TAMPEREEN TEKNILLINEN YLIOPISTO

KALERVO AHO

BUILDING AN ENVIRONMENTAL MANAGEMENT SYSTEM IN CRANE MANUFACTURING

Diploma Thesis

Examiner: Prof. Jouni Kivistö-Rahnasto
Guiding: MSc. Johanna Pirinen

Examiner and topic approved in Science and Environmental engineering Department council meeting on 5 September 2011

TIIVISTELMÄ

TAMPEREEN TEKNILLINEN YLIOPISTO
Ympäristö- ja energiatekniikan koulutusohjelma
AHO, KALERVO: ISO 14001 mukaisen ympäristöjohtamisjärjestelmän rakentaminen nosturivalmistuksessa.
Diplomityö, Tammikuu 2012
Pääaine: Vesi- ja jätehuoltotekniikka
Tarkastaja: professori Jouni Kivistö-Rahnasto
Avainsanat: Ympäristöjohtamisjärjestelmä, ISO 14001, ympäristönäkökohtien tunnistaminen, yritysvastuu, nosturivalmistus

Diplomityön tavoitteena oli rakentaa dokumentoitu ympäristöjohtamisjärjestelmä Konecranes Finland Oy:n tuotantoon. Tavoitteena oli, että diplomityön jälkeen ympäristöjohtamisjärjestelmälle voitaisiin suorittaa ulkopuoleinen alustava audit.

Työ aloitettiin tekemällä lähtötasoarviointi, jolla arvoitiin, että millä tasolla nykyinen ympäristöjohtaminen vastaa ISO 14001 standardin vaatimaa johtamistasoa. Tämän pohjalta laadittiin diplomityön projektisuunnitelma. Seuraavaksi tunnistettiin tuotantolaitosten ympäristönäkökohdat. Näkökohtien pohjalta laadittiin toimenpideohjelmat ja tavoitteet. Tavoitteden täyttymiselle ehdotettiin mittareita. Diplomityön aikana luotiin ympäristöjohtamisjärjestelmälle organisaatio. Lopuksi laadittiin kaikki standardin vaatimat menettelyt, joilla pystyttäisiin johtamaan Konecranes Finland Oy:n ympäristöasioita mahdollisimman tehokkaasti.

Konecranes Finland Oy:n merkittävin ympäristönäkökohta todettiin olevan energiatehokkuus etenkin kiinteistöjen osalta. Muiksi ympäristönäkökohdiksi tunnistettiin kemikaaliturvallisuuden taso, jätehuolto, ympäristötietoisuus, melu ja VOC päästöt.

Työ onnistui tavoitteessaan ja Konecranes Finland Oy:lle luotiin dokumentoitu ympäristöjohtamisjärjestelmä, joka on valmis ulkopuolisen tahon audintontiin, ja poikkeamien korjauksen myötä, myös sertifiontiin. Tässä diplomityössä pyritään kuvaamaan niitä työvaiheita joilla pystytään luomaan dokumentoitu ympäristöjohtamisjärjestelmä nostureita valmistavaan teollisuuteen.

ABSTRACT

TAMPERE UNIVERSITY OF TECHNOLOGY
Master's Degree Programme Environmental Engineering
AHO, KALERVO: Building an environmental management system in crane manufacturing
Master of Science Thesis, April 2012
Major: Water- and waste management
Examiner: Professor Jouni Kivistö-Rahnasto
Keywords: Environmental management system, ISO 14001, environmental aspect identification, corporate responsibility, crane manufacturing

The aim of the thesis was to build up an documented environmental management system in Konecranes Finland Plc. manufacturing sites. The goal was that after the thesis, the environmental management system would be ready for initial external audit, in which the level of documentation is assessed.

Building was started by conducting present state analysis, which assessed the level of present environmental management compared to the requirements of ISO 14001 standard. Based on the analysis, project plan for thesis work was made. After this, the environmental aspects of production facilities were identified. From the identified aspects, programmes, goals and targets were defined. Specific metrics was proposed to monitor progress. An environmental management organization was defined during the thesis. Finally, all the standard required procedures were defined so Konecranes Finland Plc. could manage its environmental issues as effectively as possible.

The most significant environmental aspect of Konecranes Finland Plc. was identified to be energy efficiency, especially regarding the facilities. Other identified environmental aspects were: chemical safety, waste management, environmental knowledge, noise and VOC emissions.

Thesis was successful in achieving its goal. A documented environmental management system was created to Konecranes Finland Plc. production facilities. The management system is ready for the third party initial audit. And after the correction of non-conformances, certification of the system is also possible. In this thesis work, the phases required towards documented environmental management system in crane manufacturing are described.

PREFACE

This master thesis was done as a part of job contract with Konecranes Oyj between 1.2.2011 – 31.08.2011. I would like to thank Konecranes Oyj of this unique opportunity to conduct a thesis project in their interesting and cross-sectional field. I would especially like to thank my officer, Johanna Pirinen, from all the supportive critique and cheering. Without your support this thesis would have not ever finished.

The field of thesis was particularly difficult to me and I would like to thank Professor Jouni Kivistö-Rahnasto from all the expertise he had to offer during the writing process.

I would like also to give my heart full thanks to all the loved ones who have made this thesis and all my studies possible, you know who you are.

Tampere 12.2.2013

Kalervo Aho

CONTENTS

ABBREVIATIONS AND NOTATION

EMS	Environmental management system is a part of organization management that is used to develop and execute its environmental policy and to govern its environmental aspects.
QMS	Quality management system.
CSR	Corporate social responsibility. "economic, legal, ethical, and discretionary expectations that society has of organizations at a given point in time". (Carroll, A.B. & Buchholtz A.K. 2003)
ISO	The international organization for standardization.
ISO 14001	A standard developed by ISO which defines requirements for environmental management system
ISO 9001	Standard that defines requirements for quality management system
EMAS	Eco-Management and Audit Scheme
OHSAS 18001	Occupational health- and safety specification
STAKEHOLDER	Any person, group, organization, or institution that can influence the focal organization or be affected by it, either directly or indirectly
ENVIRONMENT	Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation.
SUSTAINABLE DEVELOPMENT	Meeting the needs of the present without compromising the ability of future generations to meet their own needs.
LTA1	Lost time accident; Accidents that lead to 1 to 3 days of sick leave
ENVIRONMENTAL ASPECT	Elements of an organization’s activities or product or services that can interact with the environment.

ENVIRONMENTAL IMPACT	Any change to environment, whether adverse or beneficial. Environmental impact is result from environmental aspect
PROCEDURE	Specified way to carry out an activity or
AUDIT	Systematic, independent and documented process for obtaining evidence and evaluating which how the requirements of environmental management system are fulfilled.
oneKonecranes	Process unification project in Konecranes
CERTIFICATION	An audit process done by independent third party recognized organization. As a result a certificate is given to the organization if it meets all the requirements in the standard and in their own defined processes.
VOC	Volatile organic compound. A organic chemical that is used as a solvent in some paints.
NONCONFORMITY	Non-fulfillment of a requirement
RECORD	Document stating results achieved or providing evidence or activities performed.

1 INTRODUCTION

1.1 Background of thesis

Throughout the 20th century, in the age of globalization of business and emergence of corporations, the footprint of business activities on environment has grown rapidly and the effects can influence geographically the whole globe. The development of new technologies and use of wide range of synthetic chemicals pose new and more complex threats to flora and fauna and the human habitat. The corporations are required to carry more and more responsibility over their actions. The awakening of environmental movement in 1970s gave birth to various non-governmental organizations that even further heightened the demands of corporations to operate ethically by enhancing human rights and developing nature preservation. Non-governmental organization and legislators are working continuously with ever increasing pace to create tighter legislations to prevent pollution and cleanse already fouled locations. This external legislative and social pressure has made corporations to react by starting to systematically manage these effects of corporate operations. To ease the implementation of management processes and to create a unified way to manage environmental aspects, the businesses, with other societal actors, have created a set of standards to work as guiding documents. These standards promote corporations to shift their role from legislative reactive actors to more pro-active and aware actors that continuously improve their own operations. One of these standards is created in collaboration of various standardization organizations all over the world and it is called ISO 14001. This standard has been made especially to tackle with the environmental impacts of business activities.

The Konecranes Corporation has also identified the need to manage environmental impacts systematically. Since the corporation is a global actor and its customers are more and more aware of the effects of global trade, the need for environmental management system and a certification has become reality. The growing pressure from legislation has also been identified and the systematic tracking of directives and legislations is needed. The motives, for integrating EMS to Hyvinkää and Hämeenlinna –locations, are in one hand to work as a pilot project and on the other hand to support the existing management system. The creation of EMS to these two mentioned sites works as an example for the rest of the corporation and creating it to Hyvinkää has a special value because the corporate headquarters is located there.

1.2 Study object and methods

The main aim of the thesis is to build up a documented environmental management system to a crane manufacturing. This thesis work has following sub-tasks:

- Present state analysis on the compliance of present management level in respect to ISO 14001 standard is conducted.
- The identification of significant environmental aspects in crane manufacturing, which is conducted in co-operation of key personnel.
- Creating a questionnaire and making a SWOT analysis based on that and other related information found in corporate study.
- Identifying internal and external requirements
- Setting of goals, targets and programs to respective sites and the proper metrics to measure the progress of these targets.
- Creating an organizational model of Konecranes' environmental management system.
- Creating ISO 14001 required procedures.

Theoretical study will concentrate on finding out the main theories of environmental management, and a short study of the societal motives behind the rise of environmental management. One part of the theoretical study is to study the mechanisms of law enforcement in the EU. The ISO14001 will be briefly discussed and a research for the usefulness of certification will be done. Material from theoretical study is used as supportive material in achieving attitudinal and organizational change.

1.3 Structure of the thesis

In introduction -part the object of the study is pointed out and the motives to strive for this object. Methods for this study are shortly discussed about in the introduction part. Theoretical background includes short review of human influence on environment and a brief historical glimpse on ideas behind environmental management, sustainable development and responsible corporate action in general. This part includes some of the important sections of ISO 14001 -standard explained and described. In this part of the thesis legislation study is conducted and most of the common theories in EMSs are elaborated. Theoretical study charts out the business opportunities in general. The concrete usefulness of EMS certification to business is researched. Business opportunities are studied through literature review.

Materials and methods -section includes brief description of Konecranes Corporation in general and detailed descriptions of the two manufacturing sites and business functions in the study scope. In this section precise information is given on how the surveys, questionnaires, present state analysis and environmental aspect

identification or other practical work was conducted. The section contains information on how the required data sheets were produced and it includes the project plan of the thesis work.

In results -section the data from collected material is presented and produced into information. The result of documented EMS is discussed from the most relevant parts of the study. In this section the compliance to company's QMS is discussed. In conclusion and further actions -section the success of the study is evaluated. The proposal for future actions is listed here. The section includes programmes and their schedules to improve present state EMS.

2 THEORETICAL BACKGROUND

2.1 Corporate social responsibility - the big picture of corporate environmental management

Although all societies have had some expectations that organizations act responsibly, the concept of corporate social responsibility (or CSR) is fairly new. The businesses in pre-globalized world acted according to traditional economics model. That states that the needs and desires of society could be best met by unrestricted interaction of individuals and organizations in the markets. (Barnett 2006) This model was further strengthened by the ideologies of economists in 19th century. They stated that the only responsibility of business is to maximize profits to its owners inside legal boundaries (Gill 2005, Look Friedman, Milton. *The New York Times*, September 13, 1970). Even though tradition economic model encouraged unrestricted economic interaction, it also stated that:

"free market did not always perform perfectly and he stated that marketplace participants must act honestly and justly toward each other if the ideals of the free market are to be achieved." (Barnett 2006)

Corporate social responsibility is a construct mainly of developed countries. Especially United States has been the fore runner on CSR related literature (Carrol 1999). The definition of the term: "corporate social responsibility" has been debated from as early as 1960s. The definition took a change in early 1970s when some scholars modified the term to "social responsiveness" due to the idea that the corporations should be proactive instead of reactive. Although this idea was introduced in 1970s the businesses widely started to adopt responsive and proactive approach not until the middle of 1980s (Kallio, 2004). Proactive idea states that organizations should promote action and implementation of their social role instead of passive reaction to requirements from outside. In recent years another term: "corporate social performance" has been introduced to encompass the entire spectrum of corporate social performance terminology.

Carrol has defined CSR in 1979 as a four level hierarchical term. He illustrated the term in 1991 as a pyramid model that is depicted in Figure 2.1. In the pyramid model the four principals of CSR are described. In the bottom layer is the economic responsibility, which is the base of all the other responsibilities, because without it business does not exist. Economic responsibility means maximizing earnings, being as

profitable as possible and maintaining strong competitive edge for instance. Next on the CSR pyramid model is legal responsibilities, which mean that businesses have to operate inside the legal restrictions set by governmental organizations. The placement above economic responsibilities in the pyramid is due to historical facts. Legal responsibilities can be seen to co-exist with the same level as economic responsibilities as the prerequisite for corporate existence. Third block in the pyramid is the ethical responsibility of a corporation, which means that corporations should do what is right, just and fair and minimize the harm done to the stakeholders. The tip of the pyramid is the last stage of CSR which means that business or organization is a good corporate citizen. This block includes the idea that businesses should voluntarily support the communities they operate in and thus improving quality of life for the members of the community. Examples of these voluntary actions are donations and other resource support such as labor. The difference between ethical responsibility and philanthropic responsibility is that the latter is voluntary and the community does not require it as a minimum level of support from the organization or the company. (Carrol 1991)

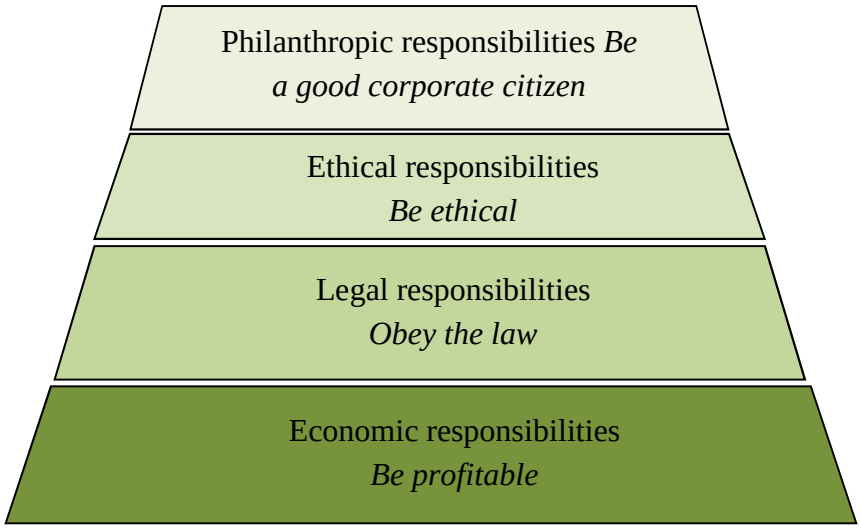


Figure 2.1. *The pyramid of corporate social responsibility. (Carrol 1991)*

A survey through corporate internet sites reveals that terminology has changed during recent years from “Corporate Social Responsibility(CSR)” to “Corporate Responsibility(CR)” or to “Corporate Citizenship(CC)” and even to some other term or terms. The reason for this change might be misleading or narrow impression that the “Corporate Social Responsibility” definition provokes. The definition somewhat depends on the business area of the corporation. Shell and BP talk about “Sustainable Development”, HP declares itself as “Corporate Citizen”, Nokia and Konecranes defines their responsibility under the term “Corporate Responsibility”. On the other hand Toyota for example talks about “Corporate Social Responsibility” and “Corporate Citizenship” as well as “Sustainability” and “Environmental Responsibility” as separate terms, which is a somewhat confusing. (Respective internet sites)

All in all the different variations of the terminology indicate that unified model for responsible corporate behavior is unfinished and the glossary is still a work in process.

2.2 Stakeholder theory

The term “corporate social responsibility” does not exactly define the actors to whom the corporation is responsible. Therefore term stakeholder has been introduced as a broader term to replace the stockholder as the only actor to whom the corporations should be responsible to. (Carrol 1991) Lefkowitz defines: “A stakeholder is generally defined as any person, group, organization, or institution that can influence the focal organization or be affected by it, either directly or indirectly." (Lefkowitz 2007) Carrol and Buchholtz define these “direct” and “indirect” stakeholders as primary stakeholders and secondary stakeholders. Table 2.1 represents stakeholders that are identified and classified by Carrol and Buchholtz. (Carroll, A.B. & Buchholtz A.K., 2003)

Table 2.1. *Classification and identification of different stakeholders. (Carroll, A.B. & Buchholtz A.K.. 2003)*

Primary Stakeholder	Secondary Stakeholder
Shareholder(Owner)	Local State and Federal Government
Employees	Regulatory Bodies
Customers	Civic Institutions and groups
Business Partners	Special interest groups
Communities	Trade and Industry groups
Future Generation	Media
The Natural Environment	Competitors

Corporations have direct moral and legal obligations to some of the stakeholders such as owners and employees. They also pose responsibilities to customer, by ensuring that their product provides promised functionality and it is safe, and to future generations by meeting the needs of the present without compromising the future, defined by the Bruntland commission. (Carroll, A.B. & Buchholtz A.K. 2003) The stakeholder approach is ethical and moral in nature since it includes other interests besides classical profit maximization and regulation obedience. (Lefkowitz 2007)

2.3 Anthropogenic influence of metal industry on environment

The metal industry consists of long production chains of many different processes from ore mining to smelting and rolling and finally to an end-product. Typical process in this chain involves high energy consumption, heavy machinery and long transportation routes. In addition, some of the steps before actual raw material such as steel or aluminum, there is a significant amount of waste generated in the mining processes itself and in different refining operations. Table 2.2 lists the impacts of metal production

from cradle-to-gate, which means from ore mining to actual usable raw material for manufacturing industries, such as crane manufacturing (Norgate et al. 2007).

Figures in table 2.2 clearly show that metal production is very energy intense and it produces greenhouse gases, acidity and a lot of solid wastes. The solid waste produced by mining contains metals that are toxic and may leach to environment, which poses a further risk to environment (Norgate et al. 2007).

Table 2.2. Energy, pollution and solid was residues per kilogram of refined raw material from cradle-to-gate. (Norgate et al., 2007)

Metal	Energy (MJ/kg)	CO_2 emissions (kg CO_2e/kg)	SO_2 emissions (kg SO_2e/kg)	Solid waste (kg/kg)
Aluminum	211	22.4	0.131	4.5
Steel	23	2.3	0.020	2.4
Stainless steel	75	6.8	0.051	6.4

The cradle-to-gate environmental impacts of metal production depend greatly on various factors, such as ore grade, production method, electricity production, technology level of additional purification equipment and material transportation. The most significant factor increasing environmental impacts is ore grade (Norgate et al. 2007). The deposits of ore in 19th century copper were 10 % ore grade, which 1997 were average of 0,9% (Ayres 1997). The amount of solid waste per kilogram of raw metal is raising because of the depletion of rich ore veins. The main driver for changes in mining and ore processing industry is and will be reacting to environmental problems (Ayres 1997).

2.4 History of environmental management

Before the birth of modern environmentalism in the late 1960s, there had been few regulations on the environmental impacts of the corporations. The earliest ones were created in the United States in the 18th century. In the sixties author Rachel Carson wrote a groundbreaking novel "Silent Spring" that described the effect of DDT on birds. The name of the book: "Silent spring", denotes the high bird death rate due to pesticide that tends to accumulate on birdlife. Figure 2.2. describes National Academy of Sciences(NAS) Environmental Learning Curve. The Figure describes how the maturity of environmental management has developed in industry from pre-1970 to 1999. (Johnston et al. 2009)

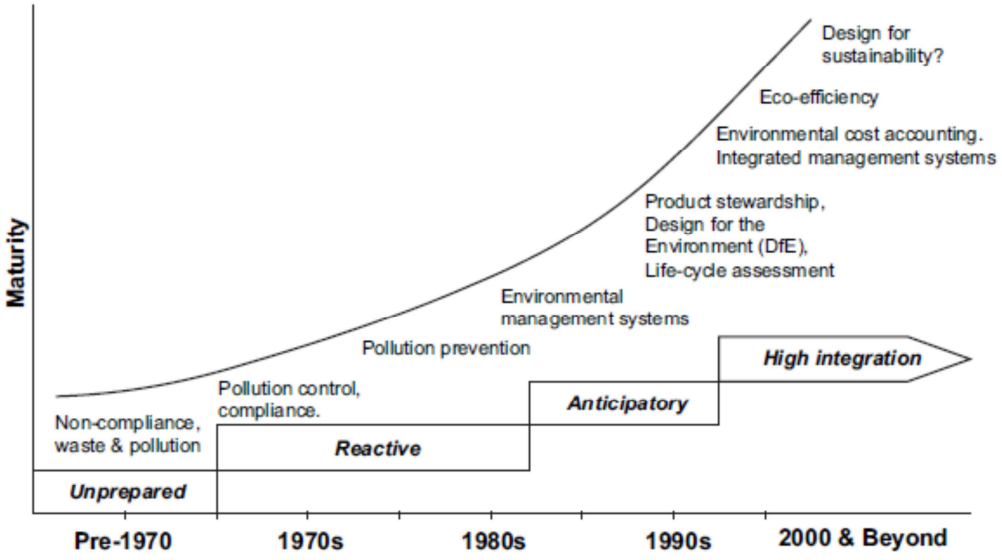


Figure 2.2. *Environmental learning curve. (Hussey, D. M. & Eagan, P. D. 2005)*

The y-axis represents the maturity of environmental management in industry and the x-axis represents the timeline. From the Figure the development of environmental management has evolved from unprepared to high integration of environmental management to business management.

The operation model of global corporations is not just reaction to environmental law enforcement anymore. The emphasis has shifted more to preventive and proactive approach. Still the systematic management of environmental impacts, that cross-section through most of the industries, is fairly new idea amongst other issues concerning corporate social responsibility. The environmental management systems were introduced between 1980s and mid 1990s and the first standardized version of ISO 14001 was launched in 1996. Environmental management is active approach to measure and manage environmental impacts of an organization.

