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*A Web-Based Environmental Toolkit to Support Small and Medium-Sized Enterprises in
the Implementation of Their Own Environmental Management System*

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Attestation of Authorship

I confirm that this thesis is my own work and that all sources of material that were consulted have been acknowledged in notes to the text or the references. I confirm that this thesis has not been submitted for a comparable academic award.

Acronyms

CEO – Chief Executive Officer

EMAS – Eco-Management and Auditing Scheme

EMS – Environmental Management System/s

ISO – International Organization for Standardization

IT – Information Technologies

SME – Small and Medium-Sized Enterprises

URL – Uniform Resource Locator

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Abstract

With small and medium sized-enterprises (SMEs) taking up the majority of the global businesses, it is important they act in an environmentally responsible manner. Environmental management systems (EMS) help companies evaluate and improve their environmental impact but they often require human, financial, and temporary resources that not all SMEs can provide. This research encompasses interviews with representatives of two small enterprises in Germany to provide insights into their understanding, and knowledge of an EMS and how they perceive their responsibility towards the environment. Furthermore, it presents a toolkit created especially for small and medium-sized enterprises that serves as a simplified version of an EMS based on the ISO 14001 standard and is evaluated by the representatives of the SMEs. Some of the findings are: while being open to the idea of improving their environmental impact, SMEs do not always feel it is their responsibility to do so; they seem to lack the means to fully implement an EMS. The developed toolkit is considered useful and usable and recommendations are drawn for its future enhancement.

Keywords: Environmental management system, Environmental toolkit, Small and medium-sized enterprises

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1. Introduction

The objective of this thesis is to develop and present a toolkit that aims at helping small and medium-sized enterprises implement their own environmental management systems. The toolkit itself is developed together with two small companies and tested and evaluated by those companies, a group of non-experts, and two experts in the field of environmental management systems. Based on the evaluation, challenges will be discussed and recommendation for future improvements will be provided at the end of the thesis.

The first chapter of this research introduces background information regarding various threats to the environment imposed by business, especially by small and medium-sized enterprises, and presents the therefrom drawn motivation and scope of the research. The structure and methodology to achieve the thesis' objective will conclude this chapter.

1.1 Background on the Environmental Impact of Business

Environmental sustainability has been gaining increasing importance in times when limited resources become scarce and the climate change-related problem become more and more pressing. Over the past decades, the necessity for taking action towards becoming a more eco-friendly global community has become increasingly evident. Thus, environmental action has to be taken by all segments of society, especially the industrial and business sectors which have a significant impact on the environment.

With a current global development that threatens the concept of sustainability, various organizations and institutions have taken steps towards influencing a more environmentally friendly future. The European Commission, for example, has laid out a strategy for achieving a more resource-efficient Europe by 2020 (European Commission, 2014), provided a framework for a reduction of greenhouse gas emissions and an increase in renewable energy resources by 2030 (European Commission, 2015a), and defined a Green Action Plan for SMEs (European Commission, 2015b). Other recommendations towards a more sustainable development are made by the SMART 2020 report (The Climate Group, 2008) that focuses on green strategies and objectives in the area of Information Technologies, and by the Flash Eurobarometer report of 2012 (European Commission, 2012) that analyses the areas and potential of environmental impact of small and medium-sized enterprises.

While first steps have been taken, research still needs to be conducted in the field of small and medium-sized enterprises (SMEs). In spite of their relatively small size, SMEs can have a significant impact on the environment (Frijns and Van Vliet, 1999; Hillary, 1998).

A measure that is commonly used in companies and that effectively helps them to improve their footprint is the implementation of an environmental management system (EMS). Though an EMS for SMEs is often highly desirable and its implementation voluntary, it is associated with numerous barriers for small and medium-sized enterprises. According to the above mentioned Eurobarometer 2012 report (European Commission, 2012), 43% of SMEs in the EU receive external support with regards to their environmental actions. Implementing an EMS is a complex and often challenging task which the majority of SMEs will require outside help for. This poses another barrier as not all small and medium-enterprises have the resources to employ additional support. Hence, providing a toolkit that supports SMEs in the implementation of an EMS, without imposing the often found barriers, is the goal of this research.

1.2 Aim, Research Objectives and Contributions to Research

The aim of the presented research is to develop and evaluate an environmental toolkit for small and medium-sized enterprises in order to support them in the implementation of a simplified EMS that is based on the ISO 14001:2004. The following list of research objectives will help achieve this aim:

- 1) Research Objective 1: To draw the system's requirements from literature review and interviews with target users
- 2) Research Objective 2: To develop an environmental toolkit based on those requirements
- 3) Research Objective 3: To validate that toolkit with the help of experts, non-experts, and the target users
- 4) Research Objective 4: To outline recommendations for future research based on the validation results

It is intended for the environmental toolkit to be less complex than the reviewed existing environmental management systems and at being easily comprehensible and employable by a variety of firms. Its goal is to make the organizations aware of their environmental impact and to help them identify and improve it.

Novel data is gathered from two small German enterprises which are included in the toolkit's development and testing. The target system will be validated by experts, the target users, and a focus group and recommendations for future work on the toolkit will be drawn.

1.3 Structure of the Thesis

For the purpose of this research, the thesis is structured as follows. In chapter 2, related work will be discussed, particularly on the concept of sustainability, on sustainability in industry,

environmental management systems and EMS in small and medium-sized enterprises. The subsequent chapter will present the methodology applied in this study which includes the ISO 14001 as EMS methodology, the research methodology which encompasses interviews and questionnaires, and the systems development life cycle which the two previously presented methodologies will be part of. Chapter 4 will present and describe the developed toolkit. Results will be discussed in chapter 5 and conclusions and recommendations for future work will be provided in chapter 6. References and the appendices will conclude this thesis.

2. Literature Review

This chapter will help explain the importance and occasional lack of sustainability in business, particularly in the sector of small and medium-sized enterprises and, thus, justify the relevance of this work. For this purpose, it is necessary to review the fields of sustainability, sustainability in industry, environmental management standards, and environmental management standards in small and medium-sized enterprises.

2.1 Sustainability

Sustainability is an important aspect of today's society. The demand for limited resources is getting increasingly high while those resources, such as crude oil or coal, are getting increasingly rare. Hence, acting in an environmentally responsible and sustainable manner is highly important especially for businesses which have a significant impact on sustainability. However, in order to act responsibly in that aspect, it is important to first understand the concept of sustainability. The terms sustainability and sustainable development have been defined on March 20, 1987, by the World Commission on Environment and Economy in their Brundtland Report as “[... development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (United Nations, 1987). The definition implies a responsibility towards future generations that has to be respected within all areas of our current generation and is especially applicable to environmental sustainability. Handling natural resources in a way that is sustainable and allows future generations to meet their own needs with regards to those resources is the sense the term sustainability will be used for the purpose of this research.

The responsibility described in the Brundtland Report (United Nations, 1987) has to be met by all areas of our generation, including the industrial and business sectors which have a significant impact on the environment. With a current global development that threatens the previously defined concept of sustainability, however, many organizations and institutions have taken steps towards influencing a more environmentally friendly future. The European Commission, for example, laid out a strategy for achieving a more resource-efficient Europe by 2020 (European Commission, 2014). Other incidents of measures towards a more sustainable development are the SMART 2020 report (The Climate Group, 2008) that focuses on green strategies and objectives in the area of Information Technologies, or the Flash Eurobarometer report of 2012 (European Commission, 2012) that analyses the areas of impact and the potential of small and medium-sized enterprises.

2.2 Sustainability in Industry

The business industry generates a major environmental impact which needs to be regulated in order to secure sustainable development. Here, the main focus for environmental responsibility in that area often lies on large companies. They have a respectively large, mostly disadvantageous impact on the environment and, thus, on sustainable development. Though these companies are far smaller in number than small and medium-sized enterprises, their environmental footprint is much more significant. This explains why responsible behavior with regards to the environment is generally expected from them and often enforced with laws and other regulations and additionally secured with pressure from stakeholders. Hence, a significant amount of research has been conducted in the field of large enterprises and measures have been developed to improve their environmental performance.

In comparison, small and medium-sized enterprises are often exempted from environmental regulations and responsibilities. However, even though their individual impacts are not as significant, with SMEs counting for 90% of the European market (European Commission, 2015c), their combined footprint has a tremendous disadvantageous potential. Thus, based on the possibility of their environmental impact, there is an explicit need to provide SMEs with the tools to optimize and limit their footprint. A widely used attempt at improving an enterprise's environmental impact and sustainable acting is the implementation of an environmental management system.

Because environmental regulations for small and medium-sized enterprises are highly desirable but still voluntary, providing frameworks for implementing an environmental management system is currently one of the most favored options to increase SMEs' environmental awareness and use of sustainable strategies. An example of such a strategy can be found in the Green Action Plan for SMEs provided by the European Commission (European Commission, 2015b).

2.3 Environmental Management Systems

Environmental Management Systems (EMS) provide guidance for voluntary action of businesses that seek help in improving their environmental impact. Extensive research (Blundel et al., 2013; Chan, 2011; Hillary and Burr, 2011; Nulkar, 2014; Seiffert, 2008; Zorpas, 2010) has been conducted to show the relationship between a reduced environmental footprint and the adoption of an EMS. A variety of benefits is associated with its implementation but, at the same time, a number of concerns and barriers have been expressed in previous research (Blundel et al., 2013; Chan, 2011; Hillary and Burr, 2011; Nulkar, 2014; Seiffert, 2008; Zorpas, 2010), as well, which will be presented shortly in this chapter.

Two of the most commonly used EMS are the ISO 14001:2004 standard for environmental management systems which has been developed by the International Organization for Standardization (International Organization for Standardization, 2004a) and the EMAS Eco-Management and Audit Scheme, developed by the European Commission (European Commission, 2015d). Both standards are composed of the same principal steps that require an organization to develop an environmental policy and to go through the stages of planning, implementation and operation, checking and corrective action, and the management review. With the EMAS, companies additionally need to publish a report on the environmental performance of their sites (Hillary, 2004). The two standards aim to be applicable to both large as well as small and medium-sized companies and they generally result in various benefits for the organizations that implement them. However, due to its slightly less strict requirements and because it is said to have been designed with the small chip shop owner in mind (Dodds, 1997), the ISO 14001:2004 appears to be the preferred model for SMEs. Maier and Vanstone (2005) further showed that in September 2004, there have been 4,019 EMAS-registered sites in Europe compared to 23,000 ISO 14001 certificates. On a global scale, more than 66,000 ISO 14001 certifications have been awarded. The study contributes the success of the ISO 14001 standard partially to the success of the predecessor ISO 9000 quality standard. The figures, as well as table 1 in the appendix, indicate a higher acceptance and broader implementation of the ISO 14001 as an environmental management systems standard. Thus, it is the standard that will be used as basis for the system developed in this research.

2.4 Environmental Management Systems in Small and Medium-Sized enterprises

The European Commission describes SMEs as follows, “The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding 50 million euro, and/or an annual balance sheet total not exceeding 43 million euro. ...within the SME category, a small enterprise is defined as an enterprise which employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million. ...within the SME category, a microenterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million.” (Commission of the European Communities, 2003).

Even though their benefits are proven and discussed widely, EMS are still implemented more by large enterprises than by SMEs. This is largely related to the environmental pressure that is put on large organizations due to their significant impact but also to the resources they have

that can be invested into properly developing a certifiable EMS. SMEs, on the other hand, have a smaller individual impact on the environment but, while their combined impact is not known exactly (Seiffert, 2008; Zorpas, 2010), it is often estimated to be approximately 70% of the overall industrial pollution (Frijns and Van Vliet, 1999; Hillary, 1998). Thus, regulating and optimizing their footprint is highly desirable.

Acknowledging the significance of their combined pressure on the environment, ongoing research has been conducted in the field of SMEs and EMS and barriers have been determined that often keep SMEs from implementing environmental management systems. Apart from the fact that many do not feel it is their responsibility to implement such a system, other important factors are limited financial resources, a lack of expertise knowledge, the complexity of the EMS, a lack of awareness regarding their responsibility as well as solutions, and a lack of motivation (Blundel et al., 2013; Chan, 2011; Hillary and Burr, 2011; Nulkar, 2014; Seiffert, 2008; Zorpas, 2010).

In spite of the barriers, numerous benefits speak in favor of the implementation of an EMS and have motivated a growing number of SMEs to do so. The main benefits include cost savings over time, risk aversion, improved environmental performance inside the company, improved corporate image as well as improved relation with stakeholders and clients, better marketing options, pollution prevention, enhanced legal compliance, and conservation of resources (Hillary, 2004; Hillary and Burr, 2011; Maier and Vanstone, 2005; Seiffert, 2008; Zackrisson et al., 2000; Zorpas, 2010(Blundel et al., 2013; Chan, 2011; Hillary and Burr, 2011; Nulkar, 2014; Seiffert, 2008; Zorpas, 2010). Maier and Vanstone (2005) find that the main motivation companies have for implementing and certifying the ISO 14001 is primarily to improve their environmental performance and to enhance their corporate image which is followed by a desire to gain marketing advantages and improve their relations with stakeholders.

2.5 Existing EMS for SMEs

In order to facilitate the use of official environmental management standards such as the ISO 14001 or the EMAS, toolkits have been developed with the aim of supporting organizations in the implementation of an EMS. Prominent examples of such toolkits are the Energy and environment SME toolkit by the Federation of Small Businesses in Scotland and the Scottish Energy Efficiency Office of the Scottish Executive (2003) or the SME Toolkit by the International Finance Corporation (2015). Both toolkits provide guidance for the user enterprises to build an EMS. However, both systems are fairly complex and contain a large amount of information the user has to read and understand in order to develop the EMS which

may present a barrier for SMEs. The Energy and environment SME toolkit, for example, is divided into the four main categories of energy, waste, water, and transport. Aspects of each category and their environmental impact are explained in detail and with the help of illustrations, while the two last chapters are concerned with the environmental legislation and further advice. Although the toolkit appears very informative, it does not allow for interaction and offers a large amount of text, both of which can seem unappealing to potential users. The SME Toolkit by the International Finance Corporation explains the EMS in eleven chapters. Each of them offers very detailed information on included steps and aspects for a successful EMS but just as in the Energy and environment SME toolkit, no interaction is included and the amount of text is even larger.

More examples of existing EMS for SMEs can be found in the toolkit provided by the Fachgruppe Green IT (Swiss Information Society, 2015) which offers a responsive system that targets the promotion of Green IT and supports companies in improving their impact in the area of information technologies, or in the Environment management toolkits to help specific business sectors by The Environment Agency (2014) which targets various specific business sectors. While both of these systems address small and medium-sized enterprises, the first one is limited to the sector of IT only and the second one represents a fairly complex toolkit which has been archived in 2014.

Toolkits that have been developed for particular organizations can be found in the Environmental Management System for a Métis Workplace (Thompson, 2009) and in the Environmental Management System Manual by the Kenya Forestry Research Institute (2010). While these systems are adapted ideally to their respective organizations, they are not usable to other companies.

Thus, the presented research introduces a system that shall serve as toolkit for small and medium-sized enterprises to implement a simplified EMS based on the ISO 14001:2004. It aims at overcoming the often found complexity in favor of a toolkit that is easily understandable and applicable to a variety of firms in order to support them in defining and improving their environmental impact.

3. Methodology

The purpose of this study is to develop an environmental toolkit for small and medium-sized enterprises. As the literature review has shown, SMEs play an important role in contributing to the European as well as to the global environmental impact for several reasons. They include: a lack of resources; a lack of environmental responsibility; and an absence of an environmental management system. While such a system is not always necessary to ensure that a company be ecologically responsible, it is a very useful and proven tool that provides a framework to assist organizations in evaluating and improving their environmental impact. An EMS is more commonly implemented by large companies than by small or medium-sized organizations. One reason for this is the fact that large companies are likely to have more resources and can invest in expert advice for the implementation of such a system. Another argument for the implementation of an EMS in large companies is made by external pressure that is put on them by stakeholders and environmental protection organizations. Clients and customers, investors, and employees often expect large organizations to be conscious of their impact on the environment and to try to keep it minimal.

However, since the above mentioned factors do not apply to SMEs to the same extent as large companies, small and medium-sized enterprises are significantly less likely to implement an EMS. The presented research introduces a toolkit that is resource-efficient and easy to use and, thus, invites SMEs to utilize it for the implementation of a simplified version of an environmental management system.

The presented chapter includes and discusses the following methodologies that are used in the process of data collection and development of the target system: EMS Methodology, System Development Life Cycle, and the Research Methodology.

3.1 EMS Methodology

The EMS methodology lays the basis for the development of the target system that simplifies environmental management systems. There are two formal existing EMS frameworks that are taken into consideration for this study, namely the ISO 14001 Environmental Management System and the EMAS Eco-Management and Audit Scheme. Both are very similar in their basic steps and concepts. However, the EMAS framework consists of more steps and is, thus, more complex and detailed than the ISO 14001. Furthermore, as stated earlier, the ISO 14001 is more commonly used than the EMAS. Since the goal of this research is to develop a toolkit

that facilitates the implementation of an EMS for the SMEs Community, the ISO 14001 standard has been chosen as basis for this study.

