

Supply chain environmental requirements and EMS

Is there an interface?

Alexandra Tsitsia

Supervisors

Beatrice Kogg

Dagmara Nawrocka

Vladimir Dobes

Thesis for the fulfilment of the
Master of Science in Environmental Management and Policy
Lund, Sweden, October 2004

© You may use the contents of the IIIIEE publications for informational purposes only. You may not copy, lend, hire, transmit or redistribute these materials for commercial purposes or for compensation of any kind without written permission from IIIIEE. When using IIIIEE material you must include the following copyright notice: 'Copyright © IIIIEE, Lund University. All rights reserved' in any copy that you make in a clearly visible position. You may not modify the materials without the permission of IIIIEE.

Published in 2004 by IIIIEE, Lund University, P.O. Box 196, S-221 00 LUND, Sweden,
Tel: +46 – 46 222 02 00, Fax: +46 – 46 222 02 10, e-mail: iiiiee@iiiiee.lu.se.

ISSN 1401-9191

Acknowledgements

Even though this acknowledgement part should only be associated with the thesis I would take this chance to refer to the challenging master's era which ends with this thesis completion. This master course has been a beautiful journey. Following different paths people appeared, stayed and went off the stage. I am grateful to all of you for making a year "not to miss, in your lifetime" ☺.

The presence of certain people has brought into light different dimensions of this year. Being into environmental studies I really believe in synergies of groups comparing to the power of the individuals. I would like to start by thanking "le grande blue" group. Nancoulita; "Arleko" and Maria, we met again at a turning point of my life and we justified our bond once again. I cheer to our eternal laughs and positive vibes. "Deutschland" group our coexistence in the continental Northern Europe has final conciliate us with "geography". Stellina, I could not have made it without our virtual but soul healing laughs. Thanks and a smile to the cosmopolitan soul mate, research-fever-sharing, Vassilis. I would also like to thank Ms Ranitsa, Mrs. Tsifotsis and Aristeia for your support.

Special thanks go to the Batch 9 for all the moments shared inside and out of the lecture rooms. "Grunsgatan 13 Gang" and all friends which shared with us, you proofed that summer does not always come with bright sun and warm weather but it comes all year long with the warmth in your heart. Thanks for making this a summer year long.

There were times when thesis seemed a never ending meander but I was lucky enough to have supportive supervisors. Beatrice and Dagmara and Vladimir thank you for your guidance and insights during the whole thesis period. Beatrice tack så mycket for your help, alternatives and fighting with me from the formulation to the completion of this project. Dagmara dziękuję for all the contacts and assistance you offered during the telephone interviews and your presence (and more) during the interviews in Poland. Vladimir děkuji for your inspiring comments. I would like to thank Hanna for the contacts you provided me when time was running out. Charlotte your kindness for sharing your office and the tips you offered me after the "mandatory" over hearing of my interviews are more than appreciated.

This research would also not be possible to happen without the interest and efforts of Thomas Lindhqvist and the funding he ensured for the project. Thank you for always having time and fruitful inputs when issues had to be solved. I would also like to thank the Lions Clubs International and especially Hans-Åke Lindelöw for believing in young researchers and for proving funding for this project.

This research would not be possible without the kind co operations of the interviewees. Even though their names are not mentioned their time and interest have been impressed in this research. Thank you all!!

Finishing I would love to thanks my family for flooding me with the light of unconditional and "open credit" love, support and warmth. You make it beautiful to carry home inside me wherever I go. Paterouli, miteroula and Marikaki this is for you!

Alexandra Tsitsia

Abstract

The importance of supply chains and the dissemination of EMS concept triggered this research to *explore the environmental supply chain requirements, the way these requirements are controlled and to reveal the potential interface with EMS*. The focus of this research has been in supply chains in Sweden and Poland. Interviews were conducted with companies of various sectors and members of the consultancy and auditing society in both countries.

The research concluded that the environmental supply chain requirements are different between the two countries. It was amplified that the requirements are either product or process oriented. It was also illustrated that EMS usually appears as supply chain environmental requirement. The EMS in a supply chain context is used as a communication tool. The environmental supply requirements are usually mandatory but they are not closely associated to structured audit mechanisms. Finally the research presented that different levels of the society's structure are involved as gaps between the EMS and environmental supply chain management. The scenario of :

- *incorporating EMS certification audits* with suppliers' audits was perceived innovative from the interviewed groups.
- *EMS standards per sector* was unclear about the added value it will provide.
- developing and implementing a *common EMS among key supply chain members* was perceived with scepticism.

Executive Summary

During the production of goods and the provision of services, multiple entities are, usually, involved. Vertically integrated companies, companies that supply their own parts, are an exception (UNEP, 2002). Modern business management manifests that it is hard for solely autonomous entities to compete, as a result supply chains have emerged (Charter, Kielkiewicz-Young, Young, & Hughes, 2001; Lambert & Cooper, 2000; Young & Kielkiewicz-Young, 2001). The developments in the information and telecommunications have enabled corporations to “reach beyond their own organizational and national boundaries” for outsourcing, avoiding the problems of direct ownership (Schary & Skott- Larsen, 2001) p.42. In general outsourcing products and services outside national borders is accompanied with challenges relating for example with culture and communications or payment terms and conditions. On the other hand, international supply chains are established because benefits are recognised in quality, timeliness, costs, new technologies, and broadening the supply chain (Dobler, Burt, & Lee, 1990).

Many organizations that supply to the end consumer have faced the consumers’ concerns about sustainability issues (Bakker & Nijhof, 2002). In order to satisfy the customers, organizations direct these demands upstream to the supply chain (Young & Kielkiewicz-Young, 2001). As a result of this, for an increasing number of companies it has become essential to understand the environmental and social impacts associated with their suppliers, trace the origin of their components and present in a credible manner their responsibility efforts (UNEP, 2002).

It has been argued that several large sized companies, such as multinationals, do not own anything else but their brands (UNEP, 2002). Brand reputation is an important asset, hard to build up but easy to diminish (Roberts, 2003). However, generally, organizations lack the resources to have a total control (owning) of the supply chain (Cox, 1999b). The success of a company is very much depending on its ability to enhance the total quality of its supply chain. In order to reduce risks many companies have started including environmental considerations in the suppliers’ contracts.

Resource dependency drives control “to ensure that those resources outsourced are forthcoming” and they comply with predefined conditions (Green & Welsh, 1988) p.291. Moreover, audit schemes targeting suppliers require significant amounts of resources both from the auditor’s organizations (buyer) and the audited organization (supplier) in terms of man hours or preparing, conducting, communicating and following up the audits.

Environmental Management Systems (EMS) have been introduced as a tool for improving the environmental performance and communicating these efforts to external actors’ through the certificate. At the same time standardised EMS implemented by companies, including suppliers, are being audited to ensure compliance and commitment to environmental improvement. The last decades there has been an increase in the number of organizations certified/ verified with EMS. In Europe and in other parts of the world the implementation of EMS has become an important aspect of many companies (Brorson & Larsson, 1999).

Each company acting independently towards environmental improvements has limited results. It has been suggested that coordinated efforts between supply chain members is increasingly required. The different members of the supply chain are required to adapt to each others environmental considerations (Canning & Hanmer- Lloyd, 2001) to achieve significant environmental improvements.

The interesting issue is what happens after the supplier – buyer relationship is established and the EMS is in place. Leveraging control of supply chains has been an interesting area with limited research (Cox, 1999a). Further, in practice, the high dependency on suppliers is accompanied by risks for supply chain interruption or reputation scandals. These potentials elevate the control mechanisms regarding the environmental issues in the international supply chains an interesting issue.

The study investigates whether a standardized EMS¹ can be developed to a tool for setting specific environmental requirements towards suppliers. Also, this paper assesses whether a standardized EMS can be developed to a tool for controlling that the above requirements are met. There is a high level of concern regarding the verification of the suppliers' environmental requirements. This research attempts to perform a preliminary assessment in this concern. The purpose of the research *is to explore the environmental supply chain requirements, the way these requirements are controlled and to reveal the potential interface with EMS.*

The following questions were answered along the endeavour of this research:

- What is the current situation regarding the environmental requirements put along the supply chain (from a buyer to the supplier)?
- How do the buyers control the environmental requirements that put towards their suppliers?
- What is the perception of key stakeholders about the potential use of EMS as a tool to set and control environmental requirements within the supply chain?

This study will only be focused in ISO 14001, because it is the most prevalent EMS standard internationally. This research is a comparative study between two countries Sweden and Poland. The study was based in primary empirical data collected through interviews. The interviews involved members of organizations, belonging to various sectors and located in two different countries, Sweden and Poland; and by interviewing relevant key stakeholders in the field of EMS and supply chain issues which consisted by consultant companies, the certification society, and experts in the supply chain audits and EMS placed in both Sweden and Poland.

The analysis is believed to have resulted in solid results because it was based on verified data, since the transcripts of the interviews around 25 were approved.

The study starts by reviewing the relevant literature about supply chain management issues and interorganizational relationships.

At the next step, the research intends to introduce interorganizational control in supply chain and present different tools that have been used or proposed to ensure performance in the supply chains.

Following, focus is in focal companies and their adopted methods for dealing with environmental impacts through EMS. Also an overview of the stakeholders in the field is offered.

¹ For the purposes of this study the term “Standardized Environmental Management Systems” implies EMSs which comply with predefined standards and are audited and certified by an independent third party auditor.

During the research it was found that supply chain members *require EMS* certification from their partners but nowadays they want more information about *specific* points of the suppliers' environmental performance. The study concluded that environmental considerations deriving from mother companies with headquarters in Sweden and applied in *Poland* are associated with many difficulties. The environmental requirements were perceived to be very *innovative* and forward thinking. It was concluded that the auditing activities performed at the suppliers' sites in the context of the EMS implementation were *not combined* with suppliers' audits. It was revealed that a more holistic approach is necessary to escape the "*silo mentality*" of the organizations. The hindering factors for potential using the EMS as a tool in defining and controlling the supply chain environmental requirements were recognised in three levels. In the level of *society's mindset*, in the *institutional level* and finally the in level of the *standard* per se.

The analysis of the three different scenarios showed that: The possibility of *incorporating EMS certification audits* with suppliers' audits was perceived innovative from the interviewed groups. The interviewed group was unclear about the value added of potentially developing *EMS standards per sector*. The last scenario regarding the development and implementation of a *common EMS among key supply chain members* was perceived with scepticism.

Table of Contents

List of Figures

List of Tables

1	INTRODUCTION	1
1.1	BACKGROUND AND PROBLEM DEFINITION	1
1.2	PURPOSE AND OBJECTIVES	3
1.3	RESEARCH QUESTION	3
1.4	SCOPE AND LIMITATIONS	3
1.5	METHODOLOGY	4
1.6	STRUCTURE OF THE THESIS	8
2	CONTEXT FRAMEWORK	11
2.1	SUPPLY CHAIN & SUPPLY CHAIN MANAGEMENT	11
2.1.1	<i>Supply chain</i>	11
2.1.2	<i>Supply chain management</i>	13
2.2	INTERORGANIZATIONAL SUPPLY CHAINS RELATIONSHIPS	15
2.3	IMPLICATIONS FOR THE STUDY	18
3	CONTROL TOOLS USED IN SUPPLY CHAINS	19
3.1	INTERORGANIZATIONAL CONTROL IN SUPPLY CHAIN	19
3.2	AUDITS	20
3.3	TYPE OF ENVIRONMENTAL AUDITS	21
3.3.1	<i>Audits in the ISO 14001 context</i>	21
3.3.2	<i>Internal environmental audits</i>	22
3.3.3	<i>External - third party environmental audits</i>	22
3.3.4	<i>Second party environmental audits</i>	23
3.4	IMPLICATIONS FOR THE STUDY	23
4	ENVIRONMENTAL MANAGEMENT SYSTEMS	24
4.1	STANDARDISED EMS	24
4.2	ISO 14001 AND SUPPLY CHAIN	27
4.3	GROUPS INFLUENCING EMS (STAKEHOLDERS)	27
4.4	IMPLICATIONS FOR THE STUDY	28
5	DATA ABOUT SWEDEN AND POLAND	29
5.1	OVERVIEW OF POLAND	29
5.2	OVERVIEW OF SWEDEN	29
5.3	IMPLICATIONS FOR THE STUDY	30
6	ANALYSIS	31
6.1	ENVIRONMENTAL SUPPLY CHAIN REQUIREMENTS AND THEIR CONTROL	31
6.1.1	<i>Supply chain environmental requirements</i>	31
6.1.2	<i>Control of supply chain environmental requirements</i>	41
6.2	STAKEHOLDERS' VIEW ABOUT THE USE OF EMS AS A TOOL TO SET AND CONTROL SUPPLY CHAIN ENVIRONMENTAL REQUIREMENTS	44
6.2.1	<i>Gaps for initiating supply chain environmental requirements</i>	44
6.2.2	<i>Gaps between EMS and supply chain environmental requirements</i>	45
6.3	POTENTIAL CHANGES IN THE AUDITING AND CONTROLLING MECHANISMS REGARDING SUPPLY CHAIN ENVIRONMENTAL REQUIREMENTS AND EMS	49
7	CONCLUSIONS AND RECOMMENDATIONS	52

7.1	CONCLUSIONS	52
7.2	REFLECTIONS AND FURTHER DISCUSSION	54
7.2.1	<i>Areas of further research</i>	55
	BIBLIOGRAPHY	57
APPENDIX I	ABBREVIATIONS	61
APPENDIX II	QUESTIONNAIRES	63
APPENDIX III	LIST OF INTERVIEWS	72

List of Figures

Figure 1-1	Methodological approach of the study.....	4
Figure 2-1	Simplified supply chain	11
Figure 2-2	Simplified supply chain (Based on (Lambert & Cooper, 2000)).....	12

List of Tables

Table 1-1	Companies' profile interviewed in Poland	6
Table 1-2	Companies' profile interviewed in Sweden.....	5
Table 6-1	Information collected through interviews.....	34
Table 6-2	Control for supply chain environmental requirements	43
Table 6-3	What is the gap for using EMS as a tool to define and control environmental supply chain requirements.	48

1 Introduction

In this section, background information related to thesis topic is presented and the problem area under research is justified. The purpose and the objectives are presented and the research questions with the scope and limitations are described. The methodology followed during the research is introduced. The last part of this section describes the structure of the thesis and areas where the findings of this research can be utilised.

1.1 Background and problem definition

The degradation of the natural environment has been closely associated with production activities serving human needs and wishes. Since 1987 with the Brundtland Commission, environmental protection has been stressed and sustainable development is the society's main goal. The decision of the international community for sustainable development has put pressure on the production side being represented by companies. Production processes have been in focus and currently many companies are dealing with issues related to the life cycle of the products or services (Sinding, 2000).

During the production of goods and the delivery of services, multiple entities are, usually, involved. Vertically integrated companies, companies that supply their own parts, are an exception (UNEP, 2002). Modern business management manifests that it is hard for solely autonomous entities to compete, as a result supply chains have emerged (Charter et al., 2001; Lambert & Cooper, 2000; Young & Kielkiewicz-Young, 2001).

Many organizations that supply to the end consumer have faced the consumers' concerns about sustainability issues (Bakker & Nijhof, 2002). In order to satisfy the customers, companies direct these demands upstream to the supply chain (Young & Kielkiewicz-Young, 2001). As a result to this, for an increasing number of companies it has become essential to understand the environmental and social impacts associated with their suppliers, trace the origin of their components and present in a credible manner their responsibility efforts (UNEP, 2002).

Efficiency and profitability criteria motivate supply chain members to cooperate regarding environmental issues. Moreover, legislative pressure such the European directives for the End of life vehicles² and for Waste Electrical and Electronic Equipment³, have initiated cooperation between business partners. The anticipation of additional legislative requirements motivates companies, with buyer and supplier relationship, to work closely regarding environmental issues (Canning & Hanmer-Lloyd, 2001).

It has been argued that several large sized companies, such as multinationals, do not own anything else but their brands (UNEP, 2002). Brand reputation is an important asset, hard to build up but easy to diminish. Brands face challenges because they rely significantly on long

² Directive 2000/ 53/EC of the European Parliament and of the Council of 18 September 2000 on end of life vehicles. O J L 269. 21.10.2000. p. 34-42.

³ Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. O J L 37. 13.02.2003. p. 19 -23. and Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE) - Joint declaration of the European Parliament, the Council and the Commission relating to Article 9. O J L 037. 13.02.2003. p. 24 – 39.

supply chains (Roberts, 2003). In order to reduce risks these companies have started including environmental considerations in the suppliers' contracts.

It is common that buying companies are requiring from their suppliers more than on time deliveries. Extra requirements either refer to the environmental performance of the product or the environmental performance of the process the supplier employs. These demands are put to supply chain members either to satisfy internal needs of the organizations (e.g. profitability, expertise) or external demands (e.g. stakeholders demands, legislative requirements).

Resource dependency initiates control "to ensure that those resources outsourced are forthcoming" and they comply with predefined conditions p.291 (Green & Welsh, 1988) p.291. In the past many organizations have developed their own audit schemes to ensure that their suppliers comply with the preconditions. Moreover, many organizations have experienced increased pressure from stakeholders to develop verifying and auditing schemes to ensure that their suppliers comply with environmental requirements. The different approaches for interorganizational relations vary on terms of costs involved arranging and maintaining these relations (Sinding, 2000). In any case, audit schemes targeting suppliers require significant amounts of resources both from the auditor's organizations (buyer) and the audited organization (supplier) in terms of man hours or preparing, conducting, communicating and following up the audits.

It has been illustrated that interpersonal communication between companies, regarding environmental issues, facilitates to including supply chain members in environmental considerations, but it is not enough. On the other hand, it has also been exemplified that only optimum technical solutions is not efficient for achieving environmental improvements, but there are clearly managerial implications involved (Canning & Hanmer- Lloyd, 2001). (Charter et al., 2001). The management of environmental issues has been on the agenda of many organizations the last decade.

Environmental Management Systems (EMS) have been introduced as a tool for improving the environmental performance and communicating these efforts to external actors' through the certificate. At the same time standardised EMS implemented by companies, including suppliers, are being audited to ensure compliance and commitment to environmental improvement. The last decades there has been an increase in the number of organizations certified/ verified with EMS. In Europe and in other parts of the world the implementation of EMS has become an important aspect of many companies (Brorson & Larsson, 1999).

The discussion about the results of standardized EMS has been focused within the boundaries of the organization implementing the EMS. A more holistic view taking the supply chain perspective has not been elaborated enough. Although the problems of environmental management are well recognised the EMSs have been heavily criticised for not achieving to address the urgency of the situation. It has been argued that EMS according to ISO 14001 can only address internal environmental issues of a company (Krut & Gleckman, 1998).

Each company acting independently towards environmental improvements has limited results. It has been suggested that coordinated efforts between supply chain members is increasingly required. The different members of the supply chain are required to adapt to each other environmental considerations (Canning & Hanmer- Lloyd, 2001) to achieve significant environmental improvements.

Environmental management systems, in the past, have appeared to be prequalification criteria for accepting a new supplier. Suppliers nowadays go beyond the national borders and

differences and distances are larger. The interesting issue is what happens after the supplier – buyer relationship is established and the EMS is in place. Leveraging control of supply chains has been an interesting area with limited research (Cox, 1999a). Moreover, in practice, the high dependency to suppliers is accompanied by risks for supply chain interruption or reputation scandals. These potentials elevate the control mechanisms regarding the environmental issues in the international supply chains an interesting issue.

1.2 Purpose and objectives

The study investigates whether a standardized EMS⁴ can be developed to a tool for setting specific environmental requirements towards suppliers. Also, this paper assesses whether a standardized EMS can be developed to a tool for controlling that the above requirements are met. There is a high level of concern regarding the verification of the suppliers' environmental requirements. This research attempts to perform a preliminary assessment in this concern. The purpose of the research *is to explore the environmental supply chain requirements, the way these requirements are controlled and to reveal the potential interface with EMS.*

First of all this study aims to map out the existing situation in this field taking into considerations the concerns of high control costs and the need for ensuring the requirements are met. This study investigates the potential interface of EMS and environmental supply chain requirements. Also this study will result to recommendations for improving the control of environmental issues within the supply chains and the implementation of standardised EMS.

1.3 Research question

The following questions will be answered along the endeavour of this research:

- What is the current situation regarding the environmental requirements put along the supply chain (from a buyer to the supplier)?
- How do the buyers control the environmental requirements that put towards their suppliers?
- What is the perception of key stakeholders about the potential use of EMS as a tool to set and control environmental requirements within the supply chain? What is the gap between current practices regarding EMS and environmental supply chain management?