Sustainability plays a key role in environmental management and the term is used to describe the desired outcome of longevity in human actions. Sustainability or sustainable development has had many definitions, but the first one was conducted by the Brundtland commission in 1987 and it was defines as:

"Meeting the needs of the present without compromising the ability of future generations to meet their own needs."(Brundtland 1987)

Environmental responsibility is part of sustainable development and the actual managerial approach is fairly new. Figure 2.3 illustrates the environmental responsibility as a part of bigger picture of sustainable development construction.

Figure 2.3. *Three pillar model of sustainable development.(Pohjola 2003)*

The corporation taking the first steps toward environmental protection in 1970s, did only the minimal needed to comply with regulations, that were not so stringent at that time. The general approach was reactive instead of proactive. This industrialized point of view was to make more out of more, and the responsibility of a company was mainly economic and the environmental responsibility was carried out with as minimal effort as possible. (Pohjola 2003)

2.5 Legislation, regulations and international agreements and protocols

Legislation has been a driving force of environmental improvements in organizations and corporations up until the recent years of introduction to environmental management and corporate social responsibility. These approaches have been adapted to top strategic planning during the past 30 years. The rising concerns about climate change, reduced availability of resources, fossil fuel depletion, deforestation and access to freshwater – all these are reality now or in the near future and the effect of these factors have to be projected and accounted for. Proactive approach is taking some companies to even more stringent measures than legislation requires, but sanctions and restrictions to misbehavers is still effective and necessary control mechanism. It is quite probable that

environmental legislation, derived from global pacts and national regulations, will tighten the requirements of corporate environmental management in the near future.

The initial focus on environmental conservatism concentrated on cleaning the pollution after fouling. This reactive approach was stated already in environmental policies in 1970s as Keijzers points out. The environmental policies of law formation have developed greatly from the initial emergence of environmental protectionism in early 1970s through pollution prevention to multi-sectorial concerns about sustainable development. Keijzers has recognized four phases in Dutch governmental policy development described in table 2.3. (Keijzers 1999) Governmental policies outlined the legislation planning in Holland.

Table 2.3 *Development of focus in Dutch policies through 1970-2000. (Keijzers 1999)*

Classification of policies	**Focus of policies**
Shaping the ecological arena 1970-1983	Cleaning up national air and water resources. First steps towards soil cleanup operations.
Encouraging pollution prevention 1984-1989	Pollution prevention to further keep the natural resources; water, soil and biodiversity, clean. Attention on acidification and ozone depletion.
Enhancing eco-efficiency 1990-1999	Increased attention to global issues of acidification, global warming and ozone depletion.
Super-optimization for sustainable development 2000-	Added attention to limiting national resource usage and improving management of global biodiversity, energy and minerals.

The mechanism of environmental law formation is described in the Figure 2.4. There are two different bodies in Finland, and the other EU countries, from which the regulations may be introduced. First there is EU legislation which can directly affect national law through regulations. Regulations are to be implemented as the EU introduces them in every member state without exceptions. Secondly there is national judiciary that defines most of the laws and policies affecting national level. Behind EU legislation and national judiciary there are international agreements and protocols which guide EU and national legislation. In addition to direct effect of EU regulations to national legislation, there are EU directives, which obligate national lawmakers to the goals designated in the directive. Unlike regulation, directive renders national lawmakers free to choose the means to achieve the goals. Thirdly there is EU decisions that are passed to specific institutions of specific countries. Example for selection could be the governments of these and these countries or the corporations of these and these countries. Similar to regulation, decisions are obligatory and they are to be implemented as introduced to countries and institutions specified. In addition to these lawmaking

mechanics there are inconclusive legislative processes such as recommendations or opinions. Recommendations and opinions are more of political and moral tools for the EU. (Teknologiateollisuus 2010)

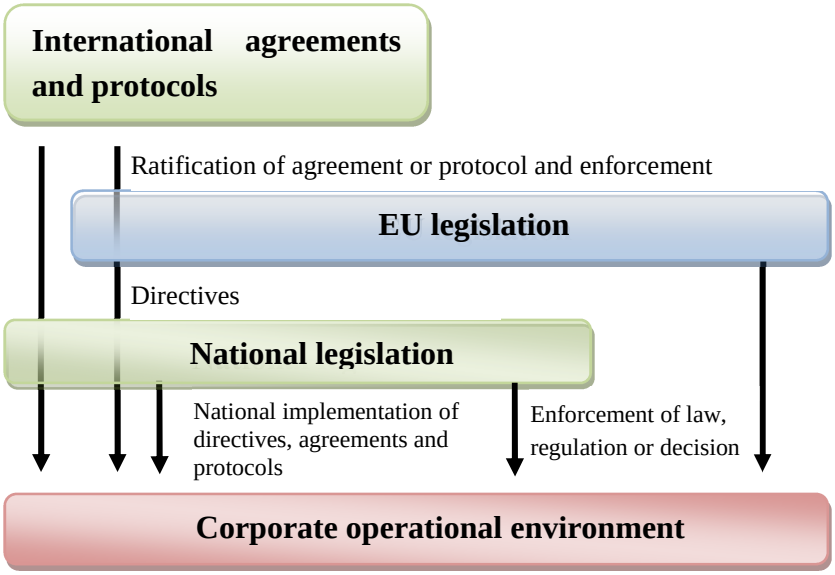


Figure 2.4. *Institutional legislative bodies affecting corporate environment in EU. (Teknologiateollisuus 2010)*

European Union has been a central institution for passing directives and regulations in Europe. As Keijzers pointed out, the focus on environmental law controlling policy shifted in Holland, for example, from reactive to proactive and further, including more and more stakeholders and phenomenon's to the scope of legislation. At the same time we can observe, the amount of EU acts concerning environmental issues passed annually grown by scores from 1970 to 2008 as illustrated in the Figure 2.5.

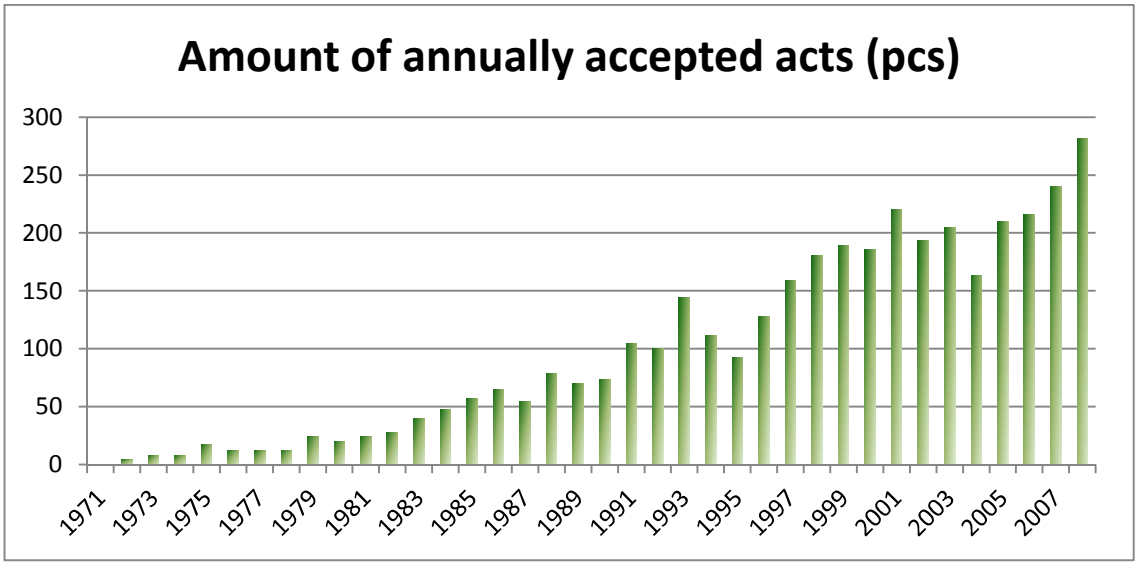


Figure 2.5. *The amounts of annually passed EU environmental related documents. (Eurofer 2009, look Teknologiateollisuus 2010)*

Some of the more important environmental related acts passed, from the corporate perspective, in European Union are European Community (EC) regulation on Restriction, Evaluation, Authorization and Restriction of Chemical substances (REACH) and EC directive on Restriction of Hazardous Substances (RoHS). REACH aims to improve protection of human health and the environment by shifting the focus to early inspection and testing of the chemical products. REACH obliges the producer or the importer of specific chemical to do all the required tests on their products containing new chemical substances. Producers and importers will define measures for safe handling and create material safety data sheets for their products which will be stored in database run by European Chemical Agency (ECHA). (UNEP, 2010c)

The conference of the United Nations on the human environment in Stockholm 1972 was the launch of United Nations Environmental Programme (UNEP), the first global and international institution to address the environmental impacts. (Stockholm convention, 1972) After the launch of UNEP there have been more than 90 international environmental agreements. One of the most successful one has been the restriction of ozone depleting substances which was agreed in two conventions, first in 1985 in Vienna and second in 1987 in Montreal. Achievements of UNEP also include establishment of such organizations as International Panel on Climate Change and defining millennium development goals for sustainable development. (UNEP, 2011b) One of the more widely known protocols agreed internationally is the Kyoto protocol. It was adopted on 11 December 1997 and it aims to take global action towards climate warming. 37 participating countries agreed to reduce their greenhouse gases 5,2% taking the 1990 level as the reference point. 184 countries had signed the protocol as of the end of 2009. The protocol also defines Clean Development Mechanism which is an agreement for developing countries to be able to trade or sell emission reduction credits to industrialized countries. This means that a developing country that uses the best available technology, instead of the cheapest one, to complete a project can trade the generated emission reminder to a developed country. (UNEP, 2010c)

2.6 Environmental management system and standards

Environmental management system is collaboration of scientific information, political decision making and socioeconomic applications. Its focus is on practical problems with human-nature encounters. It strives to technological and economic growth with minimized resource usage (McGraw-Hill Concise Encyclopedia of Science and Technology, 2005). In other words environmental management strives for sustainable development. There are standardized management systems, such as ISO 14001 and EMAS. ISO 14001 is designed to work internationally and EMAS is mainly implemented in organizations in European Union. Figure 2.6 and Figure 2.7 describe the distribution certified standardized management systems. ISO 14001 is more popular with almost 200 000 certified systems in year 2008. United Nations Environment

Programme uses the amount of certified ISO 14001 EMS systems as one of their key environmental performance indicators. In their recent publication from 2011 the amount of certified ISO 14001 systems was over 223000 (UNEP, 2011a).

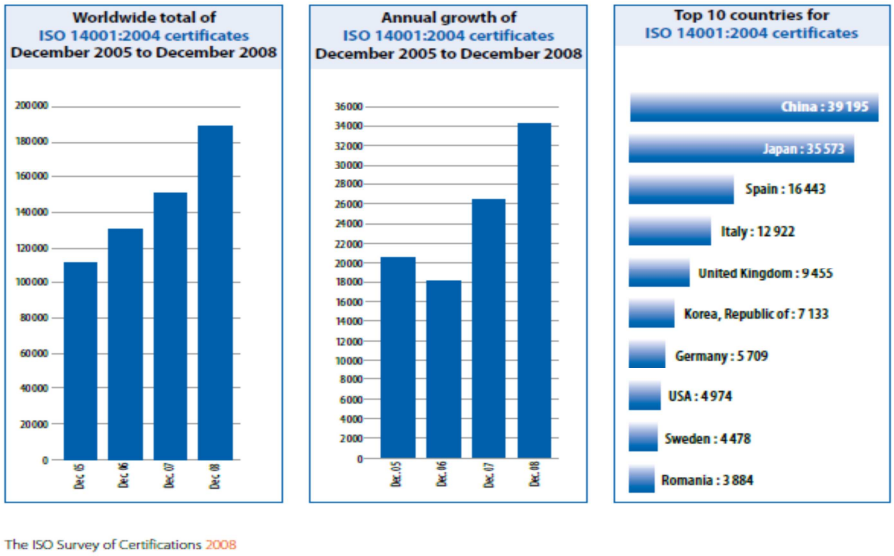


Figure 2.6. *Certified ISO 14001 standards from 2005 to 2008. (The ISO Survey 2008)*

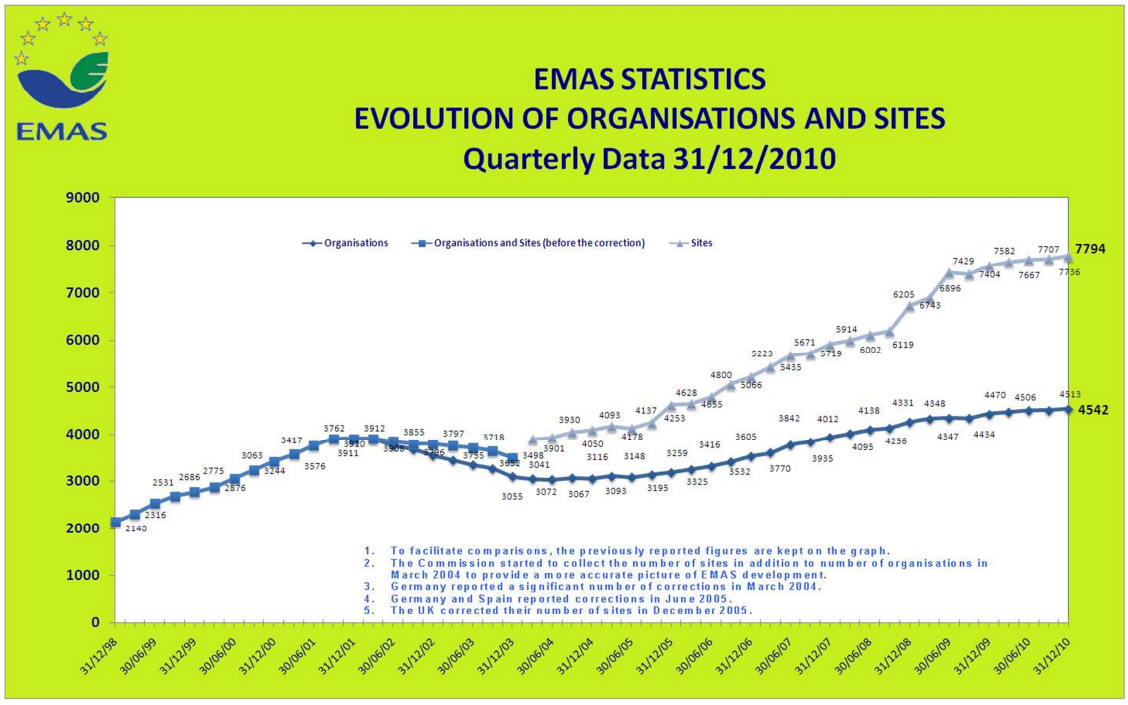


Figure 2.7. *Certified EMAS systems from 1998 to 2010. (Eco Management and Audit Scheme, 2011)*

The amount of EMAS certificates has grown with gentle slope and even decreased between 2001 and 2003. The amount of EMAS certified systems in the end of year 2010

was 7794 and the amount of ISO 14001 certifications at the same time over 200 000. The growth of ISO 14001 certificates is much more rapid compared to EMAS. This is mainly due to the fact that EMAS is mainly used in mature markets unlike ISO 14001 that is implemented in growing markets with rapid pace. The largest contributors to the amounts in certified ISO 14001 systems, during the last few years, has been China, which has increased the certifications within the country by almost 10000 annually. (The ISO Survey 2008)

2.6.1 Eco-management and audit scheme (EMAS)

The Eco-Management and Audit Scheme was first introduced to industries in 1993 it was the first version EMAS I and it was voluntary to participate. The official release of the system was made in 1995. (Eco Management and Audit Scheme, 2011) Six years later came the second version EMAS II. The present version is EMAS III. Present EMAS system is based on regulation (EY) N:o 1221/2009. Previously EMAS system could be only implemented in EU and EEC areas, but with the update on regulation it can be implemented in other countries also with certain restrictions. The EMAS system includes all the same requirements as the ISO 14001 and even more.

Unlike the ISO 14001, the EMAS system has a mandatory annual internal audit requirement. EMAS system requires organization to produce public environmental report that is updated annually. (Eco Management and Audit Scheme 2011; Valtion ympäristöhallinto 2011)

2.6.2 ISO 14001 and ISO 14000 standard family

ISO is a joint global institution which is a collaboration of various national standardization organizations. All the ISO standards are prepared in technical committees of ISO organization. Each member has the right to be represented in these committees. International governmental and non-governmental organizations are participating in standard preparation. Technical committees' main responsibility is preparation of standards which are approved in each member national standardization organization. Standards will be internationally accepted if 75% of members concur with the proposal. (SFS-EN ISO 14001:2004)

ISO 14001 -standard is a collection of requirements for environmental management system. With the standard, organization is able to develop its policies, conformance with legislation and identify its significant environmental aspects. The standard is designed to work in organization operating in all cultural, social and geographical environments despite the size. There are two versions of this standard, the first one is from 1996 and the second from 2004. The 2004 revision clarifies some aspects stated in 1996 version, but the main difference is enhanced integration to ISO 9001 quality management standard. (SFS-EN ISO 14001:2004)

There are almost 30 documents in the ISO 14000 family of Environmental management. Besides for the requirements of an EMS, the documents describe such standards as life cycle assessment, ISO 14001 user guidance, environmental label declarations, environmental assessment, guidelines for QMS or EMS auditing, carbon

footprint quantification, material flow cost accounting and many more. (Environmental management The ISO 14000 family of International Standards) The ISO 14001 is just a small portion of the standard family, but nevertheless one of the most important.

2.6.3 Brief description of ISO 14001 standard

The main differences in the revisions of the standard are the synergies with the quality management standard ISO 9001 and operational health and safety guideline OHAS 18001. The ISO 14001 standard builds on a cyclical philosophy of plan-do-check-act(PDCA) similarly to other management systems. This philosophy is also titled as Deming-cycle derived from its developer, William Edwards Deming. Deming is considered to be one of the founding fathers of quality thinking. One illustration of PDCA cycle is described in Figure 2.8. The idea of the PDCA cycle is to review the present state of corporate environmental management critically and establish systematic procedures to continual development. It is important to understand the requirements listed in the standard if the corporation is planning to certificate its environmental management system.

Figure 2.8. *Plan-do-act-check cycle as described in SFS-EN ISO 14001 standard.* (SFS-EN ISO 14001:2004)

In Figure 2.8 it can be seen, that the environmental policy is the base for all environmental activities according to ISO 14001 standard. As the picture imposes, the environmental policy should be the first step in creating environmental management system. Environmental policy is a corporate commitment to obey present legislation, prevent pollution and work towards continual improvement. It is made by the top management of the organization or corporation. The policy is designed to be publically available and it has to be consistent with the line of operation the business is in. The

policy also defines the framework for environmental objects and targets that are used for further application of the management system.

After the policy has been introduced to desired scope for the management system the actual planning phase may begin. The corporation has to identify its environmental aspects. That means the parts of its operations, products or services that may be in interaction with the environment. For example – transportation of goods is an environmental aspect. Then the environmental aspects need to be identified whether or not they impact the environment in adverse or beneficially. This part of the EMS creation is critical, since most of the concrete actions taken will be related to recognized environmental aspects. It is vital to document these identified aspects as it is the same with all the other document products that generate data throughout the system.

ISO 14001 standard requires organization to systematically follow legislation and how to fulfill legal requirements on the identified environmental aspects. In Figure 2.8 in the planning phase the most important procedure is setting up goals, targets and programmes. These three are the actual tools that will start to change the organizational behavior to desired direction. Goals are tied to corporate environmental policy, for example energy saving. It is important to be able to measure the progress and completion of specific programmes. Target must be defined for the goal, for example 10% decrease in used energy per produced income. And finally the organization has to set out concrete programmes with scheduled resources to achieve targets.

Implementation and operation block in the Figure 2.8 is the practical work to be done with the environmental management system. In corporation that is, operating the system. This means that the top management needs to define the roles for all the required personnel involved in the system. Everyone has to know their role and responsibility in the environmental management system and the employer has to keep track of it. Top Management is responsible to provide all the necessary resources to ensure proper function of the environmental management system. The employer is required to educate personnel to work with the management system. The corporation has to recognize need for different education to different roles designated and everyone working for the corporation has to be made aware of its environmental policy. Employees should be made aware of the important environmental aspects concerning their individual tasks and the impacts on the environment. Organization must define the procedures to deal with nonconformity. It has to define means to reduce environmental impacts of nonconformities. Organization has to study why the nonconformity appeared and it has to prevent them from reoccurring. Results of the corrective action have to be saved in records. Organization has to take into account major risks, such as fire or other emergencies that are not part of everyday operation and evaluate such effect on environment.

“What is not measured cannot be managed” important part of EMS and other management methods is proper metrics that indicate the progress of programmes initiated via EMS. Proper metrics compare the results of the actions, and the targets initiated and the overall performance of the system itself. Part of the measurement is

internal audits to assure that the EMS is in conformance with the ISO 14001 -standard and it is implemented and up kept properly. Reason for internal audits and measuring is to produce data for management reviews so that proper actions might be taken. Top management of the organization has to meet periodically to ensure its suitability, adequacy and effectiveness of the environmental management system. These reviews use most of the data produced by the whole EMS as input to produce such outputs as changes in the system and new objectives or targets.

2.6.4 Environmental aspect identification, environmental impact assessment and management

Every company has to identify it environmental impacts. An environmental aspect, that is an element of organizational activities that can have impact on environment, needs to be identified and its environmental impact assessed. These impacts can be beneficial or adverse. The environmental aspect identification is started by identifying organizations processes (Pesonen et al. 2005). Environmental aspect identification is a part of ISO 14001 procedures. Figure 2.9 describes the process of environmental aspect identification and the inputs and outputs of the process.