The ISO 14001 Environmental management system is part of the ISO 14000 family defined by the International Organization for Standardization and focuses on environmental management. At the moment, the ISO 14001:2004 version is used for EMS but the standard itself is currently under revision. An updated version is expected to be available by the end of this year (2015) and will be named ISO 14001:2015. The revision will ensure the standard's compatibility with other standards and focus on a better understanding of a company's context. According to ISO (International Organization for Standardization, 2015), the principal changes will relate to the following points:

- “Increased prominence of environmental management within the organization's strategic planning processes”
- “Greater focus on leadership”
- “Addition of proactive initiatives to protect the environment from harm and degradation, such as sustainable resource use and climate change mitigation”
- “Improving environmental performance added”
- “Lifecycle thinking when considering environmental aspects”
- “Addition of a communications strategy”

This standard follows the Plan – Do – Act – Check principle (International Organization for Standardization, 2004b). This refers to the process cycle an enterprise is expected to go through when implementing an EMS.

In more detail, the ISO 14001:2004 (International Organization for Standardization, 2004a) outlines five steps, each of which encompasses several documentable sub-steps. The steps are: 1) environmental policy, 2) planning, 3) implementation and operation, 4) checking and corrective action, and 5) management review in the end. The five steps and their related sub-steps are illustrated in Figure 1.

It is important to notice that in order to keep the environmental toolkit as simple to use as possible, a large number of the phases will be omitted in the system's realization. For the purpose of this research, merely steps from the planning phase and from the implementation and operation phase will be implemented.



Figure 1 ISO 14001:2004 Detailed Steps

1) Environmental Policy

In the first step, the enterprise is asked to develop, implement, and publish an environmental policy. The policy mirrors general environmental guidelines the company claims to adhere to, such as pollution prevention, and forms the basis of their EMS.

2) Planning

In the next phase, the actual procedures and operations are being planned. Sub-steps of this phase are: 1) environmental aspects, 2) legal and other requirements, 3) environmental objectives and targets, and 4) the environmental management program.

The environmental toolkit focuses primarily on the planning phase of the EMS standard. In the toolkit, the user will be asked to define the company's environmental aspects, their environmental objectives and targets, and to select the criteria of their environmental management program. Legal and other requirements will be omitted as they are not as generally applicable throughout organizations as the other steps.

2.1) Environmental Aspects

At the beginning of the planning phase, companies are asked to assess all areas within their organization that have an environmental impact, regardless of whether that is a positive or an adverse impact. Based on the findings, they are then asked to define those aspects that have a significant environmental impact. Those will be the points the EMS will address primarily.

2.2) Legal and Other Requirements

Another important aspect of the planning stage focuses on legal and other requirements. In order to be compliant with all mandatory legal requirements that may apply but also with requirements the company voluntarily decides to abide by, it is necessary to first assess all of the existing relevant regulations. Because environmental regulations are likely to extend further in the future, already including voluntary actions is recommended.

2.3) Environmental Objectives and Targets

Being aware of their own environmental impact, as well as of requirements they have to or choose to comply with, the standard asks organizations to define their environmental objectives and targets. In this case, objectives are the overall goals while targets are the means necessary to achieve those goals.

2.4) Environmental Management Program

In the ISO 14001:2004 framework, the last step of the planning phase is the development of the actual environmental management program. The program defines how and when the objectives and targets described in the prior step are to be realized.

3) Implementation and Operation

According to the ISO 14001:2004 standard, the implementation and operation phase focuses on the realization of what has been defined in the planning stage. Again, there are several sub-steps in this section which are composed of: 1) structure and responsibility, 2) training, awareness, and competence, 3) communication, 4) EMS documentation, 5) document control, 6) operational control, and 7) emergency preparedness and response.

Out of those sub-steps, options for training, awareness, and competence of the employees will be included in the environmental toolkit in order to help make the system as successful as possible inside an organization.

3.1) Structure and Responsibility

Having completed the planning phase, the organization needs to structure and define responsibilities related to positions rather than individual people in order to ensure sustainability of the developed EMS.

3.2) Training, Awareness, and Competence

The goal of this section is to identify training needs for all employees whose work may impact the environment. These actions have to be developed and coordinated by the responsible person which often falls onto a designated environmental management officer.

3.3) Communication

The standard recommends to direct communication about the EMS internally as well as externally. Internal communication is necessary to communicate guidelines regarding the environmental management system to all staff and enable them to comply with them. External communication is merely recommended.

3.4) EMS Documentation

According to the ISO 14001, documented information describing core elements of the EMS needs to be established and maintained. Besides listing all core elements, elements that interact with it or are otherwise related to the EMS should be listed or referenced, as well.

3.5) Document Control

The standard further requires that all created documents are being controlled and updated properly. Those may include manuals, procedures, forms, and other documentation. Among others, the document control includes points such as the document location, periodical revision, availability, and removal if necessary.

3.6) Operational Control

This step involves all staff whose work may have a significant environmental impact and ensures their awareness thereof.

3.7) Emergency Preparedness and Response

In the last step on the implementation and operation phase, an organization needs to identify potential areas of risk and implement measures to try to prevent the associated environmental impact and define response actions in case of an emergency.

4) Checking and Corrective Action

Stage four aims at finding potential errors in the system and at correcting those. Again, it consists of several sub-steps which are: 1) monitoring and measurement, 2) non-conformance and corrective and preventive action, 3) records, and 4) the EMS audit.

4.1) Monitoring and Measurement

The organization must first develop procedures to periodically monitor and measure the key characteristics of their operations and activities with a significant environmental impact. This includes but is not limited to the objectives and targets defined by the enterprise.

4.2) Non-Conformance and Corrective and Preventive Action

The second step in this section requires the enterprise to identify responsibility for cases of non-conformance and for providing corrective or preventive action if needed. This may result in changed to already existing procedures.

4.3) Records

Records are defined differently from documents and are generally explained as evidence of something. This could encompass training records as well as records of the EMS audit or the management reviews.

4.4) EMS Audit

Audits are the final step of this section and are meant to assess whether or not the enterprise conforms with the regulations of the EMS and with the ISO 14001 itself.

5) Management Review

The final stage of the ISO 14001 is the management review in which the management area of an enterprise reviews and, if considered necessary, changes their EMS. This last step can include revisions and additions to the environmental management program of their company.

It is important to note that the standard represents a process cycle so that, once the five steps have been accomplished, an organization is asked to go through the steps again from the beginning. It is a repetitive practice with the purpose of continuous improvement. It is assumed that companies change processes, actions, and other business-related area that can have an impact on the environment during the course of their life cycle. Hence, implementing an EMS requires continual processes that ensure a continual improvement of the organization's EMS. Thus, the goal of the standard is to continuously improve the environmental management

system itself rather than the company's actual environmental impact. It is assumed that the impact improves with the improved system.

This research's target system focuses mainly on the planning phase and provides an abstracted guideline for SMEs to define their areas of significant environmental impact, to specify their environmental objectives and, based on them, to outline their environmental management program. Furthermore, support for the training of staff is included, too. This is to facilitate the use of the system and lay out a basis for organizations to start assessing and improving their ecological impact.

3.2 Systems Development Life Cycle Methodology

In the area of systems engineering, the systems development life cycle (SDLC) describes the phases associated with the entire life cycle of systems development. According to Hoffer et al.(2002), SDLCs differ from organization to organization and the number of their phases varies. However, a systems development life cycle typically consists of: 1) the systems analysis, 2) the systems design, 3) the systems development, 4) the systems integration and testing, and 5) the systems maintenance. There are various models that guide through the mentioned steps which can be iterative, sequential, or agile. Depending on the scope of the project, one model can be more favorable than the others. For instance, iterative models are particularly useful in projects with a limited scope, such as the expansion of an existing system, as they integrate repetitions of already applied cycles. The sequential model builds up on a detailed planning phase prior to the development of the system in order to achieve a predicted result. Thus, this model is particularly suitable for large projects with predictable outcomes. Agile models, in contrast, are favored in the development of systems which need to allow for rapid and numerous changes, and whose outcome may not be predictable from the beginning (Yeates and Wakefield, 2004).

For the purpose of this research, the waterfall model (figure 2), which falls into the category of iterative models, is selected. As the desired result of the systems development is already known, this model is particularly advantageous and reduces the necessity of applying changes later in the development processes due to its planning phase in the beginning.

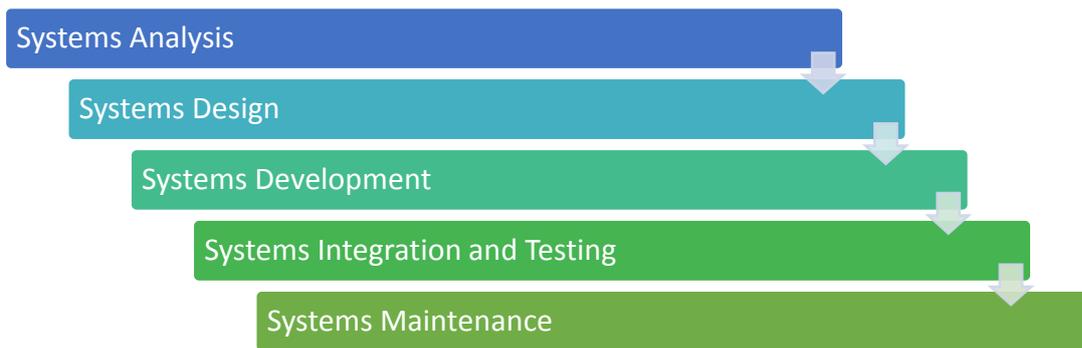


Figure 2 SDLC - Waterfall Model

1) Systems Analysis

In the analysis phase, the target system's feasibility is tested. The concept of the system is defined and user requirements are being analyzed. In this study, the target system is based on the EMS methodology discussed previously and the user requirements are drawn from interviews with target users which will be explained in more detail in chapter 3.4.

2) Systems Design

Having completed the analysis stage, the target system is designed. This phase often includes wireframes to help visualize the future system. However, in this research, the designs adopted for the web-based toolkit is provided by the selected WordPress theme.

3) Systems Development

In the following phase, the actual systems development is being realized. Here, the systems development refers to outlining the target system based on the drawn user and system requirements. This functions as guidance for the following integration phase into the website.

4) System Integration and Testing

In a fourth step, the developed system is integrated, and tested. For this research, the system is integrated into the WordPress frame and evaluated by 13 participants. The evaluation process is based on a questionnaire and will be explained in more detail in the research methodology chapter.

5) Systems Maintenance

The final phase of the SDLC consists of its maintenance. This is particularly important in software systems but applies to most other developed systems, as well. Although this is the last step of the life cycle, SDLCs are often considered to be continuous cycles and their phases to

be iterative (Hoffer et al., 2002). For this study, the systems maintenance is not considered but will be part of future work.

It is important to note that each of the phases should end with a verification or validation process. This is to ensure that each completed step aligns with the requirements defined beforehand. Verification is generally provided by feedback sessions with the author's supervisors who are experts in the topic, while validation is derived from testing sessions with a focus group and also with target users.

3.3 Research Methodology

As the objective of this research is to develop a system that aims to be usable by small and medium-sized enterprises, interviews have been conducted with representatives from two small firms during the design and the validation phase. This approach shall support the production of authentic, relevant, and novel data, and allow a better understanding of the target users and their requirements (Bailey, 2014; Keegan, 2009). Furthermore, the system has been evaluated by experts and a group of non-experts with the help of questionnaires.

3.3.1 Interviews

The interviews have been conducted with representatives of two small German enterprises, one of which falls into the category of small enterprises and one is part of the group of micro enterprise as defined by the European Commission (Commission of the European Communities, 2003).

Enterprise one is a cosmetic retail store in Berlin that is part of a larger company but is run independently on a franchise level. Decisions relating to the shop in Berlin are made by the local manager and franchisee. It is a small enterprise in itself with 14 employees that has started business since 2001.

The second enterprise is a micro start-up business in the IT sector, situated in Berlin, as well. It is founded in 2009 and currently has nine members of staff. The enterprise moved from a home-based office to a proper office at the beginning of this Year (January 2015).

The language used for the interview questions and the language of the toolkit is English. In both cases, the representatives have conversational and written English language skills. They are able to understand and work with the developed system. However, in order to ensure complete understanding of all interview questions as well as of all parts of the toolkit, the interviews have been conducted via the video conferencing service Skype™. The interviewees have been asked the questions online and translations and additional information is provided for them by the

author whenever necessary. The questions themselves are based on a questionnaire that has been made accessible to them via Google Forms™ prior to the interview. The interview note (see Appendix 1), that explains the purpose of the interview as well as the way their data is being handled and their rights regarding the withdrawal of their given answers, has been sent to the interviewees beforehand. In addition, they have been provided that information orally before each interview.

Ethical concerns about the research have been taken into account and the study has been approved by the research ethics committee at Leeds Beckett University.

Representatives of the management area of these companies (the manager of the retail store and the CEO of the IT company) are interviewed in two cycles, the pre-intervention and the post-intervention cycle. Here, intervention refers to the use and testing of the developed environmental toolkit.

3.3.1.1 Pre-Intervention Cycle

In order to develop a system that targets small and medium-sized organizations' EMS needs, it is important to first assess the target group's understanding of the given topic and to provide insight into their requirements. Therefore, interviews have been conducted prior to building the system.

The pre-intervention interview (see Appendix 2) is based on 15 questions that focus on general assessment of the enterprise in the first part, such as the business area, the business form and the number of years in business, the number of staff, and the representative's role inside the firm. In the second half, areas such as the prior knowledge of EMS, the existence of an environmental policy and eco-friendly practices, SMEs responsibility towards the environment and barriers to an EMS implementation, are assessed. In the end, the enterprises are asked to provide any requirement they may have for the development of an EMS.

The questions are open, multiple choice, or grid-based. Open questions are used whenever a limitation of the possible answer options is considered disadvantageous, multiple choice is selected whenever answer options are considered helpful and better to evaluate, and the grid-based questions are applied whenever agreement to provided statements is being ranked.

3.3.1.2 Post-Intervention Cycle

After the development of the toolkit, the SMEs are asked to test and validate it. The aim of the post-intervention interview is to assess its usefulness to SMEs and whether their requirements

have been met. Furthermore, recommendations drawn from the post-intervention interviews will be part of the recommendations for future work on the toolkit.

The post-intervention interview (see Appendix 3) is based on a total of 13 questions and, just as in the pre-intervention questionnaire, the first part provides the same general information of the enterprise. In the second part of the questionnaire, the organizations are asked to provide feedback on the usefulness and usability of the toolkit, on whether or not it raised their awareness regarding the environmental impact and whether they are more inclined to introduce eco-friendly changes, and on whether the system informs them of EMS or whether additional information is desired. Finally, the enterprises are asked for any additional points that should have been included in the system and if they would recommend using it.

Again, the questions are open, multiple choice, and grid-based.

3.3.2 Expert Evaluation

During the development of the toolkit, regular meetings have been held with the author's supervisors Prof. Colin Pattinson and Dr. Ah-Lian Kor. Both are lecturers at the Leeds Beckett University in the faculty of Arts, Environment, and Technology. They are experts in the field of sustainable information technology and are knowledgeable of EMS. The meetings are held in order to receive regular oral and written expert feedback on the design as well as the content of the toolkit.

In order to evaluate the toolkit's usability and receive additional feedback regarding its content, a group of postgraduate students has evaluated the system.

3.3.3 Non-Expert Evaluation

The group of non-experts consists of 13 master students from the field of sustainable information technology at Leeds Beckett University. Thus, the students have background in green computing and are aware of the necessity of sustainable strategies in industry. Prior to the questionnaire, they are given a presentation by the author on the environmental management systems, the ISO 14001 in particular, the definition and role of SMEs, as well as a short introduction to the developed toolkit. In the following step, the participants of the focus group are given the URL to the toolkit and asked to evaluate it based on the provided questionnaire.

During the evaluation, questionnaire forms are provided. They aim to assess the human-computer interaction as well as the content regarding the implementation of EMS. In order to enhance the likelihood of receiving accurate and complete responses, the forms are anonymous and consist mainly of grid-based questions in which participants are asked to rate their

responses to a set of given statements. Open questions are asked, too, with the purpose of allowing the group to provide their feedback (see Appendix 4).

The group is divided into two halves where one half is asked to assume the role of a CEO of a micro enterprise in the field of IT while the other half should act as a manager of a retail store that sells cosmetic products. Without explaining further how the toolkit works, they are asked to test it and give feedback by completing the forms they are given.

