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The Use of the Environmental Management Systems

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Abstract: **This project studies the use of environmental management systems (EMS) in the United Kingdom. Environmental management systems are set of standards and guidelines that provide a framework to the companies to improve their environmental practices. The international standards ISO 14001 and EU standards EMAS are the main competitors in the marketplace. The process of developing an EMS requires conformity to environmental and legal aspects. The impact of EMS on the company's performance is improving the financial sector and public image of that company.**

Analysis of the current trends of EMS in the UK and worldwide was carried out to provide a justification of the low uptake. The study was based on the number of certification with respect to population, GDP, ecological footprint and the total number of registered companies. It was found out that Scandinavian countries have the highest level of awareness of the importance of the conservation of environment.

The difference in the uptake between EMAS and ISO 14001 in the UK was highlighted. ISO 14001 is more popular due to its affordable costs and international status. However, EMAS has a better environmental performance as it strictly emphasizes on environmental aspects and requires continual improvement.

The major drivers of EMS are legislation and costumer requirements. Governments exert a great influence on the uptake of EMS. Nevertheless, small and medium sized enterprises (SMEs) showed lack of awareness of the significance of EMS and absence of customers' pressure. On the other hand, the major barriers of EMS are the management time and costs of implementation, certification and maintenance.

Keywords: **environmental management systems (EMS), company's performance, financial sector.**

1. INTRODUCTION

1.1 Introduction

The purpose of this project is to provide a detailed study into the use of environmental management systems in the UK and how can it affects the environmental impacts. This project is divided into six chapters that present the relevant information and studies to support the main discussion and findings. The project will further give a number of considerations and recommendations.

1.2 Background of the Research

"It was the industrial revolution that gave birth to environmental pollution as we know it today"[1]. The environmental impacts associated with the industrial activities imposed serious risk on human health as well as natural environment. Therefore, organizations were forced to obey certain environmental regulations. In order for an organization to incorporate environmental policies in the planning and decision making processes, it is encouraged to adopt an Environmental Management System (EMS).

As our lives have become dependent on certain system, it is impossible to completely eliminate the harmful impacts on the environment. From example talking generally, the transport systems of the modern world produce smoke and pollute the

atmosphere and eventually harm the environment. This is a fact that the environment cannot be completely preserved as it is. However, we can try to minimize the harm and try to preserve the nature by finding the ways that reduce the pollution of environment. In this context, there have been done many works; there have been done experiments by the scientists and many environmental technicians who have spent time in search of the facts about atmosphere and the factors and materials that damage the nature. The findings of the studies and the research done in this field led to many new laws and practices which were made applicable by the regulatory authorities that are directed by the governments and work for the betterment of the whole world.

Several EMS have been introduced. However, two of them are widely spread; the European Eco-Management and Audit Scheme (EMAS) and the International Standard ISO 14001. Both of them design a framework that allows the organization to develop its own EMS, which will reduce the negative environmental impacts of its activities.

1.3 Findings from Previous Projects:

Further work suggested by previous projects highlights the need for:

- Examining the effectiveness of EMS on improving the environmental performance.
- Investigation of the cost of implementing and maintaining an EMS.
- Further studying of the success of the cluster approach among SMEs at promoting the implementation of EMS.
- Research of the government role in promoting EMS countrywide.

1.4 Aim and Objectives:

This project aims to study the penetration and impact of environmental standards in the UK industry.

The main objectives of this project are:

1. To review the structure and the requirements of environmental standards.

2. To summarize the findings on the impact of environmental studied as reported by previous students and as published in research papers.

3. To quantitatively analyze data on 2010, for ISO14001, ISO9000 and EMAS certifications.

4. To assess the impact of EMS and propose how the UK industry can manage environmental performance.

1.5 Project Outline:

This project has been carried out in six chapters. Chapter 2 provides an overview of environmental management systems. It explains what is EMS? How the organizations implement its own EMS following the requirements of either ISO 14001 or EMAS? The chapter highlights the key similarities and differences between ISO 14001 and EMAS and what are the benefits of each one. Finally, it describes the general process of certification of an EMS.