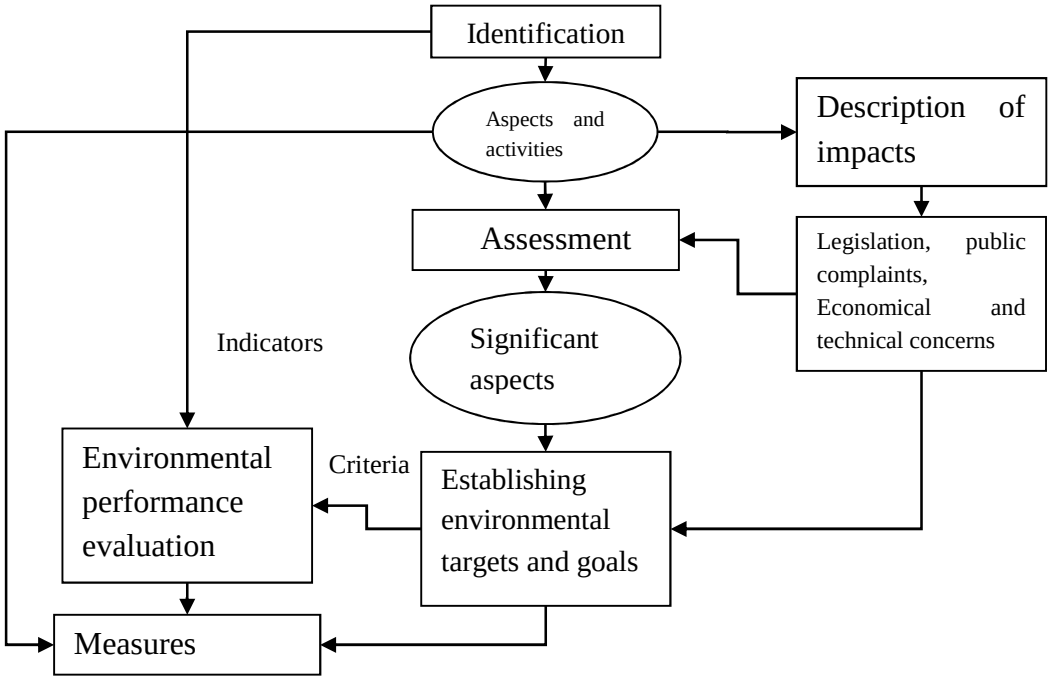


Figure 2.9 Environmental aspect identification procedure. (Zobel et al. 2001)

The identification produces as a result the aspects of an organization which may interact with the environment and a description of processes. There are various methods for assessing the impacts such as adhoc, checklists, matrices, networks, overlays, environmental indexes, cost/benefit analysis and so on(Anjaneyulu, Y. & Manickam, V. 2007.). The assessment process is complicated and usually requires large amounts of

unorganized data, thus the approach to assessment generally should fulfill the following criteria:

"1. It should be systematic in approach;
2. It should be able to organize a large mass of heterogeneous data;
3. It should be able to quantify the impacts;
4. It should be capable of summarizing the data;
5. It should be able to aggregate the data into sets with the least loss of information because of the aggregations;
6. It should have a good predictive capability;
7. It should extract the salient features, and
8. It should finally be able to display the raw data and the derived information in a meaningful fashion."(Anjaneyulu, Y. & Manickam, V. 2007.)

The quantifiability of the data handled in assessment is crucial for the future processing and selection of the significant environmental aspects. These significant aspects are managed by setting goals and targets for organization. To be able to direct organizational efforts by setting goals, there has to be metrics to evaluate. First of all, the initial level of performance needs to be identified, and the change of performance between selected timescale. In the identification process indicators need to be set in place for the performance to be evaluated. By setting goals and targets, the organization sets the level of desired performance, which is a quantitative value. Aspects and activities, performance evaluation and goals and targets will provide measures that can be used by management to conduct continual improvement in environmental performance.

2.6.5 Motives to adopt ISO 14001

The ISO 14001 is designed to be an internationally usable standard for building an EMS. Successful environmental management system is often described to promote win-win solutions. This means that while taking environmental aspects into consideration organizations and companies can also achieve economical and other benefits in form of: energy savings, material savings and economic savings by avoiding fines. The environmental management system can be built according to ISO 14001 -standard, but it does not mean the same as the certification of the system. Certification is done by a third party that verifies the compliance of the present state procedures to the standard itself. It has to be made clear that the standard itself neither the certification does not guarantee or verify the level of environmental protection performance but the level of environmental management system performance. (Raines 2002)

EMS is based on a philosophy of continual improvement through PDCA-cycle, described in Figure 2.8. By implementing this philosophy, the organization creates a mandatory process for continual improvement in the management system itself, and through the improvement of the system, the actual performance of the organization.

This continual improvement is monitored by internal audits and external audits, if the organization chooses to certificate it. The actual motivations and benefits vary depending on the size of the organization, the line of business it is conducting, the base-line level of environmental management, the corporate environment it is acting and many other factors.

Sources for the motivational drivers can be roughly divided into four different categories: market, social, financial and regulatory drivers. The relationship between these drivers is described in Figure 2.10. Market motivators are external pressure on company to be competitive on the business field it is working. Social drivers are inflicted to a company through various stakeholders that are affected by the activities of the company. Financial drivers are due to investors, insurance companies and legal liabilities. Fourth category of driving factors is the regulations and guidelines set both internationally and nationally (Zutshi & Sohal 2002). As discussed earlier, regulatory motivators were the most influential and the only motivating force in the early years of environmental management, but nowadays the companies face more pressure from various stakeholder groups. Social drivers do not affect directly to financial drivers and vice versa, but indirectly through regulatory drivers and market drivers.

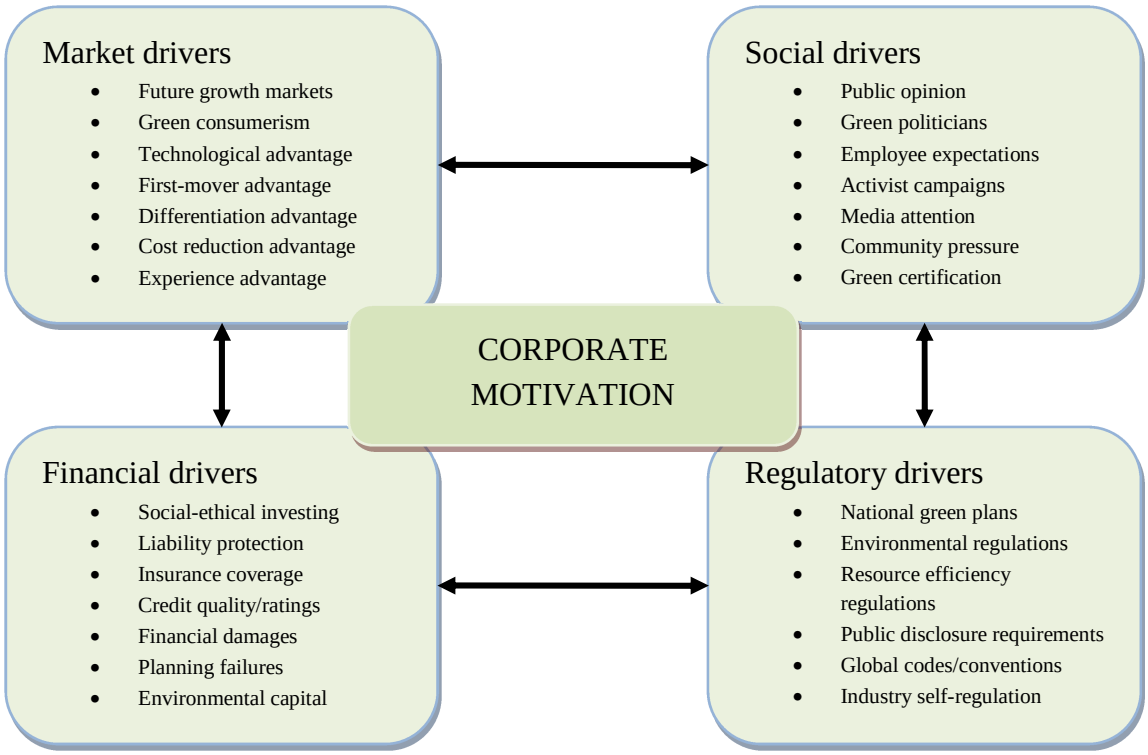


Figure 2.10. *Classification of motivating drivers for sustainable development of companies and the interrelation of the drivers. (Bansal P. & Howard E. 1997)*

Raines interviewed 131 companies internationally to find out the benefits of ISO 14001 and certification of the system. In the article, Raines shows the initial motivating forces to certification of the system depicted in Figure 2.11 (Raines 2002). The most influential factor, that the companies identified, is the motive to be the best in the

business. For modern global organizations this means also to be responsible and to take environmental impacts into consideration in their operations. This leadership is furthermore seen as a possibility to produce competitive advantage in the long run. Environmental leadership can be classified mainly as a market driver in Figure 2.10.

Most of the drivers described in the Figure 2.10 are external that come outside the organization and demand it to change for desired result. The change might come from inside the organization; in this case the driver is more of an expectation than a demand. Many drivers classified as market drivers in are originated from within the organization.

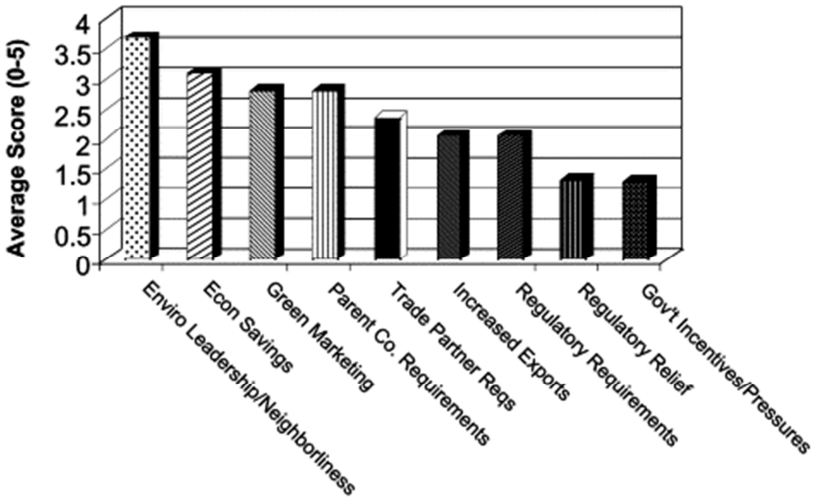


Figure 2.11. *Motivating factors of 131 companies for certificating ISO 14001 standard.(Raines 2002)*

The second biggest motivating factor through environmental management was economic savings that can be seen as a financial and a market driver. Economic savings can be achieved through improved processes that require less material and energy. Energy saving related to real-estates are also very commonly achieved by repairing and renewing such production infrastructure as air-conditioning, pressurized air network and insulation of buildings. Green marketing is seen to be the third important motivating factor. The three next motivating factors are quite interesting: parent company requirements, trade partner requirements and increased exports. These factors are introduced to a company by other companies and requirements they set on their business partners. This is due to the fact that businesses, that have a working environmental management system, may require it from their partners also. These three can bee see as an industry self-regulatory drivers classified as regulatory drivers in Figure 2.10. The last three in Figure 2.11. are also regulatory drivers that are set by governmental institutions.

It is surprising to see that governmental regulations are seen to be less significant motivating driver for adopting environmental management system as industry self-

regulation. As it can be seen in Figure 2.11. the market and financial drivers seem to be the most important drivers for companies to shift towards sustainable development. Initially the most important driver, governmental environmental regulation, is not seen that important anymore. This might be due to lack of proper environmental regulations in some developing countries or that the regulations are not seen that stringent. Controversy to Raines' study, Labonne and Johnston argue that unintentional non-compliance with regulations seems to be the most important motivation for environmental management system. Labonne and Johnston sampled 4000 facilities in seven OECD countries (Johnston et al. 2009) The conflict of motives can be seen through the fact that OECD countries are developed countries with more stringent legislation. Unlike Labonne and Johnston, Raines also studied the motives in developing countries. One reason for difference might also be that Raines' study was conducted in 2002 when Labonne and Johnson did theirs in 2009 and as it was discussed in chapter 2.6 the legislation has been getting more stringent and stringent. Zutshi and Sohal made similar observations on motives in Australasian organization as Labonne and Johnson did in their study. In the their study the most significant driving factors, on a scale 1=not at all and 5=to a very large extent, were: improved corporate image (4,04), identifying potential areas for improvement (3,74) and complying with existing regulatory requirements (3,45). (Zutshi & Sohal 2002)

2.6.6 Benefits from adopting ISO 14001

One classical example of successful implementations of EMSs is from as early as 1970s. Major global corporation 3M implemented a famous environmental strategy of 3Ps, which denotes for "Pollution Prevention Pays". The corporation started the project in 1975 and after 17 years of active environmental management, 3M reported to achieve a 575 000 tons reduction in harmful emissions and generating 550 million dollars of savings at the same time. (Kallio, 2004)

Zutshi and Sohal studied how well the expected benefits of the organization were fulfilled after the implementation of EMS. These results are shown in table 2.4.

Table 2.4. *Expected and achieved benefits of implementing EMS - scale 1=not at all and 5=to a very large extent.(Zutshi & Sohal 2002)*

Benefit	Benefits expected(mean)	Benefits achieved(mean)
Waste reduction	2,86	2,83
Cost saving from waste reduction/disposal	2,63	2,54
Protection from prosecutions, fines and legal fees	3,02	3,20
Reduction in cleanup costs	2,15	2,15
Establishing and monitor cleaner production/eco-efficiency	3,05	2,91
Leniency in international trade barriers	1,26	1,18
Reduction in organizational risks(health, safety &	3,92	3,99

environment		
Decreased insurance costs	1,78	1,69
Compliance to legislation	3,95	3,78
Market and competitive advantage	3,02	2,57
Fulfilling of customer expectation	2,78	2,73
Good-will from the customers and community	3,23	2,98
Morale building within the organization	3,02	2,95

The expected benefits were slightly higher in most cases than the actual achieved benefits. This study was conducted using roughly 130 companies operating in Australia and Asia. Zutshi & Sohal 2002). In few cases the achieved results were actually higher than expected, these were: protection from prosecutions, fines and legal fees and also reduction in organizational risks. The greatest difference between the achieved benefits and expected was in gaining market and competitive advantage. The achieved benefit was almost 0,5 smaller than the expected. It is interesting to see that the expectations tend to be higher than actual results. It could be because of the aggressive marketing of environmental management system or it could be misunderstanding about what the EMS actually is and thus put more emphasis on the expectation of results.

Companies reported costs from developing the EMS and savings of adopting it. These approximate values are described in Figure 2.12. Costs reported for developing EMS included such as new equipment, software, auditor fees, surveillance audit fees and training of employees. Higher savings were more often reported to involve manufacturing. Companies stated that it was difficult to measure total savings in monetary value, since such things as corporate image, better workplace morale and employee morale were impossible to measure in dollars. Some also stated that the actual savings were quite low because of the recent implementation of EMS. The size of the organization and the maturity of existing systems and practices had influence on total costs of developing EMS. (Zutshi & Sohal 2002)

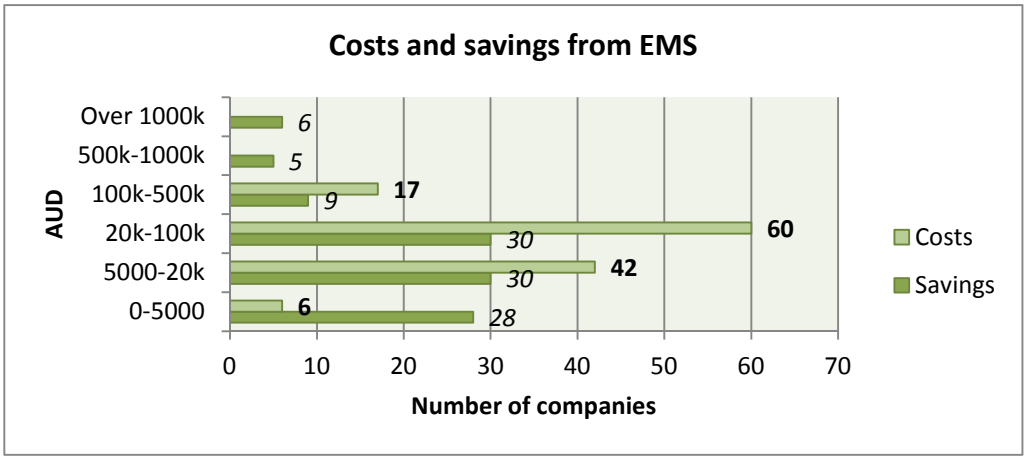


Figure 2.12*. Number of Australasian companies that reported respective amounts of EMS adoption savings and development costs (Zutshi & Sohal 2002).*

Raines' study indicates that there is a difference of achieved benefits whether the company is situated in developing country or developed country. In Figure 2.13 it is shown that companies operating in developing countries benefit economically more often from EMS adoption than companies in developed countries. Only exception in Raines' study is that the waste disposal is more often beneficial to companies operating in developed countries. Raines speculates that the economic benefits are easier to achieve in developing countries because the history of environmental activism is short and the environmental regulation might be quite weak therefore there are more "low hanging fruits" to be picked. The controversy related to waste disposal is explained by more expensive waste handling fees in developed countries and thus reducing waste amounts cumulate more savings than in developing countries, where the waste handling fees can be comparatively low. (Raines 2002)

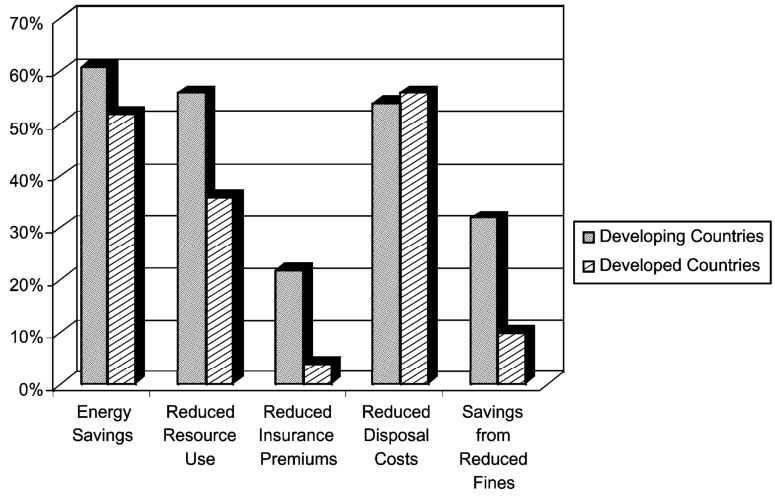


***Figure 2.13**. Percentage of companies that reported economic savings from implementing environmental management system.(Raines 2002)*

2.6.7 Impediments of adopting EMS

Literature speaks of impediments, barriers or obstacles which in this case all mean the same. Kallio (2004) lists that there are impediments for corporations to change its environmental behavior. He points out six different impediments factors: compulsive, normative, mimic, market pressure, ethical pressure and path commitment. Most of the impediments to change can also work as motivating factors. Compulsive impediments are the legislations, which may encourage or force companies to work in a certain way. Normative impediments are derived from the cultural setting of the corporation, which may also be encouraging or forcing. Mimic impediments encourages corporations to do similarly as other corporations, in maintaining the present state of organizational behavior. Market pressure prohibits corporations to execute non-cost-profitable endeavors. The corporations may also think that change from the present state to new state might not be ethically right. Path commitment is natural human behavioral way to function the same way as before. It is also defined as resistance to change. All of the

above factors may work as impediments or motivating factors, except path commitment.(Kallio, 2004)

Zuzhi and Sohal researched these impediments in their study concerning Australasian companies. They surveyed the expected and experienced impediments during the adoption of environmental management system. The companies were asked to identify the impediments and to grade them with five point Likert scale. These impediments mainly related to cost and time. Table 2.5 lists the identified impediments as they were expected and experienced during the process of planning and adopting of EMS. (Zutshi et al. 2002)

Table 2.5. *Expected and experienced impediments during the planning and implementing of EMS on a Likert scale, where 1=not at all and 5=to a very large extent.(Zutshi et al. 2002)*

Impediment	Expected impediment (mean)	Experienced impediment (mean)
Documentation(cost, time)	2,98	3,14
External auditors/consultants costs	2,80	2,79
Training of employees	2,75	2,73
Internal audits costs	2,48	2,66
Communicating EMS issues to contractors	2,32	2,63
Training of contractors	2,47	2,58
Resistance from the employees due to changes in operating procedures	2,52	2,34
Time lost by employees	2,44	2,42
Resistance from the employees	2,25	2,19
Resistance from the suppliers due to lack of information regarding EMS	1,68	1,73
Disclosure of confidential information to a third party	1,69	1,67

The most significant experienced impediment was documentation, but it was just slightly over 3, which means in Likert scale “not able to tell”. Few interesting observations can be made from the table. The expected resistance of the employees was quite low and the experienced even lower. This means that path commitment, which Kallio discussed seems not be that great impediment when adopting environmental management systems in Australasian companies. Smallest evaluated impediments were resistance of suppliers and disclosure of confidential information to a third party, which were very low. (Zutshi & Sohal 2002)

Yeo Soo Wee & Hesan (2005) defined the critical factors of EMS development and approaches to handle these factors, by conducting a literature review and interviewing six environmental managers in different companies. They identified seven critical factors, which are:

1. Top management commitment to environmental management

2. Involvement of employees
3. Training
4. Green products and product processes
5. Supplier management
6. Measurement
7. Information management (Yeo Soo Wee & Hesan 2005)

To the first critical factor, the literature study found out several approaches. Top management leadership is vital and an environmental champion should be appointed amongst senior officers (Yeo Soo Wee & Hesan 2005, look Berry, M. and Rondinelli, D. (1998), "Proactive corporate environmental management: a new industrial revolution"). On the other study an effective environmental policy is stated as mean to tackle with top management commitment (Yeo Soo Wee & Hesan 2005, look Epstein, M. (1996), Measuring Corporate Environmental Performance). The approaches found in eight different studies indicate that top management involvement is best achieved by making policy, vision, mission statement or equivalent and appointing a specific environmental manager or champion. (Yeo Soo Wee & Hesan 2005)

The literature study found out that the most common approach to employee involvement was through reward systems and personal environmental targets. Involvement of employees in decision making was suggested in one paper. Formation of "Green" teams was suggested in two papers. The third critical factor of training was mainly approached by raising the environmental awareness of personnel (Yeo Soo Wee & Hesan 2005). One paper suggested that training of new personnel would avoid environmental mistakes and sharing the information about new regulations and other stakeholder concerns would mitigate the impediments of lack of training (Yeo Soo Wee & Hesan 2005, look Dechant, K. and Altman, B. (1994), "Environmental leadership: from compliance to competitive advantage").