The questionnaire itself is divided into the two main parts of human-computer interaction (HCI) evaluation and content evaluation. In the first part, the focus is on the human-computer interaction and aims primarily at evaluating the system's usability. The HCI principles chosen for the present research are based on Shneiderman's "eight golden rules of interface design" (Shneiderman and Plaisant, 2010), Mandel's three "golden rules of interface design" (Mandel, 2013), Nielsen's "10 heuristics for user interface" (Nielsen, 2005), and Sutcliffe's HCI principles (Sutcliffe, 1995). The derived principles are the system's consistency, compatibility, predictability, adaptability, economy, user control, structure, match with the real world, error prevention, recognition, flexibility and efficient use, help and documentation, and error handling. After testing the toolkit, the participants are asked to evaluate the system based on these criteria and to provide any additional feedback.

In the content section, participants are requested to evaluate the content of the toolkit by appropriately responding to a set of statements. Again, an open question in the end aims at receiving feedback that has not been targeted in the grid-based questions. The nine statements are composed of "The content is easy to understand", "The content is relevant", "There was sufficient supporting material", "I would have needed additional explanation for using the toolkit", "I would have wanted more information on the ISO 14001", "I would have liked to use a more detailed toolkit", "I can see the point of toolkit", "I think the system is useful", and "Would you want more multimedia included in the toolkit?".

In the very last section of the questionnaire, the group is presented with an open question to add any further comments and recommendations they have for toolkit.

4. The Environmental Toolkit

The developed system can be found at www.EnvironmentalToolkit.com. It is a web-based toolkit that aims at supporting SMEs in the implementation of a simplified environmental management system. It allows them to more easily assess and improve their environmental footprint. This chapter will provide a detailed presentation of the system, as well as of the systems development life cycle.

As already stated in the methodology, the system is based on the ISO 14001:2004 Environmental Management System standard. However, in order to meet the objective of this research, the standard has been highly simplified to make it easier to use for small and medium-sized enterprises that are not experts in the field of EMS and only have limited resources for the implementation of such a system.

The environmental toolkit is divided into two sub-systems. The focus of the toolkit lies on the first system 1, the *Environmental Management System*, which can be found at www.environmentaltoolkit.com/environmental-management-system/ and is a far more simplified version of an EMS than the alternative system 2, *Template-Based Environmental Toolkit*, which can be accessed here: www.environmentaltoolkit.com/template-based-environmental-toolkit/. Depending on the proficiency of the user, either one of the other systems can be chosen. Generally, it is recommended to start working with system 1 as its implementation is easier and quicker. Thus, system 2 is only recommended after a company has prior experience and is familiar with EMS, or for those that are interested in complying with the requirements in ISO 14001:2004. Both systems will be described in the following sub-chapters.

4.1 System1: Environmental Management System

As already described, the *Environmental Management System* is the main system of the environmental toolkit. It represents a simplified version of an EMS that is targeted at inexperienced users who want to implement an EMS but have limited resources. Its pages structure and content will be discussed below. Screenshots of all pages of this system that are not presented in this chapter can be found in appendix 5.

4.1.1 System1: Environmental Management System – Pages

The *Environmental Management System* has a *Home* and an *About* page which present the toolkit as well as background information on the ISO 14001 standard. The page of the toolkit

itself is divided into the three main areas of energy consumption, water consumption, and recycling.

1) *Home* and *About* Pages

The homepage (figure 3) of the system gives a general overview of the toolkit and presents both available sub-systems (the *Environmental Management System* and the *Template-Based Environmental Toolkit*). It also provides a short introduction on how the toolkit is to be used. The homepage further offers quick access to the forms which are the key feature of the toolkit, the alternative system and its templates.

Environmental Toolkit

Create your own simple environmental management system and make your company greener. Easy!

HOME ABOUT ENVIRONMENTAL MANAGEMENT SYSTEM TEMPLATE-BASED ENVIRONMENTAL TOOLKIT



Home

The EnvironmentalToolkit has been made for small and medium-sized enterprises with the aim of functioning as a simplified environmental management system and helping them improve their environmental impact.

Working in an environmentally friendly manner has many benefits, such as cost savings, an improved image towards clients and consumers, and a smaller environmental footprint. This toolkit helps you make your own company greener in an easy way. Just choose the area you want to assess, fill the forms, and have the results sent directly to your email address. All you have to do then is follow them!

Start the [Environmental Management System](#) now!

For a system that more closely follows the ISO 14001 and provides corresponding templates, please go to the [Template-Based Environmental Toolkit](#). This system is more detailed and complex and is suggested to be used as improvement after implementing the [Environmental Management System](#).

 Search

FORMS

[Energy Consumption](#)

[Water Consumption](#)

[Recycling](#)

OTHER SYSTEMS

[Template-Based Environmental Toolkit](#)

ISO 14001 TEMPLATES

[Templates](#)

Figure 3 *Environmental Management System - Home*

In the *About* section (figure 4), the user is presented with information about the ISO 14001:2004 standard in general and is linked to its official website in case more information on the topic is

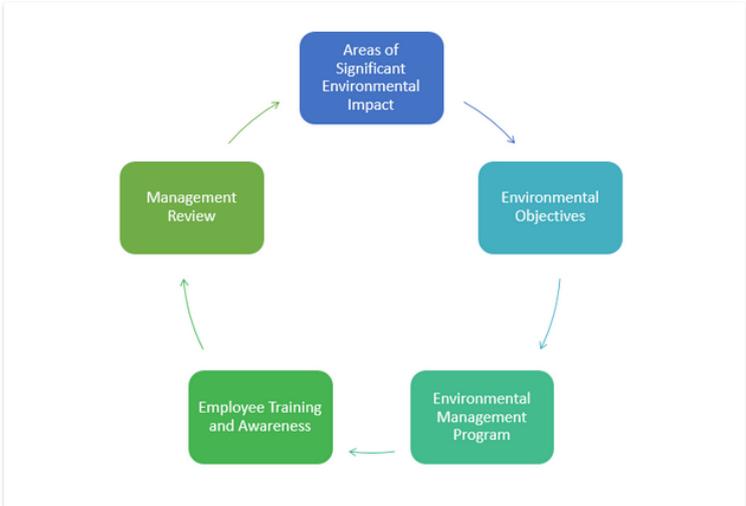
desired. A graph is included in order to facilitate the understanding of the EMS cycle defined by the standard and to provide a brief overview of the relevant steps of the framework.

About

The Environmental Toolkit is derived from the concept of the ISO 14001 – Environmental Management System. The standard defines guidelines that help companies evaluate and improve their environmental impact. The steps, however, require human, temporary, and financial resources that are difficult to provide especially for small and medium-sized enterprises (SMEs). Thus, the presented toolkit is an abstracted and highly simplified version of the standard that aims at guiding SMEs towards more environmentally friendly operating methods.

It is divided into the areas of energy consumption, water consumption, and recycling. Each area provides forms that guide through the steps of an EMS, following the principle illustrated below.

Please visit the [ISO website](#) for more information on the ISO 14001.



EMS Steps

Figure 4 Environmental Management System - About

2) Environmental Management System Page

The *Environmental Management System* (figure 5) is divided into three main areas that are considered to be common and to have an environmental impact in most SMEs. The areas of focus are energy consumption, water consumption, and recycling. At the beginning of the page, a short introduction and a guidance to start the toolkit are provided. Images are used to represent the three areas and function as additional links that lead to each respective sub-page.



Environmental Management System

Every area of a company's business has some impact on the environment. Evaluating and improving all of it can be resource-intensive and complicated. This toolkit focuses on three main areas that are kept more general in order to make this system applicable to a wide range of businesses. However, feel free to add anything you think is important and has an impact on the environment.

Get started by filling the form of the area(s) you want to work on. The results will be sent to your email and will help you realize your environmental goals.



**Energy
Consumption**



**Water
Consumption**



Recycling

FORMS

[Energy Consumption](#)

[Water Consumption](#)

[Recycling](#)

OTHER SYSTEMS

[Template-Based Environmental Toolkit](#)

ISO 14001 TEMPLATES

[Templates](#)

Learn more about the background of this toolkit in the [About](#) section.

Figure 5 Environmental Management System Page

3) Sub-Pages of the *Environmental Management System*

Each of the field briefly presents the topic and then links to forms that depict steps in an actual EMS. In the cases of energy consumption and water consumption, links are provided that point the user to calculators offered by external parties and that allow them to assess their current energy or water consumption and to compare their results for pre and post implementation of the toolkit. For the energy consumption (figure 6), links are provided to the Electricity Cost Calculator (TurnRound Ltd, 2015) and to the Water and Energy Calculator (Affinity Water, 2015). The water consumption section merely links to the Water and Energy Calculator (Affinity Water, 2015) to guide SMEs towards assessing their own water consumption.



Energy Consumption

Energy is an important factor when it comes to a company's environmental footprint. Not only does it have a significant impact on the environment, it is also one of the easiest factors to measure.

To evaluate and improve your organization's footprint on the environment, fill the energy consumption form.



To calculate your energy consumption, you can visit free websites such as www.sust-it.net or AffinityWater.

Or go to:



Figure 6 Environmental Management System - Energy Consumption

4.1.2 System1: Environmental Management System – Forms

The actual EMS support is provided by the forms (figure 7) that are linked to each of the environmental impact areas. They follow the ISO 14001:2004 standard by integrating its fundamental steps of Plan – Do – Check – Act to an extent that is considered feasible for the target group of inexperienced users with limited resources. In practice, the forms focus on the planning phase and are divided into the areas of: 1) Significant environmental impact, 2) Environmental objectives, 3) Environmental management program, and 4) Employee awareness and communication. The provided options have been designed with the purpose of being applicable to as many SMEs in general. However, in this research project, the needs of two German target companies have been addressed. Their facilities include offices, a cosmetic store, as well as a small storage space.

When using the forms, the users are asked to select the fields that they find appropriate for the respective SME and submit the form. Upon submission of the completed form, the enterprise

will receive an email to the previously provided address with a document containing the outline of their personal EMS. This document will include their selected areas of significant environmental impact, their chosen environmental objectives, the measures of their environmental management program they want to implement, as well as guidance regarding the staff training and communication. It is meant to be used as framework and guidance and to help the organization realize the outlined steps.

Energy Consumption

Select the areas you want to implement in your EMS regarding your company's energy consumption and add those you feel are missing.

*Required

Email Address *

Please provide the email address you want the results to be sent to.

Areas of Significant Energy Consumption

Please check the areas that contribute significantly (to a measurable amount) to your company's energy consumption.

Areas of Significant Energy Consumption

- Heating / Air Conditioning (AC)
- Lighting
- Electronic devices (monitors, computers, etc.)
- Kitchen equipment (refrigerator, freezer, etc.)
- Other:

Environmental Objectives

Please select (and add) the objectives you want to achieve with this environmental management program.

Environmental Objectives

- Retrieve energy from environmentally sustainable sources
- Generally reduce energy consumption
- Other:

Environmental Management Program

Depending on the area you want to improve, please select and add the measures you want to take.

Environmental Management Program - General

Monitoring the energy consumption will help you evaluate your improvement after implementing energy_saving measures.

- Monitor and measure energy consumption
- Other:

Environmental Management Program for Heating

- Reduce heating in rarely used business areas (e.g. storage rooms, etc.)
- Do not use heating/AC when not necessary
- Separate unheated areas by closed doors/walls
- Implement automated heating/cooling system
- Assess and improve buildings' insulation
- Other:

Environmental Management Program for Lighting

- Switch lighting off when not needed
- Implement automated lighting system
- Install energy-saving light bulbs
- Other:

Environmental Management Program for Electronic Devices (ICT)

- Turn electronic devices, such as monitors and computers, off when not in use
- Define PC saving options
- Turn wifi access points off during the night, weekend, holidays
- Optimize the energy consumption of your software
- Turn off all electronic devices during the night, weekend, holidays
- Introduce few centralized printers, shared by all employees
- Decrease monitor brightness whenever possible
- Acquire energy-saving, eco-labelled electronic devices
- Other:

Environmental Management Program for Kitchen Equipment

- Open doors of freezer and refrigerator only for short period of time
- Do not put warm food inside freezer/refrigerator
- Do not overfill freezer/refrigerator
- If you acquire new equipment, pay attention to eco labels
- Use a microwave over a stove
- Recycle old equipment to prolong their life span
- Other:

Environmental Management Program Regarding the Acquisition

- Retrieve energy from renewable sources
- Other:

Employee Awareness and Communication

In order to implement the environmental management program successfully throughout the entire organization, it is important to raise the environmental awareness of all staff and to communicate the program with them.

Employee Awareness and Communication

- Inform employees about company's environmental responsibility and commitment
- Set meetings to inform about environmental actions
- Introduce seminars that teach employees their environmental actions
- Place posters inside the offices that visualize environmental responsibility/actions
- Put reminding notes next to relevant areas such as reminders to switch off lights next to light switches, or to close doors of not heated/cooled areas
- Communicate company's environmental awareness through newsletters
- Communicate company's environmental awareness on their website
- Other:

Submit

Figure 7 Environmental Management System - Energy Consumption Form

1) Areas of Significant Environmental Impact

In the first part of the form, the enterprise is asked to define the areas of their significant environmental impact. The purpose of this step is to raise awareness of the environmental footprint a company produces so users of the toolkit are more conscious of their own impact and can better estimate and include enterprise-specific measures they want as part of their own environmental management system.

In the form for energy consumption, they are called *Areas of Significant Energy Consumption* and in the water consumption form, it is *Areas of Significant Water Consumption*. Recycling does not have this section included as it is not applicable.

In the example of energy consumption, areas of significant energy consumption are divided into: “Heating/Air Conditioning (AC)”, “Lighting”, “Electronic devices (monitors, computers, etc.)”, “Kitchen equipment (refrigerator, freezer, etc.)”, and “Other”. The last option allows the user to add any areas that apply to the company in question but that are not listed in the form.

In the case of water consumption, the predefined areas of significant water consumption include: “Cooling water”, “Cleaning or equipment and property”, “Production processes”, “Consumption by equipment such as dishwasher”, “Bathroom appliances (e.g. toilets, showers, sinks, etc.)”, “Involved in manufacturing process”, and “Other”.

2) Environmental Objectives

In the second part of the form, the enterprise is presented with options for defining their objectives with regard to the environment. Again, the objectives are kept more general in order to be as applicable to as many companies as possible, while the individual enterprise always has to opportunity to add further options.

The suggested environmental objectives for energy consumption are: “Retrieve energy from environmentally sustainable resources”, “Generally reduce energy consumption”, and “Other”.

The form for water consumption lists the options: “Reduce overall water consumption”, “Discard waste water in a responsible manner”, and “Other”.

For recycling, the options entail: “Recycle all plastic”, “Recycle all paper”, “Recycle all aluminium”, “Reduce company’s overall waste”, “Recycle all glass”, “Compost all garbage that can be composted”, and “Other”.

3) Environmental Management Program

The focus of this EMS is the environmental management program. It lists the measures the company wants to take in order to achieve its environmental objectives. Users are asked again to select desired measures from the provided list and add points they think are still missing.

3.1) Environmental Management Program – Energy Consumption

Energy consumption holds the biggest potential out of the three areas of environmental impact included in the toolkit because it is considered to be used in every aspect of business in most SMEs. Furthermore, comparing the impact before and after implementing the EMS is fairly easy, by way of comparing the energy bills or by using an online energy calculator, for example.

For *Energy Consumption*, the options are listed under sub-points that relate to the previously defined areas of environmental impact. Thus, depending on the areas of significant energy consumption applying to the enterprise's field of business, they can more easily decide which points are relevant to their company. A general section suggests measures that do not fit into exactly one category of environmental impact but that are important for measuring the consumption. The sub-categories of the *Environmental Management Program* part of the form for *Energy Consumption* are: 1) Environmental Management Program – General, 2) Environmental Management Program for Heating, 3) Environmental Management Program for Lighting, 4) Environmental Management Program for Electronic Devices (ICT), 5) Environmental Management Program for Kitchen Equipment, and 6) Environmental Management Program Regarding the Acquisition.

3.1.1) Environmental Management Program – General

The first part of the program lists a point that does not directly correspond to any of the aspects defined in the areas of environmental impact. However, it is important to measure the impact in order to understand and improve it. Because most SMEs work with computers in one way or another, it is recommended to measure their energy consumption. Measuring the consumption in other areas, as well, is desirable but may require more effort, expertise, and resources. Hence, the options listed under this point are limited: “Monitor and measure energy consumption” and “Other”. If a company feels comfortable with implementing further tools for monitoring and measuring the energy consumption in additional areas, they are invited to specify so under “Other”.

3.1.2) Environmental Management Program for Heating

In the second part, the suggested measures for improving the environmental footprint with regards to heating used in the organization are listed. The provided options encompass: “Reduce heating in rarely used business areas (e.g. storage rooms, etc.)”, “Do not use heating/AC when not necessary”, “Separate unheated areas by closed doors/walls”, “Implement automated heating/cooling system”, “Assess and improve buildings' insulation”, and “Other”.

3.1.3) Environmental Management Program for Lighting

Lighting is another area that can be found in most SMEs and that, depending on their business, can have a fairly significant impact on the environment. The proposed options for saving energy in the lighting department are: “Switch lighting off when not needed”, “Implement automated lighting system”, “Install energy-saving light bulbs”, and “Other”.