Chapter 3 discusses the importance of implementing an EMS. Then, it gives short comparison of ISO 14001 and 9001 through analyzing the performance of each one over a decade.

Chapter 4 analyses the current trends of EMS in the UK and worldwide based on the number of certification with respect to population, GDP and ecological footprint. Additionally, it analyzes the performance of EMS in regard of the total number of registered companies.

Chapter 5 discusses the current trends of EMS in more depth. It identifies the drivers and barriers of implementing EMSs. It sheds light on the differences in the uptake of ISO 14001 and EMAS. There is a focus on the small and medium sized enterprises (SMEs) trends of EMS. Finally, the chapter provides a study into the barriers of implementing EMS in the United States.

Chapter 6 summarizes the project and points out the reasons of the current trends. It discusses the limitation of this research and suggests some area of improvement and further work.

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1.6 Project Relevance:

There are many important processes considered to be the main contributors of all the damage to the environment. One of them is the oil and gas industry as it belongs to the primary industries. T oil and gas flares contribute to global warming by slowly increasing the temperature of the earth and perhaps lead to climate change. According to U.S. Environmental Protection Agency EPA, the total greenhouse gas emissions in 2010 were 6,821.8 Tg[1] where 5,387.8 Tg of it were generated through burning fossil fuels [44]. Additionally, oil spills can cause harmful damage to marine ecosystems. The applicable EMSs provide a good starting point for controlling the greenhouse gas emissions. The cycle base process of EMS can allow a continual reduction of the emissions. By implementation of EMS, companies can integrate the management of greenhouse gas emissions into their existing systems; thus, avoid the additional costs of developing a separate data collection and reporting system [46].

2. LITERATURE REVIEW

The second chapter analyzes the literature review of the environmental management systems. Outline the current trends of EMS, and illustrating the key differences between ISO 14001 and EMAS.

2.1 Definition of Environmental Management Systems

Environmental Management systems are set of actions that aim to maximize rationality in decision-making on conservation, protection and improvement of the environment; based on the coordinated multidisciplinary information and citizen participation.

There are several environmental management system models, among all; two primary approaches dominate the marketplace: ISO14001 and EMAS.

2.2 ISO 14000

ISO refers to International Organization for Standardizations. ISO 14000 is a given name to a collection or a family of standards, which directly deal with the management of systems of environmental benefit. ISO 14000 has a series of standards that make the activities of organizations bend in accordance with the rules of environmental management. There are different packages to allow different companies and industries to choose the best suitable for them.

The following packages in the ISO 14000 family are currently available for adoption by the companies:

- ISO 14001 Environmental management systems—Requirements with guidance for use.
- ISO 14004 Environmental management systems—General guidelines on principles, systems and support techniques.
- ISO 14015 Environmental assessment of sites and organizations
- ISO 14020 series (14020 to 14025) Environmental labels and declarations.
- ISO 14030 Discusses postproduction environmental assessment.
- ISO 14031 Evaluation of Environmental performance —Guidelines
- ISO 14040 series (14040 to 14049), Life Cycle Assessment, LA, discusses pre-production planning and environment goal setting.
- ISO 14050 terms and definitions.
- ISO 14062 discusses making improvements to environmental impact goals.
- ISO 14063 the Environmental communication, and it provides basically Guidelines and examples
- ISO 14064 Measuring, quantifying, and reducing the Greenhouse gas emissions.
- ISO 19011 Specifies single audit protocol for both the ISO 14000 and ISO 9000 series standards together.

[1] Tg refers to million metric tonnes of carbon dioxide equivalents

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2.3 ISO14001

The ISO 14001 is part of a series of international environmental management standards applicable to any organization. ISO 14001 is a voluntary instrument aims to assist companies in developing their own environmental performance framework based on their targets and performance measures. Based on the cycle Plan - Do - Check - Act, ISO 14001 specifies the most important requirements to identify and control the environmental aspects of any organization [5].