Fourth critical factor of implementing the environmental ideology to product design and product processes is solved in two studies by conducting a life cycle analysis. Pollution prevention and waste reduction is mentioned in five papers. Supplier management is mentioned as fifth critical factor and the literature study reveals approaches from pressuring the suppliers to partnership and co-working in environmental management. Sixth critical factor of measurement is resolved in seven of eight papers in the literature study, by conducting audits. Only two papers proposed quantifiable and measurable targets and goals. The last critical factor of information management is handled by setting up a specific information system that is easy to access and an internal and external reporting procedures need to be set. (Yeo Soo Wee & Hesan 2005)

Overall experienced impediments prove not to be very significant and it seems that there are no overwhelming obstacles for adopting EMS. Thus the lack of motivating drivers might weight more, when a company decides whether to implement EMS or not.

Nevertheless there still exists a risk that the management system is only a stack of papers, unless the critical factors are taken into account.

2.6.8 Comparison of ISO 9001, ISO14001 and OHSAS 18001

Appendix 5 lists the structural correspondence of management standards ISO 14001 and ISO 9001 and specification OHSAS 18001. All the management systems are based on the PDCA-cycle depicted in Figure 2.9., therefore it can be observed that there are a lot of similarities in the correspondence list. The difference of these three systems is the point of view. All systems are related to processes, products and services, but only ISO 14001 observes these from the point of view of the environment. ISO 9001 observes above three aspects in a way, from with-in, as the products, processes and services and their quality are the intrinsic value. OHSAS 18001 observes all the above from the point of view of the personnel who are operating to make the products, processes and services.

In conclusion the management systems aim to produce safest, most environmentally effective and the best quality products, processes and services. ISO 14001 and OHSAS 18001 can be seen as extensions to quality management. These extensions enlarge systematical management to cover all three pillars of sustainable development.

2.7 Criticism on business responsibility

The initial call for corporations to act responsibly was resisted with the arguments introduced already by Adam Smith and later Milton Friedman. They outlined that the sole responsibility of corporations is to make profit. The advocates of this ideology argue that social and moral issues are not economically feasible and corporations should concentrate on earning profit and leave social issues to others. In addition they argue that assuming social responsibilities corporations will eventually lose their competitive edge. They state that those, who are best equipped to deal with social issues, mainly governments, should do so. These arguments are against the general idea of responsible business activity (Barnett 2006). There is criticism also on actual implementation and practice of corporate responsibility. These critics argue that multiple different manifestations and terminology of corporate responsibility are just another way to hide the ugly reality of maximizing profit without making any concrete improvements or even further by creating a corporate self-regulatory hegemony.

Kallio states that the present state of corporate connection to environmental issues is one and a half relational. This means that even though the corporations have introduced social and environmental values to their operations, they only exist to increase the profits of the corporation. It started in the middle of the 1980s and it is adaptive and innovative. It regards nature as a weak stakeholder and promotes restricted sustainable development and it is anthropocentric. As long as the profit maximizing is the dominant

value, a real change towards sustainable development cannot be achieved. At the time being, social and environmental responsibilities are not equal to economic responsibilities, although they are often viewed as equal in corporate communications as represented earlier in Figure 2.2. This value transformation cannot occur unless it happens simultaneously in all levels of human societies. Kallio states that if the consumers and regulators do not share the same level of interest in environmental protection, the corporation that takes the first step towards intrinsically valued environment will end up in bankruptcy. (Kallio, 2004)

Sikka argues that corporate social responsibility is used to disguise tax avoidance. He states that corporations can work through double standards. By managing these two, maybe even opposite views, corporations may be talking about social responsibility and at the same time avoid and evade taxes. He lists that G20 countries donate around $120 billion to developing countries, that are at the same time losing $500 billion to different forms of tax avoidance mainly by western corporations. Sikka discusses this tax evasion and avoiding hypocrisy with examples of Enron, KPMG, UBS, Wall Mart and WorldCom. (Sikka 2010)

Philanthropic responsibility, by being a good corporate citizen, described in Carrols' pyramid in Figure 2.3, has got some researchers to be skeptical also. Matten, Crane and Chapple have studied the meaning of corporate citizenship theoretically in respect to the definition of citizenship. They argue that corporate citizenship in addition to corporate social responsibility is due to neo-liberalistic cut down of welfare society enabling corporations to enter the gap by promoting practices that formerly were the responsibility of the governments (Matten et al. 2003). They state:

"Therefore in the industrialized world, it can be argued that CC consists of a partial attempt, motivated by self-interest, to take over those unserved governmental functions that were the result of a cutback in social rights two decades ago." (Matten et al. 2003, p. 117.)

Supportive study of CSR and CC as a neo-liberalistic "roll-out" has been conducted by Sadler and Lloyd. In their study they argue that it is no coincidence that USA and UK have been the most active in CSR business. They state that these two countries have been the most eager in "rolling-out" of the neo-liberalization and shifting the boundaries of corporate and governmental responsibilities. In their study they state that it is highly problematic to combine social and environmental issues to the financial investments since short-termism is deeply rooted in financial sector (Sadler & Lloyd 2009) and social and environmental issues are on the other-hand dependent on long-term planning and sustainable development, according to its true definition by Bruntland commission. Sadler and Lloyd argue that the neo-liberalization is manifested by two key features; firstly the rise of CSR industry of consultants and advisers whose motives are strongly market driven and secondly series of international framework agreements that enter the "in-between" spaces of governments and corporations characterized by the Global

Compact, the Equator Principles and the World Economic Forum's Global Corporate Citizenship Initiative (Sadler & Lloyd 2009)

In more radical criticism of CSR Sklair and Miller argue that CSR is just another term to mystify and obscure capitalistic globalization that is the source of class polarization and ecological unsustainability. The voluntary approach of CSR is actually an evasive measure to avoid compulsory regulations and furthermore an attempt to influence on social policies. The effect of CSR is mainly considered to public relations work instead of actually striving for sustainable development. In their study they state that creating an alternative framework to a genuinely democratic global CSR is needed to solve the crises introduced by capitalistic globalization. This can be achieved by placing human need and ecological sustainability at the core of the new CSR values unlike the present, which is seen only as a profit maximizing tool. (Sklair et al. 2010)

Standardization in industry can be seen controversy since it contributes to corporate self-regulatory measures. King and Lenox define industry self-regulation as a practice where:

"…companies join together to regulate their collective action to avoid a common threat or to provide a common good by establishing a standard code of conduct." (King & Lenox 2000)

In their study King and Lenox use an example of Responsible Care, which is a program created 1989 in response to decreasing public opinion towards chemical industry in the U.S. They state that during 1980s the favorable public opinion drastically reduced from 30 percent to 14 and respectively the unfavorable opinion rose from 40 to 58 percent. Industry wide self-regulation was needed because public reacts to one or two poor performers of chemical industry by considering the whole chemical industry as neglectful as the worst operators. The interesting fact is, as King and Lenox point out, that the self-regulatory standard titled as Responsible Care was made to protect the reputation of the corporations not the actual effect on the physical environment that is water, air and ecosystem. Excessive polluting of firms does only affect the reputational welfare of the corporation, since the operations of chemical corporations are not directly dependent on the cleanliness of physical environment – so the trade association, in this case the Chemical Manufacturers' Association (from 2000 The American Chemistry Council), could protect its members trough creating a better image rather than affecting the true problem of polluting. (King & Lenox 2000)

ISO standards could be seen as similar self-regulatory standards. The ISO consists of various national standardization organizations. These organizations furthermore consist of various actors on economic, political and social fields. The industries itself are quite widely represented in these committees that create standards for the industry itself. So the widely recognized and accepted environmental standard ISO 14001 is actually heavily influenced by the actual target group it tries to standardize and to make sustainable. As it is stated in various sources, the most influential motive for a corporate

behavior still is strive for bigger profits for its shareholders. This fact sheds a controversial light on the reason for standardization in fields such as CSR and environmental management.

3 MATERIALS AND METHODS

3.1 Introduction to corporation

Konecranes Plc. is one of the world-leading manufacturers of lifting equipment. Its business areas include service and equipment. The composition of business units (later BU) and areas(later BA) with included market operations is described in Figure 3.1.(Konecranes 2009b) According to European NACE V2 classification the corporation is classified as 28.22 Manufacture of lifting and handling equipment and in similar Finnish classification 2816 TOL-2008 (2822) Manufacture of lifting- and handling equipment.

On the topmost of Figure vertical bars represent geographical market operations. AME stands for Americas, mostly North America. EMEA stands for Europe, Middle-East and Africa and lastly APAC which stands for Asia-Pacific. And finally NEI that stands for North Europe and India(Konecranes 2009b)

The two horizontal bars represent the two BAs: equipment and service. The BAs are divided to BUs. These BUs are industrial cranes, components, lifttrucks, nuclear cranes and port cranes for equipment BA and cranes service, port service, parts, machine tool service and modernizations for service BA. (Konecranes 2009b)

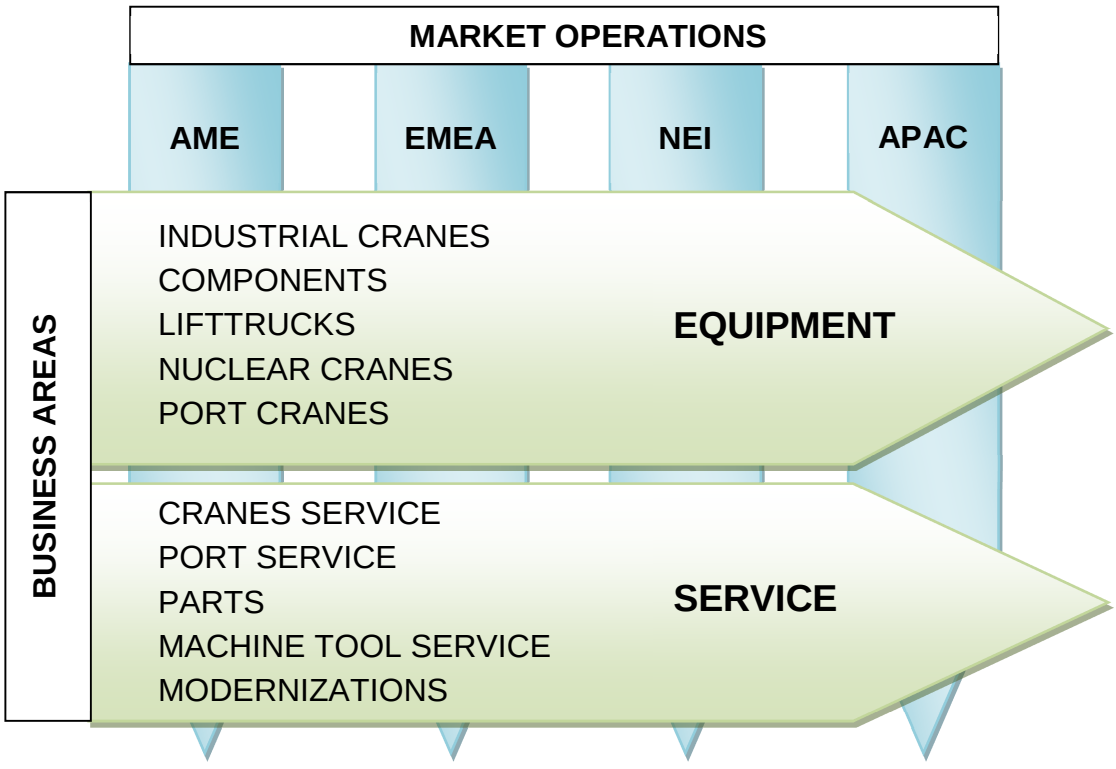


Figure 3.1. *Intersections of business areas, business operations and market operations. (Konecranes 2009b)*

The two manufacturing sites of Hyvinkää and Hämeenlinna are part of legal company Konecranes Finland Plc. (later company) and it is situated in the equipment business area. Hämeenlinna site manufactures lifting equipment that is part of the standard product family of equipment and they consist of pre-designed modularized products. Hämeenlinna products belong mainly to industrial cranes. Hyvinkää site manufactures Heavy duty cranes and other large component, which are specified according to customer needs. These products tend are capable of lifting very heavy loads of over 80 tons. The typical customers are ports, paper mills, steel mills or waste processing facilities. Both Hyvikään and Hämeenlinna sites manufacture crane components for their own crane assembly and to the global supply. The corporate structure is matrix organization so there are both geographically formed organizations and also the organizations that are formed according to business areas and business units.

The corporation has grown rapidly in the past ten years. Growth has been achieved through organic growth and acquisitions. Figures 3.2 and 3.3 illustrate growth of the corporation through personnel and market value indicators. For personnel the corporation has more than doubled its size in last six years. The market value has more than tripled in ten years as seen in Figure 3.3. For 2010 the quantity of personnel is the number at the end of the year and for earlier financial years it is the average personnel.

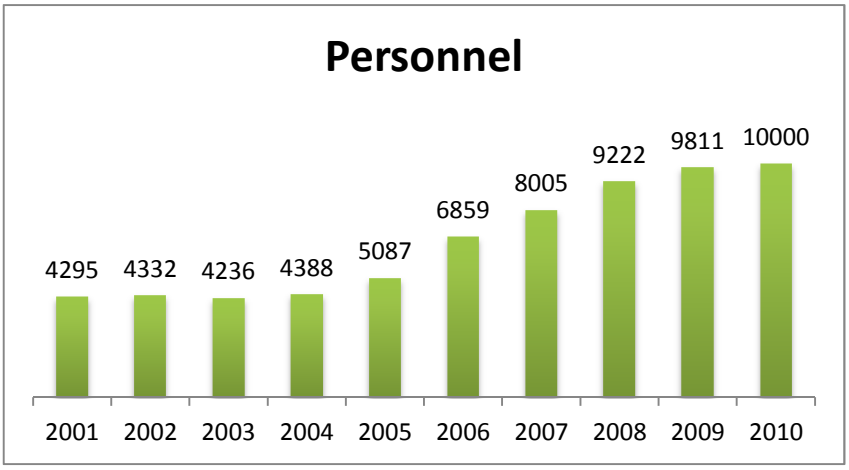


Figure 3.2. *Personnel quantity of the corporation from the last 10 years. (Konecranes 2005a, Konecranes 2009b)*

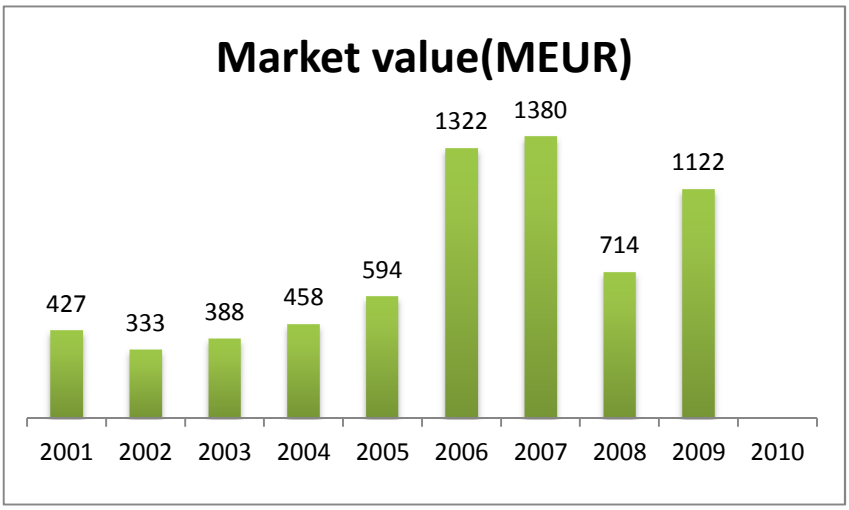
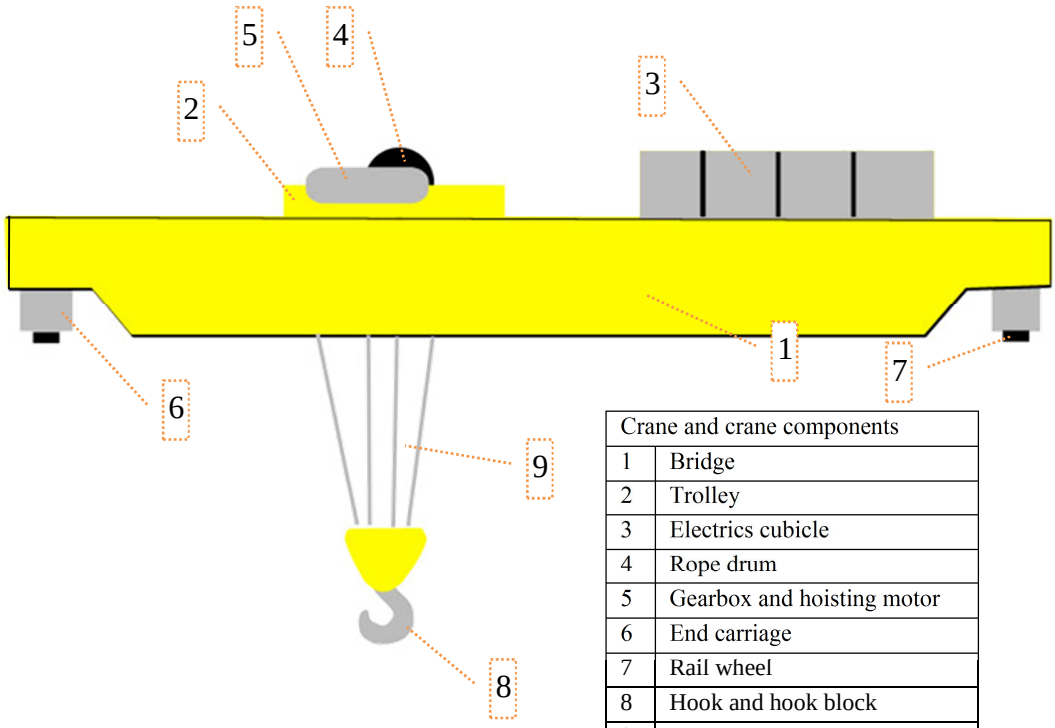


Figure 3.3. *Market value of the corporation from the last 9 years. (Konecranes 2005a, Konecranes 2009b)*

Since the growth has been rapid and the changes in the corporation have been vast the need for systemic management is reality. The corporation is going through several process unification projects and management systems such as QMS and EMS will be incorporated. It is problematic to grasp the scale of corporation business operations since the expansion has been so fast. And being truly an actor on global markets, the corporation needs to start to manage its corporate responsibility accordingly, and environmental responsibility is a part of it.

3.2 Crane and crane components

Electrical overhead travelling (EOT) crane, depicted in Figure 3.4, is the whole installation of mechanics, electrics and steel structures that is needed for moving material. The crane can operate in three dimensions: x,y and z or some combination of these. Division of components in Figure 3.4, was selected only because of further understanding of production processes.



Crane and crane components	
1	Bridge
2	Trolley
3	Electrics cubicle
4	Rope drum
5	Gearbox and hoisting motor
6	End carriage
7	Rail wheel
8	Hook and hook block
9	Ropes

Figure 3.4. *Crane and main crane components*

Bridge in Figure 3.4 is the dominant structure that is situated horizontally above the crane operating area. A crane can have one, two or even more bridges, depending on the application of the crane. Bridge described in Figure 3.4 is constructed of a steel plate that is used to create the casing of the structure. It is then reinforced from inside with steel structures. Trolley is the component of a crane that holds all the mechanics and electrical motors that are need for the load to move between the ends of the bridge and to perform the hoisting. The movement of the trolley between the ends of the bridge is called traversing. The trolley encompasses the needed devices to perform traversing, such as wheels and motors. Component numbered 3 in the Figure is the electrics cubicle that encompasses all the other electrics besides the motors such as inverters and programmable logic circuits. Rope drum is the cylinder on which ropes are reeved during hoisting. Hoisting motor operates the up and down movement of the load. The motor is attached to gearbox which then transfers the torque through various gears to the cogs inside the rope drum. The bridge is mounted on the end carriages on each end. These carriages have certain amount of rail wheels, depending on the weight of the crane and the amount of bridges it has. These wheels are used by a travelling motor to travel on the rail that is mounted usually on the steel beams near the rooftop. Hook is used to attach the load to hoisting machinery. Hook block encompasses of rope wheels to minimize the friction between the rope and other mechanical equipment. The ropes are attached to the rope drum and the amount of ropes used linearly correlates with the

amount of load the crane can hoist. Usually the rope amounts vary between four and sixteen.

3.3 Project flowchart

The project timetable for actual work of creating the environmental management system was planned with the person responsible of guidance of the master thesis. The project of thesis making can be seen as a simultaneously running two different but closely interconnected projects. Project one is the actual thesis work that answers the question “How to create an environmental management system?” The second project can be seen as the actual work that is done to the corporation. And the second project answers to question “What has been done and needs to be done in order to have an environmental management system operational?” In the terms of thesis structure, this could be seen that the scope of project one is the whole thesis, and project two, chapters 3.-5. In Figure 3.5 the flow diagram of the whole project is depicted. The round cornered rectangles represent start and end of the project. Rectangles represent and individual operation. Diamonds represent a boolean operation. Cylinders represent a documentation, product or record that is created from operations.