1.4 Scope and limitations

This study will be focused on the management control of supply chains; thus excluding the formation of supply chain relationships. Also, it will be associated only with the environmental issues that organizations face, in a supply chain context. It is not the purpose to discuss how these environmental considerations are raised or to compare them with other sustainability concerns but rather to accept that this is happening. On the other hand, the focus of this study will be placed on external supply chains up to the first tier of suppliers. The scope of this study heavily depends on the availability of existing cases, including enterprises and stakeholders, from which primary data will be collected. The varieties of EMSs available have

⁴ For the purposes of this study the term “Standardized Environmental Management Systems” implies EMSs which comply with predefined standards and are audited and certified by an independent third party auditor.

forced to focus only on standardised EMSs, EMSs that can be audited by external independent auditors that certify the compliance with the requirements presented in the standard. Moreover, the research was focused only in ISO 14001, because it is the most prevalent EMS internationally. The geographic scope of this research is limited to industrialized countries, Sweden and Poland. Data from industrialised communities will be used but in more detail organizations located in the Baltic region, Sweden and Poland, will be further investigated. The stakeholders' financial dependency on EMS entails a level of bias in their answers.

1.5 Methodology

This research is a comparative study between two countries Sweden and Poland. The study was based in data collected through interviews. The interviews involved members of companies and relevant key stakeholders in the field of EMS and supply chain issues. The companies interviewed belong in various sectors and are located in two different countries, Sweden and Poland. The relevant key stakeholders were members of the consultant companies, of the certification society, and experts in the supply chain audits and EMS placed in both Sweden and Poland. In more detail the researcher followed several steps, presented in Figure 1-1, in order to fulfil the goal of this research.

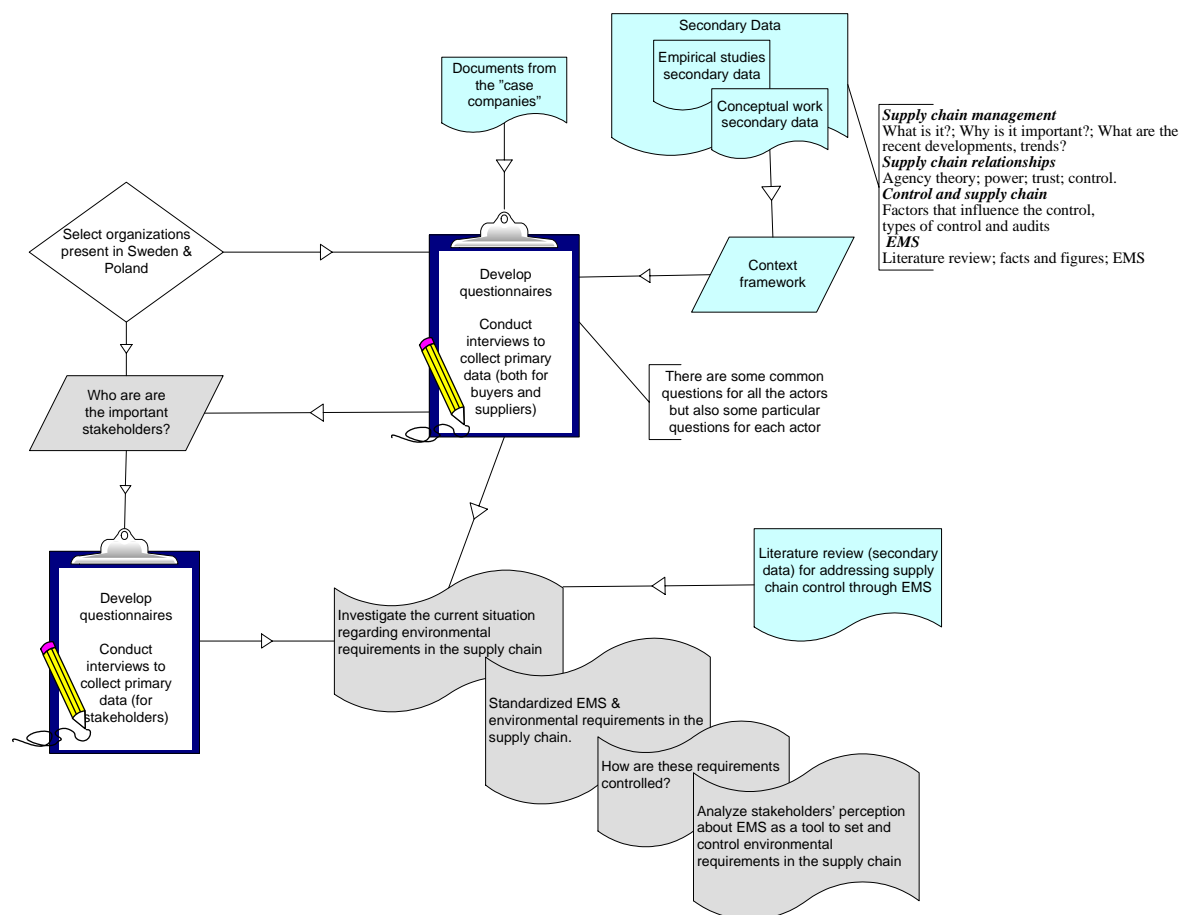


Figure 1-1 Methodological approach of the study.

Initially, secondary data stemming from relevant literature were collected and analysed to present the scientific discussions about the research field. The main key words to be explored were: “supply chain, supply chain relationships, control, EMS, audit, certification/verification”. The information was extracted from various sources (reports from international

organizations, scientific papers and books and credible web sites). The nature of this research demanded interdisciplinary approach and different terms were explored. The literature review included both previous conducted empirical studies and conceptual work. The author did not present the data according to discipline but rather according to concepts (key words). At this stage the common issues/ ideas, overlaps and gaps were drawn. The objective of this step was to draw the context of the issues under study.

Primary empirical data were collected during semi structured discussions using sample questions, presented in Appendix II. “ Asking everyone the same questions makes little sense in qualitative interviewing when the goal is to find out what happened and why, in rich and individualistic terms” (Rubin & Rubin, 1995). The targeted interviewees were companies placed in Sweden or in Poland that were members of supply chains and were connected with these two countries. The interviewed companies were limited to their availability to be involved in the research. Cases served as multiple sources of evidence for the purpose of the research. The majority of the companies are big companies because these cases are expected to present interesting supply chain environmental considerations. The small and medium sized has been reported to acquire limited resources (Fassoula & Rogerson, 2003) for having supply chain initiatives.

The involvement of cases in this research is justified because the phenomena under study are not readily distinguished from its context. Moreover the phenomena of supply chain management is relative new and interviewing companies in more useful than surveys (Larson & Halldorsson, 2002). The selected companies were active in different countries and from different sectors of the world in order to serve the purposes of the comparative study. Selecting supply chains of different sectors is ensured that the findings will not reflect only one sector and similarities and differences will be revealed (Business for Social Responsibility (BSR), 2001).

5 Swedish companies, which are major buyers, were interviewed and are presented in Table 1-1. These 5 companies are from a great variety of sectors and belong to multinational Groups; thus having great size. The interviews were conducted via telephone (with the exception of one personal interview), recorded and the transcripts were sent for confirmation. The interviews were conducted in English.

Table 1-1 Companies' profile interviewed in Sweden

	Products or services?	Size	Interviewee member of...	ISO 14001 certificate	ISO 9001 certificate	OSHAS 18001
Company 1S	Product manufacturing	MN*	Global auditing	✓		
Company 2S	Product manufacturing	MN	Sustainability department	✓		

* multinational

Company 3S	Product manufacturing	MN	Environmental and purchasing	✓		
Company 4S	Service provider	MN	Environmental department			
Company 5S	Service provider	MN	Environmental department	✓		

In Poland 7 companies were interviewed in total and are briefly presented in Table 1-1. 3 of them had Swedish capital and were acting as buyers. The rest 4 were relatively smaller; belonging to Polish capital and delivering their goods and services directly to Swedish companies or to companies in Poland with Swedish capital. The data were collected through personal interviews in the companies' sites. The interviews were performed either in English, when the interviewee felt comfortable or in Polish with direct interpretation. The interviews were once again recorded and transcripts were sent for approval

Table 1-2 Companies' profile interviewed in Poland

	products or services?	Size	Interviewee member of...	ISO 14001 certificate	ISO 9001 certificate	OSHAS 18001
Company 1P	Product manufacturing	Big	Environmental and Quality management department	✓	✓	✓
Company 2P	Service provider	Big	Environmental department	✓		
Company 3P	Product processing-service	Medium sized	Environmental and quality department	✓	✓	✓
Company 4P	Service provider	Medium sized	Trade department	✓		
Company 5P	Service provider	Medium sized	Environmental department	✓		
Company 6P	Service provider	Medium sized	Top management			
Company 7P	Service provider	Small sized	Top management			

The interviews were based on the same sample questions for both Swedish and Polish companies. Different sample questionnaires were developed for the companies acting as buyers and for the ones mainly acting as suppliers. The list of the interviews is presented in Appendix III. The full data about the interviews are not revealed because the interviews are covered by confidentiality.

The interviews with the supply members and the literature review designated the key stakeholders involved in the issue. The stakeholders interviewed “should satisfy three requirements. They should be knowledgeable about the situation or experience being studied; they should be willing to talk; and when people in the arena have different perspectives, the interviewees should represent the range of points of view” (Rubin & Rubin, 1995). The key relevant stakeholders were interviewed in order to approach holistically the issue. Moreover the inputs of the relevant key stakeholders were used to evaluate the acceptance of proposed changes in the control methods employed in the supply chains. Three categories of stakeholders; consultants, auditors and experts, were recognised to have high degree of relevance to the research questions. In total, 7 EMS consultants were interviewed both in Poland and in Sweden; 2 auditors (1 Polish and 1 Swedish) and 5 experts in the field of supply chain and environment. Most of the interviews were conducted through telephone, except 3 which were performed face to face. The interviews were recorded, transcripts were produced and approvals were granted. All the interviews were conducted in English. The questionnaires used are presented in Appendix II and the list of interviews is presented in Appendix III. The full data of the interviewees are not presented since the interviews are covered by confidentiality

In order to present the supply chain environmental requirements the research used the case of the automotive industry. In more detail, literature review was performed to summarize the discussion around supply chain environmental requirements in the automotive industry. Moreover, more data were collected by the suppliers’ portal of the specific case of VOLVO 3P (trucks). Later data collected by a telephone interview of a Swedish automotive company. The automotive industry was selected because is one of the most explored supply chains and Volvo 3P is a Swedish company in accordance with the research’s scope. Moreover, the section of trucks was selected because the products of this sector are one of the main sources of greenhouse emission during transportation of goods.

As next step, documentation provided by companies was used to elevate the specific requirements put by buyers to suppliers. Moreover, primary data were collected through site visits and interviewing supply chain members and interviewing the relevant key stakeholders. The primary empirical data collected by supply chain members were grouped regarding their source and are presented in Table 6-1. These data were analysed to explore the issues regarding the current supply chain environmental requirements and in order to reveal any possible differences in the two countries. The data collected were associated to i)the drivers, ii)the types, iii)the status of supply chain environmental requirements and their integration in the purchasing decision, iv) the communication of supply chain requirements and their compatibility to ISO 14001 clauses.

The primary empirical data provided by interviewing relevant stakeholders and supply chain members were used to define the control mechanisms used in supply chain environmental context. The data collected were analysed to reveal gaps, overlaps and level of acceptance of the two autonomous audit methods (the one employed by buyers and the other connected to standardise EMS of the supplier).

Following, the primary empirical data collected, by relevant key stakeholders in the field of standardised EMS and supply chain issues from Poland and Sweden, were processed to reveal the factors hindering and fostering the use of EMS in the supply chain environmental requirements. The process of the data resulted to possible gaps. The fostering and hindering factors were categorised according to the proposed by Meadows (1999) levels to intervene in a system.

During the collection of primary empirical data three scenarios for changes in the field of EMS and the control of supply chain environmental requirements were introduced to the respondents. The interviewees provided feedback to the proposals and their perception was analysed and presented. In general, the data collected (both primary and secondary) were analysed to present the current situation and to attempt a recommendation as to how the system can be changed (Easterby-Smith, Thorpe, & Lowe, 1991).

Summing up, primary and secondary data were used by the researcher. Primary empirical data were collected through qualitative interviews involved semi structured discussions following questionnaires, informal discussions (face to face and through communication media such as post, emails and - or teleconference) and field notes. Secondary data were collected from various sources such as reports from international organizations, scientific papers and books, credible web sites, internal organization documents.

Validation of the results was not possible to be performed by reviewing findings of similar previous studies and comparing them to the findings of this research. As it has already been said this is an explorative study and similar previous study was not identified. The analysis is believed to have resulted in solid results because it was based on verified data, since the transcripts of the interviews were approved.

1.6 Structure of the thesis

The thesis is structured in a way that it is easy to be followed by readers coming from different disciplines. The aim of the structure is to lead smoothly to the answers of the research questions. At each chapter the implications to the study are extracted.

The second section of the thesis is titled “Context framework” and introduces to the reader the basics about supply chains and the terminology to be used to the rest of the paper. Important aspects of interorganizational management are presented.

The third section presents the control mechanisms in a supply chain context. Also the control and certification mechanisms implemented under standardised EMSs are presented to the reader.

The fourth section is about the standardised management systems and the discussions initiated around them are reviewed.

The fifth section presents general data about Sweden and Poland, the countries under study..

The sixth section analyzes the collected primary empirical data and the research questions are answered.

The last section concludes to the main findings, recommendations are attempted and areas for further research are suggested.

The findings of the research can be utilised in various fields.

- The outcomes of this research can be utilized by *policy makers* to provide an overview of the existing situation and the dynamics that exist in the field of supply chain management in combination with EMS. The findings can be used in decision making process. Also, policy makers might find this study useful when considering policies to improve the competitiveness.
- The findings of this study can be used by *business* (individual business or business associations) as inputs to their efforts to improve their supply chain management. Moreover, *business* can utilize this study to recognize challenges and opportunities that lie in the field of supply chain control; thus improving their competitiveness. In addition, this research can be used by business in the discussions for the developments- improvements of standards regarding EMS (e.g. ISO 14001).
- Different *stakeholders* (e.g. local communities, Consumer organizations, NGOs, verification companies, consultancies, e.t.c.) can benefit from this research because they can increase their knowledge on the field. They might refer to this research when working on supply chain control issues; thus increasing the synergies and improving the effectiveness of their involvement.
- Finally, this study is interesting for *researchers* because it provides scientific findings. Also, it is a starting point for further research.

2 Context framework

This section aims to introduce to the reader the main concepts of the supply chain and supply chain management. This is done by communicating to the reader findings from previous research. Secondary data are used to define the context framework of this research .

2.1 Supply chain & supply chain management

“Supply chain” and “supply chain management” have been used for various significations. The discussions around the terms have produced several definitions and have added to a number of dimensions. At this part of the theses terms are presented.

2.1.1 Supply chain

Alignments of organizations that exist in all the production and usage phases of a product or service are members of a supply chain. The supply chain concept is simple as it includes sources of material and the organization of processors, distributors and users. It, also, includes supporting enterprises which provide transport, communication, and other specialized functions (Scharj & Skott- Larsen, 2001). A supply chain is a network of organizations that are involved in the process of creating value to deliver to the end consumer (Mentzer et al., 2001).

The extent to which different departments of an organization satisfy their needs for inputs and to which the organization outsource for materials and services defines the boundary of internal supply chains and external supply chains. The focus of this research is put on external or interorganizational supply chains and management.

Simplified Supply Chains

At least three entities are required to create a supply chain (Mentzer et al., 2001). A simplified picture from the supply chain is presented in *Figure 2-1*. The member in the supply chain that is in focus or is under the spotlight is called *focal company*. The organizations that supply the focal company are called *suppliers* and the organizations to which the focal company sells are called *buyers*. It is obvious that each member of the supply chain can be member of another supply chain. Actually, this reflects the reality as most of the organizations sell to and buy from several organizations. Also, within the same supply chain each member can be a buyer and a supplier simultaneously. The differentiation is very thin and it is determined by the focus regarding the focal company.

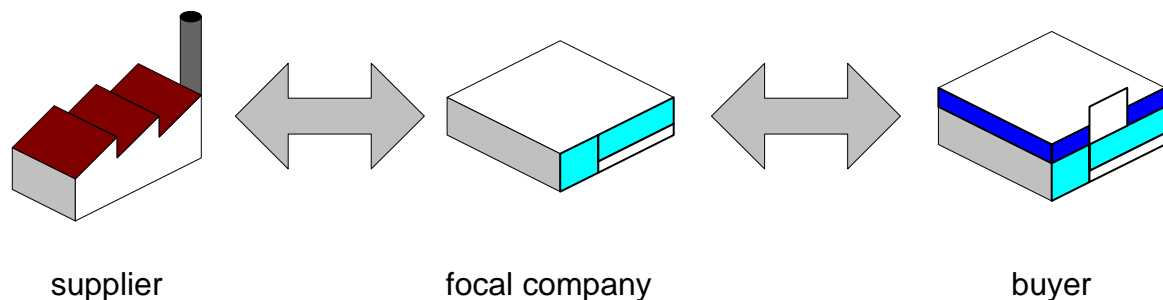


Figure 2-1 Simplified supply chain

The supply chain can be viewed as an effort to simplify a complex reality. The supply chains are not linear as pipelines or chains but they resemble more to a tree formation (Cox, 1999a; Lambert & Cooper, 2000).

Supply chain structure

It has been proposed that the supply chain consists from: (i) supply chain structure (ii) supply chain process and (iii) supply chain management components (Lambert & Cooper, 2000). Briefly explaining, the supply chain structure describes the members that constitute the supply chain and the links between them and is presented in *Figure 2-2*.

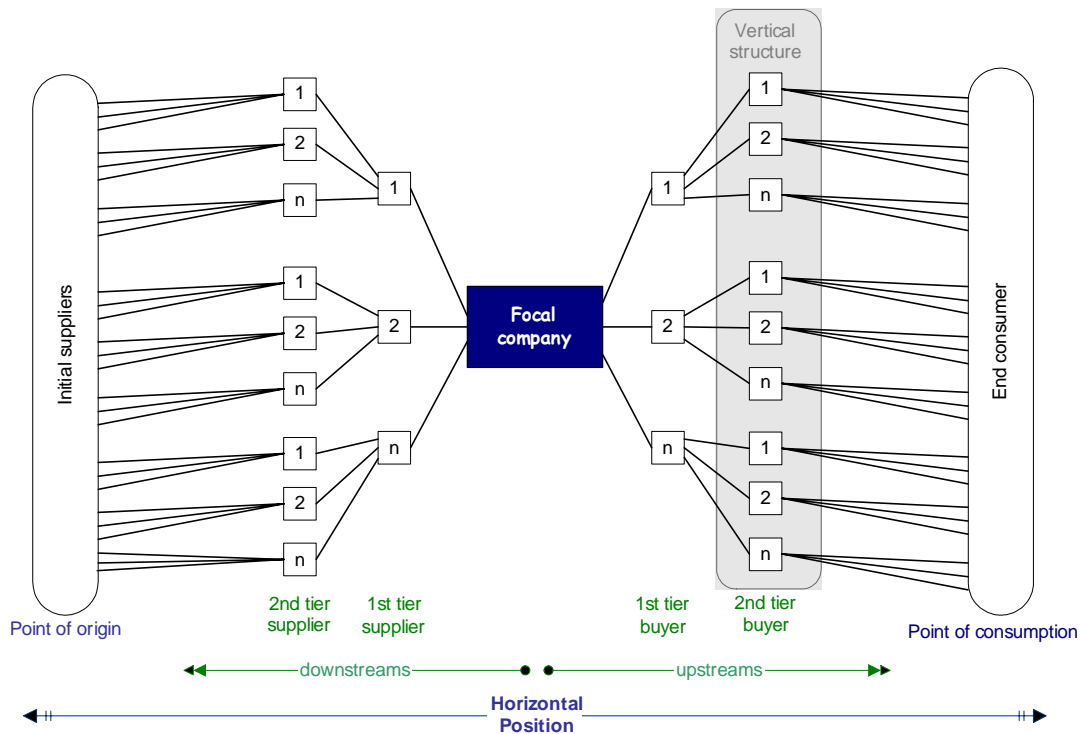


Figure 2-2 Simplified supply chain (Based on (Lambert & Cooper, 2000))

The structure of the supply chain defines how many members participate in the supply chain and the number of suppliers and buyers at each level of production. Three dimensions are associated with the structure of the supply chains: (i) the horizontal structure, (ii) the vertical structure and (iii) the horizontal positioning of the focal company. The horizontal structure refers to the number of tiers across the supply chain. The vertical structure refers to the number of suppliers present in each tier. The horizontal position within the supply chain refers to the position of the focal company regarding its distance from the end and the starting point of the supply chain. The point of origin of the supply chain is the starting point where no other previous supplier exists. The supply chain is ended at the point of consumption where no further value is added and the good is consumed (Lambert & Cooper, 2000). As the analysis of empirical data has illustrated, the supply chains configurations change rapidly thus mapping out the structure of a whole supply chain is something that demands resources and needs to be regularly updated (Choi, Dooley, & Rungtusanatham, 2001).