3.1.4) Environmental Management Program for Electronic Devices (ICT)

Electronic devices, especially those related to ICT, have a high environmental potential and numerous measures can be taken to improve their environmental impact. The options recommended in this form include: “Turn electronic devices, such as monitors and computers, off when not in use”, “Define PC saving options”, “Turn wifi access points off during the night, weekend, holidays”, “Optimize the energy consumption of your software”, “Turn off all electronic devices during the night, weekend, holidays”, “Introduce few centralized printers, shared by all employees”, “Decrease monitor brightness whenever possible”, “Acquire energy-saving, eco-labelled electronic devices”, and “Other”.

3.1.5) Environmental Management Program for Kitchen Equipment

Not all SMEs have kitchens but many use at least single pieces of electrical equipment such as refrigerators, microwaves, coffee machines, or water kettles. For companies that fall into the category of having kitchen equipment, the following options are proposed to be included in their EMS: “Open doors of freezer and refrigerator only for short period of time”, “Do not put warm food inside freezer/refrigerator”, “Do not overfill freezer/refrigerator”, “If you acquire new equipment, pay attention to eco labels”, “Use a microwave over a stove”, “Recycle old equipment to prolong their life span”, and “Other”.

3.1.6) Environmental Management Program for Acquisition

Finally, an important factor of energy consumption and saving is the acquisition of energy. Supporting sustainable energy sources is another relevant step towards improving an organization's environmental footprint in the area of energy consumption. Hence, the last part

of the *Environmental Management Program* in this field lists as criteria for energy acquisition: “Retrieve energy from renewable sources” and “Other”.

3.2) Environmental Management Program – Water Consumption

The measures for *Water Consumption* are far fewer than those for *Energy Consumption* and hold less potential than those which is why they are not divided into sub areas. They are kept fairly general, as well, in order to be as generally applicable to various kinds of SMEs, as well.

The points recommended in the Environmental Management Program part of the form for - water consumption are the following: “Install water-saving taps in sinks”, “Install water-saving shower heads”, “Use rain water for toilet flushing”, “Use rain water for outdoor cleaning”, “Install water recycling system”, “Replace water-consuming equipment with more environmentally friendly options when replacement is needed”, and “Other”.

3.3) Environmental Management Program – Recycling

In the section for recycling, no areas of environmental impact were provided as they are not applicable in this aspect. Hence, the suggestions provided for the respective environmental management program are not separated into sub-divisions, either.

The included points are the following: “Agree on recycling contracts with vendors”, “Install glass recycle bins”, “Install plastic recycle bins”, “Install paper recycle bins”, “Install aluminium recycle bins”, “Donate/sell used electronic instead of discarding them”, “Install company's own compost”, “Reuse partly printed (one-sided) for notes”, “Use recycled paper”, “Properly dispose of electronic waste (e.g. batteries, light bulbs)”, and “Other”.

4) Employee Awareness and Communication

A key importance of implementing the environmental management program is the communication of all agreed upon measures to all staff working within the organization. This is a necessary step in order for the system to encompass the entire enterprise and reach the highest possible effect. The detailed realization of the recommended steps depends on the company and factors such as their size, their number of employees, and their resources. The sections of energy consumption, water consumption, and recycling all have the same recommendations for raising awareness of the EMS to their staff and to communicate their measures to them.

The suggested arguments across all areas (energy consumption, water consumption, and recycling) are: “Inform employees about company's environmental responsibility and

commitment”, “Set meetings to inform about environmental actions”, “Introduce seminars that teach employees their environmental actions”, “Place posters inside the offices that visualize environmental responsibility/actions”, “Put reminding notes next to relevant areas such as reminders to switch off lights next to light switches, or to close doors of not heated/cooled areas”, “Communicate company's environmental awareness through newsletters”, “Communicate company's environmental awareness on their website”, and “Other”.

4.1.3 System1: Environmental Management System – Response Forms

When filling out the forms of the toolkit, the user is asked to provide an email address in order to receive the filled response form which will then serve as framework and guideline for implementing the enterprise’s EMS. In summary, the resulting form will show their selected areas of significant environmental impact, their chosen environmental objectives, the measures of their environmental management program they want to implement, as well as guidance regarding the staff training and communication. Furthermore, the date of submission is included in each form so it can be counted towards the documentation of a more detailed EMS in the future. An example of such a completed response form is presented in figure 8.

Environmental Toolkit

~Energy Consumption~

04/10/2015 18:44:54

Areas of Significant Energy Consumption:

Heating / Air Conditioning (AC), Lighting, Electronic devices (monitors, computers, etc.), Kitchen equipment (refrigerator, freezer, etc.)

Environmental Objectives:

Retrieve energy from environmentally sustainable sources, Generally reduce energy consumption

Environmental Management Program

Environmental Management Program - General:

Monitor and measure energy consumption

Environmental Management Program for Heating:

Reduce heating in rarely used business areas (e.g. storage rooms, etc.), Do not use heating/AC when not necessary, Implement automated heating/cooling system

Environmental Management Program for Lighting:

Implement automated lighting system, Install energy-saving light bulbs

Environmental Management Program for Electronic Devices (ICT):

Define PC saving options, Turn wifi access points off during the night, weekend, holidays, Turn off all electronic devices during the night, weekend, holidays, Introduce few centralized printers, shared by all employees

Environmental Management Program for Kitchen Equipment:

Do not put warm food inside freezer/refrigerator, Use a microwave over a stove

Environmental Management Program Regarding the Acquisition:

Retrieve energy from renewable sources

Employee Awareness and Communication:

Inform employees about company's environmental responsibility and commitment, Introduce seminars that teach employees their environmental actions, Place posters inside the offices that visualize environmental responsibility/actions

Figure 8 Environmental Management System - Completed Response Form

4.2 System 2: Template-Based Environmental Toolkit

The *Template-Based Environmental Toolkit* is the first version of the system. During the course of the system's development, it has been simplified even more and system 1, the *Environmental Management System*, has become the main focus of the toolkit as it is simple and targeted at inexperienced users. Nevertheless, system 2, the *Template-Based Environmental Toolkit*, has been kept as part of the toolkit in order to offer users a framework that closely follows the ISO 14001:2004 standard and that can even help lead to an ISO certification of the company's practices.

The *Template-Based Environmental Toolkit* follows the main steps of the ISO standard and provides users with examples and templates that aim at simplifying the process steps of the standard.

Just as in the ISO 14001:2004 standard, the second system on the website is divided into five main categories of: Environmental Policy, Planning, Implementation and Operation, Checking and Corrective Action, and Management Review which can be found under the section "EMS Steps". The home page of this system (figure 9) links to the following sections: 1) About, 2) EMS Steps, 3) Templates, and 4) Definitions. Screenshots that are not provided in this section can be found in appendix 6.



Template-Based Environmental Toolkit

The template-based environmental toolkit is a more complex system that was developed based on the ISO 14001 and includes its main steps. It is still a simplified version of the standard that has the purpose of guiding enterprises through the steps with short explanations and templates they can adjust and use to implement their own environmental management system.

To use this more advanced system, please follow the links below or go directly to the template section if you already know the standard a little.

[About](#)

[EMS Steps](#)

1. [Environmental Policy](#)
2. [Planning](#)
3. [Implementation & Operation](#)
4. [Checking & Corrective Action](#)
5. [Management Review](#)

[Templates](#)

[Definitions](#)

FORMS

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[Recycling](#)

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[Template-Based Environmental Toolkit](#)

ISO 14001 TEMPLATES

[Templates](#)

Figure 9 Template-Based Environmental Toolkit

1) About

In the *About* page (figure 10), the user is given an overview of the system. Quick access is possible through links on the right-hand side. In order to facilitate navigation throughout, the next step is linked to on the bottom of the page.

About

The template-based environmental toolkit offers a free system that has been designed to help small and medium-sized enterprises (SMEs) manage and improve their own environmental impact. Implementing an environmental management system (EMS) is often complicated and requires time, expertise, and humans as well as financial resources. Thus, many SMEs have not been able to develop an appropriate system that would help them monitor their environmental footprint and help them make improvements.

This system is meant to serve as a guide that explains what EMS are, why they are important, and how they can be implemented. The steps will be based on the ISO 14001 for Environmental Management but they will be simplified to make the system more feasible and easier to use. However, it will follow the the basic Plan – Do – Check – Act model.

EMS are much more common in large enterprises as they have the necessary resources to get experts to advise them and implement their systems and because many feel the public pressure to do so. Interestingly, although SMEs make for a much larger portion of the overall business in Europe, they often do not feel in charge for acting environmentally responsible.

Go to [EMS Steps](#).

FORMS

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[Water Consumption](#)

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ISO 14001 TEMPLATES

[Templates](#)

Figure 10 Template-Based Environmental Toolkit - About

2) EMS Steps

The key part of this system is the EMS Steps (figure 11). It encompasses the major sub-steps of the ISO 14001 standard and provides templates as Microsoft Word files wherever applicable. Those templates can be downloaded and filled by the user and will be part of the EMS documentation. As one of the priorities in the design of this toolkit is to make it usable for SMEs with limited resources and expertise in EMS, not all of the sub-steps of the standard are part of this toolkit. Hence, only those parts that are deemed most important and most applicable, have been included.

EMS Steps

In this section, steps to implementing a simplified EMS are presented. Supporting media and files aim at facilitating the process and at making this system more usable.

Referring to the ISO 14001, the basic model of the system will follow the steps of making an [Environmental Policy](#), [Planning](#), [Implementation & Operation](#), [Checking & Corrective Action](#), and a [Management Review](#). However, it must be noted that this is a continuous model which is built with continuous improvement in mind. Here, the continuous improvement refers to that of the EMS and not to the enterprise's environmental impact per se. However, it is assumed an improved EMS will lead to an improved environmental impact.

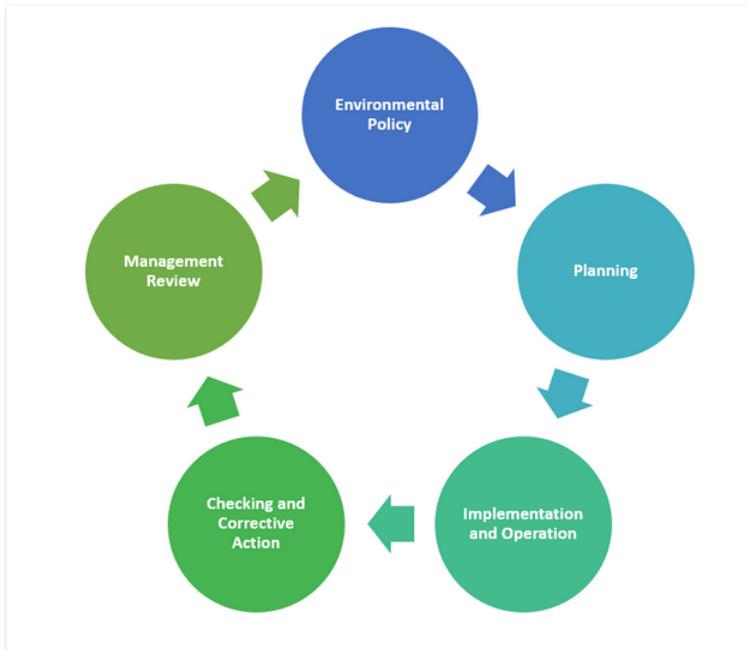


Figure 11 Template-Based Environmental Toolkit - EMS Steps

The Template-Based Environmental Toolkit comprises the following main parts: 1) Environmental Policy, 2) Planning, 3) Implementation and Operation, 4) Checking and Corrective Action, and 5) Management Review.

2.1) Environmental Policy

In the first section of the EMS Steps, the user is provided with information regarding a company's environmental policy. With it comes a template that can be used with only slight changes or only as general basis for the enterprise' own policy (figure 12).

FORMS

[Energy Consumption](#)

[Water Consumption](#)

[Recycling](#)

OTHER SYSTEMS

[Template-Based Environmental Toolkit](#)

ISO 14001 TEMPLATES

[Templates](#)

Full name of the organization

Environmental Policy

The company commits to protecting the environment at all/specific locations. In particular, the organization's objectives regarding the environment are the following:

- As best as they can, preserve the environment for this and for future generations.
- Minimize pollution as much as possible.
- Comply with current regulations regarding sustainability and the environment.
- Aim at minimizing the releases to water, land, and air as much as possible.
- Implement corrective actions on past practices wherever applicable.
- Continually improve the Environmental Management System.
- Use recycled materials wherever possible.
- Reuse, recycle, and reduce first in order to try to prevent pollution.
- Refrain from using hazardous materials/products with hazardous ingredients.

Issued by Representative (such as CEO/president/etc.) of the company

Date

NOTE: All words in green must be replaced/chosen from. All other parts can be kept as they are or adapted and added as desired.

Figure 12 Template-Based Environmental Toolkit - Environmental Policy Template

2.2) Planning

After defining their environmental policy, the SME is asked to complete the planning phase. Here, all steps required by the ISO 14001:2004 are included in the system which are: 1) Significant Environmental Aspects, 2) Legal and Other Requirements, 3) Environmental Objectives and Targets, and the 4) Environmental Management Program. Each section has a short explanation on the topic and, except for Legal and Other Requirements, they all are supported with templates.

2.3) Implementation and Operation

Out of the ISO-provided steps for the section of implementation and operation of the EMS, only the first four have been considered applicable and have been included in this system. Thus, the

sup-points are: 1) Structure and Responsibility; 2) Training, Awareness, and Competence; 3) Communication; and 4) EMS Documentation. Each section is supported by templates. Not included are 5) Document Control, 6) Operational Control, and 7) Emergency Response and Preparedness.

2.4) Checking and Corrective Action

The steps included in Checking and Corrective Action are: 1) Monitoring and Measurement, 2) Non-Conformance and Corrective and Preventive Action, 3) Records, and the 4) EMS Audit. Templates are provided for the first three. The EMS Audit is a fairly detailed step in the ISO 14001:2004 but it is only mentioned in this system as it is not considered applicable for the purposes of this toolkit.

2.5) Management Review

The last step of the framework is the Management Review. The system provides recommendations for possible changes during the management review and offers a template for documenting those.

3) Templates

For users who are already familiar with the *Template-Based Environmental Toolkit*, a short-cut is provided which leads directly to only the templates on one page (figure 12). This aims at facilitating the use of the toolkit over time and at making content more easily available.

Templates

Find all templates provided by this toolkit here.

Environmental Policy

[Environmental Policy Template](#)

Planning

[Environmental Aspects Template](#)

[Significant Environmental Aspects Template](#)

[Objectives and Targets Template table](#)

[Environmental Management Program Template](#)

Implementation & Operation

[Structure and Responsibilities Template](#)

[Training and Awareness Needs Template](#)

[Communication Methods Template](#)

[Core Elements Template](#)

[EMS Documentation Template](#)

Checking and Corrective Action

[Performance Tracking Template](#)

FORMS

[Energy Consumption](#)

[Water Consumption](#)

[Recycling](#)

OTHER SYSTEMS

[Template-Based Environmental Toolkit](#)

ISO 14001 TEMPLATES

[Templates](#)

Figure 13 Template-Based Environmental Toolkit - Templates

4) Definitions

Another section is provided merely for definitions that are distinct in the ISO 14001 standard (figure 13). The defined terms and terminologies include: “Organizations”, “Environmental Management System”, “Continual Improvement”, “Environmental Aspect”, “Significant Environmental Aspect”, “Environmental Impact”, “Environmental Objective”, “Environmental Target”, and “Interested Party”.

Definitions

The ISO 14001 uses many terms that can lead to questions. In order to eliminate any potential doubts about the meanings of particular expression, terms as the defined by the ISO are provided here.

Organizations

An organization is a “company, corporation, firm, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own function and administration”. (ISO 14001, Section 3.12)

Environmental Management System

An EMS is “the part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy”. (ISO 14001, Section 3.5)

Continual Improvement

Continual improvement is defined as “process of enhancing the environmental management system to achieve improvements in overall environmental performance in line with the organization’s environmental policy”. (ISO 14001, Section 3.1)

Environmental Aspect

An environmental aspect is an “element of an organization’s activities, products, or services that can interact with the environment”. (ISO 14001, Section 3.2)

Significant Environmental Aspect

A significant environmental aspect is one “that has or can have a significant environmental impact”. (ISO 14001, Section 3.3)

Environmental Impact

The ISO defines as environmental impact as “any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization’s activities, products, or services”. (ISO 14001, Section 3.4)

Environmental Objective

Environmental objectives are explained as “overall environmental goal[s], arising from the environmental policy, that an organization sets itself to achieve, and which is quantified where practicable”. (ISO 14001, Section 3.7.)

