmental aspects</b>                    |   |  |                                      |

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| a) Has the organisation determined the environmental aspects of its activities, products and services that it can control and those that it can influence?             | Green  | Complies with the requirement        |
| b) Has the organisation determined their associated environmental impacts considering a life cycle perspective?  | Red    | Non-conformance                      |
| c) Has the organisation determined the aspects with a significant environmental impact by using established criteria?  | Green  | Complies with the requirement        |
| d) Has the organisation determined the influence of abnormal/emergency conditions and their effect on environmental aspects?   | Green  | Complies with the requirement        |
| e) Has the organisation determined how to communicate its significant environmental aspects among the various levels and function of the organisation?                 | Yellow | Partly complies with the requirement |
| f) Has the organisation maintained documented information of its environmental aspects, impacts, significant aspects and its criteria?                                 | Green  | Complies with the requirement        |
| <b>6.1.3 Compliance obligations</b>  |        |                                      |
| a) Has the organisation determined and documented the compliance obligations related to its environmental aspects?   | Green  | Complies with the requirement        |
| b) Has the organisation determined and documented how these compliance obligations apply to the organisation?  | Green  | Complies with the requirement        |
| c) Have the compliance obligations been considered when establishing, implementing, maintaining and improving the EMS?   | Green  | Complies with the requirement        |
| <b>6.1.4 Planning action</b>   |        |                                      |
| a) Has the organisation planned to take actions to address its significant environmental aspects, compliance obligations, risks and opportunities identified in 6.1.1? | Yellow | Partly complies with the requirement |

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| b) Has the organisation planned how to integrate and implement the actions into its EMS processes or other business processes and how to evaluate the effectiveness of these actions?                    | Yellow | Partly complies with the requirement |
| <b>6.2 Environmental objectives and planning to achieve them</b>   |        |                                      |
| <b>6.2.1 Environmental objectives</b>  |        |                                      |
| a) Has the organisation established environmental objectives at relevant functions and levels taking significant environmental aspects, compliance obligations and risks and opportunities into account? | Red    | Non-conformance                      |
| b) Are the objectives measurable, monitored, communicated, updated, documented and consistent with the environmental policy?   | Red    | Non-conformance                      |
| <b>6.2.2 Planning actions to achieve environmental objectives</b>  |        |                                      |
| a) Does the plan to achieve environmental objectives determine what will be done, resources, responsibilities, completion and how the results will be evaluated?   | Red    | Non-conformance                      |
| b) Does the plan consider how these actions can be integrated into the organisation's business processes?  | Red    | Non-conformance                      |
| <b>7 Support</b>   |        |                                      |
| <b>7.1 Resources</b>   |        |                                      |
| a) Has the organisation determined and provided the resources needed for the establishment, implementation, maintenance and continual improvement of the EMS?  | Green  | Complies with the requirement        |
| <b>7.2 Competence</b>  |        |                                      |

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| a) Has the organisation determined the necessary competence of persons whose work affects its environmental performance and ability to fulfil its compliance obligations?  |  | Complies with the requirement        |
| b) Has the organisation ensured that these persons are competent to work (education, training or experience) or taken actions to acquire the necessary competence?   |  | Complies with the requirement        |
| c) Has the organisation determined training needs associated with its environmental aspects and EMS?   |  | Partly complies with the requirement |
| d) Has the organisation retained documented information as evidence of competence?   |  | Complies with the requirement        |
| <b>7.3 Awareness</b>   |  |                                      |
| a) Has the organisation ensured that employees are aware of the environmental policy and their contribution to the effectiveness of the EMS?   |  | Partly complies with the requirement |
| b) Has the organisation ensured that employees are aware of the significant environmental aspects and impacts associated with their work?  |  | Partly complies with the requirement |
| c) Has the organisation ensured that employees are aware of the implication of not conforming to the EMS requirements?   |  | Partly complies with the requirement |
| <b>7.4 Communication</b>   |  |                                      |
| <b>7.4.1 General</b>   |  |                                      |
| a) Has the organisation established, implemented and maintained processes needed for internal and external communications relevant to the EMS (what it will communicate, when to communicate, with whom to communicate, how to communicate)? |  | Partly complies with the requirement |
| b) Has this information been documented as evidence of its communications?   |  | Partly complies with the requirement |