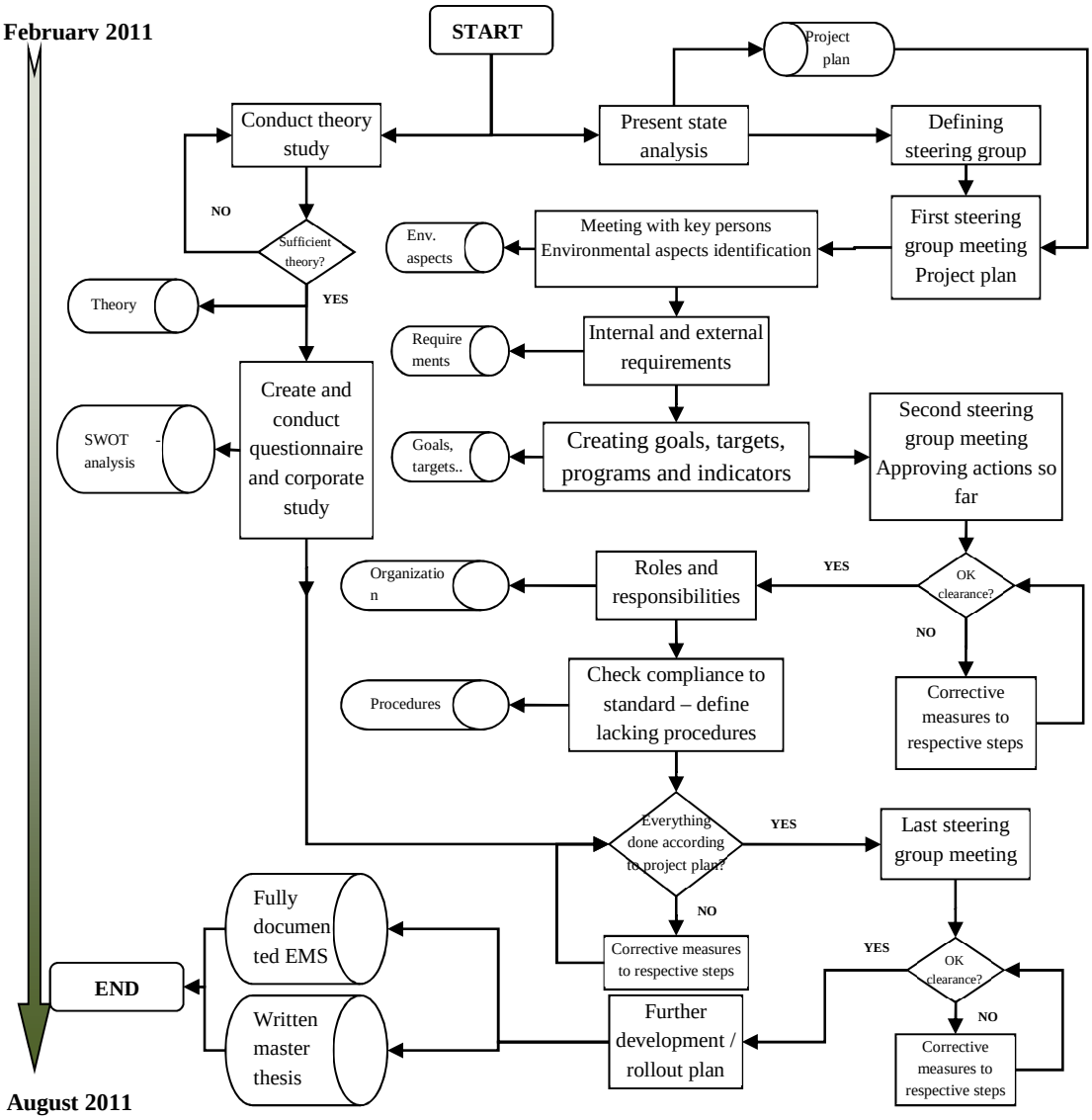


Figure 3.5. *Flowchart of master thesis project*

The flowchart is made at general level of project description. Each process block is described in greater detail in later sections of the thesis. The project was started in February 2011 and is planned to be ready in August. As the Figure depicts there are two main products from the thesis, documented environmental management system and the completion of the thesis. The documented environmental management system will be handed out to full implementation and rollout. Each step in the flowchart is placed approximately on the right place in relation to the timeline on the right.

3.4 Site descriptions

3.4.1 Hyvinkää site

The site in Hyvinkää is located in the industrial area of Hiiltomo. The general layout of the factory site is depicted in Figure 3.6. The site is situated on top of a groundwater reserves. There are several different Konecranes operations on Hyvinkää site. The corporate headquarters is situated there, and it operates mainly in the building labeled as Y in the appendix. Konecranes Finland Oy operates mainly in the buildings N, V, L, A. Subcontractors for Konecranes Finland are operating in buildings L, P, HEVES and to some extent in all of the buildings. Production facilities are in buildings N, V and L. Crane factory operates in the middle part of building N. Electrics factory operates in the northern part of building N. Gear factory is situated in the western part of building V and component factory on the others, the east side of the building V. The trolley assembly is in the L building. K and H buildings in the appendix 4 belong to KONE. Konecranes Service operates in the M building and is out of the scope of this study. The total are of facilities in the site approximately 60 500 m2 and the total personnel working is around 1100.

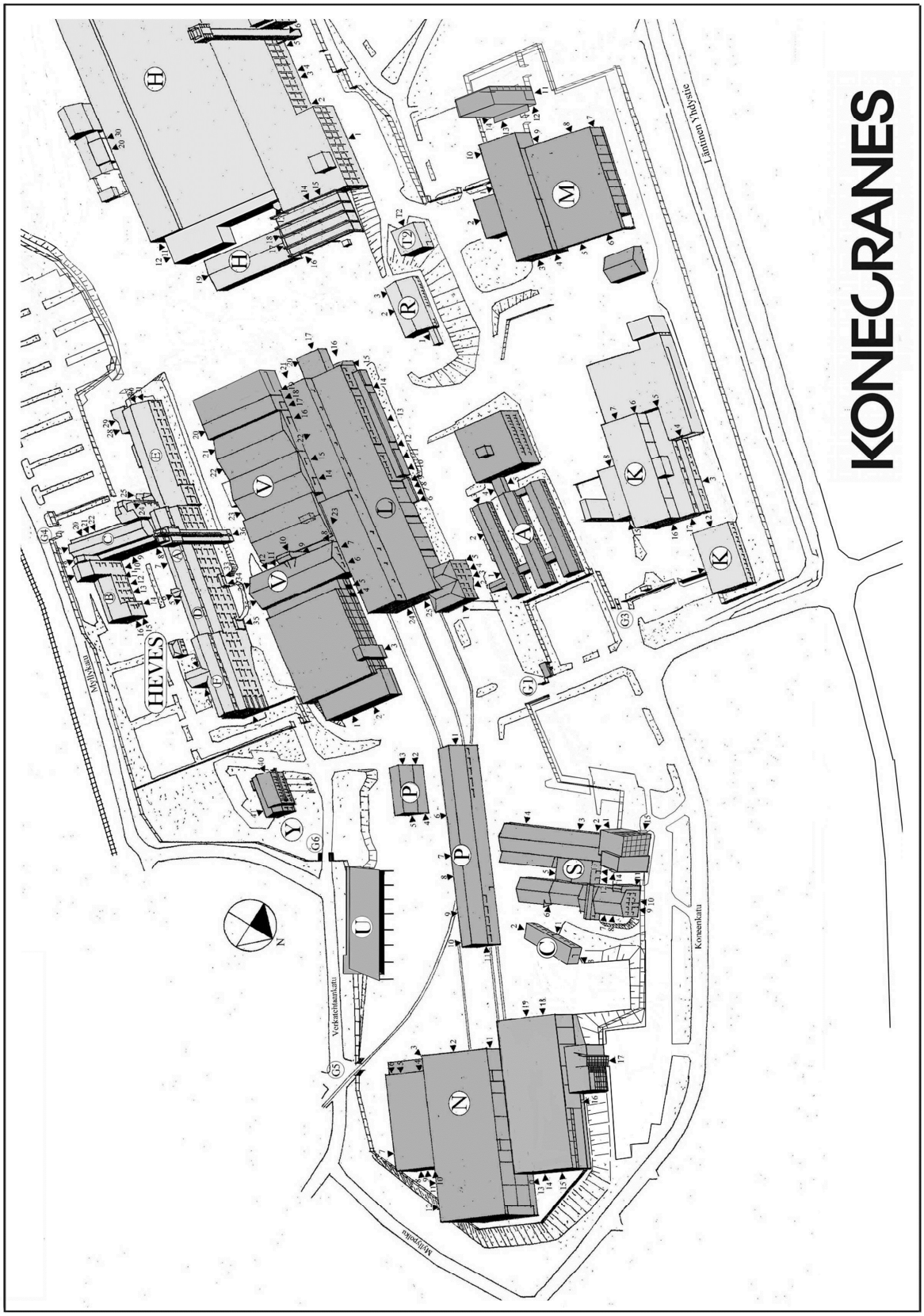


Figure 3.6 *Hyvinkää factory site isometric view*

3.4.2 Hämeenlinna site

The factory site is located in Ruunumyllyntie Hämeenlinna. The general layout of the factory site is depicted in Figure 3.7. The operations in Hämeenlinna site are concentrated on production of standard family hoists. Building labeled as KHT manufactures helical gear reducers for standard family hoists. HH1 and HH2 buildings consist of hoist assembly and rope drum manufacturing of different sizes of standard family hoists. Inside buildings HH2 and HH1 also operates production line HH6 that assembles electrics for standard hoists. There are approximately 280 employees working in the factory area which is approximately 9600 m^2.

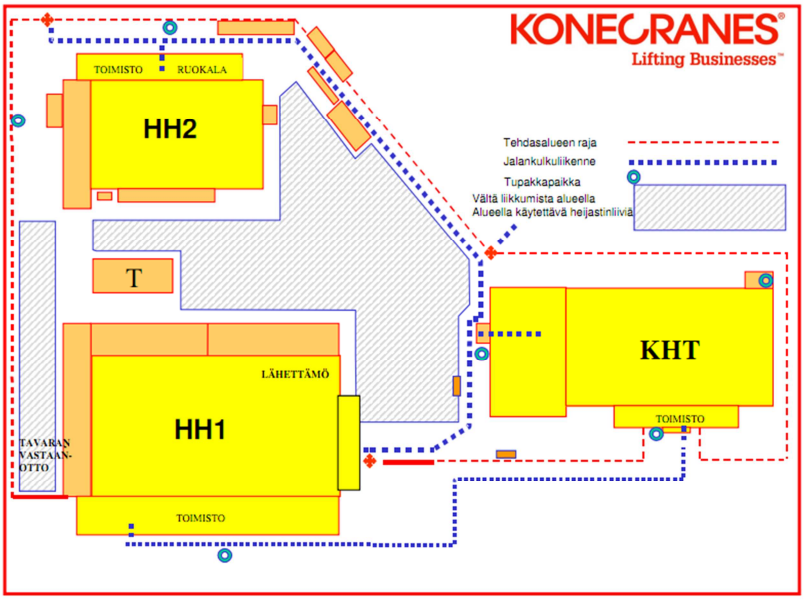


Figure 3.7. *Two-dimensional lay-out of the Hämeenlinna site.*

3.5 Description of the quality management system

The company has an ISO 9001 –certified quality management system. It has been separate for Hyvinkää and Hämeenlinna, but there is an ongoing process to combine these two and certificate the combined system. The original certification was done in 1994 and the last external audit to check the conformance was done in 2008. The certification audit of harmonized Konecranes Finland quality system was done in April 2011 and the certificate will be achieved before the end of 2011. Figure 3.8. depicts the Quality management system and the operation flow.

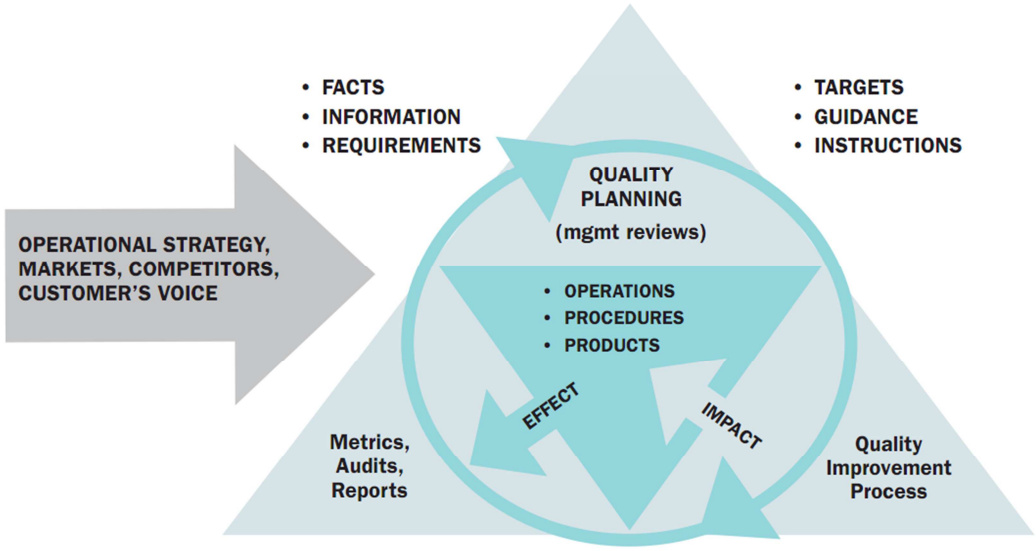


Figure 3.8*. Description of Konecranes Finland Quality management system (Konecranes 2011g)*

On the background there are motivators such as facts, information, targets and guidance that are visualized on the top left and right of Figure 3.8. The top part of the pyramid represents the planning phase of quality. The pyramid in the middle represents the core actions, which are operations, procedure and products. These are depicted to be the heart of whole quality management system in Konecranes Finland. On the bottom left is quality improvement process that is a tool to affect the heart of operations. This means actual reaction to observed quality defects. Quality improvement processes are mainly conducted by meetings with quality, design and production personnel. On the bottom right of the pyramid are tools for measuring quality management system operational level and the quality itself. The impact of quality improvement process is observed in metrics. The circular pattern on top of the pyramid represents the continual commitment to quality management that receives input, in addition from the background factors, from operational strategy, markets, competitors and customers.

The scope of Konecranes Finland unified quality management system is defined as:

"Marketing and sales, engineering, project management and manufacturing of cranes and crane components" (Konecranes 2011j)

This scope is depicted in Figure 3.9. In Figure the turquoise blocks of business area equipment that are operating in Finland are the operations included in the quality management system.

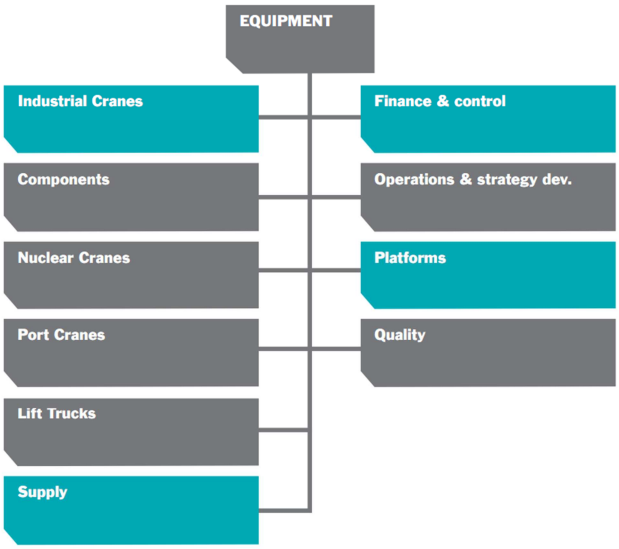


Figure 3.9. *Scope of Konecranes Finland Quality management system (Konecranes 2011g)*

On the left side of the Figure 3.9 the different business areas are illustrated in addition block of supply, which is more of support organization to these business areas. For example supply provides crane parts to industrial cranes and port cranes. The two turquoise blocks on left cover “manufacturing of cranes and crane component” in written scope mentioned above. On the right side there are supportive functions that cover the “marketing, sales, engineering and project management” in written certification scope.

3.6 Description of health and safety management procedures

The health and safety management in Konecranes Finland is fairly young and a certified system is not yet achieved neither it has never been the objective earlier. Each respective site of Hyvinkää and Hämeenlinna has had their safety managers less than five years. In addition the safety organization includes all the regulatory based institutions and persons such as industrial safety delegates and committees. Nevertheless the safety culture in Konecranes Finland is fairly young. The development of safety practices has gone somewhat hand in hand with Hyvinkää and Hämeenlinna and the Konecranes group. The group has been a strong driver and support in safety development. The corporate top management has defined safety as number one priority. The corporation published its new vision in spring 2011 that includes safety accordingly.

”We know in real time how millions of lifting devices and machine tools perform. We use this knowledge around the clock to make our customers’ operations safer and more productive.” (Konecranes 2011h).

There is a health and safety policy defined by the group that is adopted by local organizations such as Konecranes Finland. The approach to safety development has been more from top to down than vice versa. Due to historical arrangements very small units working in Konecranes used to be very independent. The recent push towards oneKonecranes unified way to conduct business is driven from top to down, from corporation to local units, and the safety approach correlates to same approach.

Although the safety culture is fairly new, Konecranes Finland has already quit a few safety related processes in place. The company has defined the roles, responsibilities and authorities of personnel. It has also made a decision to train 100 % of the personnel with the Finnish Occupational Safety card. The risks are identified through a systematic process and identified hazards are managed using specific instructions. Konecranes Finland has a unified way to report dangers and accidents. Konecranes keeps track of LTA1 globally and publishes the Figures in annual report. (Konecranes 2011g)

Even though the objective for Konecranes Finland has never been to achieve certified OHSAS 18001 –management system, many requirements of the specification has already been met in company processes. If the company wishes to achieve certificate for health- and safety management, it could be achieved without heavy investments.

3.7 Description of environmental management system

The approach of environmental management is similar to that of safety management which means that the development comes from top to down. The group environmental manager has been working on corporate level to provide local operatives, such as members of Konecranes Finland, with necessary material to start the construction of systematic environmental management practices. Konecranes Finland has not had any specified environmental engineers and the minimal interaction demanded by governmental organizations, for example on reporting, has been done by separate individuals working in different roles of the organization. The level of environmental management in both locations before the master thesis was mostly at the same level with Hämeenlinna slightly ahead. The pre –master thesis level of environmental management is listed in appendix 3.

3.8 Corporate Stakeholders

Konecranes listed the following stakeholders, in annual report 2010, as the most important: customers, personnel, suppliers and subcontractors, students, universities and research institutes and the shareholders. Figure 3.10 depicts the current interaction of the corporation with its most important stakeholders.

Figure 3.10. *Konecranes stakeholders and stakeholder interaction (Konecranes 2011i)*

The pressure of legislative demand is growing as discussed earlier in chapter 2.4. One of the reasons for implementing environmental management system to Konecranes Finland is to have more active relation to authorities by having open discussion. Using the classification in table 2.2 the primary stakeholders of Konecranes group are: customers, personnel, business partners, shareholders and educational instances. Secondary stakeholders include local communities, authorities, media, interest groups, trade unions and non-governmental organizations.

3.9 Survey for ISO 14001

Survey was conducted with quantitative and qualitative methods. Quantitative questions have restricted answer options and qualitative have open-end spaces for answering. The quantitative questions were mostly in “yes”-“no” –format. The questionnaire sheet used is in appendix 2. It is in Finnish to take into consideration the target group. The purpose of the survey was to recognize the level of general environmental knowledge and willingness to adopt the system. It was also used to detect the aspirations for working with fully implemented system. The target group of the survey was mainly management or specialists working for Konecranes Finland Oy – the personnel that would be partly responsible for the operation of the EMS. The survey was conducted synchronously with the construction of the EMS, but the aim of the survey was to analyze the pre-EMS state of knowledge and willingness for the upcoming change. Information gathered from the interview was later used in making of the SWOT analysis. The answer sheets were returned anonymously, but the survey situation was a face to face meeting, which may have affected the results of the survey.

3.10 SWOT analysis

SWOT analysis was developed in early 1970s. The four elements of SWOT analysis consists of the company's strengths, its weaknesses, the possible opportunities of the company in its operational environment and t threats the company might encounter in its environment. Strengths and weaknesses are factors, which only occur in the company that is analyzed, therefore they are internal. Threats and opportunities exist in the field, the location and furthermore the whole environment the company operates, thus they are external. (Simmering, 2006)

Originally the SWOT analysis was designed to answer the following questions about the company and its environment:

1) What can we do?
2) What do we want to do?
3) What might we do?
4) What do others expect us to do?

In the analysis, strengths are considered to be company's resources to engage activities that generate economic value, or other assets that puts it ahead of its competitors, such as: wide global presence, strong research and development, cash reserves and so on. On the other hand, weaknesses are the lack of such resources. Opportunities, expected or abrupt, provide companies the chance to shift its weaknesses to strengths and threats work the other way around (Simmering, 2006). Opportunity could be signing new strategic alliance with a competitor. An example of a threat could be a new competitor on the field.

4 MATERIALS AND METHODS

4.1 Environmental management system present state analysis

Present state analysis is done by comparing the level of environmental management in Hyvinkää and Hämeenlinna target sites with the requirements listed in the ISO 14001 standard. This approach is useful to recognize the level of EMS completion respective sites and to evaluate further required labor to construct and implement a working EMS. Table 4.1 consists of clauses and headings from the standard itself and verbal definition of the level and preparedness in sites. It was done in the beginning of the project. The first column of the table represents clause and heading precisely as found in the ISO 14001:2004. The next two columns are used to describe what actions have been done to achieve the level of activity required by the standard. From the table the different activities will be evaluated and the importance decided. This table was used as a reference material for outlining the project plan of environmental management system creation, which is presented in appendix 3.

Notable to see from the table is that, there is quite a lot of work already done concerning environmental management system on the different levels of the organization and something's that can be adopted from quality management system. Scope definition is important initial step towards the build-up process, since it set the perimeters for all the upcoming actions. The scope was selected to be the same as in quality management system.

The environmental policy has been defined in the group level and it will be used on local level as well. Environmental policy is top level commitment to environmental improvement and it is the foundation of environmental management in Konecranes. Environmental aspects of the sites have not been identified properly, although something has been done in Hämeenlinna, but a more systematic and unified process is required, and it is the first perquisite of environmental management system. Another larger subsystem of build-up process will be defining the objectives, targets and programmes using the identified environmental aspects as a basis and furthermore creating an organization that can conduct the work to achieve these set of goals and targets.

Bureaucratic mechanisms were mostly thought to be adopted from existing quality management system. Procedures such as, document control, record control and management review, were already defined in the quality management system. It was seen that there was no benefit to define these procedures again, so the existing quality management procedures were used.