Drivers and importance of supply chains

Under the supply chain approach the focus has moved from functions to integrating activities into processes. The supply chain processes produce output and value to the end consumer. The importance of the supply chains is evident as it is one of the three fundamental processes, together with product development and customer relationship, determining the course of a company. Nowadays the supply chain developments are dictated by market place forces. The organizations respond to the last customer pressure by creating conditions for low costs, rapid deliveries, information and rapid deployment of technology or other concerns. The developments in the information and telecommunications have enabled corporations to “reach beyond their own organizational and national boundaries” for outsourcing, avoiding the problems of direct ownership (Schary & Skott- Larsen, 2001) p.42. In general outsourcing products and services outside national borders is accompanied with challenges relating, for example with culture and communications or payment terms and conditions. On the other hand, international supply chains are established because benefits are recognised in quality, timeliness, costs, new technologies, and broadening the supply chain (Dobler et al., 1990).

Porter’s famous 5 forces model has placed the suppliers as one of the factors that influence positing of business. The decision what to outsource depends on many factors proposed by relevant literature (Macpherson, 2001). In any case, organizations lack the resources to have a total control (owning) of the supply chain (Cox, 1999b). Nonetheless it is out of the scope of this research to investigate how supply chains are formed but rather to explore the following step, “how supply chains are managed”. The success of a company is very much depending on its ability to enhance the total quality of its supply chain. The suppliers play an important role in the performance of the buyer. (Cox, 1999b; Lambert & Cooper, 2000; Macpherson, 2001; Project Sigma, 2001; Sakaguchi, Nicovich, & Dibrell, 2004). Companies are realizing that the value added along the supply chain is connected to the value they deliver to their customer (either the customer is another member of the supply chain or the last point of consumption). It is believed that no longer “company is competing against company but rather supply chain competing to supply chain” (Cox, 1999b) p.168. Moreover because of spatial distribution around the world, cultural differences, specific institutional and legislative contexts and many more particularities (within which supply chains operate) amplify the barriers to improve environmental performance. The 24-hours news era; the increased customers demands for minimizing the costs, and improving quality, environment, delivery times, technology; the increased global competition and visibility; global sourcing; outsourcing of goods and services ;and the new types of interorganizational relationships are some of the drivers of the supply chain phenomena (UNEP, 2002).

The supply chains are an independent phenomena and they exist either they are managed or not. In order to move to supply chain management the supply chain should be viewed as a “single entity rather than a set of fragmented parts” (Mentzer et al., 2001) p.7.

2.1.2 Supply chain management

History

The automotive sector has contributed in changing the mind set, of how business is, conducted from purchasing materials and services to managing external resources. Specifically, Toyota in the 70s and 80s is believed to have been the leader in supply chain management (Cox, 1999b). The concept of Supply Chain management was first introduced by consultants in the 80s. The concept gained popularity as the dominant trends of global sourcing, focused on quality and in time delivery. On the other hand, uncertainty has asked for coordination of materials into and out of the company (Mentzer et al., 2001). In the begging supply chain

management was very close related to logistics and many times it was just another word for logistics or purchasing (Lambert & Cooper, 2000).

In a conceptual level, supply chain management relating to purchasing has been viewed as (Lambert & Cooper, 2000) :

1. Traditionalist: including in the purchasing process and limiting the emphasis in first and second tier suppliers.
2. Relabeling: changing the name from purchasing to supply chain management with no other changes.
3. Unionist: incorporating logistics, marketing, operations management, e.t.c
4. Intersectionist: coordinating different functions from different companies.

The four mentioned categories can serve as guidance when evaluating the companies' attitudes to the new managerial challenges of sourcing, purchasing and supply chain management.

Main elements of supply chain management

Supply chain management, in the simplest form, involves only the dissemination of the strategy of one member of the supply chain to the rest of the members (Young & Kielkiewicz-Young, 2001). According to Mentzer et al. (2001), the discourse about the supply chain management has three approaches reflected in the given definitions: as management philosophy, implementation of a management philosophy and a set of management approaches. And finally the supply chain management components are the way that the processes are integrated and managed across the supply chain (Lambert & Cooper, 2000).

Nowadays, the suppliers do not compete on delivery times, product quality but these are the standards to be in the market (Mentzer et al., 2001; Reilly, 1999). The best suppliers are considered the ones that go beyond their minimum requirements and they learn about their customers' business and how to serve best the buyer's demands. Supply chain management exists in different sectors, either or not environmental issues have been addressed. In the same context, the environmental performance that a company delivers to its buyers is the sum of the social, ethical and environmental impacts of these goods and services along the supply chain. The level of environmental performance depends on environmental requests to focal companies from their buyers or from their suppliers. Also, it has been argued that even though environmental issues might have been addressed, many small sized focal companies do not have the appropriate level of awareness or expertise to cope with environmental demands of their exchange partners (Project Sigma, 2001; Young & Kielkiewicz-Young, 2001).

Supply chain management provides the link between different businesses and an understanding that relationships between businesses are very important (Cox, 1999a). Taking into consideration the alterations in the supply chain configurations, developing a supply chain strategy with the involvement and consensus of all the members of the supply chain has many barriers (Choi et al., 2001). Supply chain management can be implemented in a strategic level in the presence of antecedents regarding trust, commitment, interdependence, organizational compatibility, share of the same vision and key processes between members and the creation of a leader and top management support (Mentzer et al., 2001)

Pitfalls and criticism for supply chain management

A very common problem encountered in the implementation of supply management is the “silo mentality” that many organizations have. Using the term “silo mentality” is implied that organizations are trapped within the boundaries of their organization; thus failing to capture the whole picture that is produced from all the members of the supply chain (Young & Kielkiewicz-Young, 2001).

However the whole supply chain concept has accepted criticism that it appeared as success case in the Japanese automotive industry and it can not be successfully taken out of this context. It has been argued that the particular circumstances cannot be generalised (Cox, 2001b).

According to empirical data from Business for Social Responsibility survey, suppliers expect increased environmental requirements within the supply chains. They also anticipate great involvement of internet and other communication technologies with positive and negative results in the environment. They also, predict that the supply chains will continue to sprawl globally increasing the complexity of environmental impacts (Business for Social Responsibility (BSR), 2001). Another empirical research suggested that supply chain management plays an important role in exploring the capabilities of potential suppliers and encouraging them to be creative and share risks in the development of new products (Carter, Kale, & Grimm, 2000).

2.2 Interorganizational supply chains relationships

The introduction of the supply managements is followed by the presentation of data regarding the type of relationships developed in supply chain and the challenges met. More over the concepts of power, trust and control are presented in a supply chain perspective. This section concludes with a brief introduction to supply chain requirements.

Types of inter organizational relationships

It has been argued that supply chain relationships are so complex that no replicating can be made (Cox, 1999a). It has been proposed that supplier and buyer can participate, generally, in two main kinds of relationships:

- A. “exit relationship” where the relationships are very loose and buyer escapes as soon as s/he is dissatisfied with the supplier.
- B. “voice relationships” where buyer and supplier work closely for remedy (Preuss, 2000).

The above mentioned categories are very important because the dependency level is implied. Moreover, the type of relationship indicates whether common projects and efforts towards environmental improvements can be developed. Good relationships between buyer and supplier benefit the buyer in many levels such as in superior performance, extra service, cooperation on cost reduction programs, sharing new processes and procedures (Dobler et al., 1990).

It has been noted that cultural differences, that are present between organizations from different countries, have formulated two different models of interorganizational relationships. The so called Western model, where the suppliers are rather opportunistic (resembling the “exit relationship”); and the so called Japanese model where suppliers are rather deferential (resembling to the “voice relationships”) (Cox, 1999b).

Nonetheless the introduction of supply chain management has been suggested that causes changes in the organizational culture of the members that participate in the same supply chain (Macpherson, 2001). So, even though organizations might belong to different countries once they cooperate in a supply chain context, then their cultures have to adjust. This observation has high significance in the field of international supply chains and the environmental supply chain requirements.

Challenges in the supply chains

The supply chains are consisted of many members that obtain and specialise in different levels of power. The supply members face many problems when they try to interact. For example multinationals acting as buyers⁵ delegate work to the SMEs (agents) requesting them to fulfil environmental and social standards. The problem arises because (Eisenhardt, 1999) p.58:

- “the desires and the goals of the principal and the agent conflict and
- it is difficult or expensive for the principal to verify what the agent is actually doing”.

Power in the supply chain

The supply chain member which has direct relationship with the end consumer has the *power* in the supply chain to be recognisable and thus initiate changes. It has been proposed by Cox (2001) that power is another important factor that determines the relationships that are developed within the supply chain. In more detail power depends on :

- buyer dominance,
- interdependence,
- independence,
- supplier dominance.

The microprocessors company Intel created a relationship with the consumer when Intel demanded from the computer manufacturers to put a label “Intel inside”. Computer manufacturers found it difficult after this to switch to other microprocessor supplier (Lambert & Cooper, 2000). The power balance affects the implementation of integrated supply chain management and the adoption of proactive supply development or proactive supplier selection. The dominant player in the supply, having the power, can create the hierarchy with relatively depending, so to pass value to the dominant player. Nonetheless, in the beginnings of the 90s power was denied to be an important factor(Cox, 1999b).

In this context, supply chain strategy is formulated by the supply chain member who has more power (principal or buyer) to push its demands to the supply chain and the rest of the chain implements. The size of the organizations plays an important role in the success of the implemented strategies within the supply chain. Larger organizations have the potential to highly influence smaller suppliers and customers (Young & Kielkiewicz-Young, 2001).

Trust and Control in the supply chains

It has been stated that contracts and agreements between supply chain members depend in high degree on *trust* and *control*. In many cases trust is perceived something laudatory, and control a pejorative for the agent been controlled. Although, the era of information is happening, there are many cases where organizations face limited availability of related

⁵ In the agency theory terminology the buyers are called “principals”

information. (Bachmann, 2001; Birnberg, 1998). The paucity of information reveals trust as an important factor that has to be equally distributed to bridge information gaps. Trust is closely linked with control and in many cases trust may replace control mechanisms; thus cutting down control costs. Nonetheless trust and control is a complicated issue deriving from organizational relationships. (Bachmann, 2001; Birnberg, 1998). One of the main components of supply chain relations refer to communication and exchange of production information and product and knowledge support. The information sharing between actors in the supply chain reduces the uncertainty and can increase the level of trust. What is more important is that trust and experience have been reported to be cornerstones for good relationships in the supply chains (Reilly, 1999).

In the context of interorganizational relationships, described above, the role of control has gained attention. *Control* is an important element of the success of the organizations because its purpose is to ensure that strategies and commitments are carried out so that organizations' goals are attained. Suppliers' relationships can be improved in the "*presence of a performance measurement system*"(Handfield & E., 1999).

Choosing and controlling the supply chain is not influencing only the productivity but it has impacts at the image of the focal company, as well. The wide influence is explained because supply chain management is an autonomous concept that lies in a range of functional areas within the organizations. The management of the supply chain involves many departments of organizations in order to: (i) Identify (ii) understand and (iii) manage issues that go beyond their boundaries. The influence of the supply chains is very important because it expands beyond the boundaries of an organization. (Lambert & Cooper, 2000; Preuss, 2000; Project Sigma, 2001).

Requirements in international supply chains

Concerning environmental issues in an inter organizational perspective; the cooperation of organizations can lead to improvements. In order to optimise the performance buyers have established criteria which their suppliers have to follow. The involvement of the whole supply chain can reduce the risks of sub optimizations, by adopting a more holistic view (Ammenberg, 2003). Having a holistic supply chain perspective the negative externalities are limited because they are internalised within a member of the chain.

On the other hand, the requirements put on the supply chain can possibly confine the pool of potential suppliers. In general one of the most common form of supply chain requirements' abuse reduces the competition (Dobler et al., 1990).

Most of the SMEs do nothing or little to address their relevant environmental issues (depending to their sector) in their "supply network practices". Also, many SMEs fall into the "tyranny of best practices" as they try to copy success stories from big or multinational companies. Copying something is an approach that rarely delivers positive results (Cox, 2001a).

The Environmental Management Systems (EMS) manage the environmental performance of the organizations and have been required from buyers to suppliers. Nonetheless, EMS is not the only supply chain environmental requirement to control its performance. Some other examples consist of Code of Conducts, supply chain councils and more.

2.3 Implications for the study

It should also be mentioned that the supply chain perspective found in literature does not consider the whole lifecycle of the product or service, but is limited in the production. The supply chain approach is ended when the ownership is transferred to the consumer. The severance of links between different actors during the use and the “end-of life” phase reveals that environmental issues were not taken into consideration during the development of the supply chain concept.

Over the literature review it has not been clear what exactly is supply chain management and what is the difference with purchasing. The scope of the term lacks in clarity. The lack of absolute consensus to what is environmental responsible supply chain management has lead the author to the conclusion that it is a continuously changing issue involving many stakeholders, internal and external.

The arguments found in relevant literature justify the choice to focus on companies that are active in both in Poland and Sweden or that are placed in Poland but have Swedish capital. These international chains are expected to have high interest in the environmental field. Moreover the illustrative cases of this study which have the closest relationship to end consumers are big companies. And they have the resources and the power in the supply chains.

The paper will continue by exploring the initiatives companies take to manage and control supply chain issues.

3 Control tools used in supply chains

As it has already been stated control is an important dimension in the context of supply chain management. This section intends to introduce interorganizational control in supply chains and present different tools that have been used or proposed to ensure performance in the supply chains.

3.1 Interorganizational Control in supply chain

This section presents the main elements of control and its criteria regarding the supply chain requirements. Finally, sanctions and rewards connected to control results are presented.

What is control

The control is closely linked to the concepts of power and influence and relates to the need for an “activity to be done repeatedly in some standard fashion”. Control is initiated where unwanted deviations are present (Green & Welsh, 1988) p.289. In general control is implemented in order to ensure success of the predefined goals. A management control system is often called as black box and can appear either as strategy formulation or as task control (Anthony & Gorndarajan, 1995; Birnberg, 1998).

The traditional control process involves four steps. Defining the goals is the first step of a control process. The goals or the standards against to which the performance will be measured have to be measurable and specific. The next step is monitoring these standards. At this stage the organization decides when, where and the frequency of the actual control. The management of the organization needs a system in place that provides accurate monitoring of the variables defined in the first step. Systematic monitor determines the actual performance. The third step in the control process is when the actual performance is compared against the goal. At this stage it is important to define the critical deviations, the gap between the monitored performance and the goal which affects the successfully performance of the monitored process. The last stage is then to take corrective actions to improve the performance when necessary (Hess & Siciliano).

Control mechanisms are introduced in the supply chain after a supplier buyer relationship is established. “The purpose of the control is to enhance the relationship and thereby control performance” (Dobler et al., 1990) p.366. The inter organizational control systems appeared with the intention to eliminate the information gap between the buyer and the supplier. The outsource of activities disrupted the information flow thus negatively affecting the development and production activities. The objective of inter organizational control activities is to “create more harmonious and efficient inter organizational relations as shared information is seen to create closeness and trust” (Mouritsen, Hansen, & Hansen, 2001) p.222. It has been presented that focal companies monitor processes to audit the supply performance based on buyers perception (Reilly, 1999).

Control criteria and supply chain requirements

The establishment of supply chains includes the selection of suppliers from a pool of potentials. The selection of the supplier has been argued that nowadays is more important than ever before because the long term relationships between supply chain members are common. Preselection criteria are defined and potential suppliers are eliminated by comparing suppliers’ performance against the criteria (Dobler et al., 1990).

Birnberg (1998) suggests that there are five dimensions that define which is the critical aspect to be controlled in inter organizational context:

- the degree of absolute and relative commitment,
- the symmetry of rewards,
- the extend of uncertainty present,
- the degree of mutual trust between parties, and
- the length of the relationship.

According to empirical data presented by “Business for Social Responsibility” (2001) the types of environmental issues that are requested by buyers to their suppliers vary by sector. Nonetheless these requirements can be categorised in: (i) product focused (e.g. ban or restrictions of chemical substances in products) and (ii) process focused (e.g. implementation of EMS). The requirements are often presented to the suppliers by questionnaires and lists.

The increasing pressure put on corporations and the unlimited supply chains have resulted to the development of lists presenting restricted chemical substances to different parts of the world, e.g. the list compiled by Business for Social Responsibility (Business for Social Responsibility (BSR), 2002). In general, many suppliers want to engage requirements that lead to environmental improvements. Regarding the business effects from buyers’ requirements, suppliers argued to be positive including cost reductions and increased sales. However, suppliers were mainly disappointed because environmental issues “played an incidental role” in the purchasing decision making (Business for Social Responsibility (BSR), 2001).

When it comes to connecting the control of social or environmental issues within the supply chain and each member’s performance little research has been done. Nonetheless evidence indicates when one member of the supply chain adopts environmental purchasing it can improve its economic position (Carter et al., 2000).

Sanctions and rewards

The performance in the supply chain is controlled in general with punishment and reward. The most obvious punishment is cancelling or not renewing the contract. The simplest reward is the renewing of contracts. Many companies have developed evaluation systems for their suppliers and have connected it with contract allocation (Dobler et al., 1990). Nonetheless, the corrective actions in most cases are related with giving negative feedback but it is suggested that positive feedback can increase the autonomy of the members of the supply chain; thus triggering innovation. The alternative of rewards and bonuses for positive performance has been proven to contribute to attempted changes (Hess & Siciliano). Another suggestion has been that the penalties and sanctions issued by control can be replaced by self disclosure procedures linked with premiums (Emery & Watson, 2003).

3.2 Audits

One of the tools used for controlling and monitoring performance is the execution of audits.

History of audits

The term audit was initiated in the management discipline referring to financial issues. The auditing field expanded towards quality concerns, soon after towards environmental concerns and lately towards health and safety considerations (Karapetrovic & Willborn, 2000). It was reported that the International Chamber of Commerce introduced environmental auditing in

the '60s and then froze the issue until 1989 (Matbly, 1995). Nowadays environmental audits are common in the organizations' world. The analogy of environmental audits between supply chain members and command and comply approach in environmental policy approach can be done if the conditions are simplified. It has been increasingly clear that the command and control system cannot provide a satisfactory system of environmental protection. The audit routines entail high costs and the potential of suggesting that "offending is an incident of trading" (Emery & Watson, 2003) p.632.

Criticism about the control and audit movement

It has been argued that the audit explosion in the early 90's is about "policing of policing". It corresponded to auditing the control practices rather conducting direct inspections. This practise is focused to failures and in cases of audit success (make public failures) more policing is usually asked and not analysis of the failure; thus losing the focus of the whole auditing procedure. Also it has been said that audits can serve as a path to communicate what different actors are doing and to understand if it makes sense; thus minimizing the information gap between the supply chain members. In general audits demand resources to be developed and implemented. At the same time audits might reduce potential costs because they minimise the risk (Power, 1994). On the other hand, increasing control it hinders innovation and decreases flexibility (Choi et al., 2001).

3.3 Type of environmental audits

Environmental audits can be initiated by several issues such as acquisitions, EMS certification, insurance, legislation or product audits (Welford, 1998). This section will provide a brief introduction to the environmental audits performed to comply with ISO 14001, and in general internal, third party and second party environmental audits.

3.3.1 Audits in the ISO 14001 context

This section will present the audits performed in the context of an EMS according to ISO 14001. The audits presented are grouped in certification and internal environmental audits.

Certification audits

The organizations' compliance to the EMS standard requirements is confirmed by external accredited bodies. The EMS implemented by a company is audited by a third party body to confirm compliance with the standard's requirements. The third party, also called certification body, is independent. Once the certification audit is successful the company implementing the EMS is registered at the certification's body client register. (ISO, 2003) The certification bodies are accredited or formally recognised by the national accreditation body. The accreditation of the certification bodies is issued for specific business sectors (Welford, 1998).