2.3.1 EMS Cycle

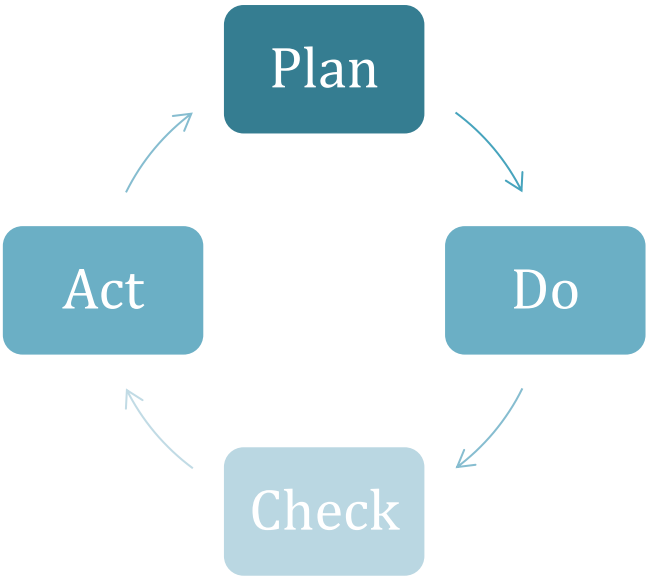

Figure 2. 1: Plan-Do-Check-Act Cycle

Plan – Establish the objectives of the organization objectives and design a plan to achieve them.

Do – Implement the plan.

Check – Measure the results in accordance to the planned targets and objectives.

Act – Investigate the roots of the problems, correct them and constantly improve the plan to achieve more desired results.

The stages of a typical EMS is shown below in figure 2.2:

Figure 2. 2 stages of a typical environmental management system [5]

2.3.2 Key Benefits

Following are the benefits that expected after the implementation of environmental management system in companies [6][7]:

1. Show commitment to customers, investors, public and community.

2. Improving cost control through waste reduction.

3. Optimization of energy consumption.

4. Reduce insurance premiums through lower incidences.

5. Facilitate obtaining permits and authorizations.

6. Improve their qualifications to access tenders and grants.

2.3.3 Requirement for ISO 14001

General requirement:

An organization must continuously improve its EMS to meet the requirement of its registered standard. The elements of ISO 14001 are organized around five steps [5]:

I. Environmental policy

II. Requirement for planning

III. Requirement for implementation

IV. Requirement for checking

V. Management Review

I. Environmental policy:

The organization must develop an environmental policy that is conformed to the legal requirements, compiled with prevention of pollution and subjected to continual improvement. This policy provides guidelines for reviewing objectives and targets.

II. Requirement for Planning

Environmental aspects:

Each organization needs to identify the aspects that need to be controlled in order to reduce the negative impact on the environment. Categories of these aspects include:

- Energy
  - Total consumption
  - Emission to air
  - Consumption of natural gas vs. coal.
- Water
  - Waste water disposal.
  - Ground water quality.
- Material resources and waste disposal
  - Solid waste production
  - Recycled waste.

Legal requirement:

The purpose of this element is to point out the legal measures associated with the activities of an organization so that the organization takes them into account when developing its EMS. Multinationals companies should pay attention to the different requirements between countries.

Objectives, Targets, and Programs

Objectives and targets of an organization must be set in accordance to the environmental policy. However, it is the organization's responsibility to decide whether it wishes to accomplish them or not and to establish the suitable methodology.

III. Requirement for Implementation

Structure and responsibility

Before developing an EMS, an organization must ensure that it is applicable within the available resources including human resources, financial and technological resources.

Roles and responsibilities must be assigned from the top management. One person should be denoted to ensure the EMS is implemented and maintained consistent with ISO 14001, and also observe its performance and report it.

Competence, Training, and Awareness

The point of this element is to ensure that the people who are assigned to perform a particular task are well skilled and have an enough knowledge and expertise to do it.

An organization may consider provided training courses to the employees and regular awareness classes to review and discuss the recent issues and measures associated with the environment.

Communication

ISO 14001 requires a company to have procedures. However, it does not ask for disclosure of information. All procedures must be recorded but it is up to the organization to keep the records confidential.

The procedure needs to describe how external communications are received and responded to.