Table 4.1. Present state analysis 1.3.2011 on ISO 14001 preparedness in respective target sites. *(Vuorinen S., Pirinen J. 2011)*

Clause and heading in ISO 14001 Standard	**Hämeenlinna**	**Hyvinkää**
4.1. Scope of EMS	The same as QMS for applicable parts.	The same as QMS for applicable parts.
4.2 Environmental policy	Global environmental policy will be used.	Global environmental policy will be used.
4.3.1 Environmental aspects	Template ready. Started, data exists.	Template ready, No proper identification done.
4.3.2 Legal and other requirements	Legal requirements checked, customers' not done.	Legal requirements checked, customers' not done.
4.3.3 Objectives, targets and programs	Some set.	Not set.
4.4.1 Resources, roles, responsibilities and authority	Some defined.	Not defined.
4.4.2 Competence, training and awareness	Global training material done. Competence and training requirements not set.	Global training material done. Competence and training requirements not set.
4.4.3 Communication	The same as QMS / Done in global level.	The same as QMS/Done in global level.
4.4.4 Documentation	The same as QMS.	The same as QMS.
4.4.5 Control of documents	The same as QMS.	The same as QMS.
4.4.6 Operational control	Some done.	Some done.
4.4.7 Emergency preparedness and response	Done, not checked for environmental compliance.	Done, not checked for environmental compliance.
4.5.1 Monitoring and measurement	Global measuring in place. Local measuring requires checking.	Global measuring in place. Local measuring requires checking.
4.5.2 Evaluation of compliance	Means ready, procedure not set.	Means ready, procedure not set.
4.5.3 Nonconformity, corrective and preventive action	Not defined/ The same as QMS.	Not defined/ The same as QMS.
4.5.4 Control of records	The same as QMS.	The same as QMS.

4.5.5 Internal audit	Not ready.	Not ready.
4.6 Managements review	Procedure not set/ The same as QMS.	Procedure not set/ The same as QMS.

The present state analysis yielded a list of task and larger subsystems that needed to be done in the management system build-up process. These were following:

- Environmental aspect identification
- Identifying internal and external requirements
- Creating goals, target and programmes
- Setting up indicators to monitor progress
- Defining roles and responsibilities

4.2 Results from survey

The first question was whether the environmental concerns have been more visible or not in the daily operations. From eleven respondents, 9 answered “yes”. It seems that the information about environmental issues has already reached the unit management and specialist level. Weather it reaches every employee in manufacturing is difficult to say and a more comprehensive survey would be needed to study it.

Second question on the survey related to customer demands and enquiries about environmental aspects of products and production. Only 4 out of 11 responders knew if there were any customer enquiries. Two of people who answered “yes” were persons who work daily with safety- and environmental issues on wider scope than unit level. This means that either the information about customer demands cannot reach the unit management or the customers do not have specific environmental requirements on cranes. In the light of the present state of Konecranes Finland environmental management it could be speculated that the main reason for small amount of known customer enquiries is due to poor flow of information from the organizations near the customer to manufacturing locations. Identified enquiries included such as “Is Konecranes ISO 14001 certified?” “What is the energy consumption and recyclability of the product?”

The next question tried to define who is responsible for environmental system management on unit level. There were a lot of variance in this question and the set-up of the question might have been a little bit confusing. This question especially tried to map out who do the respondents think that should have the overall management responsibility in environmental issues. The reason for presenting this question is the fact that there has not been a specialist before to handle environmental issues. The answers divided roughly by one half to support the idea that present management should be

responsible on system management and to the other half that thought that management should define a person to especially handle these issues. Some thought that the system management should be on responsibility of personnel, which is true for implementation and actual operation of the system, not for the management though. As of spring 2011 a specific person was hired in Hyvinkää for health- and safety management with environmental system management as one part of the job. In Hämeenlinna present health- and safety manager took responsibility for environmental system management on Hämeenlinna part.

Four of the respondents thought that environmental management system would be very useful(4 in scale from 1 to 4) and very necessary in their unit and 7 answered somewhat useful and necessary. The expectations from the system itself were simple and clear guidelines on how to do things correctly. This question was a little bit mixed with the question about what are the expected benefits of environmental management to the unit. Some of the identified benefits of the environmental management were risen awareness of environmental issues, savings in energy and waste handling fees, compliance to customer requirements, prevent possible negative environmental impacts, forming of credible business image, preventing possibility of negative image, preventing pauses in production, enhancing housekeeping and systematic monitoring.

Series of questions in the survey were dedicated to identify the present level of environmental awareness and education level. First question was related the requirements of environmental permit from local authorities. 7 of the respondents were well informed that the Konecranes facilities in Hämeenlinna and Hyvinkää neither require an environmental permit. Almost all of the respondents claimed to know environmental impacts of the operations, but when asked for clarification the answers were vague and the concept of environmental impact seemed to be unclear. So a requirement for environmental impact education is evident. 8 of 11 answered to identify the waste fractions produced by their units. And they also listed all the waste fractions quite well. Used chemical were quite well know, but the question sheet did not include any listing of chemicals so the chemical knowledge of the respondents could not be cross-checked.

Another group of questions on the questionnaire sheet measured the responsiveness of adapting environmental management system. Only one out of 11 respondents answered that the environmental risks were managed at acceptable level. This indicates that there is requirement to identify and manage environmental risks and also the lack of information about environmental aspects in general. Only one of the respondents was not ready to allocate any man hours to environmental management system. The amount of hours / varied from 2 to 40 hours. This would indicate that at least this sampling of managers is not reluctant to participate in environmental management.

The general tone from the survey was positive and the integration of environmental management to everyday practices is possible. Although the sampling was too small to estimate the responsiveness of the whole organization from down to top, it is positive information for the system construction phase. A wider more thorough survey would be

required to estimate the corporate drivers and barriers for environmental management system adoption. Even though lacking in volume, this survey served well for mapping out the initial atmosphere to start the systematic construction process.

4.3 SWOT analysis

The SWOT analysis was conducted to answer the questions: what strengths, weaknesses, opportunities and threats are involved in creating and implementing environmental management system into Konecranes Finland Oy. The interview and other company related material was used as information source to SWOT analysis. Main identified factors in SWOT analysis are depicted in Figure 4.1.

Figure 4.1 *SWOT analysis on implementing of environmental management system to Konecranes Finland Oy*

The economic structure of the corporation is strong which enables investments on new technologies and development. The corporation has also the benefit of being a market leader on some of its operating areas. The process of building up an environmental management system has already begun on a global corporate level, which helps the local building of the system. For example the global environmental

policy will be used to guide local environmental management. The examples of certified ISO 14001 in some of the corporate locations have helped to create the processes to locations in Finland. The strong interaction with the health and safety operatives has also brought valuable help to environmental management procedures. The roles will strongly revolve around existing health and safety organization. The driving motive of the corporation, to be the undisputed market leader, is an ideology that pushes new innovations and new ways of doing things even further. The middle management has shown that they understand that environmental risks should be handled more systematically. This realization of lacking environmental protection level can speed up the implementing process.

There are some weaknesses in implementing the environmental management system in Konecranes Finland Plc. The organization structure has changed a lot in past two years, for example the sites of Hyvinkää and Hämeenlinna belonged earlier to different juridical companies that were combined in the beginning of 2010. The transformation is still in process. The original idea of integrating the environmental management system to quality management system has proven to be difficult since the quality management is going through some profound changes because of the integration of the two different legal companies. The late awakening of the corporation to environmental management poses some weaknesses, especially on the competition side. It is difficult to achieve market advantage anymore from environmental management system. One of the weaknesses is that the information from customer requirements does not always reach the production facilities in smaller projects.

The possible opportunities are quite obvious, especially the economical savings that are achievable. This could be done particularly in energy savings of the facilities, which are especially outdated in Hyvinkää and the energy efficiency is poor or unknown in most of the buildings. Finland sites are first crane manufacturing sites of the corporation that are building the environmental management system. The successful experiences from these sites could be then transferred to other locations that are planning to construct an environmental management system. To act globally and to penetrate new market areas, corporations need all the possible benefits they can get in order to participate in competitive bidding. If the customer itself has an environmental management system in place and fully operating, they are more likely to set performance requirements for their suppliers and sub-contractors. The obvious opportunity that the system provides is the systematic approach itself and the benefits gained from continual development of environmental management, such as better process understanding. Management system provides tools to make long term planning and means to monitor results and guide the effort to planned direction.

The first years of implementation will prove to be difficult and might pose a threat to the thriving of the system. One of the common threats is path commitment, as explained earlier, which mean that organizations tend to resist change. It is important first to concentrate on the easier target to create the atmosphere of positive and fruitful operation of the management system. From the first years the pace will quicken and the

programmes conducted through the system will get larger and longer term. It is important to make the system suit the needs of the corporation. There is a threat that by following the standard too slavishly might lead to system that is too complex and useless to the organization. System should back up the operations of the organization, not burden it. The third threat is related to line of business of the corporation. The products that the corporation manufactures are varying a lot. Especially on Hyvinkää site, the crane manufacturing and component manufacturing, the products are different sizes and they require different manufacturing times. In order to manage environmental impacts the performance level needs to be measured through different indicators. If these indicators are not successfully set the improvements done through the system are impossible to track. Human resources might be insufficient for operating and pushing the advancements. The other aspect that relates to resources is the lack of decisive power that needs to back up the identified environmental aspects and objectives related to them. The environmental reformation has been strongly driven from the corporation level; the proper local top management support can prove to be insufficient. The risk that the management is too busy to take the needed time for attending the issues related to environmental issues is evident. Although Hyvinkää has just recently hired a new employee to tackle with health- safety and environment issues, the employee's workload is already piling up high and without proper decision making procedures there is no ease coming to that load anytime soon.

If the threats will take place, the system might collapse even before it is up and running, without any actual improvements achieved. On the other hand, if the organization overcomes the threats it might reap good economical saving and improvements in the processes.

4.4 First steps of building up the EMS

4.4.1 Selecting the scope of EMS

SFS-EN ISO 14001 standard states, that: "The organization shall define and document the scope of its environmental management system." It is important to define the scope, in order to further build up the environmental management system. The complexity of the organization structure of the company has proven to complicate the scope definition of the environmental management system. Originally it was planned that the environmental management system is closely related to quality management system already in place. The recent organizational changes, within the corporate structure, have introduced various challenges for the quality management. The harmonization of the quality system is still ongoing process, the tight integration of environmental management system and quality management system was therefore postponed.

Original idea of the environmental management system was to inherit the same scope as the quality management, which was stated**:** ”Marketing and sales, engineering, project management and manufacturing of cranes and crane components”. On organizational level this scope is covered by following operations; supply, platform, industrial cranes and finance and control. The realized scope of environmental management system is supply and industrial cranes, which means the manufacturing of cranes and crane components. The scope is depicted in Figure 4.2.

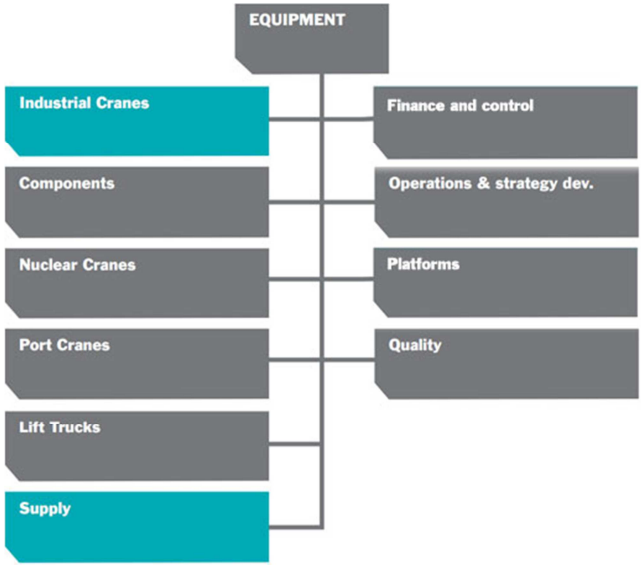


Figure 4.2 *Scope of Konecranes Finland Environmental management system (Konecranes 2011g)*

Due to facts stated in chapters 3.7 and 3.11, about the state of health- and safety management in Konecranes Finland, and the tight relation to environmental management corporation started to work towards OHSAS 18001 certification in Hämeenlinna with the same scope as environmental management system. Since the environmental management system was defined to cover both sites and the aspirations to certified health- and safety management system, all the procedure that were to be written for environmental management system were modified to cover also health- and safety management. At the time of writing the thesis the motivation or readiness of Hyvinkää site to work towards certified OHSAS 18001 system was still unclear. The health- and safety management side of the system is not covered in detail in this thesis.

4.4.2 Defining steering group and other key personnel

As the scope was selected to consist from industrial cranes and supply in Finland, the steering group of the project should consist of persons operating in these premises. The group formed out to be six members, site manager from Hyvinkää, site manager from Hämeenlinna, quality managers from Hyvinkää and Hämeenlinna and environmental managers from group level and Hämeenlinna. Other key personnel involved in the

build-up process were identified to be the unit managers, who are needed in the initial environmental aspects identification process.

The steering group was planned to have three meetings. First meeting was held as early as possible, after the present state analysis and project plan. In this meeting the project plan was accepted. Second meeting was a control meeting, where the current phase of system buildup was confirmed and the accuracy of the project plan was re-checked. The main purpose of the last meeting was to ratify further steps of system buildup, such as external audits and certification schedule. Steering group meetings failed to achieve all the defined goals. Especially the last group meeting was a failure, and the decisions required for further actions in buildup process were left undefined.

4.5 Environmental aspects identification

Before any actions towards systematic environmental management, the initial environmental aspects of the organization needed to be identified. This means that the processes of organization are identified and the impacts to environment identified. At Hyvinkää this was done by production site visit and interview with the factory managers. In Hämeenlinna the identification was done only by interviewing the management and supervisors from specific factory.

The aspects were identified in according to division represented in section 3.5 For identification a global template was used. In the template one factory or a building was assessed through four different aspects. From the production aspect, the facilities aspect, the used materials aspect and produced wastes aspect. The processes in production were divided according to which section the process might impact in nature – air or ground and groundwater. The processes were listed and the environmental impacts identified and the severity was scaled using a three point numbering method. The points were – scale, severity and probability of the impact. In addition a letter was given to each identified aspect to denote how easy or cheap it was estimated to be to remove or reduce the according aspect. The numbers of scale, probability and severity were summed up. Through this systematic numbering method the most important environmental aspects were identified for each production facility. These identified aspects work as a basis for future actions to be conducted in target sites. Generally the identified aspects were related to energy efficiency in buildings, chemical safety, waste management, noise and environmental trainings.

4.5.1 Hyvinkää production processes and products

The production processes will be briefly illustrated here with the aid of tables. Processes will be observed based on building and operational functions of the site. These are: crane factory, electrics factory, gear manufacturing, component manufacturing and trolley assembly. All the above operational functions will be briefly described by material going in, production processes and products and by-products coming out.

Materials in, product processes, products and by-products were identified during the identification of environmental aspects. The summary description of material flows and production processes in Electrics factory are described in table 4.2. The data based on factory tour and interview with the factory manager. The customers of Electrics factory are internal and the products are supplied to industrial cranes, port cranes, rubber tire gantries and all the other demanding lifting products. Electrics factory also provides spare parts for the service business. The production processes are mainly clean assembly without any mechanical machining or use of chemicals. (Konecranes 2010c)

Table 4.2. *Electrics factory material streams, processes, products and by-products.(Martin J. 2011)*

Electrics factory – North end of building N		
Material in	**Processes**	**Products**
• Copper wire • Various electrical components • Steel casings(roster, zinc) • Aluminum covers strip • Copper plate and shaft • Minor amounts of chemicals (paints and aerosols)	• Assembly of electrics • Electrical installation • Minor scale painting • Minor scale metal cutting(copper and aluminum)	• Electrical cubicles • Special crane electrics • Motor controls • Programmable logic controlled crane electrics • Electrics-rooms • Crane cabins
Side-products/waste		
• Metal scrap(wires) • Cardboard waste • Mixed waste	• Energy waste • Hazardous waste(aerosol cans)	• Wooden waste • Paper

Similar summary identification was done to Crane factory, which is the part next to Electrics factory in building N. The equivalent observations of Crane factory are summarized in table 4.3. The data was collected during a factory tour and interview with the factory manager. The Crane factory produces end-products that are shipped to external customers. All the products of are specifically made to meet customer demands and specifications. Factory produces heavy duty electrical overhead travelling(EOT) cranes with lifting capacity from 10 tons to 500 tons and standard duty EOT cranes with lifting capacity of 10 to 80 tons. (Konecranes 2009d)

Table 4.3. *Crane factory material streams, processes, products and by-products.(Heikkinen T. 2011)*

Crane factory – Middle of building N		
Material in	**Processes**	**Products**
• Steel plate • Copper wiring • Various electrical components • Gear oil and grease • Cutting lubricants • Paints • Other procured components	• Metal cutting(flame and mechanical) • Metal grinding • Submerged arc welding • Machine assembly • Painting • Electrical installation	• Heavy duty special cranes

Side-products/waste		
• Metal scrap	• Energy waste	• Paper
• Cardboard waste	• Hazardous waste (paint)	• Welding powder waste
• Mixed waste	• Wooden waste	

The gear factory that is situated in the east end of building V depicted in appendix 5 manufactures helical gear reducers for all the larger scale cranes that are for example port cranes, rubber tired gantries and heavy duty cranes. The customers of the gear are only internal, for example Trolley factory and Crane factory. The main material flows and production processes in gear manufacturing are listed in table 4.4. (Konecranes 2010e)

Table 4.4. *Gear factory material streams, processes, products and by-products.(Mattila M. 2011)*

Gear factory – East end of building V and parts of building L		
Material in	**Processes**	**Products**
• Steel wheel • Gear oil and greases • Paints • Cutting lubricants • Steel plate • Other procured components	• Turning and milling • Metal drilling • Metal grinding • Electrical hardening • Gearbox painting • Gearbox test-drive • Gearbox assembly • Mechanical parts washing	• Helical gear reducers
Side-products/waste		
• Metal scrap(swarfs, cuttings and turnings) • Cardboard waste	• Energy waste • Hazardous waste (paint + washing water) • Mixed waste	• Wooden waste • Paper

The component factory is situated in the western part of the V building depicted in appendix 5. The factory produces three main products that are used mainly internally. The sizes of manufactured products vary similarly to other factories. The rough description of material flows and processes is listed in table 4.5.

Table 4.5. *Component factory material streams, processes, products and by-products.(Laiho P 2011.)*

Component factory – West end of building V		
Material in	**Processes**	**Products**
• Steel wheel • Gear oil and greases • Paints • Cutting lubricants • Steel plate • Other procured components	• Turning and milling • Plate rolling • Metal cutting(flame and mechanical) • Submerged arc welding • Propane-oxygen flame hardening • Rail wheel and end carriage assembly	• Rail wheel • Rope drum • End carriage

	• Rope drum induction hardening	
Side-products/waste		
• Metal scrap(swarfs and cuttings and turnings) • Cardboard waste	• Energy waste • Hazardous waste (paint) • Wooden waste	• Paper • Welding powder waste • Mixed waste

Trolley factory is located in the building L of the appendix 5. It occupies most of the space in L building. Processes conducted there are mainly assembly, which includes electrical installations, mechanical assembly and minor painting. Trolley factory produces heavy duty crane trolleys and rubber tired gantry trolleys. The trolley factory includes test bench for testing all assembled trolleys. The material flows and processes are listed in table 4.6. (Konecranes 2010f)

Table 4.6. *Trolley factory material streams, processes, products and by-products.(Laiho P. 2011)*

Trolley factory– Parts of building L		
Material in	**Processes**	**Products**
• Trolley bodies • Hook components • Trolley components • Copper wiring • Hoist rope • Oils and greases • Paints • Other procured components	• Trolley assembly • Minor scale painting • Hook block assembly • Trolley test-drive	• Heavy duty crane trolley • Rubber tired gantry trolley • Lifting hook block
Side-products/waste		
• Metal scrap(coppers wires, rope scraps) • Cardboard waste	• Energy waste • Hazardous waste (paint) • Mixed waste	• Wooden waste • Paper

The operations in Gear factory and Components factory are similar. Crane factory produces the largest products and its customers are usually end customers, not internal customers as the case is for the other production factories. Electric factory differs from all the other factories since it mainly assembles electrical components and spare parts. Trolley factory and Electrics factory do not operate heavy metal works machinery, except the test bench in Trolley factory.

4.5.2 Hämeenlinna production processes and products

Production processes in factories are similar to those in Hyvinkää, but the sizes of the products are smaller and the quantities higher. In every building at Hämeenlinna sites there are offices situated at the side of manufacturing facilities. There is a separate dangerous waste storage that is emptied by a subcontractor. Shipping and receiving of items is done by subcontractor.

The gear factory in Hämeenlinna produces helical gear reducers to standard products, so the size of products is smaller than in Hyvinkää gear factory, but the volumes are higher. The processes are typical to metal workshops. The material flows and processes of Hämeenlinna gear factory are listed in table 4.7.

Table 4.7. *Gear factory Hämeenlinna material streams, processes, products and by-products .(Virtanen S., Huhtanen T. 2011)*

Gear factory – KHT		
Material in	**Processes**	**Products**
• Oils and emulsions • Hardening oil • Aluminum • Cast iron • Steel • Washing chemicals • Aerosol propellants	• Turning and milling • Metal drilling • Metal grinding • Electrical hardening • Washing • Assembly	• Helical gear reducers
Side-products/waste		
• Metal scrap(swarfs and cuttings and turnings) • Cardboard waste • **Paper**	• Energy waste • Wooden waste • Waste as product claims • Mixed waste	• Hazardous waste (washing machine waste water, metal paste, used oils and emulsions, used aerosol propellants)

In Hämeenlinna there are two separate hoist assembly lines, HH1 and HH2. The difference of these two manufacturing lines, is in the product sizes they produce. The process in both lines consists of sawing and turning the rope drum. There is manual welding, rope cutting and main, assembly. The material flows are similar to those of Hyvinkää site and they are listed in table 4.8.