However the organization can claim that is complying with ISO 14001 requirements without having an external certification, since it is a voluntary standard. It has been argued that the certification contributes positively in the fields of: a. Auditing methodology, experience and practice, because the certification auditors have accumulated experience and knowledge; b. Knowledge and validation because the certification bodies can act as agents of information and be unbiased; c. Customer advance stemming from independent audits; d. Business harmonization provided by external periodic audits; e. Objectivity provided by the external auditors and; f. Integration and coordination because ISO 14001 audits can be combined with ISO 9001 or occupational health and safety management systems (Thorton, 2000b).

The actual certification audits are performed by individual auditors. The standards' general wording leaves lot of freedom for interpretation to the auditors. The general clauses are more or less defined, after negotiating with the environmental manager, by the auditors.

Concerning the EMS scope, a research which focused on the auditors' perspectives, illustrated that the majority of them are satisfied with site specific EMS; thus excluding the suppliers. The inclusion of the supply chain in the EMS considerations demands an environmental mature and well experienced company that is confident to open up its scope (Ammenberg, 2003).

Internal audits

According to ISO 14001 and under the paragraph 4.5.4 about EMS audit, the organizations implementing EMS should establish a program and define methodology for conducting internal audits. The auditors can either be members of the organization or external parties with proper training (ISO 14004., 1996). The International Standardization Organization has developed 3 standards⁶ in the field of environmental auditing. In more detail the ISO has developed ISO 14011 to "determine conformance with EMS audit criteria" (ISO 14011., 1996) p.4.

The satisfaction of these requirements has been reported to lack in the auditors' competences. It was also reported failure regarding the focus in environmental improvements. Contradictory a rather more bureaucratic approach has been adopted by internal auditors (Robinson & Gould, 2000).

Moreover, a research conducted in Australia, during the first year of ISO implementation, presented that the internal environmental audits performed under the EMS focused to system conformance and not so much to the level of environmental performance. Moreover, the same research appointed that the team members of internal auditors were under qualified and that the whole internal auditing function was not supported with efficient level of human and financial resources by the companies (Taylor, Sulaiman, & Sheahan, 2001).

3.3.2 Internal environmental audits

The internal environmental audits existed prior to standardised EMS and ISO 14001. It was reported that the first environmental audits were used to detect violations against the environmental legal requirements prior to governmental auditors (Matbly, 1995). The internal audits are performed by members of the organization within the limits of the site. The companies implementing ISO 14001 embodied internal auditing activities as response to the standard's requirements.

3.3.3 External - third party environmental audits

The high number of available product and services has raised questions to the customers. Consumer protection has raised certification, inspection, testing of products and certification of management systems during manufacturing in common practises. Nonetheless, these practices cannot be performed directly by the end consumer, but other organizations, known as certification or accreditation bodies, are involved. These organizations are thought to be trusted of the consumers, as they demonstrate their competence to accreditation national

⁶ ISO 14010: Guidelines for environmental auditing- General principles, ISO 14011: Guidelines for environmental auditing- Audit procedures- Auditing of environmental management systems, ISO 14012: Guidelines for environmental auditing- Qualification criteria for environmental auditors.

bodies (European Co-operation for Accreditation). It is believed by the International Accreditation Forum (IAF) “certification in the future will become more widely accepted internationally and that the range of certification programs will become broader encompassing a variety of activities and sectors rather than just the rigid categories of quality management systems and EMS which we have today” (ISO/ CASCO).

3.3.4 Second party environmental audits

The second party environmental audits are external audits and are performed to a company by an organization having direct relationship like suppliers or customers (Bakker & Nijhof, 2002; Kanbolm, 1998). “Although second party audits are usually conducted by customers on their suppliers, it is sometimes beneficial for the customer to contract with an independent quality auditor. This action helps to promote an image of fairness and objectivity on the part of the customer” (Quality America, 1997).

The second party audits are introduced by buyers to ensure that contractual requirements are followed and to evaluate the suppliers’ potentials for satisfying future requirements. The second party audits are also introduced to protect brand from possible supply chain interruption. The second party audits are usually initiated by the purchasing department and involve quality considerations (American Society for Quality, 2000).

Empirical research has focused on codes of conducts developed and implemented in specific industry sectors (Roberts, 2003) relating environmental issues among supply chain members. The requirements of these codes are usually audited by second party auditing activities.

3.4 Implications for the study

The high involvement of the certification auditors has turned them to important players concerning the environmental considerations (Ammenberg, 2003). The impartiality of the certification auditors has been stressed as an essential element. The independence of the auditors in all the cases is almost impossible to be absolutely guaranteed as at least economic interactions are occurring with the organization employing the auditor.

Sweden and Poland have developed their own accreditation organization for accrediting the certification bodies. The Polish Center for Accreditation (PCA) and the Swedish Board for Accreditation and Conformity Assessment (SWEDAC) is responsible for accreditation to Polish and Swedish, respectively, certification bodies certifying environmental management systems (Polish Center for Accreditation, 2004; SWEDAC, 2004).

The development of control mechanisms follows the pursuit of a goal and not the other way around. The audit criteria are set after performance targets are defined. The focus of the environmental control systems should not be on monitoring the function of the system per se but on the subject of the control which is the environmental performance. Nonetheless, it is out of the scope of this study to present in detail the appropriate steps for auditing activities or the auditors’ competences.

It has been concluded during the literature review that the terms audits, monitoring, verification, registration or accreditation are not internationally clarified. There is no absolute consensus at a global level. This finding can have great implication in the international supply chains when the use of such words can have a different meaning to different members. The clarification of such definitions is an important step that has to be taken before auditing activity is conducted.

4 Environmental management systems

The previous chapters have presented the relationships between organizations adopting a supply chain perspective. This chapter will focus in focal companies and their adopted methods for dealing with environmental impacts. Also an overview of the stakeholders in the field is offered.

4.1 Standardised EMS

This research is only focusing on standardised EMS and mostly in ISO 14001. This section will present the history of standardised EMS and data regarding EMS certification. Next the discussion about the advantages and the disadvantages of EMS are briefly introduced. The expected updates from the publication of the ISO 14001 new version are displayed at the end.

History

The recognition that environmental problems meet no borders has called for internationally coordinated efforts in minimizing the environmental impacts of human actions. The environmental management systems have been introduced as voluntary tools in the environmental policy arena. Historically, standardized EMS followed the introduction of the Quality Management or Assurance standards (Ammenberg, 2003) and were triggered by the principles of the “Earth Summit” in 1992. The EMS target all types – private or public- and sizes – micro, small, medium or multinationals- of organizations.

There are two well known and recognised standardised EMS. The first is the European Regulations for Ecological Management and Audit Scheme⁷ and the second is the ISO 14001 standard (ISO 14001., 1996). However, the British Standard 7750 (BS 7750) was the first one to be developed by the British Standards Institution (BSI) in 1992 but it was superseded by ISO 14001 in March 1997 (BSI, 2004). It was the European Commission that first launched, in 1993, the Environmental Management and Audit Scheme regulation (European Commission, 2001). In the beginning, the EMAS regulation was open for the industrial sector and in 2001⁸ it was revised and opened to all sectors. On the other hand, the British Standards Institution (BSI) had developed the Environmental Management System standard BS 7750, now known as ISO 14001 (BSI, 2004). The International Standardisation Organization (ISO) published in 1996 the ISO 14000 environmental management series. The whole process lasted some four years. The ISO 14001⁹, Environmental management systems- specifications with guidance for use, standard has been under revision, since 1999, and the new edition of the standard is expected soon (Stapleton, 2002).

EMS Implementation

⁷ Council Regulation (EEC) No 1836/93 of 29 June 1993 allowing voluntary participation by companies in the industrial sector in a Community eco-management and audit scheme. O J L 168 10.07.1993 p. 0001 - 0018

⁹ The technical committee (TC) 207 is responsible for the ISO 14001 series. “Today, national delegations of environmental experts from 66 countries participate within ISO/TC 207, including 27 developing countries. In addition, 35 international non-governmental and business organizations participate as liaison organizations” (ISO, 2002).

EMAS and ISO 14001 have been open for participation since 1995. According to the ISO World until the December of 2003 there have been issued 61 287 certifications, (ISO World, 2004) according to ISO 14001, through out the world. The global number of ISO 14001 certified organizations are still increasing as new markets are entering into the certification culture. On the other hand there are 3 872 EMAS verified sites (European Commission, 2004a) but the number of EMAS organizations is decreasing since 2002 (European Commission, 2004b). All the presented data only refer to the number adoption and not to the level of implementation. During the collection of primary data for this research, and taking into account the EMAS trends, the focus was put solely to EMS according to ISO 1400.

According to empirical data (Perkins & Neumayer, 2004) the adoption of the EMAS in Europe is uneven depending on societal conditions and trading relationships. In more detail it has been proven that “the number of domestic EMAS registrations is found to be directly related to the popularity of the standard in member states with which a country shares strong import- export ties”.

Main benefits of EMS implementation

The standardized environmental management systems can be seen as vehicles which can be used to improve the environmental performance of the organizations. The standardized EMS offers the platform for structured action towards environmental improvements (Ammenberg, 2003).

The implementation of EMS has resulted to the development of a potentially beneficial infrastructure and to advantages within the focal entities regarding the management of their environmental issues. These issues have usually been addressed in the SMEs agenda (Young & Kielkiewicz-Young, 2001).

Many multinationals looking for harmonization in the environmental field have adopted and certified their EMS according to ISO 14001 (Morrow & Rondinelli, 2002).

Even though the standardised EMS have accepted lots of criticism and it is not a perfect tool, nonetheless it is said to be the most appropriate instrument for covering the lack of environmental legislation at an international level (Summers Raines, 2002).

Criticism against EMS

EMS as a tool has been placed in the same category with environmental accounting and reporting. It has been argued that their nature dictates high levels of reproducibility, in order to ensure reliability and accountability; thus these tools incorporate high levels of inertia hinder changes to occur (Sinding, 2000).

Nonetheless the desirable level of environmental performance is not defined as threshold. Moreover, the standardized EMS allows different ways of interpreting and implementing the clauses of the standards lead to various levels of environmental performance (Ammenberg, 2003).

In the beginning the EMSs were heavily criticized to be elitist and a trade barrier to the developing and small sized companies (Hillary, 2001). This criticism can have great implications in the supply chain context as many members are SMEs and placed in developing countries.

ISO 14001 and other standards have accepted negative criticism because they were developed by the business side to motivate business to improve the environmental performance. Many argued that it was a case of “fox guarding the hen house” (Summers Raines, 2002).

It has been argued that the source of the environmental impacts is associated with the socio-economic and the EMS has failed to steer the dominant patterns. The use of EMS has been limited as marketing device and as a pacifier of environmental impacts, rather as an agent for changes in the level of organizational culture (Dobes, 2001).

There have been cases where the certification has been the only reason for implementing EMS. This approach is synonymous to the traditional corporate unsustainable practises downrating the EMS potentials (Dobes, 2001).

The scope of the environmental aspects is not defined by the standard as it is left to each organization to define it. According to an empirical research previously conducted involving EMS managers, most of the companies have facility- oriented EMS, meaning that their own sites drawn the boarder. Regarding the communication of environmental requirements the majority of the managers stated that it was trivial. Most of the buyers were satisfied with their suppliers’ environmental performance if they implemented EMS. Regarding the downstream flow of environmental information focusing to customers, it was rather the exception of the research findings. (Ammenberg, 2003).

The EMS has been limited used as a tool to address sustainable production because its procedures and activities are not directed in a life cycle perspective. At the same time the EMS has not addressed successfully issues concerning sustainable consumption because it has not included communication about environmental issues with members of the supply chain downstream (Ammenberg, 2003).

Regarding the focal companies empirical data have indicated that EMS boundaries are unclear and the only recognised criterion was the fitness to easily accessible data. A very good example for the above is : “if only the activities at each enterprise are included, waste oil might be considered as harmless as long as it well stored. On the other hand, it would probably be considered as important if the final treatment was included” (Ammenberg & Hjelm, 2003).

Expecting updates for the ISO 14001

The revising procedure of ISO 14001 at the same time with ISO 14004 revision began in 1999. The revising is focused on enhancing compatibility with the quality standards and in improving the clarity (Dodds, 2003). The whole revision process has been delayed because the deadline was in March 2004 but until now the negotiations continue (Entela, 2004). The final draft was published in August 2004 and the publication is now expected at the end of the same year (NQA, 2004). The expected revisions that probably effect the EMS in a supply chain perspective refer to explicit definition of the EMS scope, the requirement for direct linkage between the policy and the “activities products and services”; and the clarification that the EMS audits in an internal process (Dodds, 2003). Also, 4.4.2 point referring to training will now require that the contractors and subcontractors have to be competent if there is a potential to cause significant environmental impact. A new clause will be added to the new standard that will require evaluation of the compliance level regarding “other requirements” (NQA, 2004).

4.2 ISO 14001 and supply chain

ISO 14001 (1996) is facility oriented standard and focuses on focal companies. The standard refers to supply chain issues in a vague and general way.

The environmental supply chain requirements posed to or by focal companies are covered by the standard under the so called “legal and other requirements”, mentioned under the so called 4.3.2 paragraph. These “other requirements” are not explained at any point in the standard. The “other requirements” are suggested to be voluntary agreements with government or industrial guidelines (such as the Responsible Care for the chemical industry) or even contract requirements (Kanbolm, 1998). The contractual requirements should be binding and thus incorporated in the EMS, nonetheless it has been argued that they are often overlooked (Robinson & Gould, 2000).

Under the 4.4.6 paragraph about operational control, special reference is made to the requirement of communicating “relevant procedures and requirements to suppliers and contractors” but is not elaborated. However it is clear that ISO 14001 certified companies are not required to demand from their suppliers to improve their environmental performance (Kanbolm, 1998) p.4.

Under the 4.3.1 paragraph about environmental aspects, the statement that the organization should “select those environmental aspects that can be controlled, and over which the organization is expected to have influence” dictates that suppliers are not intended to be an important actor of the EMS. Nonetheless the standard’s demand for proactive approach encourages the inclusion of suppliers and subcontractors. It has been argued that the standard’s wording is so vague that the interpretation is highly objective depending on the auditor’s judgement about what the organization can really control and thus include in the EMS and what the organization fails to influence and can be excluded (Kanbolm, 1998). In the implementation stage paragraph 4.3.1 has been said to be one example of pitfall in environmental supply chain requirements (Robinson & Gould, 2000)

Moreover the standard refers to supply chain member indirectly at the 4.4.3 paragraph about communication. The wording remains indefinite (“establish system for receiving communication from external interested parties”) and has been suggested that supply chain members upstreams and downstreams are suggested (Kanbolm, 1998).

According to Acorn project in UK, there was an effort to have a supply chain perspective regarding EMS in the “blue chip” sector. Support was providing to suppliers to implement or even certify EMS. This was performed by big buyer companies operating as mentors and initiating EMS to their suppliers (Gascoigne, 2002).

4.3 Groups influencing EMS (stakeholders)

The development of an EMS is usually done with the help of external assistance of consultants (ENDS, 2004a). In UK the environmental consultant industry sums up to a billion pounds (ENDS, 2004b). The influence that the consultants have on the EMSs is so apparent and sometimes stronger than auditors’ influence that it has even been proposed that the EMS consultants should also be certified (Progressive Policy Institute, 2001).

Another research focusing on EMS implementation has found that the auditors influence the EMS implementation when there a lot of non conformities. Also there is negative relationship

between the auditors' influence and the size of the company implementing EMS; so there is more influence the smaller the size of the company implementing EMS (Dalhammar, 2000).

4.4 Implications for the study

The provisions of ISO 14001 do not hinder supply chain considerations, but the wording remains vague for facilitating these considerations to be directly addressed. The expected revisions are focusing to a more product oriented EMS but it is doubted that they might have positive effects on the EMS supply chain perspective.

The early articles and books about the ISO 14001 there was no reference to the scope of the EMS; thus not dealing with supply chain issues. The scope of EMS and the problematic of the indirect environmental aspects appear in relevant documents more often recently.

According to a survey of 131 companies across the world implementing EMS it was found that firms reported fairly high levels of satisfaction with ISO 14001 (Summers Raines, 2002), indicating that regarding the criticism around EMS, it still remains a applied tool.

The consultants and the auditors are external societies to the organizations but it has been proven that influence the EMS development and implementation; thus were explored during this research.

The next section will portray the two countries in general terms and related to EMS.

5 Data about Sweden and Poland

In Sweden the GDP per capita is estimated \$25985.33 per person (natiomaster, 2004b). On the other hand the GDP per capita in Poland is estimated \$9056.85 per person (natiomaster, 2004a). The commercial balance between the two countries has changed the last months of 2003. The export rate of Poland to Sweden has increased during 2003 (Commercial and Economic Section, 2004). Eurostat reports that in 2003, Poland exported to Sweden 1 720 million Euros (5.2 % of the Polish exports) and imported from Sweden 1 578 million Euros in goods and services (4.3% of Polish imports) (Eurostat, 2004). The commercial relationships have increased after Poland's accession in the EU, in May 1st 2004. Even if both countries are members of EU differences exist between them in many stages.

5.1 Overview of Poland

The fall of centrally planned economies brought about a new development opportunity for the country, by avoiding the same mistakes that developed countries have made (Trebicky et al., 2003). These new opportunities in Poland were covered under the UNEP World Cleaner Production Programme has developed a 3 level development scheme including the promotion of EMS to production and service sector (Nowak, Wasilewski, & Cichy, 2002).

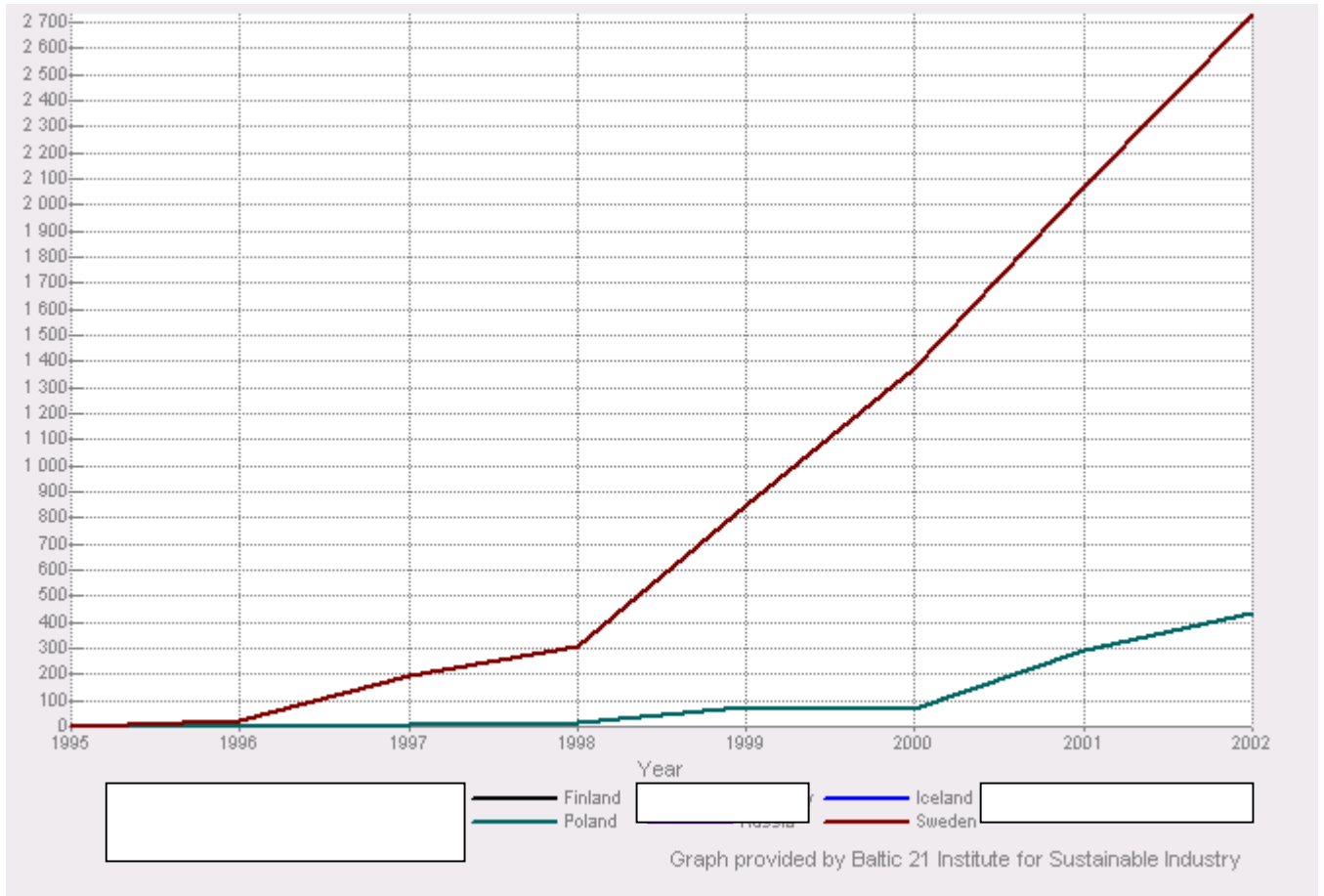
The implementation process of ISO 14001 is very dynamic and is expected that it will continue to grow according to the interviewees. Regarding the implementation of EMSs the main drivers were both internal and external. The internal forces involved top management's ambitions especially in the presence of international mother company and presence of other management systems. The external drivers are connected with the extensive privatization and the supply chain requirements (Plepys, 2000).