Documentation

The organizations are required to document the system and store the records in either electronic or paper archives. The records should describe how the organization developed its EMS taking into account each element of the standard. They also should include the environmental policy, objectives and targets of the organization.

Control of Documents

A control of documents system is required in each organization. The system is responsible of reviewing, updating and approving the documents prior to use. In addition, it is expected to distribute a new version of the documents annually and note the older versions to prevent an unintended use.

Operational control

This element is concentrating on providing the instructions and strategies for each procedure associated with implementing the EMS to ensure proper execution of the plans. The organization needs to communicate the suppliers and contractors to the relevant elements of those procedures.

Emergency Preparedness and Response

The organization is required to identify the relevant potential emergencies and have a ready plan to respond to the situation. It should also regularly test the procedure to observe the performance and make necessary improvements.

IV. Requirement for Checking

Monitoring and Measurement

A procedure is required to show how the organization will monitor the EMS performance and measure the key parameters. It should keep track of some environmental measures including temperature, pH and pressure gauge and maintain them at an appropriate range.

Evaluation of Compliance

ISO 14001 does not force the organization to conform to particular laws. However, each organization should demonstrate the efforts that were made to meet the legal requirement in order to keep its certification. A regular evaluation of legal compliances is required to avoid unfavourable environmental impact.

Non-conformances, Corrective and Preventive Action

A non-conformance is a situation where the condition does not conform to the plan. Systematic non-conformances examples include incidents and failing to follow the procedure; they are often addressed through monitoring. One must respond to the situation by identifying the root causes instead of temporarily fix of the problem. Such investigation eases the path for corrective actions and thus preventive ones to be taken.

The organization must record the effectiveness of the taken actions for evaluation and improvement purposes.

Control of Records

Records are meant to serve as verification of how the EMS of the organization meets ISO 14001 standards. Records must be clearly categorized to make them easy to identified and retrieved when needed. In addition, they should be safely stored and backed up.

Internal Audit

A procedure should be conducted to review all methodologies, schedules, forms and checklists. This is a compulsory element to ensure that the company conforms to its own EMS requirements as well as ISO 14001 requirements. Auditors need to decide how often should the internal audit be conducted, how it will be done, report the results and generate the desired statements to ensure the impartiality of the procedure.

V. Management Review

Top management should consistently review the organization's EMS to ensure its suitability and effectiveness with environmental changing conditions and situations. Meeting should be scheduled regularly to discuss the needed improvements and recommendations.

2.4 Environmental Management Systems, Quality And Safety

Systems of environmental management have similarities with the systems of quality management and safety. The structure of ISO 14001 is also largely inspired by the ISO 9000 quality [8]. These similarities are in several respects:

- The implementation of EMS is facilitated in companies that have previously engaged in a process of quality assurance. Experience has shown that implementation of a system of prior quality management (ISO 9001 or 9002) was likely to greatly facilitate the management system of environmental protection. This advantage for companies that practiced quality assurance process is due to the similarity of the focus on quality and environment. It is confirmed by the consultants, as Ronald Mc Lean, firm Arthur D Little: "From my observations, a small company that is ISO 9000 has already acquired a mindset and routine procedures that enable it to address a problem without the huge ISO 14000.

- Where systems already exist in the company, some items may be shared between the EMS and systems. There are three levels of documentation systems: documents defining the systems, such policy and program documents defining the operation of systems, such procedures, and their transcripts purely operational level, such as technical instructions. Policies and procedures are treated with different standards and cannot be combined. However, the level of technical instructions, which concerns only the company benefits from being integrated, thus avoiding the multiplication of operators instructions on the same operation. This integration facilitates further consideration of issues related to aspects of both systems (such as aspects "condition of work" related to health, safety and the environment), and can simplify the collection of information: at the factory and Solectron, which produces printed circuit boards, internal audits. It has also been proposed to merge these systems into a single system Quality - Safety - Environment (QSE), but the proposal to create an ISO committee on "Management of security" has so far been rejected [8].