Table 4.8. *Hämeenlinna hoist assembly material streams, processes, products and by-products.(Rehn T, Isomäki O. 2011)*

Hoist assembly – HH1 and HH2		
Material in	**Processes**	**Products**
• Steel tube • Semi-finished products • Oils and emulsion • Paints	• Metal sawing • Metal turning • Welding • Hoist rope cutting • Assembly • Painting	• Standard family hoists
Side-products/waste		
• Metal scrap(swarfs and cuttings and turnings, rope pieces) • Cardboard waste • **Mixed waste**	• Energy waste(Plastics from ordered products) • Wooden waste	• Hazardous waste (used aerosol propellants, batteries and accumulators and used oil containers)

HH6, electrics assembly line, consists only of assembly. In this line there is no heavy machinery or such used. The products are cubicles and power inputs for hoists

and cranes. The general operations and material flows of Hämeenlinna electrics factory are listed in Table 4.9.

Table 4.9. *Hämeenlinna electrics assembly material streams, processes, products and by-products.(Kallio K., Lehtinen K.2011)*

Electrics assembly– HH6		
Material in	**Processes**	**Products**
• Copper cable • Electronic components • Electromechanical components • Other semi-finished products	• Assembly	• Electrical devices (cubicles, power inputs etc.)
Side-products/waste		
• Metal scrap(Copper cables) • Cardboard waste • Claims (electric device waste (SER))	• Energy waste (plastics) • Hazardous waste (batteries and accumulators) • Wooden waste(cable rolls)	• Paper • Mixed waste

From all these identified aspects, the most significant for each site, were identified. And from these aspects the targets for future programmes were defined.

4.6 Objectives, targets and programmes

As a result from environmental aspects identification a list of programmes, targets and objectives was made. These programmes are tied to internal requirements, legislative requirements and other stakeholder requirements. The objective is stated, for example "Improvement of energy efficiency" and the target "5% of energy intensity reduction" and then there is a more specific list of programmes that are to be undertaken to achieve the stated targets. Everything stated in the goals, targets and programmes are in line with the corporate environmental policy. In this listing the general timetable is outlined and people responsible stated. As it was depicted in Figure 4.2 the environmental/safety responsible has the chief responsibility over the execution of the programmes with the backup support from top management and in co-operation of supportive roles and unit management.

In the corporation there were five goals defined in the Hyvinkää and Hämeenlinna. Both sites had a goal of improving the energy efficiency, improving waste management, improving chemical safety, educating environmental knowledge and in Hyvinkää monitoring of volatile organic compounds and in Hämeenlinna monitoring the noise emissions. A various list of site specific programmes were listed and the list was represented to the steering group of the project for approval. These programmes were also tied to clauses in corporate environmental policy and identified legislative or other requirements. Other requirements were for example corporate commitment to energy saving through the federation of Finnish technology industries voluntary energy savings contract.

4.7 Environmental performance indicators

The indicators are used to monitor the results of executed programmes and to use the information to steer the actions to right direction for achieving set targets and goals. The idea of the indicator is to relate the actual monitored measure, for example energy consumption, to another measure that describes the level of activity in the operations. This will make annual data comparable between each other. The difficulty of setting up the indicators is due to different operations of Hyvinkää and Hämeenlinna. As Hämeenlinna produces standard products, Hyvinkää produces special products and components. More globally comparable ratio would be measured number, for example the energy consumption, in relation to annual turnover. As the main objectives were improving energy efficiency, improving waste management, improving chemical safety, educating environmental knowledge, monitoring noise emissions and for Hyvinkää monitoring VOC emission. For each objective there were a special metrics defined. Table 4.10 describes the selected indicators for defined objectives.

Table 4.10. *Defined objectives and selected indicators for environmental management system*

Objective	**Indicator**
Improving energy efficiency	$\frac{kWh}{product}$ $\frac{kWh}{turnover}$
Improving waste management	$\frac{waste}{trunover}$
Improving chemical safety	$Checklist$
Educating environmental knowledge	$Education\ rate\ (\%)$
Monitoring noise emissions	$Number\ of\ complaints$
Monitoring VOC emissions	$Total\ VOC\ emissions$

In addition to these performance indicators, the bare values of waste, energy, material consumption and water consumption will be tracked and reported globally. Checklist indicator in chemical safety means a list with certain amount of basic tasks and situations which give you positive result if the task is in place and the situation is good and vice versa. This will yield a certain comparable numeric value.

4.8 Defining roles and responsibilities

As a part of the building of environmental management system the roles and responsibilities need to be defined. This is very important in order to get the system running. The roles and responsibilities and also the authorities have to be defined for a successful environmental system. The outline of environmental management organization is depicted in Figure 4.3.

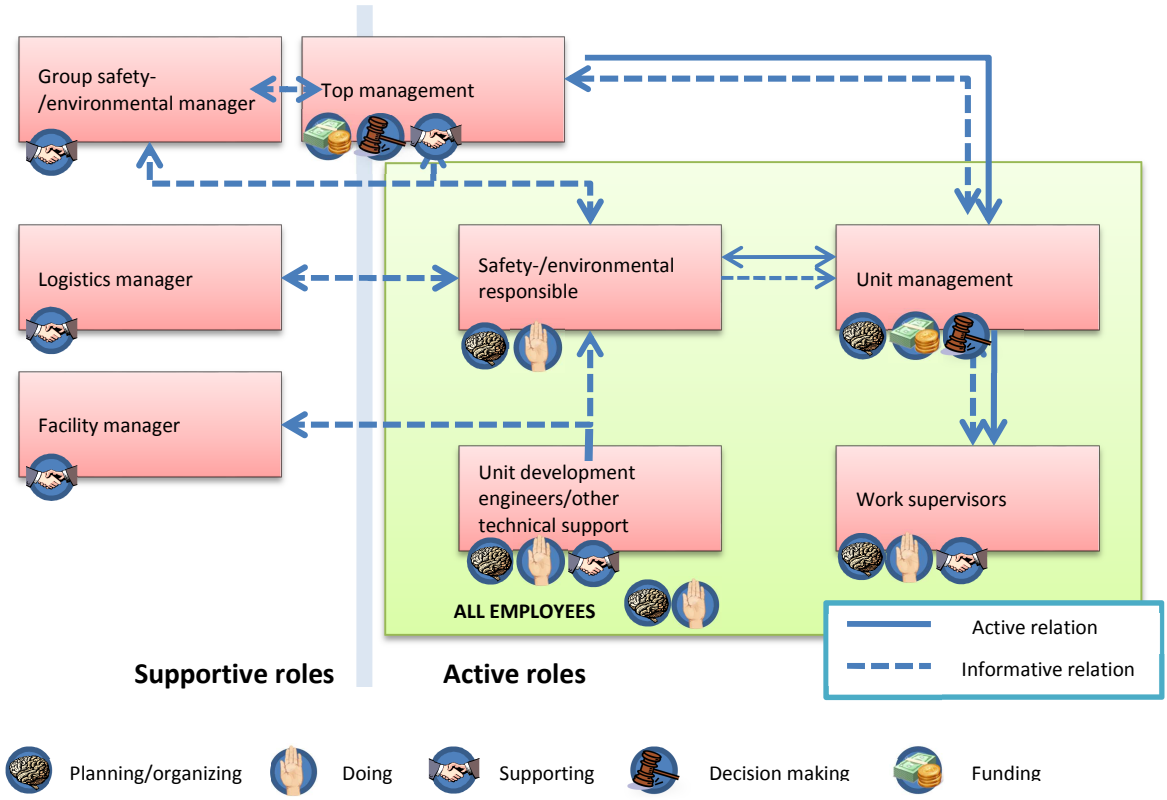


Figure 4.3 *Outline of environmental management organization*

The solid line represents a decision making connection to respective direction and the dashed line informative connection. The four roles: safety/environmental responsible, unit management, unit development engineers and unit supervisor, all work in the in direct contact with the employee interface. This means that they have direct relation to actual workforce. The supportive roles on left side can be from different legal companies, but provide and require information to and from the safety/environmental responsible who is the core person in environmental management system. This structure is supported by present model of health and safety management. Unit is limited to operation that means the same as division of production facilities in section 3.5. The idea in the organizational structure was to use the present structure as far as possible and not to create new, further complicating organizational routes. The risk in this approach is that the current organization is already overloaded with work and cannot take responsibility of environmental management accordingly. More specific responsibilities were defined and written in one of the record of the environmental management system.

4.9 Defining standard required procedures

The ISO 14001 standard requires that certain procedures need to be in place in organization to comply with the standard. These are for example, procedures to find out legislative requirements, identifying environmental aspects, conducting managements review and so on. In addition the standard requires that record of documentation has to

be kept from certain processes. As it can be seen in appendix 5, the title level of each management system corresponds quite well to each other. It was decided that operational health and safety management should be included in procedures already at this phase of writing environmental management processes. The movement towards certified system in OHSAS 18001 is getting stronger and stronger and certification can be probable in near future.

The title listing of appendix 5 lists vaguely the sort of procedures that should be in place. It does not mean that every procedure should be written as a separate document. Therefore it was decided to combine some of topics under larger aggregates. Table 4.11. lists what topics produced a procedure or other documentation.

Table 4.11. *Written procedures to correspond ISO 14001 standard requirements*

Clause and title in standard	**Written documentation and tools**
4.1. Scope of EMS	Record
4.2 Environmental policy	Procedure, using Global policy
4.3.1 Environmental aspects	Procedure, Template and record
4.3.2 Legal and other requirements	Procedure and tracking tool
4.3.3 Objectives, targets and programmes	Procedure, Template and record
4.4.1 Resources, roles, responsibilities and authority	Record, combined with 4.4.2
4.4.2 Competence, training and awareness	Look 4.4.1
4.4.3 Communication	Procedure and tools
4.4.4 Documentation	Procedure with 4.4.5 and 4.5.4
4.4.5 Control of documents	Look 4.4.4
4.4.6 Operational control	Not specified in any document
4.4.7 Emergency preparedness and response	Procedure
4.5.1 Monitoring and measurement	Procedure
4.5.2 Evaluation of compliance	Specified in separate procedure such as 4.3.2 and 4.5.5
4.5.3 Nonconformity, corrective and preventive action	Specified in 4.5.5 and 4.6
4.5.4 Control of records	Look 4.4.4
4.5.5 Internal audit	Procedure, Template, Record
4.6 Managements review	Procedure, Record

The scope of the environmental management system was decided to be in a record. This way the scope could be easily changed in this record, not in every document one by one. In every procedure there is scope defined and in most cases it is just a reference to this record which holds the actual definition of environmental management system.

As mentioned earlier the global environmental policy was already in place before the construction of local environmental management system and it was decided that local locations use the global policy. The procedure 4.2 states how the policy is received and used locally in Konecranes Finland.

The Konecranes way to conduct environmental aspect identification was stated in a procedure. It is meant to work hand in hand with the template of environmental aspect identification. It defines who and how often will conduct identification. A record, which is filled template, is kept from all the identifications. Procedure for legal requirements was made to state who and how often conducts the legislation review. In addition to procedure a third party law register tool is used to help keep track of present legislation and prepare for future regulations. How and when the objectives, targets and programmes are set, was defined in its own procedure. A template was made to work hand in hand with it. Records will be kept from all the defined objects, targets and programmes. The defined procedure 4.3.3 uses as input environmental policy, environmental aspect identification records and identified legal and other requirements. This is one of the most important procedures for environmental management system operational planning and control.

A record is kept of all the roles in environmental management system and the responsibilities and authorities are saved in this record. This record is combined with clause 4.4.2 to identify the needed competence and training of all the different roles. In the procedure communication methods are stated and who and how communicates information related to environmental management system. The right mediums used, are also listed in it.

Documentation and records control are all defined in the same way. In the procedure the different types of documents are defined. The main storage method is also listed in it and who and when the updates on outdated documentation are done. Operation control was not written into an own specific procedure because it was seen that it is included in procedure clause 4.4.3. How Konecranes Finland prepares for emergencies is stated in its own separate procedure. It states how and when emergency response plan is updated and how the exercises and are held.

Monitoring and measurement is defined in its own procedure, which holds information about when and how the indicators listed in chapter 4.7 are updated. How Konecranes evaluates compliance with the system and other requirements is defined in separate procedures such as 4.3.2 Legal and other requirements and management review. If there is nonconformity found within the procedures or requirements and the operations, corrective and preventive actions are done according to procedures of internal audit and management review.

Who is eligible to conduct internal audit and how it is done, is stated in procedure 4.5.5 internal audit. The audit intervals are defined in it and it produces record, which is audit report. Audition is done according to auditing plan that is created case by case. According to procedure 4.6 management review is conducted and a report of it has to be done.

The general approach to documenting the environmental management system was done, as it can be seen, quite heavily from standard point of view. This may cause too much of paperwork. It was seen as a logical and easy way to start the management system development. In the future the amount documentation could and should be reduced and integrated. While this initial version of environmental management system consists of 10 different processes it might be substantially lower amount in near future.

4.10 Time and resources used for constructing the system

As one part of project management is the analysis of how the planned resource usage was met and how the planned timetable kept. The main responsibility of the project of building the environmental system was on this diploma thesis and some support from the other personnel working on health, environment and safety issues. Required time resources were initially outlined in the first steering group meeting in the beginning of the project. The planned and realized man-hours of the project are listed in table 4.12.

Table 4.12. *Planned and realized work hours spent into constructing of environmental management system*

Person/Role	Planned	Realized
Main responsible/Thesis worker	1120 (full time 7 months)	1002,5
Safety/environmental responsible (Two persons)	106	59
Steering group (4 persons)	30	6
Factory manager(7 persons)	28	16,5
Group environmental manager	57	45
Other personnel(Facility management, logistics manager, development engineers and job supervisors) (5 persons)	10	9,5
Total man-hours	1351	1138,5

The number of hours per person/role is total number of all the personnel under the same title. For example all the factory manager used 16,5 man-hours all together for the construction phase. The realized man-hours for thesis worker has been done by calculating the amount of work hours in the whole seven month period and subtracted all the appointments not exclusively related to building of environmental management system building. Group environmental manager worked with the management system construction and also as superior to thesis worker. The man-hours of group environmental manager include some hours of guiding the thesis work and other general managerial tasks.

Table 4.12 represents a rough outline of used time resources and some persons have definitely done more hours that is listed. This list only includes the work-hours that involved the main responsible/thesis worker somehow.

4.11 Evaluation of selected build-up approach

The personnel involved in the build-up process were mainly health-, safety- and quality personnel in addition with management from different units and site managers, both from Hyvinkää and Hämeenlinna. After the build-up process a series of interviews were conducted to test whether the persons involved thought the process was successful or not. There were two different groups. Firstly the unit managers and other personnel who participated in the environmental aspect identification process and secondly the steering group who was responsible of decision making related to build-up.

First target group thought that on scale 1 to 5, the importance of identification of environmental aspects is 4 or 5. From 6 participant the median was average was 4,5. The target group thought that the method used to identify the initial environmental aspects was sufficient. 4 out of 6 persons rated it as a 4 or 5. Two persons thought that the method was not sufficient. All the persons replied that the used form and grading system used in the identification process was moderately understandable or very understandable. When asked about who they think should be responsible of doing the identification in their unit, all answered that the unit managers, themselves are the persons responsible. Some added that unit development engineers and the whole team might be required. The question of whether the identification process should be carried out as it is, or modified somehow, most could not respond. Some speculated that due to the fact that this is a whole new thing, there is no reference. One responded that more educational approach could be conducted and targeted to wide range of personnel. One respondent wanted that the personnel involved in defining environmental processes should have also an active approach in making these processes come to life in the actual production level. Unit managers thought that mostly communication related to environmental management system build-up and especially environmental aspect identification was sufficient. Free word from the respondents about environmental management in general had a positive tone, but also a demand to concentrate on the most important issues and greatest risks.

Second target group, the steering group, was asked to rate different stages of the build-up approach with numbers from 1 to 5, which represented 1 nothing was done accordingly and 5everything was done. Three persons out of six answered to these. Neither of site managers answered, which is a strong indicator about their commitment. The three answers came from health-, safety-, environment and quality representatives. All the respondents thought that the steering group consisted of right persons, although stronger involvement from the site managers was called out for. Three steering group meetings in the time window of 7 months of build-up process were seen sufficient. All three responses stated that most of the initial legal and other requirements were identified. The goals, targets and programmes were mostly defined to match the identified environmental aspects. The respondents thought that roles were defined or well defined. Two out of three respondents thought that documentation was done according to standard requirements and one stated that the documentation was perfectly

done to meet the standard requirements. Two out of three though that there were good amount of procedures made to sustain the environmental management system and one thought that the procedures were sufficient. All the respondents agreed that the approach depicted earlier, is good approach to build-up an EMS in crane manufacturing. And they agreed that the system should be certified, but it was unclear when. One respondent speculated that the true benefits of management systems in general will be unachievable as long as the local management is not truly committed to use the management systems as a tool.

5 CONCLUSIONS AND FURTHER ACTIONS

5.1 Conclusions

The aim of the thesis was to find out how an environmental management system according to ISO 14001 could be constructed in crane manufacturing. Tasks required for system build up were the following: present state analysis, environmental aspect identification, charting out the organization readiness with SWOT analysis and questionnaire, identifying external and internal requirements, setting goals, targets, programs and metrics, creating organizational draft and finally defining all the ISO 14001 required procedures.

The initial present state analysis was fruitful and it yielded the project plan, which was used for later steps in the system build-up process. The findings were that, the environmental management system build-up had already begun on operational level and shared, top-level, procedures for Hämeenlinna and Hyvinkää were needed. The possible shared bureaucratic resources with quality management were identified.

Questionnaire produced data that, the organization was carefully optimistic about the environmental management system, but they lacked actual information about the required work itself. The responsibility definitions were also unclear to personnel.

Environmental aspect identification was done to Hyvinkää and Hämeenlinna facilities and the most significant issues were identified to be facility energy consumption, waste management, chemical safety, lack of information, noise- and VOC emissions. From the analysis a program listing was created to improve the environmental performance and metrics were defined to be the following:

- Energy consumption: $\frac{kWh}{product}$ $\frac{kWh}{turnover}$
- Waste management: $\frac{waste}{trunover}$
- Chemical safety: a checklist
- Environmental knowledge: Education rate (%)
- Noise emission monitoring: Number of complaints
- VOC emission: Total VOC emission

Organizational model was formed to correspond to the present management structures of Konecranes. In the model the environmental and safety responsible, was defined to be planning responsible and the line organization was defined to be mainly responsible to conduct the actual procedures.

The build-up approach was illustrated earlier in a form of flow diagram. The successfulness of the approach was studied by interviewing people related to the build-up process and the feedback was mostly good, all though the feedback from operative management representatives was lacking. This is a sign of lacking management commitments and it should be addressed since it was one of the crucial factors of successful management system build-up. The successfulness of aspects identification was interviewed from the participants, and it was mostly seen as good and sufficient approach, all though as the subject is quite new to personnel, they did not have idea what could be good way to identify environmental aspects and what could be inadequate. From these findings training for the operational personnel should be held and an ideal case of environmental aspect identification should be one topic of the training.

5.2 Recommendations for future development

5.2.1 Top management commitment

The critical factors of developing environmental management system were already discussed in the earlier sections and it is good to revisit them here. The identified critical factors can be seen in Konecranes also. In the near future the top management commitment should be increased. The buildup process of the system did not come from the local company management but rather from the pressure of the corporation. This is not a good sign of the commitment of top managers to environmental management system and through pressure, the commitment might be negatively affected. Commitment of the managers should be enhanced through education or appointments and the management reviews should be conducted as thoroughly as possible so the top management would actively participate in the decision making.

5.2.2 Training plan

For the involvement of the personnel, trainings should be conducted. A general training about the most significant environmental aspects identified and the means to control them should be held. The training is important to transfer even the basic knowledge about the environmental management of the company to every personnel. The initial plans for this general education will be held during the autumn 2011. In addition to the general training other training modules are also required in near future. These modules could be such as: auditor training module, management training module and environmental aspect identification training module and specific training for buyers and additional training for marketing and sales. Target group for auditor training could be health, safety, environment and quality personnel, who could audit each other system and provide useful information about the compliance of the systems. Management

training module would be aimed to top management mostly and it would consist of more detailed information about the actual environmental management system and how it works and how the management can use the information in their decision making. The last training module about environmental aspect identification would be pointed to unit management and unite development engineers. This training would consist of material on how to divide the unit into functional groups and how to identify the material and energy flows related to these functions. In addition the module could encompass environmental impact assessment training to improve the knowledge on how to rate and quantify the impacts to environment from the production. The training for buyers would consists on education about how to compare the environmental impacts of bought products, so they would have the basic knowledge to choose a more environmentally friendly purchase. These modules are the most important ones, but other modules could be also devised such as training for marketing personnel and subcontractor training.

5.2.3 Improved environmental aspect identification

Initial environmental aspects were identified during the thesis. It is a perquisite for environmental management system build-up as it was discussed earlier. For better understanding to impacts caused to environment from crane manufacturing, a more thorough assessment should be conducted.

It should start from identifying all the sub-processes and all the material and energy flows in and all products, side-products, wastes and emissions. This process should also conclude material transportations inside the manufacturing premises. Ideally all the material and energy flows should be presented in numbers, so a whole model of crane manufacturing could be built. An ideal approach for the future was discussed earlier in chapter 2.5.1. A good addition would be to have a machine list, which would encompass all the larger industrial machines and basic information, such as power consumption, age and similar things.

5.2.4 Towards integrated management system

The three management systems: quality, health- and safe and environment management system, are very much similar. Therefore a unified single management system would be ideal. The unification would reduce the amount of time required for management procedures. Especially management reviews could all be handled in a single meeting, instead of three different meetings. The safety risk assessment and environmental aspect identification share a lot of common terminology and methodology, so collaboration on these subjects would also yield good results. Also the document management and information systems could be integrated more thoroughly.

5.2.5 System certification

Before the system can be certified, several steps must be first taken. Internal audit needs to be conducted. It is not mandatory, but it will help Konecranes itself to spot the weaknesses in the system. This audit will reveal non-conformances in the system and these should be taken care of. Secondly a management review needs to be held before external certification audit. Management should check all the documentation and processes as well as other important documents, such as objectives, target and goals, before the third party independent audit. Thirdly the training for whole personnel should be conducted and all the roles, responsibilities and authorities should be informed to the respective employees.

REFERENCES

LITERATURE

Anjaneyulu, Y. & Manickam, V. 2007. Environmental Impact Assessment Methodologies. Hyderabad, IND: Global Media., pISBN: 9788178001449, Global Media. All rights reserved. pp. 32-34.