In Poland the main driver for environmental improvements inside companies is the need for compliance with legal requirements. Raising employees' awareness has been identified crucial factor for the success of environmental programs (Hillary, 2001). Another study has proposed that "raising employee awareness and changing their old habits" is the greatest problem to overcome (Plepys, 2000).

Most of the interviewees were familiar with the EMS concept. The ISO 14001 concept had altered comparing to the findings presented by Plepys in 2000. Now the interviewees perceive ISO 14001 certificated companies as companies implementing an EMS according to ISO 14001, when 4 years ago companies implementing EMS were promoted as "environmental leaders" (Plepys, 2000). Regarding the companies interviewed, 6 out of 7 were ISO 14001 certified.

5.2 Overview of Sweden

The EMS implementation in Sweden has been a success comparing to other countries. it has been estimated that in 2000 there was one ISO 14001 certification for 8 000 people in the country, which is the highest rate in the world (INEM, 2000).



(Baltic 21 Institute for Sustainable Industry, 2003)

5.3 Implications for the study

As it has been already proven by (Steger, 2000) the different political and cultural preconditions affect the adoption and the implementation of EMSs. The way the EMS is used differentiates from one country to another. The survey conducted by Steger in 2000 has revealed that subsidiaries or highly dependent exporters from the South Europe introduced EMS either to satisfy the internal or purchasing policies of Nordic mother companies or buying companies. This finding is in accordance with the information revealed during interviewing Polish organizations that had close relationships with Swedish or Finnish organizations. In detail, Swedish subsidiaries based in Poland stated that the main driver for implementing EMS was the mother's company strong commitment towards EMS. Another Polish organization in the logistics sector decided to implement EMS in order to satisfy the environmental conscious Swedish major customer.

The situation present in Poland and Sweden regarding the research questions will be analysed in the next section.

6 Analysis

6.1 Environmental supply chain requirements and their control

As a first step this study presents the supply chain environmental requirements in the automotive sector. Later the environmental supply chain requirements and the control mechanisms were explored with interviewing supply chain members of various sectors in Poland and in Sweden. The aggregated comments from companies are presented in Table. 6-1. Each box represents the views expressed by each illustrative case explored. Moreover, the general opinion of the relevant stakeholder was also captured and is presented separately.

6.1.1 Supply chain environmental requirements

At this part the environmental requirements established in the automotive industry are presented. Later the environmental requirements forced in supply chains of numerous sectors will be presented.

6.1.1.1 The automotive case

The supply chain environmental requirements in the automotive industry will be presented in this section. The secondary data were drawn by reviewing relevant literature, internet sources regarding the illustrative case of VOLVO 3P trucks. In addition primary empirical data were collected by interviewing a member of the sector.

Introduction

The automotive industry is considered to be a leader in the environmental supply chain management. The dissemination of standards among automotive supply chain members was associated with the requirement of the US industry in 1994 to adopt QS 9000, the automotive specific version of the ISO 9000 quality management system standard (Wilson, 1999). In 1998 both GM and Ford, after conducting a survey among their suppliers and releasing that their suppliers recognised the ISO 14001 benefits, decided to require their suppliers to implement ISO 14001. In more detail Ford, in 1998, announced to its suppliers that they should implement EMS, according to ISO 14001, at least to one of their sites by the end of 2001. At the same time, Ford announced that it was expected that all suppliers' sites to be ISO 14001 certified by July 1st, 2003 (Wilson, 1999). The main drivers for including ISO 14001 in the automotive supply chain considerations was reported to be the fact that Toyota was a leader in the environmental considerations; the consumers' environmental concerns and the brand protection of negative publicity (Thorton, 2000a). A later study performed by BSR (2001) has pointed that one of the recent and major challenges faced by the automotive supply chain has been material substitution when eliminating hazardous substances and thus list with restricted and banned chemicals were introduced to the suppliers.

Detailed supply chain environmental requirements -the illustrative case of VOLVO 3P trucks

The research focused to the supply chain environmental requirements of Volvo 3P Trucks since it is a Swedish company and its requirements are available to the public through its web site (VOLVO, 2004c). The environmental considerations are incorporated in the initial stages of the supplier evaluation and the whole evaluation process is communicated to the supplier (VOLVO, 2004a). Environmental issues are covered together with the rest requirements when a supplier is applying to cooperate with the organization (VOLVO, 2004b). The

environmental requirements are integrated in the quality requirements under a different section. The main requirements refer to: ISO 14001 certification, report on black and grey lists of chemicals, best industry standards, monitoring, packing materials, recyclability and the use of recycled goods when something new is produced (Volvo, 2004). Volvo 3P considers as mandatory the environmental issues towards its suppliers and these requirements appear as part of the contract (VOLVO, 2004d).

Insights regarding the supply chain environmental requirements

One interviewee from the automotive industry has mentioned that the automotive industry produces something that is environmental unfriendly per se, so involving the supply chain in the environmental considerations was the least to do. He also mentioned that the society has a more direct link to environment comparing to quality. He elaborated his statement by saying that: “the near by neighbours do not care if an automotive industry has quality problems. The society thinks that if the company messed up in quality terms, then it is the company who pays”. If the automotive company or its suppliers face an environmental incident “then the neighbours are very concerned” since they are also exposed to the costs. He also mentioned the EU regulation that has initiated changes in their supply chain. Even though the legislative restrictions are in place in Europe, he mentioned that other places in the world are affected. The supply chains in his organization are international and the manufacturers have to comply with EU regulations even though are operating outside of EU. In order for the interviewee’s organization to comply with EU or national legislation, lists with restricted and banned chemical substances have been developed and demanded by the suppliers. The substances in question have been defined by legislation and the company is working with its suppliers in order to be in compliance. The same interviewee mentioned that the value of having ISO 14001 certified supplier is very evident in the environmental discussions, since this kind of suppliers have experienced environmental demands by their auditors and react better to customer’s environmental concerns. He stated that his company is working with the first tier suppliers but he was sure that the following tiers are also affected, but they are not directly controlled by his organization. The major pressure and control mechanisms for environmental concerns, was stated to be posed to potential suppliers comparing to the existing ones.

Concerning the implementation of EMS among the suppliers, the interviewee mentioned that all the suppliers are not performing the same. He also mentioned that the certification process and the value of the ISO 14001 certificates differ from region to region. The maturity of economic markets, the level of law enforcement and the societal environmental awareness were argued to be the reasons for the forth mentioned fluctuations.

Conclusions

The environmental requirements in the automotive industry have followed the introduction of quality demands. The automotive companies have required in the beginning ISO 14001 certification from its suppliers but now they require more specific aspects of the environmental performance. The sector is familiar with following standards and trimming them to its needs. Nonetheless, the industry has not adjusted yet the ISO 14001 to its specific demands. Even though the automotive industry implements ISO 14001 it was not clear that the EMS was used to define the environmental aspects raised upstream in the supply chain. The international nature of the automotive supply chains disseminates environmental thinking to the industries in the world.

As the companies were maturing in dealing with environmental issues the implementation of EMS was not sufficient tool for environmental supply chain management. Nonetheless, ISO

14001 was not rejected as supply chain requirements. The inclusion of ISO 14001 certification in the supply chain requirements can imply at least that it serves as a tool to minimize the information gap between the different supply chain members

6.1.1.2 Companies' insights regarding supply chain environmental requirements

The data gathered through interviewing a variety of organizations regarding the supply chain environmental requirements are compiled and they are presented at Table 6-1. The table presents the reasons why the environmental supply chain requirements were raised in the illustrative cases studied. The next section is about the types of supply chain environmental requirements and some examples of the illustrative cases are mentioned. The importance of the environmental supply chain requirements was connected to whether these requirements are mandatory or voluntary and to the level of integrating these requirements in the early stage of purchasing. Finally, the communication channels in use among the supply chain members are presented and the depth of the supply chain implication caused by the environmental supply chain requirements is described.

Table 6-1 Information collected through interviews

Country			
Sweden		Poland	
Sectors			
Service	Manufacturing	Service	Manufacturing
Drivers for environmental supply chain requirements			
End consumers' demands from Scandinavia. Easier for us to reach our environmental objectives. Move to sustainable society. Makes us proud to work with such suppliers. Help us to build up our brand.	EU regulation. End consumers' demands.	Demanded by our certification auditor but it makes no sense in the current market conditions. SCER are initiated by buyers with Scandinavian fund. Legal requirements	Cost savings and reduction of environmental impacts.
End consumers' demands. Fulfilling reporting needs. Legislative demands.	The expected generated benefits which can be measurable and/or immeasurable.	Our buyers' corporate culture. Mother company.	
Types of supply chain environmental requirements (SCER)			

Same general environmental issues addressed to all suppliers. Demand our suppliers CEO's signature about our SCER.	Encourage suppliers to EMS implementation but it is not mandatory. Receiving detail requests that not even the buyer can process.	Request to report on lists of forbidden or restricted substances.	The SCER are integrated in the quality ones.
The SCER are integrated in the quality ones. The sector should develop a common questionnaire relevant to environmental issues for our customers because we receive so many different SCER.	The suppliers are assessed and asked to fill in questionnaires. There are some common SCER for all of our suppliers but specific ones are agreed with each supplier. Adoption of different approaches for different sectors of suppliers.	The SCER are incorporated in the design phase. Lists of forbidden or restricted substances. High costs entailed to fulfil them.	
	Request EMS . Request lists of specific substances.		
Mandatory or not?			
Mandatory.	Mandatory, Economic suctions are attached to deviations.	Mandatory, the premium we get is the contract.	Mandatory.
	They receive the allocation according to the score they receive.	Mandatory since it is connected to legal requirements.	
		Mandatory partly, better price for fulfilling.	
		Mandatory, otherwise break the contract.	

Integration of the environmental supply chain requirements in the purchasing decision			
<p>Purchasing department is very integrated in the environmental considerations.</p> <p>Suppliers are informed and evaluated prior signing the contract.</p>	<p>Suppliers are evaluated prior signing the contract.</p> <p>The purchasing department is aware of environmental issues.</p>	<p>Yes, but a cheaper supplier with worse environmental performance will be preferred.</p>	
<p>There is minimum score the suppliers have to reach in order to work together.</p> <p>The score every year increases.</p>	<p>The higher score the suppliers reach the better allocation they get.</p>	<p>Up to an extend.</p>	
Communicating the SCER			
<p>Work closely with the main suppliers.</p> <p>Hold face to face meetings.</p> <p>The SCER are further communicated during the resign of the contract.</p> <p>Ending the relationships do not bring improvements.</p>	<p>We provide to our suppliers feedback about their performance and their relative place.</p> <p>The SCER are agreed with the supplier.</p> <p>SCER appear on the contract.</p>	<p>Annual meeting with all of our suppliers and face to face meeting with each one.</p> <p>SCER appear in the contract and are incorporated with the quality ones.</p>	<p>Communicate SCER during regular meeting for business matters.</p>
<p>Web based database where the suppliers update the data.</p> <p>Further documentation is provided through website.</p>	<p>Open to the public through our web site.</p> <p>Included in the contract.</p> <p>Structured additional help is not provided.</p>	<p>Documented guidance is provided.</p> <p>Relevant contact person is available for further help.</p>	

	Mother company forces SCER to the daughter but the daughter does not always pass them to the suppliers.	Communicated with our sales representative.	
		Documentation are part of the contract.	
Influenced supply chain tiers			
We push the requirements we receive down to our suppliers.	Directly we influence the first tier and it is expected from the m to work with their suppliers.	We need to push the requirements we receive down to our suppliers.	
		We push the exact same requirements we receive to our suppliers.	

6.1.1.3 Conclusions regarding the supply chain environmental requirements.

During the interviews it was revealed that most of the organizations interviewed implemented a certified EMS. In Poland the small sized companies interviewed, acting as suppliers, did not implement a standardised EMS. Following the primary empirical data concerning the supply chain requirements in both countries are analysed. Finally the compatibility of the ISO 14001 standard is presented.

Drivers for supply chain environmental requirements

The drivers for establishing supply chain environmental requirements were more evident comparing to the method followed to determine them. In both countries, Poland and Sweden, and mostly regarding the manufacturing organizations, legislation was one of the most important drivers for defining supply chain requirements. The organizations in Sweden were highly motivated by market forces and other members of the supply chain, prevalently by the end consumer. Environmental reporting and the need for reliable data from the supply chain that can be processed to present the environmental performance of the company was a very interesting driver, mentioned by a Swedish organization. “the information provided by our suppliers is important for us to map down the current status and to set the correct objectives and targets” he stated. In general the Swedish organizations seem to be more active and conscious about the supply chain environmental requirements comparing to the Polish organizations. The later were highly influenced by external factors, such as auditing procedures for ISO 14001 certification or by internal factors such as mother company. One polish interviewee stated that: “we have developed a method for environmental evaluation of our suppliers after the demand of the certification body’s auditors. Nonetheless, this procedure is only satisfactory to the certifier since our market operates in a way that does not make any sense such an evaluation, because we cannot collect data” .The market situation in Poland was highlighted as a barrier for initiating supply chain environmental requirements. It was argued that environmental considerations are not rewarded in the polish market; thus the introduction of environmental supply chain requirements has not been successful. The Polish daughter companies receive predefined environmental requirements from their mother companies but they complained that these requirements do not fit the polish situation and are “exclusive”.

Types of supply chain environmental requirements

It was found that most of the organizations in both countries, Sweden and Poland, introduce to their suppliers environmental concerns as quality demands. Lists concerning restricted or banned chemical substances (“grey” and “black” lists respectively) are a common supply chain environmental requirement in both countries Sweden and Poland. Also in both countries the buyers demand ISO 14001 certificate from their suppliers.

Many the interviewees in both countries argued that ISO 14001 does not give a clear view about the level of environmental performance and EMAS is stronger in this part with the requirements about the public environmental statement. They also argued that the level of environmental performance is what they are interested in. Nonetheless, at least two of the Swedish companies also stated that most of their plants are abandoning EMAS registration and are implementing certified EMS according to ISO 14001. The exodus of EMAS registration is contradictory because it is stated that EMAS is high respected.

The organizations in Sweden were found to have more advanced supply chain environmental requirements. Most the Swedish organizations have developed their detailed demands and the top management commitment was clear. However, lack of harmonization concerning supply chain environmental requirements was found. It is worth mentioning the case of a Swedish organization which mentioned the difficulty in fulfilling different environmental customers' demands. The organization suggested that the members of its sector should define a common understanding of the significant environmental issues associated with the sector's operations. The interviewee suggested that a common understanding will bring harmonization in environmental supply chain considerations received by customers and it will increase customers' satisfaction and the efficiency of their efforts. Another interesting comment from a Swedish organization was about the organization's policy to involve the suppliers' CEO in the environmental consideration the organization raised. The organization had noticed that only the environmental department of the supplier was associated with their demands, without the direct involvement of the top management. "The CEO's signature ensures that the environmental requirements are raised at the appropriate level" the interviewee argued.

The Polish organizations raised or received supply chain environmental requirements when they were cooperating with companies from Scandinavia. The organizations in Poland, were more passive in this field, comparing with the Swedish one, because their initiatives were limited and they were reacting and not being proactive to external pressure. A Polish organization supplying a Swedish daughter company in Poland mentioned that it receives "environmental requirements in the form of quality requirements which are very similar to the legal preconditions posed by local authorities". Another Polish company supplying to a Swedish company stated that: "We do not receive environmental requirements from any other customer. We receive ready formulated requirements from our Scandinavian customer regarding specific environmental targets". Another Polish company with Scandinavian capital argued that "in general the Polish customers do not raise environmental considerations. It usually us that pushes environmental changes to our suppliers".

Status of the supply chain environmental requirements and their integration in the purchasing decisions

During the interviews, in both countries Sweden and Poland, it was stated that most of the environmental requirements to the suppliers were "mandatory". The status was not completely justified because the sanctions were not always defined and the control mechanism was not always active. The statement that the environmental requirements are mandatory is like an empty contract. Their satisfaction was not regularly controlled. The most important feature is the lack of predefined sanctions in case of failing to meet the requirements. None of the interviews clearly mentioned that the environmental supply chain considerations were on a voluntary basis. The integration of the supply chain requirements was assessed whether or not these requirements were introduced to the suppliers prior to signing the contract and whether these requirements were used as criteria for evaluating the suppliers against them. The main finding in this field is that there is still room for improving the integration of the supply chain requirements in the purchasing decision in both countries. The allocation of the contracts in some cases was closely associated with the suppliers' performance but the link was not always clear. As very openly one Polish supplier said "we do not love people but we love money", meaning that the environmental requirements will be satisfied as long as they are accompanied by monetary rewards. The potential of positive rewards in case of satisfying the supply chain environmental requirements was not explored by any of the interviewees. A Swedish buyer mentioned that the sanction connected to failing to satisfy environmental requirements was "loosing the contract" and the reward the suppliers received was again "having our contract".

The most integrated system was mentioned by a Swedish multinational which connected the level of environmental performance of its suppliers to the allocation of contracts. A Polish company supplying a Scandinavian company mentioned that the benefits generated from its customer's requirements were clear in monetary terms from material savings.

Communicating supply chain environmental requirements

In both countries it was revealed that the environmental supply chain issues were also discussed during regular business meetings between the buyer and the supplier. Nonetheless, an important aspect is the level of environmental competence relating to environmental issues of the person assigned as contact person. The integration of environmental issues with economic and quality issues during business meeting can be considered as positive development; nonetheless it heavily depends to the level of environmental awareness of the person assigned to communicate with supply chain members. The stakeholders interviewed, in Poland and in Sweden, had stated that the purchasing and marketing departments are usually not involved in the EMS routines; thus the competence level of their personnel is questioned by the researcher. In both countries the environmental concerns was reported to usually appear in the contract between the business partners. The method is more traditional but can have high results because is more binding.

Some Swedish organizations stated the use of web based communication tools. "The use of internet is a positive development because the communication can be achieved in real time and can be interactive" one of them argued. However, an important parameter for web based solutions is the usage rate of new technologies. According to Eurostat, by 2001 in Sweden there were 51,8 internet users per 100 habitants (Eurostat, 2003) and in Poland there were 10 users per 100 habitants (Eurostat, 2002). The significant difference in the usage of internet, in these two countries, implies that the use of web for communicating environmental issues will have different impacts for the two countries.

An interesting insight was mentioned by a Swedish organization regarding the nature of relationships the organization develops with its supplier. The interviewee mentioned that longterm relationships are the ones that bring positive environmental results, because "the supplier is bonded to the agreements and has an incentive to invest in environmental improvements". Another Swedish multinational buyer mentioned that the organization develops long term dependent relationships with its suppliers because "we want to grow and we want our suppliers to grow with us and we want them to be able to supply us".

The supply chain requirements was stated to be demanded from the first tier of suppliers but eventually the supply chain members had to pass them towards upstream supply chain members. One Swedish multinational buyer argued that: "in the code of conduct communicated to our suppliers it is mentioned that it is expected by them to relate with their partners in the same way. However, our organization is not directly controlling or communicating the requirements to the second or third tier suppliers". A polish organization which has to fulfil environmental targets according to its Swedish customer mentioned that. "We push the same requirements to the subcontractors we hire".