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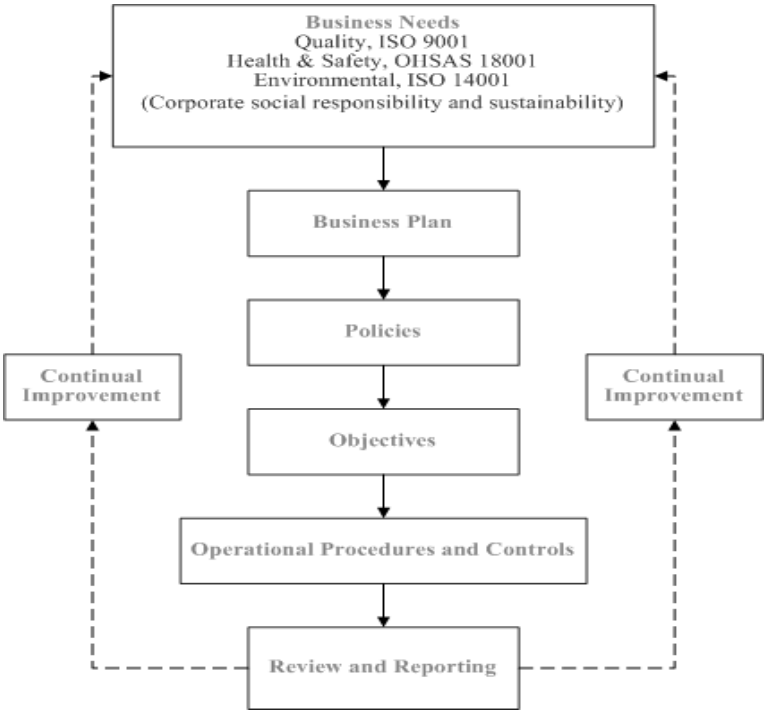

Figure 2. 3: Sample of a management system [8]

2.5 Differences Between ISO 9001 and ISO 14001

The objective of ISO 14001 is improving the environmental performance of an organization. This would give the organization a number of benefits in return besides reducing the harmful effects on the nature and human health, such as reducing costs. The objective of ISO 9001 is improving the quality system of an organization, which would consequently lead to reducing operating cost, minimizing risks, improve customers satisfactions and increase employees motivations. The benefits and advantages of ISO 9001 is what every company and organization is looking for, despite the size of the enterprises.

In other words, ISO 9001 allows an organization to understand, accept and develop the process of delivering products and services to customers and obtaining their satisfaction [9].

2.6 EMAS:

Eco Management and Audit Scheme is a voluntary environmental management system that was set by the United Kingdom. Just like ISO, EMAS is a set of standards that aim to guide organizations to develop their own EMS. EMAS is sometimes referred to as the improved version of ISO 14001, which is true to some extent. It regulates and governs the use of environmental management systems. The questions here are; what was the need of introducing a system that already has a similar system in working condition in the practical world? And what made the people in charge to move ahead? EMAS was introduced to remove the shortcomings, which were felt in the existing system of ISO 14001. EMAS is now being used and practiced in conjunction with the old prevailing system of ISO 14001. EMAS when combines with ISO 14001, they give a direction of working which is much more effective and much more improved compared with the extent of good which can be achieved by ISO 14001 alone.

EMAS also brings with it the compliance with the environmental legislation and there is a strict control of government regulations that is absent in ISO 14001. EMAS also demands a stronger involvement of the employees, which is a very necessary action that produces enhanced results [12].

There are similar packages available in the market and they are also used like the ISO 9000. Mainly, they give the chance of managing the system according to the requirements and needs in an organized way. They are programmed and tested in such a way that they can perform each task perfectly. The essential difference between ISO 14001 and the conjunction of EMAS with the ISO 14001 is that EMAS demands much more strictness within the system and asks for firmer grip over the whole scenario.

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2.6.1 EMAS III:

This is the latest version of EMAS [13], which is currently available and applicable. It was brought in to improve the standard of the present EMAS. The changes made were as follows:

- Single corporate registrations have been made possible for multinational organizations.
- A new audit cycle has been generated to help small companies.
- Registrations have been made possible for non-EU countries.
- Only one EMAS logo was offered that made an effective marketing method.