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| <b>7.4.2 Internal communication</b>  |        |                                      |
| a) Has the organisation communicated EMS related information internally among the various levels and functions of the organisation?                              | Green  | Complies with the requirement        |
| b) Has the organisation ensured its communication processes enable employees to contribute to continual improvement?   | Green  | Complies with the requirement        |
| <b>7.4.3 External communication</b>  |        |                                      |
| a) Has the organisation communicated EMS related information externally as established by the communication processes as required by its compliance obligations? | Yellow | Partly complies with the requirement |
| <b>7.5 Documented information</b>  |        |                                      |
| <b>7.5.1 General</b>   |        |                                      |
| a) Does the EMS include documented information required by the standard and determined by the organisation for the effectiveness of the EMS?                     | Green  | Complies with the requirement        |
| <b>7.5.2 Creating and updating</b>   |        |                                      |
| a) Has the organisation ensured appropriate identification and description, format, review and approval of documented information?                               | Yellow | Partly complies with the requirement |
| <b>7.5.3 Control of documented information</b>   |        |                                      |
| a) Is the documented information available and suitable for use when needed?   | Green  | Complies with the requirement        |
| b) Is the documented information adequately protected (improper use, loss of confidentiality)?   | Green  | Complies with the requirement        |
| <b>8 Operation</b>   |        |                                      |
| <b>8.1 Operational planning and control</b>  |        |                                      |

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| a) Has the organisation established operating criteria for the processes needed to meet EMS requirements and implemented control of the processes in accordance with the operating criteria?   | Green  | Complies with the requirement        |
| b) Has the organisation controlled planned changes and reviewed the consequences of unintended changes, acting to mitigate any adverse effects?  | Green  | Complies with the requirement        |
| c) Has the organisation ensured that outsourced processes are controlled or influenced? Has the type and extent of control been defined within the EMS?  | Yellow | Partly complies with the requirement |
| d) Has the organisation considered life-cycle perspective in the design and development of products and services?  | Red    | Non-conformance                      |
| e) Has the organisation considered the need to provide information about potential significant environmental impacts associated with the transportation or delivery, use, end-of-life treatment and final disposal of its products and services? | Red    | Non-conformance                      |
| f) Has the organisation communicated its relevant environmental requirements to external providers, including contractors?   | Yellow | Complies with the requirement        |
| g) Has the organisation maintained documented information that the processes have been carried out as planned?   | Yellow | Partly complies with the requirement |
| <b>8.2 Emergency preparedness and response</b>   |        |                                      |
| a) Has the organisation established, implemented and maintained processes needed to prepare for and respond to potential emergencies identified in 6.1.1?  | Green  | Complies with the requirement        |
| b) Has the organisation planned actions to prevent or mitigate adverse environmental impacts from emergency situations?  | Green  | Complies with the requirement        |
| c) Has the organisation periodically tested the planned response actions, where practicable?   | Green  | Complies with the requirement        |

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| d) Has the organisation periodically reviewed and revised the processes and planned response actions, after the emergency situations or tests?                             | Complies with the requirement |
| e) Has the organisation provided relevant information and training related to emergency preparedness and response to relevant interested parties, including its employees? | Complies with the requirement |
| f) Has the organisation documented this information?   | Complies with the requirement |

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| <b>9 Performance evaluation</b>   |                                      |  |
| <b>9.1 Monitoring, measurement, analysis and evaluation</b>   |                                      |  |
| <b>9.1.1 General</b>  |                                      |  |
| a) Has the organisation monitored, measured, analysed and evaluated its environmental performance? Has it determined the methods, criteria, indicators and schedule for this? | Partly complies with the requirement |  |
| b) Has the organisation ensured that calibrated or verified monitoring and measurement equipment is used?   | Partly complies with the requirement |  |
| c) Has the organisation evaluated its environmental performance and the effectiveness of the EMS?   | Partly complies with the requirement |  |
| d) Has the organisation communicated relevant environmental performance information both internally and externally?   | Partly complies with the requirement |  |
| e) Has the organisation retained appropriate documented information as evidence?  | Partly complies with the requirement |  |
| <b>9.1.2 Evaluation of compliance</b>   |                                      |  |
| a) Has the organisation established, implemented and maintained processes needed to evaluate fulfilment of its compliance obligations?  | Complies with the requirement        |  |
| b) Has the organisation determined the frequency of compliance evaluation and possible actions?   | Complies with the requirement        |  |