ISO 14001 compatibility and supply chain environmental requirements

The standard's requirements and potentials were detailed presented under 4.2 of this study. Summing up, the standard gives the essential space for companies to consider the indirect aspects. Nonetheless it is how the standard is interpreted and implemented regarding indirect aspects which are usually not considered. Indirect environmental aspects are usually not

included; thus supply chain environmental considerations are left out. The scope is very limited and the standard does not help in this direction because the scope is only referred to the introduction part of the standard and no great explanation is given.

The interviews revealed that the companies implementing an EMS did not use their EMS as a tool to evaluate the environmental aspects of their supply chain. The method for defining the supply chain environmental requirements was vague and not included in the EMS.

The significance of the suppliers was not associated with evaluation of their environmental impacts. Up to now the key suppliers are defined according to the financial terms and not according to environmental significance. An interviewed consultant has aptly argued the most important suppliers of big companies are themselves big companies. So buying companies should not devote their efforts towards them since they are controlled by other stakeholders since they are recognisable.. It is rather the small suppliers that are functioning in a local level that need the pressure and guidance from the buyers. However, this thinking was not met during the interviews of the organizations.

6.1.2 Control of supply chain environmental requirements

Table 6 2 presents the compiled data regarding the control of supply chain environmental requirements collected during interviewing organizations in Poland and Sweden. Moreover, relevant key stakeholders from Sweden and Poland were also interviewed. Their insights gave a more holistic view and they were presented in 6-1 section of this study.

The organizations interviewed from both countries did not implement an audit mechanism to their suppliers. In most of the cases the control is a documentation level. The exchange of documentation was used as proof for the satisfaction of environmental supply chain requirements. The data presented by the suppliers were verified either against to governmental available data or automatically as long as the supplier holds an ISO 14001 certification or during the regular business visits. A Swedish multinational mentioned that it does not have in place a structured auditing mechanism for all of its suppliers because “resource restrictions have not allowed plans for more auditing to be implemented”. Another Swedish company active in Scandinavia argued that it does not implement any suppliers’ audits but instead it develops projects and provides its suppliers with adequate time for performing environmental improvements. Nonetheless, most of the interviewees argued that the expecting costs for auditing activities will be less than the costs avoided and the benefits generated by the controlling the supply chain. Another interviewer from a Swedish multinational said: “I never thought this (suppliers’ audits) as a cost. The auditors go to the plants together with quality audits and a visit to the supplier, so it is not an extra cost”. Another interviewer representing a Swedish multinational argued “in the environment the suppliers’ control can be improved. However the business is based on money and when you deal with “soft” issues, such as environmental issues, then you have to fight really hard to take these issues serious”. Another Swedish multinational raised the issue of involving a third party: “nowadays we have to decide whether we should increase the suppliers’ audits or whether we should involve a third party”. By the same organization it was revealed that the audit mechanism depends on the sector the supplier is representing and the dominant trends per suppliers’ sector.

A polish organization performed audits on their site for the environmental requirements which were integrated with the quality ones; however the representative was not satisfied with the auditing activity. It was argued that the whole market situation should change for the suppliers’ audits to be successful. The same interviewer also rejected the potential of working together with other members of its sector to improve the environmental control of the supply

chain. “Such solutions need a lot of time, something more than a decade”, he reported. Another polish organization mentioned that the control results in some cases were very subjective and negotiations were initiated with the customer when the results were not the same. This point reveals the importance of the previous step of clear defining the requirements. The deviations in audit results introduce negotiations thus entailing more costs.

Stakeholders

The key stakeholders were interviewed and their opinion about the supply chain environmental requirements was captured. In general the stakeholders were positive about initiating environmental concerns in the supply chain, but they were sceptic about how this is actually done. A consultant made a comparison with the quality considerations and he mentioned that “the environmental issues are a small part in the whole”. A Polish expert in the EMS field mentioned that they are two types of organizations, concerning the supply chain environmental requirements. The one category consists of those who are having extreme expectations and requirements to their suppliers and the others who feel that they cannot initiate changes in the supply chain. The interviewee mentioned that the first group of organizations puts so detailed and stringent requirements that cannot either process or control them. The second group of organizations releasing its limitations for initiating changes and monitoring the progress decides to be passive and does not require environmental issues from its supply chain members. During an interview with a Swedish expert in EMS he mentioned that he has faced situations where the buyer was expecting and asking extremely detailed environmental information from its suppliers to list all the chemical substances present in the site. The supplier would need enormous resources to develop these lists and the buyer, on the other side, would not be possible to process or monitor all the detailed lists. Regarding the control the stakeholders brought up cases from organizations which outsourced the auditing of their suppliers. The organizations outsourced either the training of their personnel regarding suppliers’ audits or they outsourced the whole auditing process. The organizations outsourced the training and the auditing from big multinational consultant companies and certification bodies.

Regarding the control of supply chain environmental requirements the other hand, a Swedish supply chain auditor and consultant reported: “the related cost is not a big issue because the alternative is obvious”, implying the remedy and reputation costs.

Table 6-2 Control for supply chain environmental requirements

Country			
Sweden		Poland	
Sectors			
Service	Manufacturing	Service	Manufacturing
Control of supply chain environmental requirements (SCER)			
No environmental audits are performed to our suppliers. There are control mechanisms against objective criteria for the data provided by our suppliers.	Suppliers have to report on SCER. The control is focused in potential & new suppliers.	The control procedure is highly subjective. We monitor the satisfaction of our customer's demands but our customer re-controls them in their site.	We do not structured audit our suppliers
	Control mechanism in our site, after receiving the materials.	No structured control mechanism for our suppliers. We accept audits by our Swedish mother company.	
No audits performed in our suppliers sites.	Our suppliers' EMS certification verifies the quality of the data provided by our suppliers.	We receive annual on site audits by our customer but we do not yet audit our suppliers.	
	We do not control if our daughter companies communicate or control the SCER.	The control is performed in our sites after we accept the materials.	

6.2 Stakeholders' view about the use of EMS as a tool to set and control supply chain environmental requirements.

The interviews with key stakeholders regarding EMSs and supply chain issues from Sweden and Poland revealed first of all shortcomings for initiating environmental supply chain requirements. At the next level shortcomings in the EMS used as a tool to set and control environmental supply chain requirements were also recognised. The shortcomings are presented as gaps in the Table 6-3. Four different levels were identified in order to classify the gaps and to structure the analysis.

6.2.1 Gaps for initiating supply chain environmental requirements

During the discussions with relevant key stakeholders three major drawbacks were recognised for avoiding the introduction of supply chain environmental requirements:

- The market does not pay to be green,
- The environmental awareness of the organizations and of the society is not high,
- The purchasing department is not involved.

The first argument about the failure of the market to recognise environmental improvements was mentioned. A Swedish consultant argued that “educated and well informed consumers and costumers are the strongest driver for environmental supply chain requirements”; and one of his colleague added that “environment is considered a cost”. A polish organization that implements environmental requirements stemming from its Swedish mother company mentioned that: “the requirements are very costly and the benefits are not visible yet”. The supply chain operates within predefined market conditions and in the case externalities the environmental considerations are not rewarded.

The second argument hindering the introduction of supply chain environmental requirements was associated with the level of environmental awareness of the organizations. It was reported by a consultant that the “companies are only looking for improvements within their site”. This statement combined with the narrow scope of the implemented EMS, almost erases the potential of examining the supply chain. An interviewer mentioned that the organizations are not so familiar with environmental issues and face difficulties in recognising places to intervene. On the other hand the level of societal environmental awareness, as mentioned above, is hindering the inclusion of the supply chain in environmental improvements. A representative of a polish organization mentioned that the consumers in Poland are not environmental aware regarding their buying decisions.

The last comment about factors hindering the introduction of supply chain environmental requirements concerned the limiting participation of the purchasing department in corporate environmental considerations. A Swedish expert mentioned through his professional experience has concluded that marketing and purchasing departments are not usually close incorporated in the environmental initiatives. He argued that “they (the purchasing and marketing departments) get their rewards and bonuses depending on the lowest price they can get and not directly on the environmental performance”.

6.2.2 Gaps between EMS and supply chain environmental requirements

The recognised gaps existing between EMS and supply chain requirements are divided in four levels based on Meadows' suggestion for places to intervene in a system (1999). The first level, societal, refers to members of the society that are involved in EMS and supply chain issues. It also refers to the internal perspective of the organizations either implementing EMS or being a supply chain member. This level is associated with the mindset of the society. Changing this level requires high level of efforts and is the most appropriate for initiating permanent changes. The second level is institutional and refers to issues generated by policy initiatives or the lack of them. According to Meadows this level represents the "rules of the system" and the inertia is high. The reconstruction of the rules implies changes in human behaviour and such a shift will have a significant change (Meadows, 1999) p.13. The next level refers to the standard per se and to the barriers that it raises. The standards were placed by Meadows in "the least leverage of the intervention list". This level is very popular for initiating changes but the changes are shortterm and rarely lead to behavioural changes. The elements that enter in the predescribed levels can be debated and the author's interpretation is presented in the Table 6-3 and justified in the text below.

6.2.2.1 Societal level

Credibility of the EMS certification process

Most of interviewed stakeholders in Sweden and in Poland argued that it is rather easy to be certified according to ISO 14001. Many of the interviewees questioned the credibility of the certification bodies. "The certification bodies should be tougher when issuing certificates" a Swedish consultant noted. The criticism was not towards to the organizations per se but mostly towards the auditors. Auditors' competences and the way they approached the audit were the main points of negative criticism. The fact that most of the certification auditors had evolved by the quality issues and had limited knowledge about the environmental issues was perceived as not contributing to the credibility of EMS certificate. It was presented as if the environmental departments in the certification bodies were created because of market demand and not so much because the organizations devoted the appropriate resources for this. Even an auditor from a certification body argued that "it is known that there are differences world wide between certification bodies. I think the client and the market will verify and will decide which certification bodies will remain in the market and which will disappear". Nonetheless the EMS is a market based tool and its certification audits can not overcome this characteristic. So in order to fully overcome the barriers the market should incorporate more successfully these challenges. Moreover the accreditation system was brought up to the discussion by consultants in both countries, Sweden and Poland. A consultant mentioned "the accreditation bodies have an important role" and another noted "I have never heard of withdrawn accreditation" implying that the accreditation should be more structured. Another consultant mentioned that "the certification system is imperfect but the alternative is for buyers to develop their own auditing system which can be very expensive". All this criticism was presented as a common secret, so everybody is troubled about the credibility but there are not initiatives in this field.

A polish auditor mentioned that EMS certification as supply chain requirement will not minimize the environmental impacts of the supply chain because more specific requirements for environmental issues are needed to be controlled. Moreover auditors mentioned that by having only EMS certification as supply chain requirement there is a high risk of supply chain suboptimization to occur.

The trust towards certification bodies was questioned in open and it has to be redefined in order for certification to bring value and not just “extra costs” as a consultant mentioned.

A polish auditor argued that environmental labelling can be more environmental beneficial for comparing to EMS certification from a supply chain perspective.

The stakeholders were not clear about to the extend that the supply chains are affected. Some mentioned that nowadays it is only the first tier that is affected by environmental requirements and others mentioned that we already experiencing the influence of the second tier of suppliers. All the stakeholders agreed that many tiers upstream will be affected sooner or later. This finding somehow promotes the use of ISO 14001 as environmental supply chain requirement because the standard is developed to be implemented by all the supply chain members.

Differences between Sweden and Poland

Between Sweden and Poland the interviews revealed difference regarding the focus of the certification audits. Many Polish interviewees argued that the ISO 14001 certification audits were focused in ensuring compliance with legal requirements and having a bureaucratic approach stemming from the auditors’ quality experience. These characteristics were evaluated not to add to performance improvements and to hinder the credibility of the certificates issued. The criticism was also towards the certification organizations. It was revealed that certification bodies are not considered more respectful than any other organization in the market. Many interviewees connected the respect towards the certification bodies with the market situation. The market situation affects the credibility of the certification bodies. “The certification bodies, as any other organization is out in the market for generating profits, in times of bad economy, are lowering their standards in order to attract more customers”, a polish expert noted. The companies implementing ISO 14001 perceive the certification bodies as another supplier that needs to deliver the service (certificate) as long as they get paid for it (certification audits). The fierce competition between certification bodies is believed that has not improved the quality of their services but has made the certification audits “too easy”.

In Sweden the interviewees did not stressed the certification bodies so much but they focused more to the company’s perspective towards the EMS and its expectations. The certification audits were presented as another kind of audits in a series of audits either conducting or accepting. Nonetheless the problematic of the different levels of credibility between the certification bodies was said to be a barrier to the acceptance of the certification audits.

EMS process oriented

The dominant idea was that the EMS are implemented by companies in a process and facility oriented manner; thus failing to capture the complexity of the supply chain considerations. Some stakeholders from the consultant society stressed that companies implementing EMS are not proactive enough; because by having a scope limited to their site the companies miss the opportunities to fully improve their environmental performance. Consultants argued that by having a boarder view; thus involving the suppliers it can even be cheaper to improve the performance. A consultant stated: “The EMS according to ISO 14001 is a site specific system and if the company want to have a broader view and address issues like global warming, then it has to look beyond EMS” and he continued “it is applied for a process rather than addressing more strategic issues like supply chain management”. An expert in the EMS field

mentioned that “the EMSs have a very limited scope focusing only in their own facility”. The research pointed that the EMS is not used to its full potentials. The dominant view was that the standard offers the possibility to be implemented in a supply chain perspective but the people using the tool are not ready to use to the full extend. The main shortcoming for an EMS not being used as a tool in a supply chain context was either the lack of awareness of the actors involved in the EMS or the

Many consultants argued that even though the standard considers the environmental aspects associated with activities, products and services, 75% of the companies implementing EMS are not considering the products and services. “The focus of EMS has traditionally been on the operation and activities” a polish stakeholder stated.

Environmental competences of the organizations implementing EMS

Many of the consultants argued that not all the supply chain members can utilise EMS at the same extent but this is not happening because people cannot think out of the predefined box of EMS. They argued that the size of the company is another important limiting factor which is in accordance with other studies. They argued the smaller the company is the less available are resources for utilizing and exploring the EMS.

Auditors mentioned that the EMS has the room for catering environmental supply chain requirements. The environmental concerns raised by the buyers can be included and monitored through the operational procedures of the EMS. Auditors also mentioned that companies do not usually formulate their own environmental supply chain requirements stemming from the implemented EMS, but companies rather just push to their suppliers the environmental requirements they receive form their buyers. This means that the EMS does not bring any additional value to this field. This passive transmission of the supply considerations implies that the EMS is not considered as a useful tool for improvements.

EMS certificate as communication tool

Many of the interviewees argued that EMS certified companies exchange environmental communication more smoothly compared to the ones that are not EMS certified. The EMS seems to provide a common language that companies refer to when they want to exchange environmental information. The EMS certification does not provide enough environmental performance information but indicates that the organization is capable of handling environmental communication. The value generated from having EMS as a communication tool is intangible and very hard to estimate it. The fact that communication between members of the supply chain is significant gives a sign about the importance of EMS certification serving as a communication tool in a supply chain context.

6.2.2.2 Institutional level

EMS market based tool

The fact that the companies can only initiate environmental improvements as long as profits are promised was stressed by some Polish interviewees. On the other hand, since not all the externalities are internalised, the market will continue to give wrong signals and the EMS potentials will be underestimated.

Regulatory approach

Some stakeholders stressed the fact that the dominant regulatory approach is not fostering a broad supply chain view. The emission limits target points or media thus failing to address to initiate more holistic approach. On the other hand many stakeholders outside Poland mentioned that new EU Directives adopt a broader view and facilitate a supply chain approach.

6.2.2.3 Standard

ISO 14001 and environmental performance

Stakeholders from both countries were doubtful with the credibility of the EMS as a tool to improve or monitor the actual environmental performance. Many of them were troubled by the fact that the ISO 14001 certificate does not provide them with information concerning the environmental performance. The only information that an ISO 14001 certificate generates is that the company has at least the environmental issues in the agenda. The finding about the value of the ISO 14001 certificate leads to the result that it is almost impossible for ISO 14001 to appear solely as requirement without further guidelines. More information is demanded to ensure that the environmental efforts between members of the same supply chains are focusing to the same directions. EMS as supply chain requirement is something very vague and very hard to measure. As it has already been mentioned (in chapter ...) the requirements have to be specific and measurable.

It was concluded that EMS within has place for measuring and monitoring specific goals. The goals have to be negotiated and predefined and then incorporated in the EMS. ISO 14001 can serve as a vehicle catering for the supply chain requirements.

Indirect aspects and ISO 14001

Many stakeholders mentioned that the wording of the standard is very vague and the auditors' perception is many times what defines the certification process. It has been suggested by a Polish interviewee that more clear and direct wording of the standard regarding the consideration of indirect aspects would a way to overcome the shortcoming of not involving the supply chain in the EMS framework.

Especially the auditing society complained that they are trapped by the standard's wording. Auditors suggested that even though they think that environmental impacts from the supply chain are significant they can only refer to it as suggestion, if it is not considered by companies been audited. They mentioned that this part of the standard is weak and they do not have the possibility to treat it as non conformity.

Table 6-3 What is the gap for using EMS as a tool to define and control environmental supply chain requirements.

Level	Hindering	Fostering
Societal	Certification bodies are not so credible	EMS can be good communication tool when used by two organizations

	The certification audits are confidential between the company and the certification body	
	Process oriented EMS	
Institutional – policy	Regulations focus on emissions per media	Introduction of EU regulations having a life cycle approach (eg WEEE Directive)
	Consumers requirements	
Standard	There is no clear requirement for evaluating the indirect environmental aspects	
	ISO 14001 is not giving efficient information on the actual environmental performance	

6.3 Scenarios for potential changes in the auditing and controlling mechanisms regarding supply chain environmental requirements and EMS

During the research three possible scenarios were evolved by the author concerning the interface of EMS and the supply chain requirements. These scenarios were incorporated in the questionnaires. They evolved after reviewing the relevant literature. They were based also on the authors' experience as an environmental consultant. These scenarios were explored during the interviews with organizations' representatives and relevant stakeholders to EMS and supply chain issues. The scenarios were not presented to the interviewees, as this is an explorative study, with supportive information but rather they were presented to the respondents as regular questions.

Incorporating EMS certification audits and suppliers' audits

The potential of incorporating EMS certification audits and suppliers' audits was recognised when the similarities between EMS audits and second party environmental audits were illustrated. The structure of this scenario was not proposed to the interviewees.

The majority of the interviewees argued that they would like to see more auditing activity regarding supply chain members. The major barrier for increasing the suppliers' audits was argued to be limited human and economic resources. The scenario of using the EMS certification together with suppliers' auditing was explored during the interviews with both organizations and relevant key stakeholders in Sweden and Poland. The idea of merging EMS certification audits with suppliers' audits controlling the supply chain environmental requirements was something new to most of the interviewees had not thought beforehand. In

general as one of the interviewee mentioned “I think people are fed up with audits”. The research revealed that the credibility of the certification audits should be improved in order for the merge to happen. Many of the interviewees argued that the suppliers and the certification audits are overlapping in many levels. In more detail a Polish supplier said that “the strictest audits are the internal then less strict is the certification audit and the least strict audits are the customer’s audit”. A conjunction of the audits will result to significant cost savings to many of the actors. Some of the stakeholders mentioned the importance of “having educated auditors” when the initiative is implemented. Another stakeholder mentioned that such a development is not welcome because “the big brands are interested in an holistic view of their responsibility (compared to the environmental focus of the EMS certification audits)”.

On the other hand this potential was not welcome because of conraindicative interests between the two audits. The different nature of financial relationship between the company receiving the audit and the buyer was said by an auditor to hinder the independency. The need of impartiality of certification audit was said to be affected by the presence of second party interest.

Developing EMS standards per sector

This scenario of developing EMS standards per sector was inspired by the initiative taken by the automotive industry to develop its own quality standard. The development of such an environmental standard will be shared between supply chain members. The practicalities regarding responsibilities and minimum requirements for developing such a documents were not defined or presented to the respondents.

The development of EMS implementation guidelines per sector was received with scepticism by some companies and stakeholders. The quality standards developed by the automotive industry and the guidelines for GRI were presented as success stories by some interviewees. These successful examples served as paradigm to be copied in the EMS sector. A company representative mentioned that such a development will provide a common understanding among the sector about the environmental issues. Moreover it was suggested that EMS standards per sector will help to clarify supply chain requirements.