Certain core indicators were added to complete an inside-out consideration of the all the environmental effects. Organizations are bound to report thoroughly on each environmental effect unless it is possible to be neglected providing a clear justification. The indicators are [14]:

- Efficiency of energy in the context that consumption of total energy annually with the calculated percentage of total energy which is renewable
- Efficiency of material in terms of the annual mass flow rate for different materials
- Annual consumption of water
- Annual production of waste and the waste which is somehow hazardous
- Use of land or biodiversity
- Annual emission of the bio gases and the emission of air annually

There were different views about the efficiency of the new core indicators throughout the world. Some companies and institutes were not satisfied. They claimed that these core indicators do not reflect the environmental performance completely and they require further information disclosure on organizations.

Here is an example of how to formulate the core indicators and present it:

Table 2. 1 Leicester City Council Core Indicators [15]

Indicator	Application to Leicester City Council	Council Performance in 2009/10		
		A Input or Impact	B Measure of Activity	R Ratio or % of A to B
Energy Efficiency	Energy use data is already collected to manager usage and estimate carbon dioxide emissions for specific targets.	183.564 mWh	7402 employees	24.80 mWh per person
Water Consumption	Water consumption is already reported for a target. The figure is for corporate buildings including leisure centers and excludes schools	239.845 m^3	7402 employees	32 m^3 per person
Material Efficiency	The council has identified paper usage as the only practicable measure of its material efficiency. This is already reported.	67,890,220 A4 sheets equivalent	7402 employees	9170 A4 sheets equivalent person
Waste	The % of municipal waste landfilled is the most appropriate practicable measure and is reported here. Municipal waste includes waste from households and from Council services- the council can influence both of which.	69,526 tonnes	126,743 tonnes	54.9%
Biodiversity	The council will report on the percentage of Local Wildlife Sites receiving positive conservation management as the most appropriate measure of its performance in protection and enhancing local biodiversity.	23 sites	35 sites	67%
Greenhouse Gas Emissions	Of the greenhouse gases covered by this indicator, only carbon dioxide (CO_2) is significant emission by the council, so this is reported.	66,877	7402 employees	9.0 tonnes CO_2 per person
Air Emissions	Of the basket of pollutant gases covered by this indicator, only nitrogen oxide (NOx) and particulates (PM) are emitted in significant quantities by the Council, so these are reported.	31,830Kg NOx 1.233Kg PM	7402 employees	4.30 Kg NOx per person 0.17 Kg PM per person

2.6.2 EMAS Easy:

EMAS Easy is specially designed for places where it is hard to implement the EMAS [16]. This is a different and simple design, yet very sophisticated for smaller organizations and companies. This is designed for the SMEs, which are basically the small and medium sized organizations. EMAS Easy offer the SMEs a methodology to meet the standards of EMS covered by ISO 14001 and/or EMAS. It was developed from a method named Eco-mapping, where visual aids such as diagrams where used to ease the complexity of environmental self-assessment.

EMASeasy Group:

Activities, workshops and seminars were spread to provide an overview of environmental management concepts and tools, financial and economic benefits of EMS, plus detailed instructions to implement an EMS and gain EMAS registration. The main and important dictations of EMASeasy are the following [17]:

1. Group dynamic
2. Sharing best practices
3. Direct implementation and practice
4. Crossed internal audits
5. Cost sharing and reduction

2.7 BS 8555:

This is a British standard which is known since the year 2003 when it got published and it basically important because it breaks the implementation of EMAS and ISO 14001 into several steps which count to six and they are easy.

2.8 Difference Between EMAS and ISO 14001

Table 2. 2: comparison between EMAS and ISO 14001 [17][18].

Type of EMS	*ISO 14001*	*EMAS*
Type of Standard	Worldwide	Europe
Certification	Environmental standard	Under regulation of EU legislation
	All types of organizations	Only for companies performing industrial sites
External communication and verification	Environmental policy by Public	Environmental policy, objectives, EMS and details of organization's performance by public
Audit	Not specified	Specified
Initial environmental review	Initial review recommended but not a requirement	Preliminary review required
Policy commitment	Continuous improvement of environmental management system. Commitment to pollution prevention and to comply with legislation	Continuous improvement of environmental performance. Compliance with environmental legislation
Employee involvement	Communication to employees required. Involvement encouraged but not required.	Active participation of employees required

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2.9 Certification

2.9.1 General Process Of Certification

Figure 2. 4 General Process of Certification

2.9.2 UKAS

What is UKAS?