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| c) Has the organisation retained documented information as evidence of the compliance evaluation results?  |  | Complies with the requirement |
| <b>9.2 Internal audit</b>  |  |                               |
| <b>9.2.1 General</b>   |  |                               |
| a) Has the organisation conducted internal audits at planned intervals?  |  | Complies with the requirement |
| <b>9.2.2 Internal audit programme</b>  |  |                               |
| a) Has the organisation established, implemented and maintained internal audit programmes including frequency, methods, responsibilities, planning requirements and audit reporting?   |  | Complies with the requirement |
| b) Has the organisation defined the audit criteria and scope for each audit, selected auditors and conduct audits to ensure objectivity and impartiality, and ensured that the results are reported to relevant management?  |  | Complies with the requirement |
| c) Has the organisation retained documented information as evidence of the implementation of the audit programme and results?  |  | Complies with the requirement |
| <b>9.3 Management review</b>   |  |                               |
| a) Has top management reviewed the EMS at planned intervals to ensure its continuing suitability, adequacy and effectiveness?  |  | Complies with the requirement |
| b) Does the management review include consideration of:<br>-status of actions from previous management reviews<br>-changes in external and internal issues, needs and expectations, significant environmental aspects, and risks and opportunities?<br>-which environmental objectives have been achieved? |  | Complies with the requirement |

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| <ul style="list-style-type: none"> <li>-information on the environmental performance, including conformities and corrective actions, monitoring and measurement results, fulfilment of compliance actions and audit results?</li> <li>-adequacy of resources?</li> <li>-relevant communications from interested parties including complaints?</li> <li>-opportunities for continual improvement?</li> </ul>  |  |                               |
| <p>c) Do the outputs of the management review include:</p> <ul style="list-style-type: none"> <li>-conclusion on the continuing suitability, adequacy and effectiveness of the EMS</li> <li>-decisions related to continual improvement opportunities</li> <li>-decisions related to any need for changes to the EMS, including resources</li> <li>-actions, if needed, when environmental objectives have not been achieved</li> <li>-opportunities to improve integration of the EMS with other business processes</li> <li>-any implication for the strategic direction of the organisation?</li> </ul> |  | Complies with the requirement |
| <p>d) Has the organisation retained documented information as evidence of the results?</p>   |  | Complies with the requirement |

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| <b>10 Improvement</b>   |  |                                      |
| <b>10.1 General</b>   |  |                                      |
| <p>a) Has the organisation determined opportunities for improvements and implemented necessary actions to achieve the intended outcomes of the EMS?</p> |  | Partly complies with the requirement |
| <b>10.2 Nonconformity and corrective action</b>   |  |                                      |
| <p>a) In case of nonconformities, has the organisation reacted to them and acted to control them?</p>   |  | Complies with the requirement        |

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| b) In case of nonconformities, has the organisation dealt with the consequences and mitigated adverse environmental impacts   |  | Complies with the requirement        |
| c) In case of nonconformities, has the organisation evaluated the need for action to eliminate the root cause by reviewing, determining the causes and similar potential nonconformities? |  | Complies with the requirement        |
| d) In case of nonconformities, has the organisation implemented any action needed?  |  | Complies with the requirement        |
| e) In case of nonconformities, has the organisation reviewed the effectiveness of any corrective action taken?  |  | Complies with the requirement        |
| f) In case of nonconformities, has the organisation made changes to the EMS, if necessary   |  | Complies with the requirement        |
| g) Has the organisation retained documented information as evidence of the nature of the nonconformities, action taken and the results of corrective action?                              |  | Complies with the requirement        |
| <b>10.3 Continual improvement</b>   |  |                                      |
| a) Has the organisation continuously improved the suitability, adequacy and effectiveness of the EMS to enhance environmental performance?  |  | Partly complies with the requirement |