A consultant aptly mentioned that guidelines for environmental improvements already exist for many sectors; without substantially altering the environmental performance of these sectors. An expert from Poland said: “standards are not necessary but guidelines will be helpful”. Many interviewees stated that common documentation and international standards are expressing the lowest minimum common dominator; thus limiting the improvement’s potential. On the contrary the “resources demanded to develop these guidelines internationally deter it from happening” an interviewee mentioned expressing his scepticism. Another stakeholder mentioned that such development contradicts to the main goal of the international standard which is to serve all companies regardless sector or size.

Implementing common EMS among key members of the supply chain

The potential of implementing a common EMS among key members of the supply chain was developed by the author and was inspired by the criticism against EMSs. Practicalities were not defined because this is an explorative study.

The potential of implementing a common EMS between key supply chain members was not comprehensible for companies. They seemed to be puzzled about how something like this could be possible. It was said that a common EMS will give the opportunity for a holistic

overview of the supply chain; thus suboptimization can be avoided. An expert in EMS field mentioned that such an approach can be very beneficial at least in the auditing of the EMS. He stressed the potential of supply members of exchanging or sharing internal auditors. Internal EMS auditors shared within the supply chain is expected to improve the performance and reduce the relevant costs.

Many of them argued that sometimes it was complicated enough to have an EMS just within their organization. The consultants, the auditors and the experts on the field argued that a common EMS between key supply chain members could be possible as long as long supply chains are linear and short; the relationships are long-term and there is common supply chain strategy. A troubling issue was the nature of relationships between the key supply chain members, since it was mentioned that companies can be related with buyer and supplier relationship but be competitors at the same time. On the down side it was mentioned that the weakest part in the chain will define the environmental performance of the whole chain. One auditor mentioned that a common EMS between key supply members will be impossible according to ISO 14001 because it is site specific standard.

7 Conclusions and Recommendations

This section presents the main findings of the research and the researcher's reflections and suggestion for further research will be proposed.

7.1 Conclusions

In this section the major findings regarding the predefined research questions will be drawn.

The supply chain environmental requirements are usually driven by legal requirements and voluntary action is taken because of stakeholders' demands or for avoiding supply chain interruption. The risk of supply chain interruption can be avoided by requiring EMS certification because having EMS can be seen as a proof of at least complying with legal requirements.

The need for harmonization has raised standardised EMS as a common international supply chain environmental requirement. However the credibility of the accreditation systems (associated with certification bodies) in different countries is a troubling issue.

What is the current situation regarding the environmental requirements put along the supply chain (from a buyer to the supplier)?

During the research it was found that supply chain members *require EMS* certification from their partners but nowadays they want more information about *specific* points of the suppliers' environmental performance. The study resulted that an EMS has place to cater for supply chain requirements but it is *not used* in this way because there are pitfalls in the implementation stage. Summing up both process and product oriented environmental requirements were addressed in the supply chains.

It was performed that even though the majority of the environmental supply chain requirements were mandatory, often, there was not structured audit mechanism attached to them. Also the requirements usually were not attached to sanctions and the direct positive rewards were not explored.

It was concluded that the *big* companies which are active in many countries are the ones that *initiate* supply chain requirements. The companies which are small in size usually do not initiate environmental supply chain requirements even though they might implement EMS. The smaller companies usually *transmit* the supply chain requirements they receive from their buyers to their suppliers with no major changes.

When environmental considerations are deriving from mother companies with headquarters in Sweden and are applied in *Poland* many difficulties were revealed. The environmental requirements were perceived to be very *innovative* and forward thinking but that could not be successfully implemented. The Swedish companies were more mature and experienced in dealing with environmental issues; thus could initiate supply chain environmental requirements. Also the international supply chains face more challenges because of differences in the level of environmental awareness and the social dominant conditions. From the research it was revealed that Scandinavian companies when they posed environmental requirements to companies in other parts of the world faced opposition. The issues that buyers thought as important were comprehended by other companies outside of national borders as either irrelevant or of no importance. The *market conditions* are, once again, not

always the same and externalities are not always internalised; thus reducing the environmental significance of specific issues.

How do the buyers control the environmental requirements that put towards their suppliers?

It was revealed that the pressure from end customers is increasing regarding supply chain environmental considerations. On the other hand the resources burden related to suppliers' auditing activities can be very heavy for a buyer to cope with. The auditing activities performed at the suppliers' sites in the context of the EMS implementation were *not combined* with suppliers' audits. Unfortunately, no further findings were associated with this research questions. This fact implies that the control mechanisms are not in great use regarding environmental issues.

What is the perception of key relevant stakeholders about the potential use of EMS as a tool to set and control environmental requirements within the supply chain?

The research concluded that solutions in a great extend are not incorporated in the tools but rather to the way these tools are used by the organizations. The extent to which the tools can contribute to improvements is more or less *defined by the user*. The importance is for the organization to be always on the edge to adjust to new challenges. When the EMS was first introduced was the individual facilities that had to be improved. Now it is more and more evident that a more holistic approach is necessary to escape the "*silo mentality*" and the mindset of the organizations have to incorporate this change. The organizations have to be flexible and open to the developments occurring around them. "learning organizations" proposed by Senge are the ones that can continue improving in today's changing era, because these are companies are static but they continue to benefit from their and for other companies' experiences.

During the research it was revealed that the prevalent standardised EMS, ISO 14001 *has not been successfully* used to set and control environmental requirements within the supply chain. EMS certification is often used as a requirement to the suppliers with questionable results. The hindering factors were recognised in three levels. In the level of *society's mindset* the findings implied that in the market ISO 14001 certification is not always rewarded and the society's paradigm is not in accordance of using the EMS with a wide perspective, but rather adopting a process and site specific EMS. The *market* conditions and the general level of environmental awareness has an important role to the extent that environmental requirements are pushed through the supply chain. When the market is at initial stage and environmental externalities are not internalised and controlled then environmental considerations are almost impossible to be raised successfully. The governmental inputs have been argued to be an important factor for initiating environmental requirements in the supply chain. The EMS was said to serve as a *good communication tool* between supply chain members; thus minimizing the information gap between companies. It was revealed that even though EMS certification does not provide adequate information about the environmental performance serve as common language when discussing environmental issues. The motto "I cannot do anything to affect my neighbours' actions" is reflecting the dominant mindset in the supply chain environmental issue. The interlinkages between different companies and environmental impacts are either forgotten or ignored. Moreover the certification bodies are not trusted enough for the audits that they perform. This lead to diminishing the potential use of EMS in combination with suppliers' environmental audits. Changes in this level require longterm planning and cooperation of different actors.

At the *institutional level* it was concluded that the majority of the legal requirements keep a site and media specific perspective thus hindering the use of EMS, which is usually directed in fulfilling legal requirements, to be used as a tool for supply chain requirements. Initiatives as the new legislations taking a more life cycle approach are estimated to positively contribute to the advanced use of EMS as a supply chain tool. The efforts needed to change the laws and rules demand medium term planning.

Finally the *standard per se* is unclear and *vague* in the field of other requirements or supply chain environmental requirements. The EMS was said that is not used as a tool to initiate supply chain requirements because of vague wording and not open minded organizations. The clauses of the standard leaves out the *purchasing and marketing departments* which are crucial to the supply chain issues. Nonetheless it offers the *opportunity* to be used in a more wide perspective but the opportunity is not explored. The *revision* of the standard is not expected to affect supply chain considerations but the implementation stage remains the most important.

Possible scenarios

The possibility of *incorporating EMS certification audits* with suppliers' audits was perceived innovative from the interviewed groups. There is an apparent tension in sharing second party and third party auditing activities but the benefits are also significant. These benefits are mainly relating to resource savings from minimising duplications in many levels (e.g. training, audit preparation, performance and presentation of the findings, etc) and to reach multiple supply chain members. An extension of the third party auditing should be agreed between the two supply chain members (customer and buyer) and also the certification company should be incorporated. The moral hazard of the certification body was also suggested as drawback. Similar initiatives have been introduced in the Forestry and Textile industry.

The potential of developing *EMS standards per sector* was suggested as a scenario in the tools level. The automotive industry, the food industry, the aerospace industry have relevant experience with their sectoral standards. The inclusion of best practises and the provision of common understanding of the significant environmental aspects within supply chain members were some expressed potential benefits regarding the new standards. On the other hand the fear of "another" standard and the relevant costs were some of the drawbacks. The fact that such guidelines have already been developed by specific associations can be further researched in the perspective that the same guidelines are introduced by an international and well respected organization ISO.

The last scenario was about developing and implementing a *common EMS among key supply chain members* and it was perceived with scepticism. The nature of the supply chains with complicated and dynamic structure was said not to facilitate such development. Also the troubling experience that most of the organizations had in implementing EMS was presented as barrier. The potential sharing of internal auditors can be positive implication.

7.2 Reflections and further discussion

The conclusions presented above indicate that the cooperation of different actors is needed to implement improvements in the field of environmental supply chain management and EMS. Even though EMS and supply chain management are tools used by the industry their drivers reach out of their boundaries to consumers, neighbours shareholders. The role of the policy makers is also important because they define the minimum targets relating to EMS implementation and the provide the conditions in which the industries are or should operate.

Moreover the research endeavour important issues not directly connected to the research questions were observed and are mentioned in this section.

Most of the companies was illustrated that today are embracing sustainability concerns and not solely environmental issues. The focus only in environmental issues is one dimensional and is not serving the current and increasing social concerns raised by the society. On the other hand, companies are more experience in managing environmental issues rather than social. The accumulated experienced relating should be explored and used for the inclusion of other concerns.

The supply chain environmental requirements are very important if we consider the so called NIMBY (Not In My Back Yard) syndrome. It is common that people outsource whatever is too “dirty” to produce within the facility’s site. Does it make improve one site by excluding the “dirty” parts? This dilemma the ISO has not addressed very successfully.

Another contradiction was the fact that even though most of the companies argued that environmental considerations should be raised by both members of the supply chain. Such an approach is almost impossible to happen. The kind of relationships between supply chain members and the level of environmental improvements is something interested to see in more detail. The exit relationships described in the research seem to follow the traditional market laws because the supply chain members are changing for the optimum pricing. On the other hand, the voice relationships incorporate close cooperation and opportunities for improvements in the environmental field.

Also another troubling issue is related to the value chain of the supply chains and the costs paid for the beneficial environmental improvements. Members of the supply chain wish to avoid the costs related to environmental improvements and only benefit from the generated benefits and savings; thus it is a concern when the costs are bared from lest powerful member.

The whole EMS market involving companies implementing EMS, consultants and certification bodies is functioning under the motto time is money and not “environmental improvement is money”. The pressure for developing implementing and gaining EMS certification in the minim possible time period (as it was also the case during the interviews) squeeze the potential for environmental improvements and hinder the use of EMS as a tool for supply chain management.

Whenever a control mechanism is established automatically a cheating mechanism is emerging. In a society of increasing audit and control mechanism the focus is given to the performance of the audit and not to the actual parameter being monitored. There are always ways to fool a monitoring scheme but only the desire to improve environmental performance followed by specific actions.

In the international arena the environmental performance differs and this should be taken into consideration when establishing supply chain environmental requirements. The ultimate goal for the members initiating the demands should remain the same but the way that each supplier is approached should differ. The back casting approach can be very useful in the field of supply chain environmental requirements.

7.2.1 Areas of further research

This study was explorative thus one of the main purposes was to reveal areas where future focused research would be of great importance.

1. the community of EMS certification bodies and their differences concerning certification audits will be very interesting areas. Moreover the performance differences of the same certification organizations in different countries is relevant to the international nature of current supply chains
2. if there is a trend of connecting the operations outsourced and the level of the environmental impact these operations generate.
3. the distribution of the costs related to environmental improvements in relation with the generated benefits in a value added perspective of the supply chain.
4. further research the proposed scenarios (regarding potential changes in the auditing and controlling mechanisms regarding supply chain environmental requirements and EMS) to evaluate their feasibility using an illustrative case.

Bibliography

- American Society for Quality. (2000). *Quality Audit Handbook*. [Online] Available, <http://qualitypress.asq.org/chapters/H1046.pdf>. [10 September 2004]
- Ammenberg, J. (2003). *Do standardized environmental management systems lead to reduced environmental impacts?* Unpublished Doctoral dissertation, Linköping University, Linköping.
- Ammenberg, J., & Hjelm, O. (2003). Tracing business and environmental effects of environmental management systems - A study of networking small and medium sized enterprises using a joint environmental management system. *Business Strategy and the Environment*, 12, 163- 174.
- Anthony, J., & Gorndarajan, V. (1995). *Management Control*. Irwin.
- Bachmann, R. (2001). Editorial- Trust and control in Organizational relations. *Organization Studies*, 22(2), v-viii.
- Bakker, d. F., & Nijhof, A. (2002). Responsible Chain management: a capability assessment framework. *Business Strategy and the Environment*, 11, 63-75.
- Baltic 21 Institute for Sustainable Industry. (2003). *Environmental indicators*. [Online] Available, http://www.baltic21institute.org/helpdesc/indic_out.asp?ind=4&i_txt=&u_txt=&sec=4&c9=Poland++++&c11=Sweden++++&sp=1995&ep=2003. [20 August 2004]
- Birnberg, J. (1998). Control in Interfirm co operative relationships. *Journal of Management Studies*, July.
- Bronson, T., & Larsson, G. (1999). *Environmental Management*. Stockholm: EMS AB.
- BSI. (2004, 4 August 2004). [Online] Available, http://asia.bsi-global.com/About+BSI/BSINews/HK_BS7799_launch.xalter. [15 August 2004]
- Business for Social Responsibility (BSR). (2001). *Suppliers' Perspectives on Greening the Supply Chain*. San Francisco: Business for Social Responsibility Education Fund.
- Business for Social Responsibility (BSR). (2002). *Restricted substances in the apparel products, Substances, Limits, Legislation, Test Methods*. [Online] Available, <http://www.bsr.org/CSRResources/Environment/RestrictedSubstancesList.pdf>.
- Canning, L., & Hanmer- Lloyd, S. (2001). Managing the environmental adaptation process in supplier - customer relationships. *Business Strategy and the Environment*, 10, 225- 237.
- Carter, C., Kale, R., & Grimm, C. (2000). Environmental purchasing and firm performance: an empirical investigation. *Transportation research, part E*, 219- 228.
- Charter, M., Kielkiewicz-Young, A., Young, A., & Hughes, A. (2001). *Supply Chain Strategy and Evaluation - Case Studies: The Sigma Project*.
- Choi, T., Dooley, K., & Rungtusanatham, M. (2001). Supply networks and complex adaptive systems: control versus emergence. *Journal of Operations Management*, 19, 351-366.
- Commercial and Economic Section. (2004). *Polish foreign trade in 2003*. [Online] Available, http://www.polandtrade.com.hk/new/eng/foreign_trade.htm. [21 August 2004]
- Cox, A. (1999a). A research agenda for supply chain and business management thinking. *Supply Chain Management: An international Journal*, 4(4), 209-211.
- Cox, A. (1999b). Power, value and supply chain management. *Supply Chain Management: An international Journal*, 4(4), 167-175.
- Cox, A. (2001a). Managing with Power: Strategies for improving value appropriation from supply relationships. *The Journal of Supply Chain Management*, Spring 2001, 42-47.
- Cox, A. (2001b). Understanding buyer and supplier power: A framework for procurement and Supply competence. *The Journal of Supply Chain Management*, 37(2), 8-15.
- Dalhammar, C. (2000). *Implementation and certification of environmental management systems in small enterprises - Approaches and limitations*. Lund: International Institute of Industrial Environmental Economics.
- Dobes, V. (2001). *EMS and change of Guiding ideas in the direction of Sustainability*. [Online] Available, [http://www.iiee.lu.se/Publication.nsf/e36f5f3f8fa200a6c1256b4200480181/3f0ac3d917978175c1256c6000411092/\\$FILE/vladimir.pdf](http://www.iiee.lu.se/Publication.nsf/e36f5f3f8fa200a6c1256b4200480181/3f0ac3d917978175c1256c6000411092/$FILE/vladimir.pdf). [21 August 2004]
- Dobler, D., Burt, D., & Lee, L. (1990). *Purchasing and materials management - Text and cases*. Singapore: McGraw Hill International Editions.
- Dodds, O. (2003). Revising ISO 14001 and ISO 14004. *ISO Management Systems, June 2003*, 20-22.
- Easterby-Smith, M., Thorpe, R., & Lowe, A. (1991). *Management Research, an Introduction*. London: SAGE publications Ltd.
- Eisenhardt, K. (1999). Agency Theory: An assessment and review. *Academy of Management Review*, 14, 57-74.
- Emery, A., & Watson, M. (2003). Eco-auditing and environmental liability: an international perspective. *Managerial Auditing Journal*, 18(8), 631-636.

- ENDS. (2004a). *Effective Use Of Your Consultant*. [Online] Available, <http://www.endsdirectory.com/articles/index.cfm?action=ems>. [09 August 2004]
- ENDS. (2004b). *Environmental management survey: The ins and outs of outsourcing*. [Online] Available, <http://www.endsdirectory.com/articles/index.cfm?action=200403>. [09 August 2004]
- Entela. (2004). *ISO 14001 update*. [Online] Available, <http://www.entela.com/qsrd/reg/ISO14001.ppt>. [21 August 2004]
- European Commission. (2001). *EMAS*. [Online] Available, http://europa.eu.int/comm/environment/emas/about/summary_en.htm.
- European Commission. (2004a). *EMAS newsletter - June 2004*. [Online] Available, <http://www.europa.eu.int/comm/environment/emas>. [8 August 2004]
- European Commission. (2004b). *EMAS statistics organizations and sites*. [Online] Available, http://europa.eu.int/comm/environment/emas/pdf/5_5articles.pdf. [8 August 2004]
- European Co-operation for Accreditation. *What is accreditation?* [Online] Available, <http://www.european-accreditation.org/>. [02 August 2004]
- Eurostat. (2002). *key structural data for 10 ascending countries*. [Online] Available, <http://europa.eu.int/comm/eurostat/Public/datashop/print-product/EN?catalogue=Eurostat&product=1-05122002-EN-BP-EN&mode=download>. [8 September 2004]
- Eurostat. (2003). *information society statistics- PCs, Internet and mobile phone usage in the EU*. [Online] Available, <http://europa.eu.int/comm/eurostat/Public/datashop/print-product/EN?catalogue=Eurostat&product=KS-NP-03-015--N-EN&mode=download>. [8 September 2004]
- Eurostat. (2004). *External and intra-European Union trade*. [Online] Available, <http://europa.eu.int/comm/eurostat/datashop/print-product/EN?catalogue=Eurostat&product=KS-AR-04-007--N-EN&mode=download>. [21 August 2004]
- Fassoula, E., & Rogerson, J. (2003). Management tools for SMEs. *TQM & Business Excellence*, 14(10), 1143-1158.
- Gascoigne, J. (2002). Supply Chain Management - Project Acorn. *Corporate Environmental Strategy*, 9, 62-68.
- Green, S., & Welsh, A. (1988). Cybernetics and Dependence: Reframing the Control Concept. *The Academy of Management Review*, 13(2), 287-301.
- Handfield, R., & E., N. (1999). *Introduction to supply chain management*. New Jersey: Prentice Hall Inc.
- Hess, P., & Siciliano, J. *Management Responsibility for Performance*. MacArthur Hill.
- Hillary, R. (2001). *ISO 14001: Case studies and practical experience*. [Online] Available, <http://www.greenleaf-publishing.com/pdfs/isooint.pdf>. [14 June 2004]
- INEM. (2000). *The ISO 14001 Speedometer*. [Online] Available, http://www.inem.org/htdocs/iso/speedometer/speedo-7_00.html#. [20 August 2004]
- ISO 14001. (1996). *Environmental management systems- specification with guidance for use*. Geneva: International Organization for Standardization.
- ISO 14004. (1996). *Environmental management systems - general guidelines on principles, systems and supporting techniques*. Geneva: International Organization for Standardization.
- ISO 14011. (1996). *Guidelines for environmental auditing: Audit procedures- Auditing of environmental management systems*. Geneva: International Standardization Organization.
- ISO. (2002). *The ISO 14000 Family of International Standards*. [Online] Available, <http://www.iso.org/iso/en/prods-services/otherpubs/iso14000/environment.pdf>. [4 August 2004]
- ISO. (2003). *Publicizing your ISO 9001:2000 or ISO 14001 certification*. Geneva: ISO.
- ISO World. (2004). *The number of ISO14001 certification of the world*. [Online] Available, <http://www.ecology.or.jp/isoworld/english/analy14k.htm>. [4 August 2004]
- ISO/ CASCO. *The impact of Accreditation, Multilateral Recognition and Sector Schemes on the future Certification Market*. [Online] Available, <http://www.iso.org/iso/en/commcentre/presentations/wkshps-seminars/casco/casdev2003/casdev2003ThomasFacklam.pdf>. [2 August 2004]
- Kanbolm, J. (1998). *ISO Requirements: 61 requirements, Checklists and Compliance guide*. Los Angeles: AQA Co.
- Karapetrovic, S., & Willborn, W. (2000). Generic audit of management systems: fundamentals. *Managerial Auditing Journal*, 15(6), 279- 294.
- Krut, R., & Gleckman, H. (1998). *ISO 14001: A missed opportunity for sustainable industrial development*. London: Earthscan Publications Ltd.
- Lambert, M., & Cooper, M. (2000). Issues in supply chain management. *Industrial Marketing Management*, 29, 65-83.