Environmental Target

According to the ISO, an environmental target is a “detailed performance requirement, quantified where practicable, applicable to the organization or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives”. (ISO 14001, Section 3.10)

Interested Party

An interested party is an “individual or a group concerned with or affected by the environmental performance of the organization”. (ISO 14001, Section 3.11)

Examples: Employees, customers, neighbors, environmental groups, citizen groups, political groups, governmental agencies, stockholders

FORMS

[Energy Consumption](#)

[Water Consumption](#)

[Recycling](#)

OTHER SYSTEMS

[Template-Based Environmental Toolkit](#)

ISO 14001 TEMPLATES

[Templates](#)

Figure 14 Template-Based Environmental Toolkit - Definitions

4.3 Environmental Management System – Systems Development Life Cycle

In order to develop the presented system, the systems life cycle methodology has been applied. The methodology aims at ensuring that the system is of higher quality and that its development adheres to the life cycle's steps.

4.3.1. Systems Analysis

The purpose of this research is to develop a toolkit that helps small and medium-sized enterprises implement their own environmental management systems without imposing the same barriers and challenges that have been discussed in the literature review, such as the need for expertise or financial resources. Thus, overcoming those barriers is a requirement for the system. In addition, pre-intervention interviews have been conducted with the two small German firms in order to define further potential stakeholder requirements that must be taken into account for the development of the toolkit. For this purpose, a questionnaire has been provided in support of the interview. The questionnaire can be found in appendix 2.

4.3.1.1 Pre-Intervention Interview

The first part of the questionnaire focuses on assessing the company's details in order to be able to put the results in relation with the company's profile. It consists of the following questions: "Which business area is your enterprise located in?", "How many years has your company been in business for?", "What kind of ownership best defines your enterprise?", "What is your position in the company?", and "How many employees/staff members are associated with your enterprise?"

Enterprise one is a retail store in the area of cosmetics with a shop history of 14 years. It is part of a larger, globally acting company but is managed locally by a franchisee. The person interviewed is the manager of the store and the number of staff associated with the franchise branch is 14.

Enterprise two is in the sector of IT services and has been in business for approximately 2.5 years. It is privately owned by two CEOs, one of whom participated in the interview as the company's representative. At the time of the interview, there is a total of nine staff members associated with the enterprise.

In the second part of the questionnaire, EMS-related questions are asked in order to retrieve potential requirements for the target system. This part consists of the following questions: 1) "Do you have an environmental policy in place?", 2) "Are you familiar with Environmental Management Systems (EMS)?", 3) "Do you have an EMS implemented in your enterprise?",

4) “Do you have any eco-friendly practices implemented?”, 5) “If you answered yes, please list your practices.”, 6) “How much do you agree with the following statements regarding your enterprise and its role for the environment?”, 7) “How much do you agree with the following statements regarding barriers of an EMS implementation?”, 8) “Are you satisfied with your current environmental practices?”, 9) “If you selected ‘No’, please give reasons.”, and 10) “Please indicate your requirements for an (ideal) EMS.”

1) Do you have an environmental policy in place?

The participants are given the options of selecting “Yes” or “No” to this question. Enterprise one confirms that they have an environmental practice on place while the other negated this questions

2) Are you familiar with Environmental Management Systems (EMS)?

In the next part, the companies are asked about their familiarity with EMS. The provided answer options consist of “Yes”, “No”, and “Somewhat” and a short summary of what an EMS is was provided. Both selected “No”.

3) Do you have an EMS implemented in your enterprise?

Again, the participants are presented with the options of “Yes” and “No”. They are not familiar with EMS prior to the interview, both select “No”.

4) Do you have any eco-friendly practices implemented?

Given the choice between “Yes” and “No” again, both companies select yes.

5) If you answered yes, please list your practices.

As the two enterprises state to have implemented eco-friendly practices in their business, they are asked to specify those with an open question. Firm one answers that they separate rubbish and retrieve electricity from sustainable resources, while enterprise two answers that, at the end of each year, they donate to an organization that plants trees.

6) How much do you agree with the following statements regarding your enterprise and its role for the environment?

In the following, grid-based, question, the organizations are asked to rate their agreement with three statements on the role of their SME for the environment on a scale of “Strongly agree”, “Agree”, “Neutral”, “Disagree”, to “Strongly disagree”. The statements are: 1) “Our company

carries a big responsibility for the environment”, 2) “Our enterprise can make an impact on the environment”, and 3) “Small and medium-sized enterprises (SME) play an important role with respect to the environment.”

Both companies agree with statement 1) and statement 3), while only firm two agree with statement 2) and the other one disagree.

7) How much do you agree with the following statements regarding barriers of an EMS implementation?

In the next question, the companies are asked to rate their agreement with five statements on the barriers that an EMS implementation entails on a scale of “Strongly agree”, “Agree”, “Neutral”, “Disagree”, to “Strongly disagree”. The statements were: 1) “Implementing an EMS is too expensive”, 2) “We lack sufficient knowledge for an EMS implementation”, 3) “We lack the right technology to implement an EMS”, 4) “We do not see potential benefits of an EMS implementation”, and 5) “We lack human resources.”

Firm two strongly agrees with statement 1) while the firm one disagrees. With statement 2), enterprise two agrees and enterprise one disagrees. Statement 3) found agreement with company one while the other remained neutral. Both disagree with statement 4) while for statement 5), company two expresses strong agreement when the other disagrees.

8) Are you satisfied with your current environmental practices?

To the multiple choice question of whether or not they are satisfied with their current environmental practices, enterprise one selects “No” of the provided options of “Yes” and “No”, while the IT firm selects “Yes”.

9) If you selected ‘No’, please give reasons.

No reasons have been provided for this section.

10) Please indicate your requirements for an (ideal) EMS.

The last question of the interview is open and aimed at retrieving the companies’ specific requirements for an ideal EMS. The cosmetic retail store indicates that the ideal EMS should be easy to use and adapt to the company’s requirements. Enterprise two suggests making an app for the toolkit.

Findings for this section are shown in table 1.

Table 1 Pre-Intervention Interview Questions and Answers

Interview Question	Cosmetic Retail Store	IT Service Provider
Which business area is your enterprise located in?	Retail in cosmetics	IT services
How many years has your company been in business for?	14	2.5
What kind of ownership best defines your enterprise?	Franchise	Private
What is your position in the company?	Manager	CEO
How many employees/staff members are associated with your enterprise?	14	9
Do you have an environmental policy in place?	Yes	No
Are you familiar with Environmental Management Systems (EMS)?	No	No
Do you have an EMS implemented in your enterprise?	No	No
Do you have any eco-friendly practices implemented?	Yes	Yes
If you answered yes, please list your practices.	separate garbage, use eco-power	We donate to an organization planting trees at the end of the year.
How much do you agree with the following statements regarding your enterprise and its role for the environment?		
Our company carries a big responsibility for the environment.	Agree	Agree
Our enterprise can make an impact on the environment.	Disagree	Agree
Small and medium-sized enterprises (SME) play an important role with respect to the environment.	Agree	Agree
How much do you agree with the following statements regarding barriers of an EMS implementation?		
Implementing an EMS is too expensive.	Disagree	Strongly agree
We lack sufficient knowledge for an EMS implementation.	Disagree	Agree
We lack the right technology to implement an EMS.	Agree	Neutral
We do not see potential benefits of an EMS implementation.	Disagree	Disagree
We lack human resources.	disagree	Strongly agree
Are you satisfied with your current environmental practices?	No	Yes
If you selected "No", please give reasons.		
Please indicate your requirements for an (ideal) EMS.	Make an app for it.	It should be practical and easy to use. It should adapt to our company's requirements.

4.3.1.2 User Requirements

Based on the pre-intervention interviews with the two representatives of target users and based on the previously conducted literature review, user requirements for the target system can be defined. Thus, the following requirements are outlined:

- 1) The system must be useful.
- 2) The system must be easy to use.
- 3) The system must make SMEs aware of their environmental impacts.
- 4) The system must inform about EMS.

The drawn requirements have been verified by experts in the form of the author's supervisors.

4.3.2 Systems Design

Knowing the concept of the target system and having defined the user requirements, the system design is being conceived. The general design based is on WordPress™ as its layouts serve the purposes of this work ideally. The design theme Twenty Twelve (WordPress, 2015) has been chosen as web design template for this toolkit. Thus, the ideas of the system development discussed in the expert reviews are merely implemented within the existing design.

Throughout the design and early development stages, two different systems have evolved. The first version is the *Template-Based Environmental Toolkit* which follows most of the steps of the ISO 14001:2004 closely and provides templates whenever applicable to significantly facilitate the use of the toolkit. The templates can be used with almost no changes involved by the user, or they can be adjusted entirely. Throughout the development process, however, it has become obvious that the system may still be too complex to use and, therefore, not comply with the previously defined requirements. It is still considered a useful tool but is recommended to use for more experienced clients. Thus, a second system has been designed, the *Environmental Management System*, which is a far more simplified version of an EMS than the alternative *Template-Based Environmental Toolkit*.

4.3.3 Systems Development

In order to make the toolkit universally accessible, it has been designed in the English language and it is hosted on the webserver One.com™ with the integration of WordPress™ as content management system.

One.com™ is a web hosting service that includes hosting tools such as an effortless WordPress integration and 15 Gigabyte hosting space. Both of which facilitate the technical integration of the system.

For simplifying purposes, WordPress.org™ has been integrated into the website as it already includes many of the needed services and functionalities. It functions as content management system that is easy to use and to adapt and which allows for an uncomplicated design of the toolkit, as well as the integration of the Google Forms™ which are used for helping SME build their own EMS. Even though the system is web-based, the WordPress theme effortlessly adapts to mobile devices and therefor allows the user to work with the system on phones and tablets, as well.

4.3.4 Systems Testing

In order to ensure that the designed system is usable and that the content is relevant, it is tested and validated before its release. There are two kinds of validation applied in this study: expert validation and non-expert validation.

4.3.4.1 Expert Validation

During the expert validation, sessions are held between the author and at least one of the two experts (i.e. her two supervisors). The purpose of this evaluation is to receive regular verification on completed processes by experts.

4.3.4.2 Non-Expert Validation

The first draft of the system has been evaluated by non-professionals. A group of 13 postgraduate students in the field of Green IT at the Leeds Beckett University is asked to assess and evaluate the toolkit. The students are familiar with the concept of IT for Greening and are given a presentation on EMS and small and medium-sized enterprises beforehand. During the evaluation, forms are provided that help assess the human-computer interaction as well as the content regarding the implementation of the EMS. In order to enhance the likelihood of receiving accurate and complete responses, the forms are anonymous and consist mainly of grid-based questions in which participants are asked to rate their agreement with the given statements. Open questions were asked, too, with the purpose of allowing the test group to provide feedback that has not been targeted in the grid-based questions. The questionnaire can be found in appendix 4.

The participants of the test group receive a short introduction to the topic and are then given the URL to the toolkit. The group is divided into two halves where one half assume the role of an CEO of a micro enterprise in the field of IT, while the other half act in the role of the manager of a retail store that sells cosmetics. Without explaining further how the toolkit works, they are asked to test it and give feedback based on the forms they were given.

The results of the systems testing phase are discussed in chapter 5.

5. Results and Discussion

Following the development of the system, evaluation processes are conducted in order to validate the toolkit and verify that it complies with the SME's requirements that are defined in chapter 4.3.1.2, User Requirements. For that purpose, evaluation sessions are held with experts, non-experts, and the target SMEs themselves. The results of those sessions will be discussed in the following chapters.

5.1 Expert Validation

During the system's development, evaluation sessions have been held regularly between the author and at least one of her two supervisors who represents an expert in the area of environmental management systems. During those sessions, ideas of the realization as well as the achieved progress by the author have been discussed. This procedure helps reshape the target system based on the experts' feedback and serves as additional verification process of the system's requirements.

5.2 Non-Expert Validation

The non-expert validation, in this research, is a means for evaluating the toolkit's human-computer interaction (HCI) as well as the content. The non-experts are 13 postgraduate students in the area of sustainable computing that have knowledge of the importance of sustainability in IT but are not experts in the field of EMS.

In order to support the evaluation of the system, the students have been provided with questionnaires that contain items relating to the toolkit's HCI and its content. They are then asked to rate their agreement with each statement. The possible responses are: "I strongly agree", "I agree", "Neutral", "I disagree", and "I strongly disagree". In the next part, the responses to the questionnaires are analyzed and discussed, using a descriptive statistical approach. Thus, the achieved mean, median, and mode scores will be presented. For this purpose, the answers are first coded into numerical values. Thus, "5" represents "I strongly agree", "4" stands for "I agree", "3" represents "neutral", "2" symbolizes "I disagree", and "1" is used for "I strongly disagree". The mean score represents the average response value, median the middle value, and the mode value the score that has been selected the most.

1) Human-Computer Interaction Validation

The first part of the validation process focuses on the human-computer interaction. After going through the toolkit, the participants are asked to evaluate the HCI the system provides based on a questionnaire. The users are then asked to provide any additional feedback (see table 2).

Table 2 Systems Testing - HCI Results 1

Statement	Mean Score	Median Score	Mode Score
Consistency - The system is consistent (screens, design, etc.).	4.25	4.5	5
Compatibility - The system meets my expectations.	4	4	4
Predictability - I clearly see the actions I can take (icons, links, etc.).	4.39	5	5
Adaptability - The interface is adapted to the way I use it.	4.42	4.5	5
Economy - The steps I have to take are clear and not too many.	4.23	4	5
User Control - I feel in control of the system (I can jump through sections, undo actions if applicable, etc.).	3.92	4	3
Structure - The system appears structured and not too complex. Presented information is relevant.	4.39	5	5
Match with Real World - I understand the language and presented concepts.	4.39	4	5 and 4
Error Prevention - I don't feel like I could make any disastrous errors.	4.23	4	4
Recognition - Objects, Actions, and options are well visible and recognizable throughout the pages.	4.08	4	5 and 4
Flexibility and Efficient Use - I can find shortcuts in-between the sections and use the system flexibly.	4.15	4	4
Help and Documentation - I find help and supporting material easily.	3.9	4	4
Error Handling - I receive clear error messages and corrective action steps.	3.9	4	3

All of the responses in the questionnaire express a positive perception of the above mentioned criteria and received a majority of positive and/or neutral answers. Thus, no changes needed to be made regarding the HCI aspect of the toolkit. More relevant are the additionally provided comments that are depicted in figure 15.

Please write down any additional comments you have on the system's interface and usability.

The interface looks perfect to me.
It gives me alternative options to a course of study or search.
Suggest moving EMS Steps from About to main navigation bar. Easier to locate.
It is usable, focuses on user's goals.
Nothing to add - clear system - helpful guide - good result
I like the use of white space. More images would help me, maybe less text. Sometimes the order of navigation around the site is unclear to me. Basic numbered steps/instructions might help.
- Email requested but no email sent. - Once the form is completed there are no clear instructions. To use results maybe change "see previous responses" to "see results form responses". - Option to close or go back to main page needs to be added.

Figure 15 Systems Testing - HCI Results 2

Eight out of the 13 participants of the sample provide additional feedback in this section. The remarks regarding the system's interface and usability composed of the following comments:

- a) “The Interface looks perfect to me.”
- b) “It gives me alternative options to course of study or search.”
- c) “Suggest moving EMS Steps from About to main navigation bar. Easier to locate.”
- d) “It is usable, focuses on user’s goals.”
- e) “Nothing to add – clear system – helpful guide – good result”
- f) “I like the use of white space. More images would help me, maybe less text. Sometimes the order of navigation around the site is unclear to me. Basic numbered steps/instructions might help.”
- g) “Email requested but no email send. Once the form is completed there are no clear instructions. To use results maybe change ‘See previous responses’ to ‘see results from responses’. Option to close or go back to main page needs to be added.”
- h) “Clear and very simple.”

Comments a), b), d), e), and h) are positive and therefore not considered further for the system’s development. The suggestion from comment c) has been realized, while the recommendations from f) and g) will be considered as recommendations for the future enhancement of the toolkit.

2) Content Validation

In the content section, participants are presented with statements about the content of the toolkit and are asked to indicate their appropriate response for each of them. Again, an open question in the end aims at receiving feedback that is not targeted in the grid-based questions.

The nine statements comprise: “The content is easy to understand”, “The content is relevant”, “There was sufficient supporting material”, “I would have needed additional explanation for using the toolkit”, “I would have wanted more information on the ISO 14001”, “I would have liked to use a more detailed toolkit”, “I can see the point of toolkit”, “I think the system is useful”, and “Would you want more multimedia included in the toolkit?” (see table 3).

Table 3 Systems Testing - Content Results 1

Statement	Mean Score	Median Score	Mode Score
The content is easy to understand.	4.39	4	5 and 4
The content is relevant.	4.54	5	5
There was sufficient supporting material.	4.58	4	5
I would have needed additional explanation for using the toolkit.	3.15	3	3
I would have wanted more information on the ISO 14001.	3.39	4	5
I would have liked to use a more detailed toolkit.	3	3	2
I can see the point of toolkit.	4.62	5	5
I think the system is useful.	4.7	5	5

Generally, participants find the content of the toolkit positive. Only in some cases, few individuals express negative responses. An example is that more information on the ISO 14001:2004 standard as well as further details are desirable in a few cases. Consequently, a link to the respective ISO website has been included in the toolkit. The strongest expressed need is the use of media (e.g. videos) and also the inclusion of images. These needs have been noted and will be considered for the future enhancement of the system.