Ayres, R. 1997. Metals recycling: economic and environmental implications. Resources, Conservation and Recycling, Volume 21, Issue 3, November 1997, ISSN 0921-3449, pp. 145-173

Bansal, P. & Howard, E., 1997. Business and the Natural Environment. Butterworth Heinemann, Oxford, 222 p.

Barnett, T. 2006. "Corporate Social Responsibility." Encyclopedia of Management. Ed. Marilyn M. Helms. 5th ed. Detroit: Gale. Gale Virtual Reference Library, pp. 137-141 [www] .[referred 11.5.2011]

Brundtland, G.H 1987. Report of the World Commission on Environment and Development. 1987, 42/187. [WWW][referred 6.1.2012] Available: http://www.regjeringen.no/upload/SMK/Vedlegg/Taler%20og%20artikler%20av%20tidligere%20statsministre/Gro%20Harlem%20Brundtland/1987/Address_at_Eighth_WCED_Meeting.pdf

Carrol, A. B. 1991. The Pyramid of Corporate Social Responsibility: Toward the Moral Management of Organizational Stakeholders,. Business Horizons, July-August 1991, pp. 39-48

Carrol, A. B. 1999. Corporate Social Responsibility Evolution of a Definitional Construct. Business & Society, Vol. 38 No. 3, September 1999 © 1999 Sage Publications, Inc, pp. 268-295

Carroll, A.B. & Buchholtz A.K. 2003. Business and Society: Ethics and Stakeholder Management. 5th ed. Australia: Thomson South-Western, p. 36.

Eco Management and Audit Scheme [WWW] ,[referred:4.3.2011] Available: http://ec.europa.eu/environment/emas/

Environmental management The ISO 14000 family of International Standards [WWW], [referred: 4.3.2011] Available: http://www.iso.org/iso/theiso14000family_2009.pdf.

EUROFER. 2009. Environmental legislation in the EU, slide.

Gill, D. W. 2005. "Business Ethics." Encyclopedia of Science, Technology, and Ethics. Ed. Carl Mitcham. Vol. 1. Detroit: Macmillan Reference USA. Gale Virtual Reference Library. Web. 19 Aug. 2011, pp. 272-281.

Hussey, D. M. & Eagan, P. D. 2005. Using structural equation modeling to test environmental performance in small and medium-sized manufacturers: can SEM help SMEs, Journal of Cleaner Production 15, Volume 15, Issue 4, 2007, pp. 303-312

Johnston, N. & Labonne, J. 2008 Why do manufacturing facilities introduce environmental management systems? Improving and/or signaling performance, Ecological Economics, Volume 68, Issue 3, 15 January 2009, pp. 719–730

Kallio, T. 2004. ORGANIZATIONS, MANAGEMENT AND NATURAL ENVIRONMENT – From Problems to Organizational Environmental Studies Towards a General Theory of Business-Nature Relationship, ISBN 951-564-167-5 © Tomi J. Kallio & Turku School Of Economics and Business Administration, Paino-Raisio Oy.

Keijzers, G. 1999. The evolution of Dutch environmental policy: the changing ecological arena from 1970–2000 and beyond 1999. Journal of Cleaner Production, volume 8, issue 3, June 2000, pp. 179–200.

King, A. A. & Lenox, M. J. 2000. Industry Self-Regulation without Sanctions: The Chemical Industry's Responsible Care Program. The Academy of Management Journal, Vol. 43, No. 4 (Aug., 2000), pp. 698-716

Konecranes 2005a Konecranes annual report 2005[www], [referred: 8.2.2011] Available: http://www.konecranes.com/portal/eng/investors/reports_and_result_presentations/.

Konecranes 2009b Konecranes annual report 2009[www], [Referred: 8.2.2011] Available: http://www.konecranes.com/portal/eng/investors/reports_and_result_presentations/.

Konecranes 2010c Electrics factory presentation 2010, Konecranes intranet

Konecranes 2009d Crane factory presentation 2009, Konecranes intranet

Konecranes 2010e Gear factory presentation 2010, Konecranes intranet

Konecranes 2010f Components and trolley factory presentation 2010, Konecranes intranet

Konecranes 2011g Konecranes Finland Quality Manual version 1.1 2011

Konecranes 2011h Konecranes Safety Handbook 2011

Konecranes 2010i Konecranes Annual Report 2010 [WWW] [referred: 20.7.2011] Available: http://www.konecranes.com/files/attachments/ir/annual_reports/kc_2010_en_v03.pdf

Konecranes 2011j Konecranes Finland Quality Certificate, Det Norske Veritas

Lefkowitz, J. 2007. Corporate Social Responsibility. Encyclopedia of Industrial and Organizational Psychology. Ed. Steven G. Rogelberg. Vol. 1. Thousand Oaks, CA: Sage Reference, 2007. ISBN 1–4129–2470–7, p114-118.

Matten, D., Crane, A. & Chapple, W. 2003. Behind the Mask: Revealing the True Face of Corporate Citizenship. Journal of Business Ethics, Volume 45, pp. 109–120

McGraw-Hill Concise Encyclopedia of Science and Technology , 2005. 5th ed. New York: McGraw-Hill Professional, p831.,[WWW] [referred: 4.3.2011] Available: http://www.gale.cengage.com/.

National Research Council Staff 1999. Industrial Environmental Performance Metrics: Challenges and Opportunities, National Academies Press, ISBN-13: 978-0-309-06242-8, 264 p.

Norgate, T.E., Jahanshahi, S., Rankin, W.J. 2007. Assessing the environmental impact of metal production processes. Journal of Cleaner Production, Volume 15, Issues 8-9, 2007, ISSN 0959-6526, pp. 838-848

Pesonen, H., Hämäläinen, K., Teittinen, O. 2005. Ympäristöjärjestelmän rakentaminen. Talentum Mediat Oy, ISBN 952-14-0891-X

Pohjola, T., Talentum Media Oy 2003. Johda ympäristöasioita tehokkaasti. 236 p. ISBN 952-14-0731-X .

Raines, S. 2002. Implementing ISO 14001—An International Survey Assessing the Benefits of Certification Corporate Environmental Strategy, Vol. 9, No. 4 December 2002, pp. 418-426

Sadler D. & Lloyd, S. 2009. Neo-liberalising corporate social responsibility: A political economy of corporate citizenship, Geoforum, Volume 40, Issue 4, July 2009, pp. 613–622

Sikka, P. 2010. Smoke and mirrors: Corporate social responsibility and tax avoidance. Accounting Forum, Volume 34, Issue 3-4, 2010, pp 153–168

Simmering, M. J. 2006. "SWOT Analysis." Encyclopedia of Management. Ed. Marilyn M. Helms. 5th ed. Detroit: Gale, 2006. Gale Virtual Reference Library. Web. 13 May 2011. pp. 771-773

Sklair, L. & Miller, D. 2010. Capitalist globalization, corporate social responsibility and social policy, Critical Social Policy, Volume 30, Number 4, November 2010, pp. 472-495

Stockholm convention 1972 [www], [referred: 24.2.2011] Available: http://www.unep.org/Documents.Multilingual/Default.asp?documentid=97.

Teknologiateollisuus ry. 2010. Ympäristölainsäädäntö – seuranta ja vaikuttaminen[WWW], [referred: 24.2.2011] Available: http://www.teknologiateollisuus.fi/file/9277/ymparistolainsaadanto_verkkoversio_2009 2010.pdf.html.

The ISO Survey 2008. ISBN 978-92-67-10508-6 © ISO, 2009-11/40 [WWW], [referred: 4.3.2011] Available: http://www.iso.org/iso/survey2008.pdf .

UNEP 2011a. UNEP Year Book 2011: Emerging Issues in Our Global Environment © 2011 United Nations Environment Programme ISBN 978-92-807-3101-9 NEP/GC.26/INF/2 DEW/1300/NA [WWW] Available: http://www.unep.org/yearbook/2011/pdfs/UNEP_YEARBOOK_Fullreport.pdf

UNEP 2011b. Milestones [WWW] [referred: 18.3.2011] Available: http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=287

UNEP 2010c. UNEP, PRE-SME – Promoting Resource Efficiency in Small & Medium Sized Enterprises Industrial training handbook, Copyright © United Nations Environment Programme, 2010 [WWW] [referred: 25.3.2011] Available: www.unep.fr/scp/presme/pdf/PRE-SME_handbook.pdf

Valtion ympäristöhallinto, EMAS-järjestelmä [WWW] [referred 17.6.2011] Available: http://www.ymparisto.fi/default.asp?contentid=2125

Zobel, T., Almroth, C., Bresky, J. & Burman, J-O. 2001. Identification and assessment of environmental aspects in an EMS context: an approach to a new reproducible method based on LCA methodology, Journal of Cleaner Production, Volume 10, Issue 4, August 2002, ISSN 0959-6526, pp. 381-396

Zutshi, A. & Sohal, A. 2002. Environmental management system adoption by Australasian organizations: part 1: reasons, benefits and impediments. Technovation 24, Volume 24, Issue 4, April 2004, pp. 335–357

Yeo Soo Wee & Hesan A. Q. 2005. Development and validation of critical factors of environmental management. Industrial Management & Data Systems, Volume 105, Issue 1, pp. 96-114

INTERVIEWS

Heikkinen Torsti, Crane factory manager, Konecranes Finland PLC, Interview 7.4.2011

Huhtamäki Tapani, Process Engineer, Konecranes Finland PLC, Interview 28.3.2011

Isomäki Olli, HH1 & HH2 Supervisor, Konecranes Finland PLC, Interview 20.4.2011

Kallio Kai, HH6 Factory manager, Konecranes Finland PLC, Interview 20.4.2011

Laiho Pasi, Component and Trolley factory manager, Konecranes Finland PLC, Interview 15.4.2011

Lehtinen Kimmo, HH6 Supervisor, Konecranes Finland PLC, Interview 20.4.2011

Martin Janne, Electrics factory manager, Konecranes Finland PLC, Interview 8.4.2011

Mattila Mika, Gear factory manager, Konecranes Finland PLC, Interview 8.4.2011

Pirinen Johanna. MSc. Corporate responsibility manager, Konecranes PLC. Interview 1.3.2011.

Rehn Tony, HH1 & HH2 Factoy manager, Konecranes Finland PLC, Interview 20.4.2011

Virtanen Sami, KHT Factory manager, Konecranes Finland PLC, Interview 28.3.2011

Vuorinen Sauli. MSc. Safety manager, Konecranes Finland PLC. Interview 1.3.2011.

STANDARDS AND SPECIFICATIONS

SFS-EN ISO 14001:2004 Finnish Standards Association SFS.

SFS-EN ISO 9001:2008 Standard

Appendix 1

Kyselylomake Ympäristöjärjestelmästä

Kalervo
Aho

Työtehtävä: _____

Toimipaikka:

HÄMEENLINNA	HYVINKÄÄ	GROUP

Rakennus: _____

Asema organisaatiossa:

Työntekijä	Johto	Asiantuntija

Onko ympäristöasiat näkyneet vahvemmin yksikkösi toiminnassa viimeisen kahden vuoden aikana?

Kyllä	Ei

Onko tiedossasi asiakkaan vaatimuksia tai kyselyitä tuotteiden/tuotannon ympäristövaikutuksista?

Kyllä	Ei

Jos vastasit kyllä niin
mitä? _____
_____
_____
_____

Kenelle kuuluu mielestäsi vastuu yksikkötasolla ympäristöjärjestelmän hoitamisesta?

_____
_____

Voisiko ympäristöasioiden järjestelmällisesti johtamisesta olla haittaa/hyötyä yksiköllesi?

1 =suuri haitta	2	3	4 = suuri hyöty

Jos voi niin mitä: _____
_____
_____
_____

Tarvitseeko tehtaan toiminta ympäristöluvan?

Kyllä	Ei

Onko organisaatiosi valmis resursoimaan työtä ympäristöjärjestelmälle?

Kyllä	Ei

Kuinka monta miestyötuntia/kk? _____

Mitä odotat toimivalta järjestelmältä? _____

_____

_____

Koetko, että ympäristöasioiden hoitaminen yksikössäsi on tarpeellista?

1 = ei tarpeellista	2	3	4 =hyvin tarp.

Jatkuu toiselle puolelle….

Tunnistatko yksikkösi toiminnan aiheuttamia ympäristövaikutuksia?	Kyllä	En

Jos tunnistat niin mitä: _____

_____

_____

_____

_____

Muistatko onko yksikössäsi tapahtunut ympäristövahinkoa lähihistoriassa?

Kyllä	En

Jos muistat niin mikä se oli?: _____

_____

_____

_____

_____

Onko ympäristöriskeihin varauduttu yksikössäsi riittävän hyvin?	Kyllä	Ei

Tunnistatko yksikössäsi energiatehokkuudeltaan heikkoja tiloja/laitteita/käytänteitä?

_____

_____

_____

_____

_____

Tiedätkö mitä jätejakeita yksikkösi tuottaa?	Kyllä	En

Mitä?: _____

_____

_____

Tiedätkö mitä kemikaaleja yksikössäsi käytetään ja kuinka paljon?	Kyllä	En

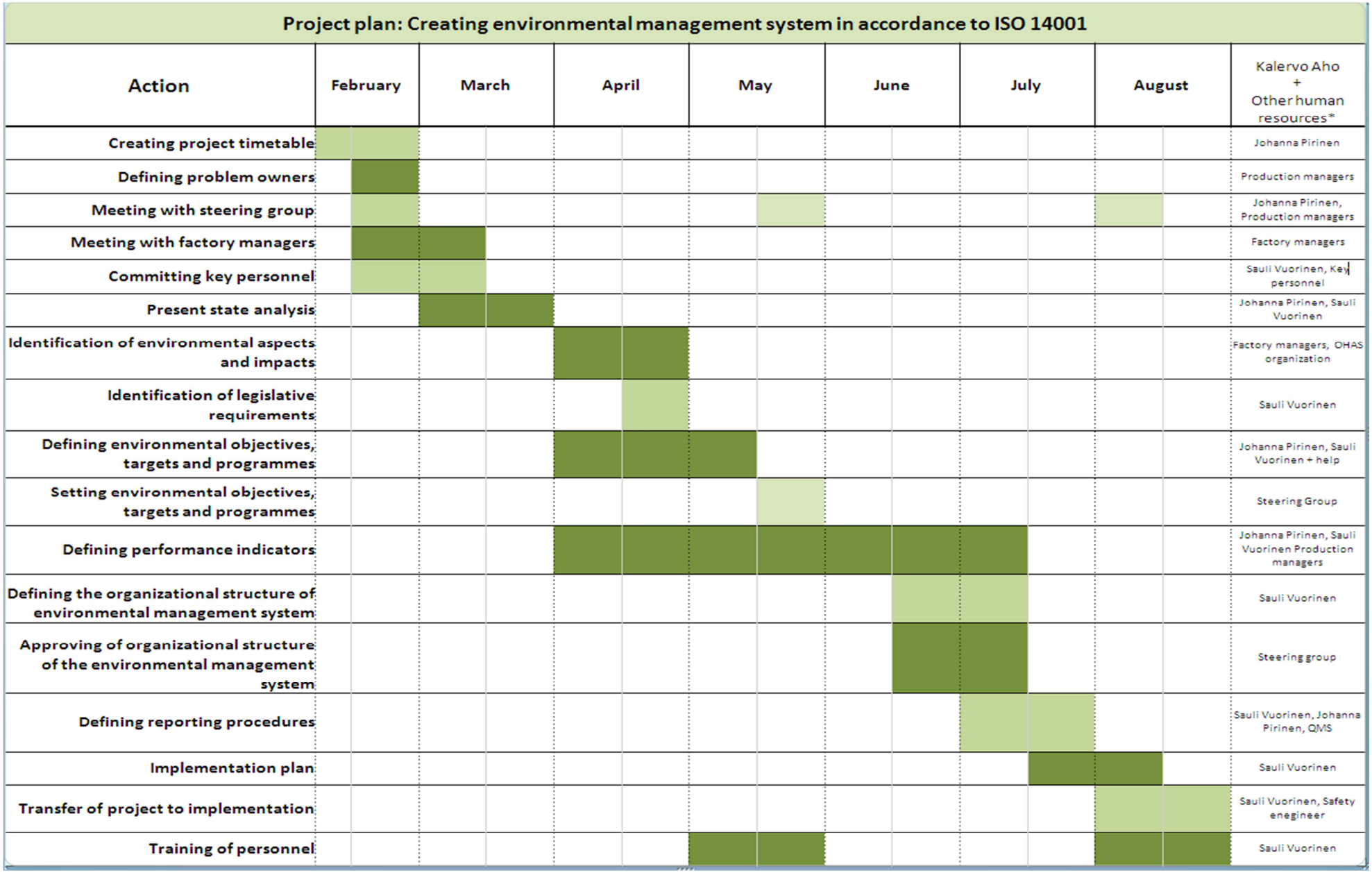
Appendix 2

Correspondence of ISO 14001, ISO 9001 and OHSAS 18001 standards (SFS-EN ISO 9001:2008)

ISO 14001:2004	ISO 9001:2008	OHSAS 18001:2007
4.Environmental management system requirements(title only)	4. Quality management system(title only)	4. OH&S management system elements(title only)
4.1 General requirements	4.1 General requirements 5.5 Responsibility, authority and communication 5.5.1 Responsibility and authority	4.1 General requirements
4.2 Environmental policy	5.1 Management commitment 5.3 Quality policy 8.5.1 Continual improvement	4.2 OH&S policy
4.3 Planning (title only)	5.4 Planning (title only)	4.3 Planning(title only)
4.3.1 Environmental aspects	5.2 Customer focus 7.2.1 Determination of requirements related to the product 7.2.2 Review of requirements related to the product	4.3.1 Hazard identification, risk assessment and determining controls
4.3.2 Legal requirements and other requirements	5.2 Customer focus 7.2.1 Determination of requirements related to the product	4.3.2 Legal and other requirements
4.3.3 Objectives, targets and programme(s)	5.4.1 Quality objectives 5.4.2 Quality management system planning 8.5.1 Continual improvement	4.3.3 Objectives, targets and programme(s)
4.4 Implementation and operation (title only)	7 Product realization (title only)	4.4 Implementation and operation (title only)
4.4.1 Resources, roles, responsibility and authority	5.1 Management commitment 5.5.1 Responsibility and authority 5.5.2 Management representative 6.1 Provision of resources 6.3 Infrastructure	4.4.1 Resources, roles, responsibility, accountability and authority
4.4.2 Competence, training and awareness	6.2.1 (Human resources) General 6.2.2 Competence, training and awareness	4.4.2 Competence, training and awareness
4.4.3 Communication	5.5.3 Internal communication 7.2.3 Customer communication	4.4.3 Communication, participation and consultation
4.4.4 Documentation	4.2.1 (Documentation requirements) General	4.4.4 Documentation
4.4.5 Control of documents	4.2.3 Control of documents	4.4.5 Control of documents
4.4.6 Operation control	7.1 Planning of product realization 7.2 Customer-related processes 7.2.1 Determination of requirements related to the product 7.2.2 Review of requirements related to the product 7.3.1 Design and development planning 7.3.2 Design and development inputs 7.3.3 Design and development outputs	4.4.6 Operation control

	7.3.4 Design and development review 7.3.5 Design and development verification 7.3.6 Design and development validation 7.3.7 Control of design and development changes 7.4.1 Purchasing process 7.4.2 Purchasing information 7.4.3 Verification of purchased product 7.5 Product and service provision 7.5.1 Control of production and service provision 7.5.2 Validation of processes for production and service provision 7.5.5 Preservation of product	
4.4.7 Emergency preparedness and response	8.3 Control of nonconforming product	4.4.7 Emergency preparedness and response
4.5 Checking (title only)	8 Measurement, analysis and improvement (title only)	4.5 Checking (title only)
4.5.1 Monitoring and measurement	7.6 Control of monitoring and measuring equipment 8.1 (Measurement, analysis and improvement) General 8.2.3 Monitoring and measurement of processes 8.2.4 Monitoring and measurement of product 8.4 Analysis of data	4.5.1 Performance measurement and monitoring
4.5.2 Evaluation of compliance	8.2.3 Monitoring and measurement of processes 8.2.4 Monitoring and measurement of product	4.5.2 Evaluation of compliance
-	-	4.5.3 Incident investigation, nonconformity, corrective action and preventive action (title only)
-	-	4.5.3.1 Incident investigation
4.5.3 Nonconformity, corrective action and preventive action	8.3 Control of nonconforming product 8.4 Analysis of data 8.5.2 Corrective action 8.5.3 Preventive action	4.5.3.2 Nonconformity, corrective action and preventive action
4.5.4 Control of records	4.2.4 Control of records	4.5.4 Control of records
4.5.5 Internal audit	8.2.2 Internal audit	4.5.5 Internal audit
4.6 Management review	5.1 Management commitment 5.6 Management review (title only) 5.6.1 General 5.6.2 Review input 5.6.3 Review output 8.5.1 Continual improvement	4.6 Management review

Appendix 3


Project plan: Creating environmental management system in accordance to ISO 14001
Action
February
March
April
May
June
July
August
Kalervo Aho + Other human resources*
Creating project timetable
Johanna Pirinen
Defining problem owners
Production managers
Meeting with steering group
Johanna Pirinen, Production managers
Meeting with factory managers
Factory managers
Committing key personnel
Sauli Vuorinen, Key personnel
Present state analysis
Johanna Pirinen, Sauli Vuorinen
Identification of environmental aspects and impacts
Factory managers, OHAS organization
Identification of legislative requirements
Sauli Vuorinen
Defining environmental objectives, targets and programmes
Johanna Pirinen, Sauli Vuorinen + help
Setting environmental objectives, targets and programmes
Steering Group
Defining performance indicators
Johanna Pirinen, Sauli Vuorinen Production managers
Defining the organizational structure of environmental management system
Sauli Vuorinen
Approving of organizational structure of the environmental management system
Steering group
Defining reporting procedures
Sauli Vuorinen, Johanna Pirinen, QMS
Implementation plan
Sauli Vuorinen
Transfer of project to implementation
Sauli Vuorinen, Safety enegineer
Training of personnel
Sauli Vuorinen