- Larson, P., & Halldorsson, A. (2002). What is SCM? And, where is it? *Journal of Supply Chain Management*, 38(4), 36-43.
- Macpherson, A. (2001). *Corporate Dimensions in Supply Chain Management: Implications for SME competences and inter-organizational relations* (No. ISSN 1471-857X). Manchester: Manchester Metropolitan University Business School.
- Matbly, J. (1995). Environmental audit: theory and practices. *Managerial Auditing Journal*, 10(8), 15-26.
- Meadows, D. (1999). *Leverage Points - Places to intervene in a System*. Hartland: The sustainability institute.
- Mentzer, J., DeWitt, W., Keebler, J., Min, S., Nix, N., Smith, C., et al. (2001). Defining Supply Management. *Journal of Business Logistics*, 22(2), 1-25.
- Morrow, D., & Rondinelli, D. (2002). Adopting Corporate Environmental Management Systems: Motivations and Results of ISO 14001 and EMAS certification. *European Management Journal*, 20(2), 159-171.
- Mouritsen, J., Hansen, A., & Hansen, Ö. C. (2001). Inter-organizational controls and organizational competencies: episodes around target cost management/ functional analysis and open book accounting. *Management Accounting Research*, 12, 221-244.
- natiomaster. (2004a). *Poland*. [Online] Available, <http://www.nationmaster.com/country/pl/Economy>. [21 August 2004]
- natiomaster. (2004b). *Sweden*. [Online] Available, <http://www.nationmaster.com/country/sw/Economy>. [21 August 2004]
- Nowak, Z., Wasilewski, M., & Cichy, M. (2002). *Cleaner Production- the Environmental Strategy for the Transition Period- the Polish Case and its Follow Up*. Paper presented at the Visegrad Agenda 21- Transition from Centrally Planned Economy to Sustainable Society?, April 4-6 2002, Prague, Czech Republic.
- NQA. (2004). *Revision to ISO 14001:1996 - Are you aware?* [Online] Available, <http://www.nqa.com/previs1400.html>. [10 September 2004]
- Perkins, R., & Neumayer, E. (2004). *The Europeanisation of the uneven convergence of the environmental policy: explaining the geography of EMAS*. [Online] Available, <http://www.lse.ac.uk/collections/geographyAndEnvironment/whosWho/profiles/neumayer/pdf/Emasarticle.pdf>.
- Plepys, A. (Ed.). (2000). *2000: EMS in the Baltic Region, a Comprehensive study*. Lund: IIIIEE.
- Polish Center for Accreditation. (2004). *Accreditation of Certification Bodies*. [Online] Available, http://www.pca.gov.pl/english/ac_en.php. [8 September 2004]
- Power, M. (1994). *The Audit Explosion*. London: Demos.
- Preuss, L. (2000). Should you buy your customer's values? On the transfer of Moral Values in Industrial Purchasing. *International Journal of Value-based Management*, 13, 141-158.
- Progressive Policy Institute. (2001). *Third-Party Auditing of Environmental Management Systems*. [Online] Available, http://www.ppionline.org/ppi_ci.cfm?cp=4&knlgAreaID=116&subsecid=150&contentid=250463. [8 September 2004]
- Project Sigma. (2001). *Supply chain mngement and evaluation*. [Online] Available, http://www.projectsigma.com/RnDStreams/RD_supply_chain_strategy.pdf. [3 June 2004]
- Quality America. (1997). *Characteristics of Audits*. [Online] Available, <http://www.qualityamerica.com/knowledgecente/articles/CQApg15-18.html>. [10 September 2004]
- Reilly, C. (1999). The very best suppliers go the extra mile. *Purchasing*, 127(8), 28-31.
- Roberts, S. (2003). Supply Chain Specific? Understanding the patchy success of ethical sourcing initiatives. *Journal Of Business Ethics*, 44, 159-170.
- Robinson, D., & Gould, R. (Eds.). (2000). *Registration to ISO 14001: the review of assessors*. Sheffield: Greenleaf publishing.
- Rubin, H. J., & Rubin, I. S. (1995). *Qualitative Interviewing: The art of bearing data*. London: SAGE Publications.
- Sakaguchi, T., Nicovich, S., & Dibrell, C. (2004). Empirical evaluation of an integrated supply chain model for small and medium sized firms. *Information Resources Management Journal*, 17(3), 1-19.
- Schary, P., & Skott-Larsen, T. (2001). *Managing the global supply chain* (2nd ed.). Copenhagen: Copenhagen Business School Press.
- Sinding, K. (2000). Environmental management beyond the boundaries of the firm: definitions and constrains. *Business Strategy and the Environment*, 9, 79- 91.
- Stapleton, P. (2002). ISO 14001 revision will promote use of environmental management systems by the SME. *ISO Management Systems*, March - April, 21- 25.
- Steger, U. (2000). Environmental management systems: Empirical evidencde and further perspectives. *European Management Journal*, 18(1), 23-37.
- Summers Raines, S. (2002). Implementing ISO 14001- An International survey assessing the benefits of certification. *Corporate Environmental Strategy*, 9(4), 418-426.

- SWEDAC. (2004). *Environmental management systems*. [Online] Available, [http://www.swedac.se/sdd/System.nsf/\(GUIview\)/index_eng.html](http://www.swedac.se/sdd/System.nsf/(GUIview)/index_eng.html). [8 September 2004]
- Taylor, D., Sulaiman, M., & Sheahan, M. (2001). Auditing of environmental management systems: a legitimacy theory perspective. *Managerial Auditing Journal*, 16(7), 411-422.
- Thorton, R. (2000a). ISO 14001 certification mandate reaches the automotive industry. *Environmental Quality Management*, 10(1), 89- 93.
- Thorton, R. (2000b). Understanding the benefits of third party audits and certification. *Environmental Quality Management*, 9(4), 99-102.
- Trebicky, V., Novak, J., Ira, V., Huba, M., Stodulski, W., & Eri, V. (2003). *Road to sustainability - Economic, Social and Environmental Dimension of Sustainability in Visegrad Countries*. Prague: Institute for Environmental Policy.
- UNEP. (2002). *Trust us- the Global Reporters - 2002 Survey of Corporate Sustainability Reporting*. Paris.
- Welford, R. (Ed.). (1998). *Corporate Environmental Management - Systems and Strategies*. London: Earthscan Publications Ltd.
- Wilson, R. (1999). Automakers require supplier certification. *Pollution Engineering*, December 1999, 2.
- Volvo. (2004). *PQP 7: Environmental care*. [Online] Available, <http://www.volvo.com/NR/rdonlyres/7ADA919F-3F15-4A62-957C-ABEBAE5C9324/0/PQP703MAR03.pdf>. [5 September 2004]
- VOLVO. (2004a). *Supplier evaluation*. [Online] Available, <http://www.volvo.com/NR/rdonlyres/6B9BB02A-582F-41CC-BE50-259CA4B682A6/0/pqp4.pdf>. [5 September 2004]
- VOLVO. (2004b). *Supplier Form*. [Online] Available, http://www.volvo.com/NR/rdonlyres/17F75921-DD83-4E49-B401-DB81C4DA0A97/0/supplier_form.doc. [5 September 2004]
- VOLVO. (2004c). *VOLVO supplier portal*. [Online] Available, <http://www.volvo.com/suppliers/global/en-gb/>. [5 september 2004]
- VOLVO. (2004d). *Volvo's general purchasing conditions*. [Online] Available, http://www.volvo.com/NR/rdonlyres/2354486C-0AED-47CE-973A-2F1AA782E8C8/0/volvo_general_purchasing_conditions.pdf. [5 September 2004]
- Young, A., & Kielkiewicz-Young, A. (2001). Sustainable supply network management. *Corporate Environmental Strategy*, 8(3), 260- 268.

Appendix I Abbreviations

BSR	Business for Social Responsibility
EMAS	Ecological Management and Auditing Scheme
EMS	Environmental Management System
EPA	Environmental Protection Agency
ISO	International Standardization Organization
MN	Multinational corporation
SCER	Supply Chain Environmental Requirement
SME	Small and Medium Sized Enterprises

Appendix II Questionnaires

A. stakeholders questionnaire

Part I: General Information

Organization:

Name/ position:

Contact info:

Date:

Place:

Documentation:

Presentation of the organization	<input type="checkbox"/>			<input type="checkbox"/>
----------------------------------	--------------------------	--	--	--------------------------



Part II: Questions

1. What do you think are the drivers for environmental requirements in the supply chain?
2. Who do you think should initiate the environmental requirements in the supply chain?
3. In general, how far do you think are the supply chain affected, regarding environmental requirements? How far do you wish to be affected?
4. Do you think that a standardized EMS is credible?
 - a. Why?
 - b. What are the strengths and what can be improved?
5. Is it common the existence of EMS to appear as supply chain requirement?
 - a. Is it justifiable?
 - b. Does the implementation of EMS ensure that environmental supply chain considerations are successfully addressed?
6. How much is a standardized EMS compatible to addressing environmental requirements within the supply chain?
 - a. Can it capture (and up to what extend) the complexity of supply chain issues (inter organizational environmental concerns)?

- b. Can it be used to address the diversity / variety of environmental requirements present in supply chain?
- 7. Do you think that an EMS can facilitate the process of introducing supply chain requirements?
 - a. If yes, how is it possible?
 - b. If no, what are the barriers?
- 8. From your experience has EMS been used to shape the environmental requirements that members of the supply chain put on each other?
 - a. Has the procedure (for deciding which environmental requirements to address) been incorporated in EMS?
 - b. Are the supply chain environmental requirements based on EMS outcomes?
 - c. Does the size of the company affect the possibilities for EMS to be used as a tool to shape environmental requirements?
- 9. Can EMS facilitate the satisfaction of supply chain environmental requirements?
- 10. From your experience, what fosters and hinders the use of EMS as a tool to satisfy supply chain environmental concerns?
 - a. Has EMS been used to implement/ satisfy the environmental supply chain requirements?
 - b. How has EMS been used to implement/ satisfy the environmental supply chain requirements?
- 11. What is your opinion about the audit schemes/ control mechanisms developed by buyers in order to control the environmental requirements put on their suppliers?
- 12. Are the external audits regarding EMS overlapping with audits within the supply chain? Why?
 - a. Is there a potential for EMS audits (external or internal) to substitute supply chain environmental control mechanisms?
- 13. How would you imagine that standardized EMS should evolve in order to include supply chain environmental considerations?
 - a. Are any changes necessary?
- 14. Do you think that a common EMS within key members of the supply chains will improve the environmental performance of the particular supply chain?
- 15. Do you think that the development of standardised EMS per sector will facilitate the consideration of supply chain environmental issues?

B. Suppliers' questionnaire

Part I: General Information

Name of company:

Date:

Place:

Supplier of:

Interviewed departments	ok	Name & contact
Top management	<input type="checkbox"/>	
Environment	<input type="checkbox"/>	
Sales	<input type="checkbox"/>	
Auditors	<input type="checkbox"/>	
Purchasing- logistics	<input type="checkbox"/>	

Documentation:

Presentation of the company	<input type="checkbox"/>		Company annual report	<input type="checkbox"/>
Copy of the contract	<input type="checkbox"/>		EMS audit results	<input type="checkbox"/>
Contracts for EMS audits	<input type="checkbox"/>		Audit results from buyers	<input type="checkbox"/>

Part II: Questions

General information of the company (size, capital, implementation of management systems)

A. Current situation regarding environmental requirements demanded from customers

1. Are you aware if your customers have a supply chain strategy?
 - a. What issues does this strategy concern?
 - b. Are environmental requirements included?

2. Is it common to receive environmental demands from your customers?
 - a. If yes, how do you respond to multiple requests from different customers?

3. Do your customers involve you during the development of their environmental requirements?
 - a. If yes, how is this done? What is the frequency?
 - b. If no, are you satisfied with the current situation?
4. Who do you think has the power to raise environmental requirements in the supply chain?
5. Do you receive from your customers any incentives or premiums for successfully satisfying their environmental requirements?
6. Are the environmental requirements demanded by your customer mandatory?
 - a. If yes, what are the potential sanctions?
 - b. If no, what are the motivations for you to comply with your customers environmental requirements?
7. What do you think are the drivers for these requirements?
8. What do the environmental requirements that your customers demand from you, concern?
9. Do you receive guidance how to fulfil your customers' environmental requirements?
 - a. If yes, how? Is it enough?
 - b. If no, would you prefer their contribution?
10. How do you fulfil your customer's environmental demands?
 - a. Have you incorporated your customer's environmental requirements in your Environmental Management System (EMS) routines?
11. Do you feel that your customer has integrated the environmental requirements into their purchasing decision?
12. Have you pushed higher in the supply chain the environmental requirements that you have received from your customer (cascading environmental improvements)?

B. Control of environmental requirements that are demanded from suppliers

13. How do you control that you satisfy your customer's environmental requirements?

14. How does your customer control that you comply with the environmental requirements?
 - a. Documentary control (regulatory requirements)
 - b. Filling in questionnaires
 - c. Reporting regularly (providing with lists)
 - d. On site visits

15. How often does your customer control that you comply with the environmental requirements?

16. What are your costs generated by your customer's control system, regarding environmental requirements? Are these costs a concern for you? Have you thought of ways to cut down these costs?

17. For you what are some of the benefits generated by your customer's environmental requirements?

18. Do you implement an EMS? What are the drivers for doing so?
 - a. If yes, how is the EMS audited (internal- external?) How often? What is the procedure? What & how much resources do you devote?
 - b. If no, how to you manage the environmental issues?

19. What are the shortcomings for the external EMS and your customer's audits regarding environmental requirements?
 - a. opportunities for improvements,
 - b. satisfaction,
 - c. level of overlapping and conjunction.

20. Has the implementation of EMS helped you to deal with your customers environmental requirements?

C. Perception of EMS

21. Do you think that a standardized EMS is credible?
 - a. Why?
 - b. What are the strengths and what can be improved?

22. How would you imagine that the standardized EMS should evolve in order to include supply chain environmental considerations?

23. Do you think that the development of standardised EMS per sector will facilitate the consideration of supply chain environmental issues?

24. Do you think that a common EMS within key members of the supply chains will improve the environmental performance of the particular supply chain?

C. Buyers' questionnaire

Part I: General Information

Name of company:

Date:

Place:

Interviewed departments	ok	Name & contact
Top management	<input type="checkbox"/>	
Environment	<input type="checkbox"/>	
Sales	<input type="checkbox"/>	
Auditors	<input type="checkbox"/>	
Purchasing- logistics	<input type="checkbox"/>	

Documentation:

Presentation of the company	<input type="checkbox"/>	Company Annual report	<input type="checkbox"/>
Copy of the supplier's contract	<input type="checkbox"/>	Audit results for their suppliers	<input type="checkbox"/>
Contracts for suppliers audits	<input type="checkbox"/>		<input type="checkbox"/>

General information of the company (size, capital, implementation of management systems)

Part II: Questions

A. Current situation regarding environmental requirements put along to the suppliers

1. Do you implement a standardized Environmental Management System (EMS)?
 - a. If yes, since when? Do you implement EMS by yourselves or do you contract consultants to do this?

- b. What are the main drivers for implementing or not implementing a standardized EMS?
2. Do you have documented supply chain strategy?
 - c. Do you have documented activities how to implement the strategy?
 - d. Do you include environmental considerations in your supply chain strategy?
 - e. If you implement an EMS, have you included these procedures in the EMS?
3. Have you developed environmental requirements for all of your suppliers?
 - f. What kind of requirements do you demand from your suppliers?
4. Who do you think should initiate the environmental requirements in the supply chain?
5. How do you determine the environmental requirements for your suppliers?
 - g. What are the drivers for these environmental requirements?
 - h. Have you developed standardized and documented procedures concerning the determination of environmental requirements for your suppliers?
 - i. Do you involve your suppliers during determining their environmental requirements?
6. How do you communicate the environmental requirements to your supplier?
 - j. How often do you communicate these to the supplier?
 - k. In which way do you communicate these requirements to your supplier?
 - i. Face to face meetings
 - ii. Workshops
 - iii. Teleconferences
7. What do the environmental requirements that you demand from your supplier concern?
8. Do you provide guidance to your suppliers how to fulfil your environmental requirements? If yes, how? If no, do your suppliers demand your contribution?
9. Are the environmental requirements that you demand from your suppliers integrated in your purchasing decision?
10. Have you noticed whether your environmental requirements are pushed higher in the supply chain (cascading environmental improvements)?

B. Control of environmental requirements that are demanded from suppliers

11. Are the environmental requirements that you demand from your suppliers mandatory?
 - l. If yes, what are the potential sanctions?
 - m. If no, what is the motivation for your supplier to comply with your environmental requirements?
12. Do you distribute any incentives or premiums to your suppliers for successfully satisfying your environmentally requirements?
13. How do you control that your supplier complies with your environmental requirements?
14. How often do you control that your suppliers comply with your environmental requirements?
15. Are you satisfied with the procedure that you have developed, regarding the control of environmental requirements of your suppliers?
16. What are the costs for your control system, regarding environmental requirements to your supplier? Is this cost a concern for you? Have you thought of ways to cut down this cost?
17. Are you satisfied with the results of the audits that you perform to your suppliers regarding environmental requirements?
18. Do you see any differences, regarding the level of compliance of environmental requirements, between suppliers that implement certified EMS and those who do not?
19. What are the shortcomings for the external EMS and your customer's audits regarding environmental requirements?
 - n. opportunities for improvements,
 - o. satisfaction,
 - a. level of overlapping and conjunction.
20. For you what are some of the benefits generated by the environmental requirements that you demand from your suppliers?
 - p. Cost reductions
 - q. Improved efficiencies
 - r. Increased sales
 - s. Positive media attention
 - t. Positive sustainability ratings
 - u. Preparations for upcoming regulatory demands

C. Perception of EMS

21. Do you think that a standardized EMS is credible?
 - c. Why?
 - d. What are the strengths and what can be improved?

22. How would you imagine that the standardized EMS should evolve in order to include supply chain environmental considerations?

23. Do you think that the development of standardised EMS per sector will facilitate the consideration of supply chain environmental issues?

24. Do you think that a common EMS within key members of the supply chains will improve the environmental performance of the particular supply chain?

Appendix III List of interviews

1. Swedish company (6 July 2004) Telephone interview.
2. International expert (9 July 2004) Telephone interview.
3. Polish company (12 July 2004) Personal interview.
4. Polish company (12 July 2004) Personal interview.
5. Polish company (12 July 2004) Personal interview.
6. Polish company (12 July 2004) Personal interview.
7. Polish company (13 July 2004) Personal interview.
8. Polish company (13 July 2004) Personal interview.
9. Polish expert in EMS (14 July 2004) Personal interview.
10. Polish company (14 July 2004) Personal interview.
11. Polish auditor (21 July 2004) Telephone interview.
12. Swedish expert (4 August 2004) Personal interview.
13. Swedish company (4 August 2004) Personal interview.
14. Swedish company (6 August 2004) Personal interview.
15. Swedish company (11 August 2004) telephone interview
16. Swedish consultant (13 August 2004) Telephone interview.
17. Swedish company (13 August 2004) Telephone interview
18. Swedish consultant (16 August 2004) Telephone interview.
19. Polish expert (16 August 2004) Telephone interview.
20. Polish EMS certification auditor (17 August 2004) Telephone interview.
21. Swedish auditor (17 August 2004) Telephone interview.
22. Consultant (19 August 2004) Telephone interview.
23. Polish auditor (19 August 2004) Telephone interview.
24. Swedish expert (19 August 2004) Telephone interview.
25. Swedish consultant (19 August 2004) Personal interview.

26. Polish consultant (20 August 2004) Telephone interview.