Again, eight of the participants added further feedback which comprises comments presented in figure 16.

Please add here all additional thoughts and ideas you have for the content of the toolkit.

It is fine.
It is good to have less images. However, the banner image does not show aspects of energy and water consumption. It is good it shows environment. It is very simple but I don't seem to like it.
Instead of submitting another response, I would like to go and select recycling or water consumption.
I find the point "Do not use heating/AC when not necessary" under EM program for lighting a bit more displaced.
Good breakdown of EMS and ISO 14001. A very useful tool for companies that want to change the way they operate. Good awareness and overall experience. :)
A case study of a SME which has used the system might be helpful. This could be a video of a testimonial also explaining what the company did and how easy it was to implement.
It should highlight the likely consequences of not complying with the environmental responsibilities.

Figure 16 Systems Testing - Content Results 2

The additional thoughts and ideas participants have regarding the content of the toolkit include the following comments:

- a) "Nothing to add."
- b) "It is fine."
- c) "It is good to have less images. However, the banner image does not show aspects of energy and water consumption. It is good it shows environment. It is very simple but I don't seem to like it."
- d) "Instead of submitting another response, I would like to go and select recycling or water consumption."
- e) "I find the point 'Do not use heating/AC when not necessary' under EM program for lighting a bit misplaced."
- f) "Good breakdown of EMS and ISO 14001. A very useful tool for companies that want to change the way they operate. Good awareness and overall experience. [...]"
- g) "A case study of a SME which has used the system might be helpful. This could be a video of a testimonial also explaining what the company did and how easy it was to implement."
- h) "It should highlight the likely consequences of not complying with the environmental responsibilities."

Comments a), b), f) are exclusively positive about the toolkit's content and are not further addressed throughout the system's development. Statements c), d), g) and h) remain unchanged due to technical limitations and time constraints but will be taken into consideration for the recommendations concerning the development of the system in the future. Comment e) has led to a change in one of the forms.

3) General Validation

As last part of the validation form, participants of the focus group are asked to provide any additional thoughts and recommendations they have regarding the toolkit. The provided comments are presented in figure 17.

Please write down any other comments, ideas, observations you have.

I recommend all supplier companies to provide this toolkit at least with the pill as advice note.
The graphs are nice but do not really tell me how to reduce my energy consumption. Maybe introduce suggestion based on response. Maybe not show all the questions at once but instead display a question at a time.
How long does it take to receive the email? And is this really necessary? There is conscience of filling email on the internet for privacy reasons. I think you should reconsider this. Also, you can include a reference to the ISO 14001 website. (Just suggestions).
Broken link between "template-based toolkit and all EMS Steps.
Icon social media sharing. Many other external websites provide code can embed into website. They visitors may share the link onto those networks without needing to leave the website.
The question is only for office use but home should also be included because people now work from home.

Figure 17 Systems Testing - General Validation

When asked about further comments, ideas, and observations about the toolkit in general, the participants provide the following answers:

- a) "I recommend all supplier companies to provide this toolkit at least with the pill as advice note."
- b) "The graphs are nice but do not really tell me how to reduce my energy consumption. Maybe introduce a suggestion based on a response. Maybe not show all the questions at once but instead display a question at a time."
- c) "How long does it take to receive the email? And is this really necessary? There is conscience of filling email the internet for privacy reasons. I think you should reconsider this. Also, you can include a reference to the ISO 14001 website [...]"
- d) "Broken link between template-based toolkit and all EMS Steps."
- e) "Icon social media sharing. Many other external websites provide code can embed into website. The visitors may share the link onto those networks without needing to leave the website."
- f) "The question is only for office use but home should also be included because people now work from home."

The main finding drawn from this part of the questionnaire is a number of non-functioning links as well as an error in the email notification service. Thus, participants are unable to receive the response documents which, consequently, cannot be evaluated by them. However, the idea has been explained to them and they have not opposed to it.

Response a) is regarded as positive comment on the toolkit and is not taken into consideration for the further enhancement of the system. Responses c) and d) point out erroneous links and notification services which have been corrected as a result. Comments b), c), e), and f) will be taken into consideration for future work on the system.

5.3 SME Validation

In order to assess whether the developed system is applicable for SMEs, the two small German enterprises are asked to test and evaluate the toolkit based on a questionnaire. Prior to

developing the system, the firms have been asked to complete a first questionnaire with the purpose of defining the stakeholder requirements (see chapter 4.3.1.1). After developing the system and including the changes derived from the testing and validation phase, the firms are invited to go through the intervention by using the system and to fill another questionnaire regarding its usability and usefulness.

During the first part of the questionnaire, the firms are asked to provide information about their company as they have been asked in the first questionnaire, in order to bring the answers in relation with the respective organization. The first section comprises the following questions: “Which business area is your enterprise located in?”, “How many years has your company been in business for?”, “What kind of ownership best defines your enterprise?”, “What is your position in the company?”, and “How many employees/staff members are associated with your enterprise?”.

The second part focuses on the usefulness and usability of the toolkit. In order to assess those aspects, the enterprises are asked the following questions: 1) Would you rate the Environmental Toolkit as useful?, 2) Was it easy to use?, 3) Did the toolkit raise awareness for the environmental impact of your company?, 4) Do feel more inclined to introduce changes after using the toolkit?, 5) Would you have needed additional information?, 6) Do you feel informed about Environmental Management Systems?, 7) What did you miss in the toolkit?, 8) What do you think should be added?, and 9) Would you recommend using the toolkit?. The findings of the questionnaire are shown in table 4.

Table 4 Post-Intervention Interview Responses

Interview Question	Cosmetic Retail Store	IT Service Provider
Which business area is your enterprise located in?	Retail in cosmetics	IT services
How many years has your company been in business for?	14	2.5
What kind of ownership best defines your enterprise?	Franchise	Private
What is your position in the company?	Manager	CEO
How many employees/staff members are associated with your enterprise?	14	9
Would you rate the Environmental Toolkit as useful?	Very useful	Neutral
Was it easy to use?	Easy	Easy
Did the toolkit raise awareness for the environmental impact of your company?	Yes	Yes
Do feel more inclined to introduce changes after using the toolkit?	Yes	Yes
Would you have needed additional information?	No	No
Do you feel informed about Environmental Management Systems?	Informed	Very informed

What did you miss in the toolkit? What do you think should be added?	Nothing I can think of at the moment.	Pictures (of effects before/after)
Would you recommend using the toolkit?	Yes	If it was more developed, yes.

1) Would you rate the Environmental Toolkit as useful?

The first question of the post-intervention interview regarding the toolkit focuses on its usability. This is an important criteria of the toolkit which represents one of the previously defined user requirements, as well. Enterprise one, the retail store, rates the system as very useful while company two selects the neutral option. The interviewees are provided the range of answers consisting of five fields ranging from “Very useful” to “Not useful at all”. Not all five fields are described but they are assumed to represent the answers of “Very useful”, “Useful”, “Neutral”, “Not very useful”, “Not useful at all”. In order to evaluate the responses, the approach of descriptive statistics is used again. For this purpose, the answers are coded into the following values: “5” for of “Very useful”, “4” for “Useful”, “3” for “Neutral”, “2” “Not very useful”, and “1” for “Not useful at all”. Thus, the following result is received (see table 5):

Table 5 SME Validation - Result 1

Question	Mean Score	Median Score	Mode Score
Would you rate the Environmental Toolkit as useful?	4	4	5 and 3

Based on the results drawn from the descriptive statistical analysis, the toolkit is considered useful and the requirement is considered fulfilled.

2) Was it easy to use?

Another user requirement is that the system has to be easy to use. Both companies agree to find the environmental toolkit easy to use. Hence, this requirement is recognized as fulfilled, as well.

3) Did the toolkit raise awareness for the environmental impact of your company?

Raising awareness on their environmental impact is represented in the third user requirement. The two enterprises confirm that they feel more aware of their impact on the environment after using the toolkit. Therefore, the third user requirement is considered to be fulfilled, likewise.

4) Do feel more inclined to introduce changes after using the toolkit?

In the next question, the companies are asked about their likelihood to introduce eco-friendly changes, which both confirmed.

5) Would you have needed additional information?

In order to assess whether more information is needed for using the toolkit in general, the enterprises are asked about their need for additional information. Both denied.

6) Do you feel informed about Environmental Management Systems?

The last requirement, requirement 4, states that the toolkit must inform users about EMS. The retail store feels informed while the IT service provider feels very informed. Thus, the requirement is considered fulfilled.

7) What did you miss in the toolkit?

In order to assess if and what additional material should be included in the system, the enterprises are asked to provide their recommendations. Company one does not wish any additions to the toolkit at the time of testing while company two suggests including pictures that illustrate the positive effects the implementation of the toolkit can have.

8) Would you recommend using the toolkit?

Lastly, the interviewees are asked whether or not they would recommend the toolkit. Enterprise one confirms while enterprise two would recommend it after further development.

In this research, it is considered that all of the stakeholder requirements have been met. Furthermore, it is interesting to notice that using the toolkit resulted in the companies feeling more inclined to introducing eco-friendly changes in their work environment than they felt before using the system. The suggestion of more media integration is a point that has been found in the non-expert evaluation, too, and will be taken into consideration for the future enhancement of the toolkit. While the retail store would already recommend using the system, it is assumed that, after further development and the integration of additional media, the IT service provider would recommend it, as well.

5.4 Discussion

After the evaluation and validation of the environmental toolkit with the help of experts, non-experts, and the target SMEs, it is possible to compare the system to already existing EMS for SMEs and to outline its differences and challenges.

As stated in chapter 2.5, selected EMS already exist that target small and medium-sized enterprises in particular. However, their drawbacks have been summarized and the developed toolkit aims at overcoming those. For example, the Energy and environment SME toolkit by the Federation of Small Businesses in Scotland and the Scottish Energy Efficiency Office of the Scottish Executive (2003) and the SME Toolkit by the International Finance Corporation (2015) are fairly complex and non-interactive systems. The environmental toolkit represents a simplified version of an EMS that interacts with the users by inviting them to select the environmental aspect they want to improve. Furthermore, the toolkit presents them with checklists based on which the users will receive their personalized guidance forms. Thus, it is considered that the developed system overcomes the factors of complexity and non-interactivity to a certain degree.

The toolkit differs from the systems developed by the Fachgruppe Green IT (Swiss Information Society, 2015) and by The Environment Agency (2014), as well, due to its applicability to companies from various different sectors instead of only specific business areas, as is the case for the already existing systems.

Hence, it is considered that the environmental toolkit has overcome some of the challenges of other EMS by offering an alternative approach. However, it must be noted that the presented toolkit is merely a first approach and that potential challenges and drawbacks may be found in future research.

6. Conclusions and Future Research

Following the detailed presentation of the target system and its evaluation, the present chapter will discuss the conclusions drawn from this research and provide recommendations for future work.

The presented research has the aim of developing and testing a web-based environmental toolkit that supports small and medium-sized enterprises in the implementation of their own environmental management systems, following the research objectives outlines in chapter 1.2. In addition, the target toolkit has to overcome the barriers SMEs often face in the implementation of an SME. For the purpose of this research, the barriers outlined in the literature review and those retrieved from the pre-intervention interviews with the SMEs (see chapter 4.3.1.2, User Requirements) are considered. The human-computer interaction the system provides has been validated by the focus group and its content has been deemed appropriate by the experts, the focus group, and the target users. Based on the evaluation processes the experts, non-experts, and the target SMEs, the objective is considered fulfilled.

However, certain suggestions are included in the recommendations for the future work on the toolkit due to time constraints. Further recommendations are drawn from the validation processes and are summarized as the following points which will be discussed in the ensuing sections: 1) Develop a mobile application of the system, 2) Expand the research to include more target companies, 3) Incorporate additional areas of environmental impact, 4) Structure the system more clearly, 5) Include the enterprise's entire supply chain, 6) Eliminate the necessity for an email address, and 6) Include more multimedia.

1) Develop a mobile application of the system

Company 2 suggests the development of a mobile application prior to the development of the system. As the objective of this research is to build a web-based toolkit, this suggestion is considered as a recommendation for the future improvement of the toolkit. Although the implemented design adapts to mobile devices effortlessly, the development of a stand-alone application is considered desirable.

2) Expand the research to include more target companies

The presented research has been developed in collaboration with two small German enterprises which adds novelty to the field and served as a small representation of target users. For further research, it is recommended to expand the sample size and include representatives of enterprises

from different fields and different countries. This strategy is expected to add further user requirements to the system and to receive a broader evaluation of the system in order to make it applicable to as many different SMEs as possible.

3) Incorporate additional areas of environmental impact

The selected areas of environmental impact in the developed toolkit are limited to energy consumption, water consumption, and recycling. However, enterprises in different work fields are likely to have different areas of impact. Therefore, fields such as waste water or hazardous waste management are recommended to be part of an improved version of the system.

4) Structure the system more clearly

As found in the non-expert evaluation, the use of the toolkit may be structured more clearly with the use of numbers or steps. However, whether the need for this measure is perceived by more users should be tested by another focus group beforehand. If the demand for this change is confirmed, the toolkit should be adapted accordingly.

5) Include the enterprise's entire supply chain

In its current version, the toolkit merely focuses on three areas of environmental impact that do not consider its supply chain. However, the supply chain may impose a significant impact potential, as well. Thus, it is recommended to investigate the potential and, if appropriate, include the added aspect into the system.

6) Include more multimedia

The demand for additional multimedia has become clear in the non-expert evaluation as well as the SME evaluation. It is recommended to incorporate more images and include videos that guide the users through using the toolkit and videos. These media could also present use cases of SMEs who implemented the environmental toolkit and show how it has affected their company. Interviews with additional SMEs could clarify the need for more supporting material which, consequently, should be integrated into the system.

The author is aware that the number of potential recommendations is far more substantial than what has been provided. However, these recommendations are noted during the system's development or that during the evaluation phases.

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Appendices

Appendix 1: Interview Note

The following note has been sent to the interviewees prior to their interview cycles:

Participant Information Sheet

My name is Maike Schmidt and I am a PERCCOM student at Leeds Beckett University. As part of my master thesis, I am conducting research on environmental management systems (EMS) for small and medium-sized enterprises (SMEs) and I am developing a toolkit to help implement an EMS in a SME. I will conduct interviews mainly to evaluate the understanding of EMS that representatives of SMEs have and to evaluate my toolkit's usability and helpfulness.

You are not obliged to take part in this interview and you have the right to withdraw from it at any time before the publication of my research. All data used for this research will be anonymized and you will not be required to provide your name or the name of your enterprise. If you wish to learn more about my research or have other questions, please contact me via email (m.schmidt3222@student.leedsbeckett.ac.uk).

Appendix 2: Pre-Intervention Cycle

Pre-Intervention Questions

Which business area is your enterprise located in?

- Finance
- Services
- Manufacturing
- IT
- Other:

How many years has your company been in business for?

What kind of ownership best defines your enterprise?

- Public
- Private
- Collective
- Franchise
- Other:

What is your position in the company?

- CEO
- Manager
- Vice President
- Other:

How many employees/staff members are associated with your enterprise?

Do you have an environmental policy in place?

- Yes
- No

Are you familiar with Environmental Management Systems (EMS)?

An EMS functions as a framework that helps an enterprise to evaluate and improve its environmental impact. It is typically structured in a Plan-Do-Act-Check cycle and includes (but is not limited to) the following basic steps. Analyzing enterprise's environmental aspects - Finding legal requirements - Defining environmental objectives - Defining measures to achieve those objectives - Monitoring progress - Reviewing and improving the EMS

- Yes
- Somewhat
- No

Do you have an EMS implemented in your enterprise?

- Yes
- No

Do you have any eco-friendly practices implemented?

- Yes
- No

If you answered yes, please list your practices.

How much do you agree with the following statements regarding your enterprise and its role for the environment?

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Our company carries a big responsibility for the environment.	<input type="radio"/>				
Our enterprise can make an impact on the environment.	<input type="radio"/>				
Small and medium-sized enterprises (SME) play an important role with respect to the environment.	<input type="radio"/>				

How much do you agree with the following statements regarding barriers of an EMS implementation?

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Implementing an EMS is too expensive.	<input type="radio"/>				
We lack sufficient knowledge for an EMS implementation.	<input type="radio"/>				
We lack the right technology to implement an EMS.	<input type="radio"/>				
We do not see potential benefits of an EMS implementation.	<input type="radio"/>				
We lack human resources.	<input type="radio"/>				

Are you satisfied with your current environmental practices?

- Yes
- No

If you selected "No", please give reasons.

Please indicate your requirements for an (ideal) EMS.

Submit

Figure A1 Pre-Intervention Interview Questions

Appendix 3: Post-Intervention Cycle

Post-Intervention Questions

Which business area is your enterprise located in?

- Finance
- Services
- Manufacturing
- IT
- Other:

How many years has your company been in business for?

What kind of ownership best defines your enterprise?

- Public
- Private
- Collective
- Franchise
- Other:

What is your position in the company?

- CEO
- Manager
- Vice President
- Other:

How many employees/staff members are associated with your enterprise?

Would you rate the Environmental Toolkit as useful?

1 2 3 4 5

Not at all useful Very useful

Was it easy to use?

1 2 3 4 5

Not easy at all Very easy

Did the toolkit raise awareness for the environmental impact of your company?

- Yes
- No
- Other:

Do feel more inclined to introduce changes after using the toolkit?

- Yes
- No
- Other:

Would you have needed additional information?

- Yes
- No
- Other:

Do you feel informed about Environmental Management Systems?

1 2 3 4 5

Not very informed Very informed

What did you miss in the toolkit? What do you think should be added

Would you recommend using the toolkit?

- Yes
- No
- I don't know.
- Other:

Submit

Figure A2 Post-Intervention Interview Questions

Appendix 4: Non-Expert Evaluation Questionnaire

HCI - Human-Computer Interaction

Please indicate your agreement with the following statements.

	I strongly agree.	I agree.	Neutral.	I disagree.	I strongly disagree.
Consistency - The system is consistent (screens, design, etc.).	<input type="radio"/>				
Compatibility - The system meets my expectations.	<input type="radio"/>				
Predictability - I clearly see the actions I can take (icons, links, etc.).	<input type="radio"/>				
Adaptability - The interface is adapted to the way I use it.	<input type="radio"/>				
Economy - The steps I have to take are clear and not too many.	<input type="radio"/>				
User Control - I feel in control of the system (I can jump through sections, undo actions if applicable, etc.).	<input type="radio"/>				
Structure - The system appears structured and not too complex. Presented information is relevant.	<input type="radio"/>				
Match with Real World - I understand the language and presented concepts.	<input type="radio"/>				
Error Prevention - I don't feel like I could make any disastrous errors.	<input type="radio"/>				
Recognition - Objects, Actions, and options are well visible and recognizable throughout the pages.	<input type="radio"/>				
Flexibility and Efficient Use - I can find shortcuts in-between the sections and use the system flexibly.	<input type="radio"/>				
Help and Documentation - I find help and supporting material easily.	<input type="radio"/>				
Error Handling - I receive clear error messages and corrective action steps.	<input type="radio"/>				

Please write down any additional comments you have on the system's interface and usability.

Content of the Toolkit

Please indicate your agreement with the following statements.

	I strongly agree.	I agree.	Neutral.	I disagree.	I strongly disagree.
The content is easy to understand.	<input type="radio"/>				
The content is relevant.	<input type="radio"/>				
There was sufficient supporting material.	<input type="radio"/>				
I would have needed additional explanation for using the toolkit.	<input type="radio"/>				
I would have wanted more information on the ISO 14001.	<input type="radio"/>				
I would have liked to use a more detailed toolkit.	<input type="radio"/>				
I can see the point of toolkit.	<input type="radio"/>				
I think the system is useful.	<input type="radio"/>				

Would you want more multimedia included in the toolkit?

- No, it's fine.
- Yes, more pictures.
- Yes, videos.
- Yes, audio files.
- Other:

Please add here all additional thoughts and ideas you have for the content of the toolkit.

Please write down any other comments, ideas, observations you have.

Figure A3 Non-Expert Evaluation Questions

Appendix 5: Complementing Screenshots of System 1 (*Environmental Management System*)



Recycling

A great resource we have for managing our waste is recycling. It allows us to reuse a lot of our consumed materials and decrease their impact on the environment. The recycling form will help you assess your organization's progress in the area and improve it.

 [Recycling](#)

Or go to:


Energy Consumption


Water Consumption

FORMS

- [Energy Consumption](#)
- [Water Consumption](#)
- [Recycling](#)

OTHER SYSTEMS

[Template-Based Environmental Toolkit](#)

ISO 14001 TEMPLATES

[Templates](#)

Figure A4 Environmental Management System - Recycling Page

Recycling

Select the areas you want to implement in your EMS regarding your company's energy consumption and add those you feel are missing.

* Required

Email Address *

Please provide the email address you want the results to be sent to.

Environmental Objectives

Please select (and add) the objectives you want to achieve with this environmental management program.

Environmental Objectives

- Recycle all plastic
- Recycle all paper
- Recycle all aluminum
- Reduce company's overall waste
- Recycle all glass
- Compost all garbage that can be composted
- Other:

Environmental Management Program

Environmental Management Program

- Agree on recycling contracts with vendors
- Install glass recycle bins
- Install plastic recycle bins
- Install paper recycle bins
- Install aluminium recycle bins
- Donate/sell used electronic instead of discarding them
- Install company's own compost
- Reuse partly printed (one-sided) for notes
- Use recycled paper
- Properly dispose of electronic waste (e.g. batteries, light bulbs)
- Other:

Employee Awareness and Communication

In order to implement the environmental management program successfully throughout the entire organization, it is important to raise the environmental awareness of all staff and to communicate the program with them.

Employee Awareness and Communication

- Inform employees about company's environmental responsibility and commitment
- Set meetings to inform about environmental actions
- Introduce seminars that teach employees their environmental actions
- Place posters inside the offices that visualize environmental responsibility/actions
- Put reminding notes next to relevant areas such as reminders to not mix waste next to recycle bins
- Communicate company's environmental awareness through newsletters
- Communicate company's environmental awareness on their website
- Other:

Submit

Never submit passwords through Google Forms.

Figure A5 Environmental Management System - Recycling Form



Water Consumption

Water is a significant environmental factor a necessary resource for us. Handling it responsibly is our duty.

To evaluate and improve your company's water consumption, please fill the Water consumption form.

 **Water Consumption**

You can calculate your current water consumption with tools like [AffinityWater](#).

Or go to:



FORMS

[Energy Consumption](#)

[Water Consumption](#)

[Recycling](#)

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Figure A6 Environmental Management System - Water Consumption Page

Water Consumption

Select the areas you want to implement in your EMS regarding your company's energy consumption and add those you feel are missing.

* Required

Email Address *

Please provide the email address you want the results to be sent to.

Areas of Significant Water Consumption

Please check the areas that contribute significantly (to a measurable amount) to your company's water consumption.

Areas of Significant Water Consumption

- Cooling water
- Cleaning of equipment and property
- Production processes
- Consumption by equipment such as dishwasher
- Bathroom appliances (e.g. toilets, showers, sinks, etc.)
- Involved in manufacturing process
- Other:

Environmental Objectives

Please select (and add) the objectives you want to achieve with this environmental management program.

Environmental Objectives

- Reduce overall water consumption
- Discard waste water in a responsible manner
- Other:

Environmental Management Program

Environmental Management Program

- Install water-saving taps in sinks
- Install water-saving shower heads
- Use rain water for toilet flushing
- Use rain water for outdoor cleaning
- Install water recycling system
- Replace water-consuming equipment with more environmentally friendly options when replacement is needed
- Other:

Employee Awareness and Communication

In order to implement the environmental management program successfully throughout the entire organization, it is important to raise the environmental awareness of all staff and to communicate the program with them.

Employee Awareness and Communication

- Inform employees about company's environmental responsibility and commitment
- Set meetings to inform about environmental actions
- Introduce seminars that teach employees their environmental actions
- Place posters inside the offices that visualize environmental responsibility/actions
- Put reminding notes next to relevant areas such as reminders to not leave water running next to sinks
- Communicate company's environmental awareness through newsletters
- Communicate company's environmental awareness on their website
- Other:

Submit

Never submit passwords through Google Forms.

Figure A7 Environmental Management System - Water Consumption Form

Appendix 6: Complementing Screenshots of System 2 (*Template-Based Environmental Toolkit*)



Environmental Policy

The basis of every environmental management system is the organization's environmental policy. It sets the tone of the company's commitment and efforts and should be reviewed continually. The commitment is very important and should be signaled from the top management as well as all other areas inside the enterprise.

Environmental policies do not need to be complicated. They merely have to set a guideline that the company will adhere to but the following features should be included:

- commitment to pollution prevention and to the continual improvement of the EMS
- commitment to complying with existing legislation regarding the environment
- framework to set and review the organization's environmental objectives
- documentation, implementation, and maintenance of the policy
- awareness of policy by all employees
- access to policy by the public

Depending on how strictly you want to follow these suggestions, your company can focus on the parts that seem most important for them.

A **template for an environmental policy** is provided here. Of course, every enterprise has the right to adapt it to their needs or write an entirely different one.

[Environmental Policy Template](#)

Next step: [Planning](#)

FORMS

[Energy Consumption](#)

[Water Consumption](#)

[Recycling](#)

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Figure A8 Template-Based Environmental Toolkit - Environmental Policy Page



Planning

The first step of the ISO 14001 model is the planning. This entails various steps that need to be accomplished before the environmental management system can be created and implemented.

1. Define environmental aspects and impacts and determine the significant environmental impacts.

In order to be able to accurately plan an EMS that helps your enterprise improve their environmental footprint, it is first necessary to find out which impact it actually has on the environment. Explanations for the terms environmental aspects, environmental impacts, and significant environmental impacts can be found under [Definitions](#).

[Environmental Aspects Template](#)
[Significant Environmental Aspects Template](#)

2. Find the legal and other requirements your organization has to/wants to comply with.

An organization might be unaware of legal requirements that it has to comply with. There are also voluntary regulations such as the ISO 14001 or EMAS (Eco-Management and Audit Scheme) of which compliance holds several additional benefits for the organization.

When searching for those requirements, scan websites and other sources to propose regulations. After defining the requirements your company wants to/has to comply with, make them publicly available and notify all employees about them.

3. Set your environmental objectives and targets.

Following the previously defined environmental policy and knowing the own impact on the environment, your organization is now able to set targets and objects to improve their environmental impacts. A gap analysis can help you determine which broad objectives you want to define and which specific targets are appropriate for them.

[Objectives and Targets Template table](#)

4. Finally, build the environmental management program that helps you achieve those objectives and targets.

In the last step of the planning stage, a program should be developed that defines how the environmental targets and objectives will be achieved. This should include clear guidelines that are communicated throughout the whole organization to achieve the best possible outcome. Make sure to include “the who”, “the how” and “the when” and to update the programs with new developments inside the organization. As in the step before, a gap analysis can help identify areas that should be addressed in the program.

[Environmental Management Program Template](#)

Next step: [Implementation & Operation section](#).

FORMS

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[Water Consumption](#)
[Recycling](#)

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[Template-Based Environmental Toolkit](#)

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Figure A9 Template-Based Environmental Toolkit – Planning Page

Implementation & Operation

After having analysed your organization with regards to the environment and after having defined the desired targets and objectives, the next measure focuses on the implementation and operation of the EMS. This includes the following steps:

1. Structure and Responsibility

Having prepared the environmental management program, it is important to define the structures and especially responsibilities in the next step. The structure should be position-dependent instead of person-dependent in order to make it more sustainable. The responsibilities must be defined and communicated throughout the organization.

The document below provides a template but, again, it is up to the company to define roles as they see most fit. Important is to include all roles and their responsibilities for the environmental management program.

[Structure and Responsibilities Template](#)

2. Training, Awareness, and Competence

The goal of this section is to identify training needs for all employees whose work may impact the environment. It is particularly important to make them aware of

- the importance to conform with the EMS,
- significant environmental aspects,
- their own roles and responsibilities in achieving that conformance, and
- the potential consequences of non-conformance.

Training and awareness plans must be developed and implemented by a responsible person (the environmental management officer). The document below identifies examples of training and awareness needs for SMEs. It can be used as basis for issues addressed during the trainings which can be held in the form of presentations, emails notifications, seminars, group work, etc.

[Training and Awareness Needs Template](#)

3. Communication

Internal as well as external communication need to inform about the EMS. Internal communication is one of the most important components of a successful EMS as it is necessary to really inform everyone involved and to set roles and responsibilities. It should happen in a multi-directional manner which is not only directed from the top to lower levels but rather initiates all levels.

Much of the external communication is voluntary but reporting one's environmental efforts to the public has many benefits.

The given template provides possible aspects that can be included when planning the communication aspects.

[Communication Methods Template](#)

4. EMS Documentation

According to the ISO 14001, information describing core elements of the EMS needs to be established and maintained. Besides listing all core elements, elements that interact with it or are otherwise related to the EMS should be listed or referenced, as well.

[Core Elements Template](#)

[EMS Documentation Template](#)

Further steps include the Document Control, Operational Control, and the Emergency Preparedness and Response. However, this system does not include those steps for simplicity reasons.

Next step: [Checking & Corrective Action](#).

FORMS

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[Water Consumption](#)

[Recycling](#)

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Figure A10 Template-Based Environmental Toolkit - Implementation and Operation Page



Checking & Corrective Action

Once the program has been developed and implemented, it should be checked and, if needed, corrected. This is part of one of the main features of the ISO 14001, namely the continual improvement.

1. Monitoring and Measurement

The organization must first develop procedures to periodically monitor and measure the key characteristics of their operations and activities with a significant environmental impact. This includes but is not limited to the objectives and targets defined by the enterprise.

The template below provides possible key characteristics and ways of monitoring and measuring them. The actual procedures and their measurements should be documented separately in a procedure file

[Performance Tracking Template](#)

2. Non-Conformance and Corrective and Preventive Action

The second step in this section requires the enterprise to identify responsibility for cases of non-conformance and for providing corrective or preventive action if needed. This usually results in changed to already existing procedures.

[Types of Nonconformance](#)

3. Records

Records are defined differently from documents. While documents, here, include procedures, documentation, manuals, or instructions, records are defined as evidence of something. Examples within the EMS include training records, as well as records of the EMS audit or the management reviews.

Requirements for records are that they be:

- legible
- identifiable as well as traceable to the involved service, activity, or product
- easy to retrieve
- kept safe from damage or loss
- retained per defined and recorded retention times

The aim of this part is to develop procedures establishing and maintaining records. The document below provides you with examples of records your company might want to include.

[Environmental Records - Examples](#)

4. EMS Audit

Audits are the final step of this section and they are meant to assess whether or not your enterprise conforms with the regulations of the EMS and with the ISO 14001 itself.

Procedure for auditing the EMS should include:

- the scope of the audit
- the frequency of the audits
- audit methodologies
- responsibilities and requirements for the conducting of audits and for the reporting of the results

The EMS Audit is a fairly detailed procedure that must be included into an EMS that strictly aligns with the ISO 14001 standard. However, it is not essential to the general implementation of this environmental management system and is left out for the purpose of simplification.

Next step: [Management Review](#)

FORMS

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[Water Consumption](#)

[Recycling](#)

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Figure A11 Template-Based Environmental Toolkit - Checking and Corrective Action Page



Management Review

Finally, the management has to review the EMS periodically to ensure its effectiveness, accuracy, and suitability. The result may be that they define changes in elements of the EMS such as the environmental policy or the objectives and targets. The aim is the revision as well as the continual improvement of the environmental management system.

Examples parts of the EMS that should be effective, accurate, and suitable are:

- All products, services, and activities of the company, including recent changes, are addressed by the EMS.
- It is without systematic flaws.
- It provides a framework for pollution prevention and continual improvement.
- Legal requirements are being complied with.
- The defined objectives and targets are in line with the environmental policy and are consistently met.
- The EMS audit result demonstrate that the enterprise conforms with its intended arrangements.

A list of possible changes that can be made to the EMS after a management review can be found here.

[Potential Changes to EMS](#)

Go Back to the [Template-Based Environmental Toolkit](#)

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Figure A12 Template-Based Environmental Toolkit - Management Review



Definitions

The ISO 14001 uses many terms that can lead to questions. In order to eliminate any potential doubts about the meanings of particular expression, terms as the defined by the ISO are provided here.

Organizations

An organization is a “company, corporation, firm, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own function and administration”. (ISO 14001, Section 3.12)

Environmental Management System

An EMS is “the part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy”. (ISO 14001, Section 3.5)

Continual Improvement

Continual improvement is defined as “process of enhancing the environmental management system to achieve improvements in overall environmental performance in line with the organization’s environmental policy”. (ISO 14001, Section 3.1)

Environmental Aspect

An environmental aspect is an “element of an organization’s activities, products, or services that can interact with the environment”. (ISO 14001, Section 3.2)

Significant Environmental Aspect

A significant environmental aspect is one “that has or can have a significant environmental impact”. (ISO 14001, Section 3.3)

Environmental Impact

The ISO defines as environmental impact as “any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization’s activities, products, or services”. (ISO 14001, Section 3.4)

Environmental Objective

Environmental objectives are explained as “overall environmental goal[s], arising from the environmental policy, that an organization sets itself to achieve, and which is quantified where practicable”. (ISO 14001, Section 3.7.)

Environmental Target

According to the ISO, an environmental target is a “detailed performance requirement, quantified where practicable, applicable to the organization or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives”. (ISO 14001, Section 3.10)

Interested Party

An interested party is an “individual or a group concerned with or affected by the environmental performance of the organization”. (ISO 14001, Section 3.11)

Examples: Employees, customers, neighbors, environmental groups, citizen groups, political groups, governmental agencies, stockholders

FORMS

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Figure A13 Template-Based Environmental Toolkit - Definitions Page

Templates

Find all templates provided by this toolkit here.

Environmental Policy

[Environmental Policy Template](#)

Planning

[Environmental Aspects Template](#)

[Significant Environmental Aspects Template](#)

[Objectives and Targets Template table](#)

[Environmental Management Program Template](#)

Implementation & Operation

[Structure and Responsibilities Template](#)

[Training and Awareness Needs Template](#)

[Communication Methods Template](#)

[Core Elements Template](#)

[EMS Documentation Template](#)

Checking and Corrective Action

[Performance Tracking Template](#)

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Figure A14 Template-Based Environmental Toolkit - Templates Page

Full name of the organization

Environmental Aspects

Company Site (if applicable, e.g. Corporate Headquarters)

Activities: Office Activity Aspects

- Energy consumption (lighting, heating, cooling, cooking)
- Material consumption (paper, toner, office products, plastic/paper cutlery, cleaning liquids)
- Non-hazardous waste (boxes, scrap paper, cartons and containers)
- Plastic, paper, aluminum, and glass recycling

Activities: Shipping/Receiving/Packing Aspects

- Material use (boxes, envelopes, pallets)
- Avoidance of waste/recycling (wood, plastic, cardboard, paper)
- Non-hazardous waste (packaging scrap, tape)

Activities: Cleaning Aspects

- Water consumption
- Cleaning material consumption
- Non-hazardous waste (dirty water, plastic bottles, gloves, cleaning utensils)
- Hazardous waste (chemicals)

Activities: Food Preparation Aspects

- Material consumption
- Non-hazardous waste

NOTE: All words in green must be replaced/chosen from. All other parts can be kept as they are or adapted as desired. Please make sure to add more factors and detailed aspects if applicable. If the company has more than one site, activities, products, and/or services should be listed for each of them.

Figure A15 Environmental Aspects Template

Full name of the organization

Classification of Environmental Aspects as Significant

Aspect: Energy Consumption

Environmental impacts of aspect: Use of natural resources; impacts on air; impacts on global warming

Legal or other requirements: None but renewable energy sources recommended

Affected company sites (if applicable): All

Significant at selected location/s: Yes

Aspect: Material Consumption

Environmental impacts of aspect: Use of natural resources

Legal or other requirements: None

Affected company sites (if applicable): All

Significant at selected location/s: Yes

Aspect: Non-hazardous Waste

Environmental impacts of aspect: Impacts to land (landfill)

Legal or other requirements: None

Affected company sites (if applicable): All

Significant at selected location/s: Yes

Aspect: Plastic, paper, aluminum, and glass recycling

Environmental impacts of aspect: Material reuse, waste reduction

Legal or other requirements: None but recycling is strongly recommended

Affected company sites (if applicable): All

Significant at selected location/s: No (if amounts are very small)

Aspect: Water consumption

Environmental impacts of aspect: Reduction of natural resources

Legal or other requirements: None

Affected company sites (if applicable): All

Significant at selected location/s: No

Aspect: Consumption of cleaning materials with chemicals

Environmental impacts of aspect: Use of resources with potential to be released unplanned and impact the environment

Legal or other requirements: None

Affected company sites (if applicable): All

Significant at selected location/s: Yes

Aspect: Wastewater discharge

Environmental impacts of aspect: Impacts to water quality

Legal or other requirements: None

Affected company sites (if applicable): All

Significant at selected location/s: Yes

Aspect: Hazardous waste

Environmental impacts of aspect: Impact on land/air/water

Legal or other requirements: Yes

Affected company sites (if applicable): All

Significant at selected location/s: No (if generated amounts are very small)

More aspects could include air emissions, unplanned releases, groundwater remediation, etc.

NOTE: All words in green must be replaced/chosen from. All other parts can be kept as they are or adapted as desired. If the company has more than one site, activities, products, and/or services should be listed for each of them.

Figure A16 Significant Environmental Aspects Template

Full name of the organization

Environmental Management Program

Document Version: 1

Document Owner: Designated responsible person

Company's Environmental Objectives and Targets

OBJECTIVE	TARGET	RESPONSIBLE PERSON (WHO)	TIMES FRAME (WHEN)	MEANS (HOW)
REDUCE ENERGY CONSUMPTION AT COMPANY WORLDWIDE.	(1) Identify areas of energy consumption	Representative of each area inside the company	Year	Investigate sources of energy consumption inside their area.
	(2) Launch energy-conservation programs	Environmental Operations Manager / CEO / other	Year	Develop plan (switch off lights, reduce/turn off heating in rarely used areas, etc.).
		Environmental Operations Manager / CEO / other	Year	Communicate plan to all employees.
	(3) Reduce energy consumption by 5%	All employees	Year	Act in accordance with program plan.
REDUCE MATERIAL CONSUMPTION AT COMPANY WORLDWIDE.	(1) Identify areas of material consumption	Representative of each area inside the company	Year	Investigate sources of material consumption inside their area.
	(2) Launch material-conservation programs	Environmental Operations	Year	Develop program plan.

		Manager / CEO / other			Communicate plan to all employees.
		Environmental Operations Manager / CEO / other	Year		
	(3) Reduce material consumption by 5% in year.	All employees	Year		Act in accordance with program plan.
INCREASE RECYCLING OF PLASTIC, PAPER, ALUMINUM, AND GLASS AND COMPOST AT COMPANY WORLDWIDE.	(1) Recycle 60% of plastic, paper, aluminum, and glass and compost 60% of compostable garbage	Environmental Operations Manager / CEO / other	Year		Agree on contracts with recycling vendors.
		Environmental Operations Manager / CEO / other	Year		Install recycling bins.
		Environmental Operations Manager / CEO / other	Year		Communicate recycle guidelines to all employees.
	(2) Recycle 90% of plastic, paper, aluminum, and glass and compost 90% of compostable garbage	Environmental Operations Manager / CEO / other	Year		Initiate programs to heighten employees' awareness towards recycling.
		All employees	Year		Act in accordance with program plan
(3) Recycle 100% of plastic, paper, aluminum, and glass and compost 100% of compostable garbage in year.	Environmental Operations Manager / CEO / other	Year		Evaluate program process.	
	Environmental Operations Manager / CEO / other	Year		Launch additional activities if necessary.	

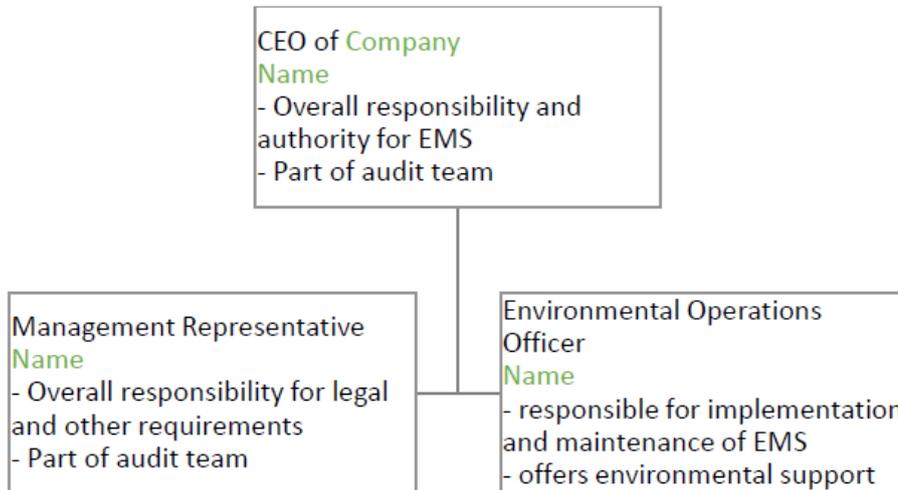
ELIMINATE USE OF (CLEANING) PRODUCTS WITH HAZARDOUS CHEMICALS AT COMPANY WORLDWIDE.			All employees	Year	Act in accordance with program plan.	
	(1)	Identify areas of use of hazardous chemicals	Cleaning staff responsible	Year	Investigate cleaning products and their materials.	
	(2)	Launch chemical-prevention/replacement program	Cleaning staff responsible	Year	Eliminate products with hazardous ingredients. Introduce eco-friendly alternatives.	
			Cleaning staff responsible	Year	Communicate change to all affected employees.	
	(3)	Eliminate hazardous chemicals completely	use of chemicals	Cleaning staff responsible	Year	Clean with new products exclusively.

NOTE: All words in green must be replaced/chosen from. All other parts can be kept as they are or adapted and added as desired. If the company has more than one site, activities, products, and/or services should be listed for each of them.

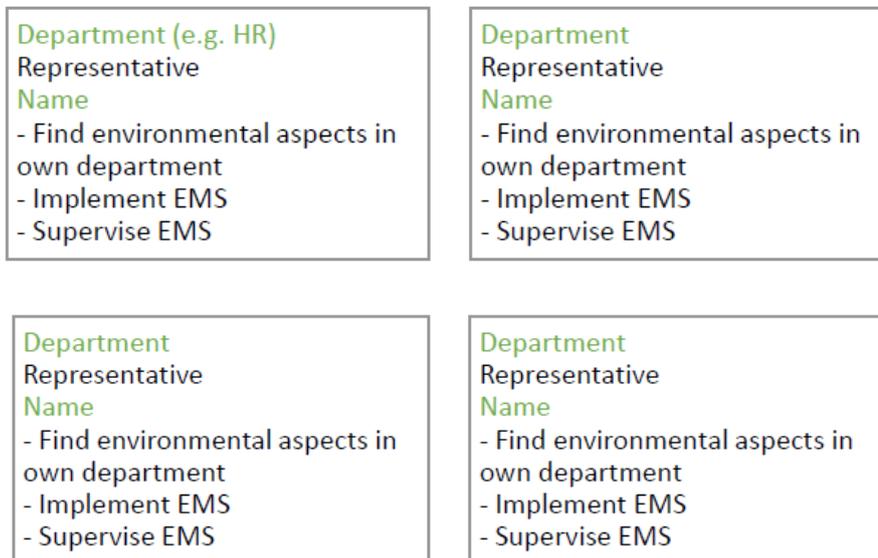
Figure A17 Environmental Management Program Template

Full name of the organization

Structure and Responsibilities



Company Site (if applicable, e.g. Corporate Headquarters)



NOTE: All words in green must be replaced/chosen from. All other parts can be kept as they are or adapted and added as desired. If the company has more than one site, responsibilities per site should be listed.

Figure A18 Structure and Responsibilities Template

Full name of the organization

Training and Awareness Needs

Need for Training on

- Hazardous and non-hazardous waste management
- Emergency response procedures
- Appropriate handling of chemicals
- Wastewater treatment
- Facility operations
- Monitoring methods
- Measuring methods
- Proper packaging of waste and chemicals in preparation for transport
- Facility's environmental policy, procedures, and the EMS

Need for Awareness of

- Environmental policy
- Significant environmental aspects of facility's products, services, and activities
- Requirements of the EMS
- Core documents of the EMS
- Access to applicable legal requirements
- Efforts to prevent pollution
- How employees' job responsibilities can impact the environment
- How they are related to the company's objectives and targets, environmental management program, and the continual improvement of the EMS
- Potential environmental improvements and potential environmental consequences

NOTE: All words in green must be replaced/chosen from. All other parts can be kept as they are or adapted and added as desired. It is likely that not all of the provided needs are required and/or that some are missing.

Figure A19 Training and Awareness Needs Templates

Full name of the organization

EMS Communication Methods

Internal Communication

- Department meetings to review significant environmental aspects
- Department meetings to review progress in achieving targets and objectives
- Employee newsletters to inform about elements of EMS
- Use of internal website/intranet
- Regular status reports about EMS
- Phone number/email address to allow questions, feedback, suggestions regarding the EMS
- Wall charts in departments to illustrate environmental measurements or progress
- Continuous communication between environmental staff and all employees

External Communication

- Reports and environmental performance
- Section on company's website

NOTE: All words in green must be replaced/chosen from. All other parts can be kept as they are or adapted and added as desired. It is likely that not all of the provided needs are required and/or that some are missing.

Figure A20 Communications Methods Template

Full name of the organization

Core Elements and Documents

Core Elements

- Environmental policy
- EMS manual (if existent)
- Significant environmental aspects
- Objectives and targets
- Environmental management program

Documents that Interact with the Core Elements

- Structure and responsibilities form
- Training plan
- EMS audit plan

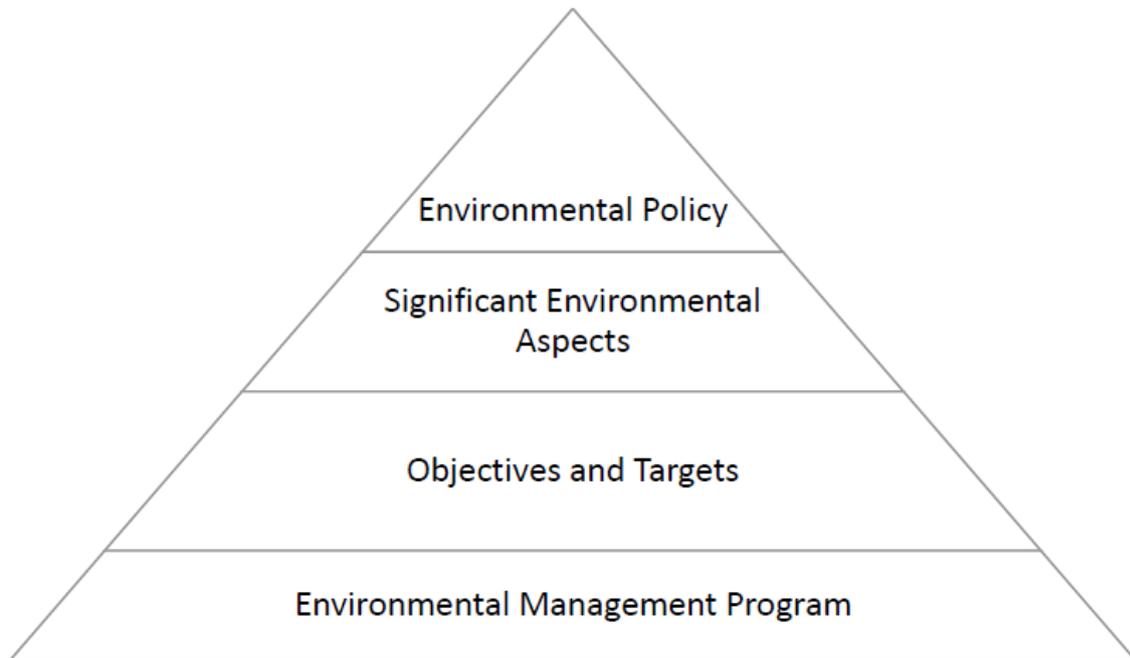
Additional Supporting Documents

- Environmental aspects
- Legal requirements?
- Communication methods

NOTE: All words in green must be replaced/chosen from. All other parts can be kept as they are or adapted and added as desired.

Figure A21 Core Elements Template

Full name of the organization
Environmental Management System
Documentation



NOTE: All words in green must be replaced/chosen from. All other parts can be kept as they are or adapted and added as desired.

Figure A22 EMS Documentation Template

Full name of the organization

Performance Tracking of Key Characteristics Methods

KEY CHARACTERISTIC	METHODS OF PERFORMANCE TRACKING
AIR EMISSIONS	<ul style="list-style-type: none">• Implementation of monitoring equipment• Regular stack sampling• online monitoring
RECYCLING ACTIVITIES	<ul style="list-style-type: none">• Periodic comparison (e.g. annual) of percentage of waste being recycled• Periodic comparison of costs avoided
UNPLANNED RELEASES	<ul style="list-style-type: none">• Periodical comparison of amount and number of unplanned releases• Comparison of (potential) cleanup cost with cost for better equipment
ENERGY USE	<ul style="list-style-type: none">• Periodic tracking of energy usage• Comparison of cost for implementing energy-efficient equipment with cost savings over time• Periodic audits within departments to ensure compliance with energy-saving methods
CHEMICAL USE	<ul style="list-style-type: none">• Periodic comparison of chemical use and trends• Investigation of departments to determine area with highest use of chemicals• Reduction of chemicals/replacement with organic products• Periodic audits to ensure that measures for chemical reduction are being deployed

WATER USE

- Periodic tracking of water use and activities
- Comparison of cost for water-saving equipment with savings over time
- Periodic audits to ensure compliance with water conservation measures

WASTEWATER DISCHARGES

- Periodic sampling of wastewater
- Implementation and operation of monitoring equipment
- Frequent calibration of given equipment

WASTE GENERATION

- Periodic tracking of waste generated
- Treatment and disposal charges
- Errors in and costs of incorrectly shipped or discharged waste

NOTE: All words in green must be replaced/chosen from. All other parts can be kept as they are or adapted and added as desired. It is likely that not all of the provided key characteristics are required and/or that some are missing.

Furthermore, please note that the ISO 14001 requires that all monitoring equipment be calibrated and maintained with records of the calibrations.

Figure A23 Performance Tracking Template