"*The United Kingdom Accreditation Service is the sole national accreditation body recognized by government to assess, against internationally agreed standards, organizations that provide certification, testing, inspection and calibration services* [19]."

UKAS aims to contribute to improve the environmental performance. It attempts to promote the fulfillment of this goal internationally. To do so, UKAS accredits certification bodies to provide certificates of EMS. However, it must ensure that accredited certification to ISO 14001 and EMAS are granted only where an organization can prove an effective EMS which:

a) Identifies the major environmental aspects, which are expected to have an impact on the environment.

b) Aims to improve the environmental performance of the addressed aspects and consequently reduce the pollution.

A full list of accredited bodies is available on UKAS website [19].

2.9.3 BSI

British Standards Institute started as Engineering Standards Committee. Now it has grown to provide standard-based solutions in more than 140 countries [20].

BSI Group services are:

1. Develops private, National and International Standards
2. Certifies management systems and products
3. Provides assessment, certification, and testing of products and services
4. Provides training and information on standards and international trade
5. Provides performance management and supply chain management software solutions.

In order to issue a certificate, BSI group visits an organization to assess its EMS depending on the chosen standards of the organization. If the formal assessment was successfully completed, BSI will issue a certificate of registration valid a defined period of time.

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Some of BSI benefits of certification [20]**:**

1. It helps to demonstrate to stakeholders that the business is run effectively.
2. It ensures that the company is continually improving and refining its activities.
3. The regular assessment process will enhance the staff responsibility, commitment and motivation.

Audit Process:

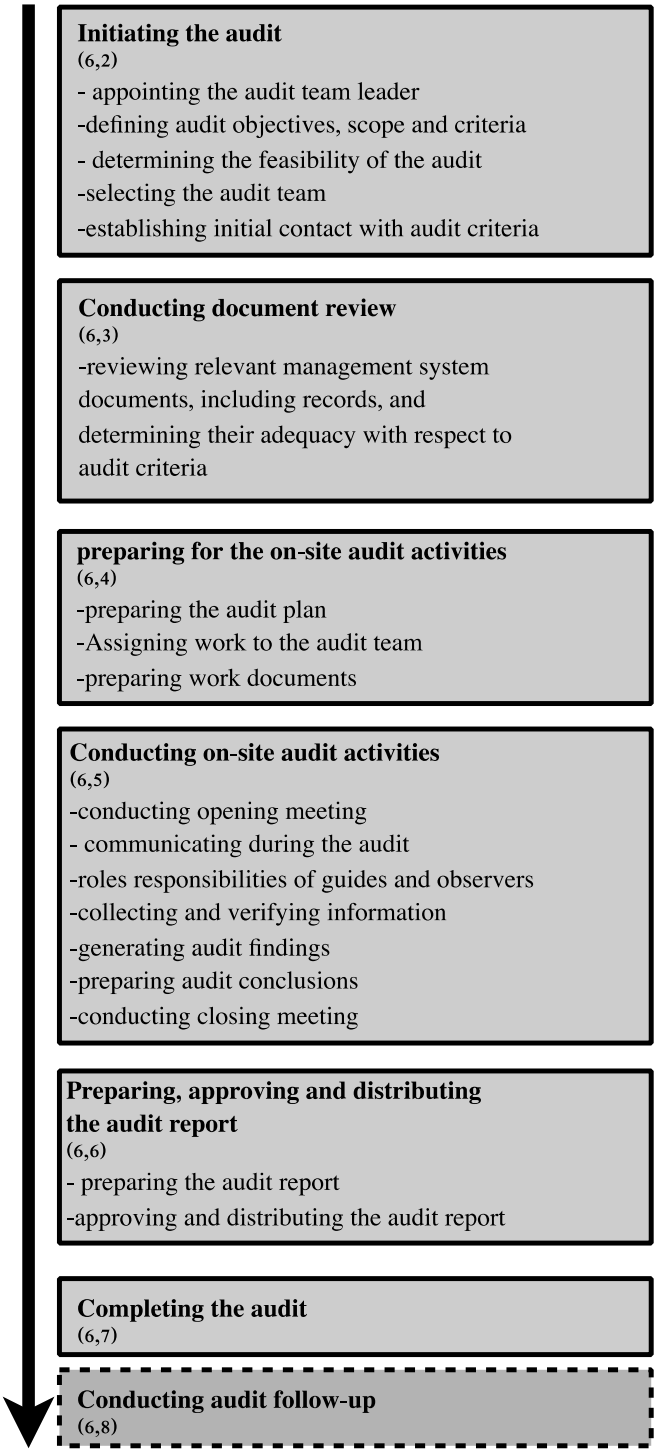

Figure 2. 5 Overview of typical audit activities [21]

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3. CRITICAL ANALYSIS

3.1 Introduction

The third chapter will provide a brief review of the significance of EMS and track the performance of ISO 14001 and ISO 9001 over a decade through analyzing the number of certificates.

3.2 Importance of Implementing Management System

The current market, globalization and ever-increasing costs pressurize companies to work every day on improving profitability, efficiency and effectiveness. The fact that an organization implements a management system is important because it becomes an excellent tool to assist in the improvement of the above objectives. The implementation of environmental management system ensures the standardization of proceses and improves the confidence level of human resource working in an organization on the management. Essentially, the advantages of EMS can be divided into two sets [22]. The first set is that fact that businesses and organizations would serve towards the sustainability of the Earth. The second set is expected to assist the internal system of organizations. EMS allows the management of the company to orgnize processes and facilitates in decision making [21]. It enhances the positive image of suppliers and customers of the company and differentiate it in the market. The most significant factor of implementing EMS is that it ensures the compliance of the company's compliance with legal framework and also minimizes the risk, because through the implementation of this system, responsibilities are assigned at each level of organiaztion.

Figure 3.1 lists some of the benefits.

1.Save company's costs.
2.Environmental targets not just set but met.
3.Procedures in place to ensure legislative compliance.
4.Improved public image and increased market opportunities.
5.Viewed more favourably by the regulator and the financial sector.

Figure 3. 1 Benefits of EMS [22]

3.3 Comparison Between Cerification of ISO 14001 and 9001

Table 3. 1 ISO 14001- Number of certificates (Worldwide) [23].

Overview											
Year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
TOTAL	**13994**	**22847**	**36464**	**49440**	**64996**	**90554**	**111163**	**128211**	**154572**	**188815**	**223149**
Africa / West Asia	337	651	924	1357	2002	2999	3994	4832	5586	7682	8813
Central / South America	309	556	681	1418	1691	2955	3411	4355	4260	4654	3923
North America	975	1676	2700	4053	5233	6743	7119	7673	7267	7194	7316
Europe	7253	10971	17941	23305	30918	39805	47837	55919	65097	78118	89237
Far East	4350	7881	12796	17744	23747	35960	46844	53286	71458	89894	112237
Australia / New Zealand	770	1112	1422	1563	1405	2092	1958	2146	904	1273	1623

Above figures show a the number of certificates of ISO 14001 in different countries throughout a decade. The requirements for the implementation of environmental management systems is gradually increasing, which can also be seen from the above figure. It is clearly identified in the above figures that requirementd for the environmental management system along

with its guidance for use is relatively high in Far East countries as compare to others [24]. The second highest rates of such requirements are from European countries. The reason why the companies are adopting it gradually is because the implementation of an EMS does not only impact the environment, it also has a impact on the organization and structure of the company. The main changes focus on technical and organizational means. The production process of the company can be rearranged (emission reduction waste, accidents and the use of toxic or hazardous) and the organization of work is often changed.

Table 3. 2: ISO 9001 certificates number (worldwide) part 1 [23]

Overview										
Year	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
TOTAL	**46571**	**70364**	**127349**	**162701**	**223299**	**271847**	**343642**	**457834**	**510349**	**561767**
Africa / West Asia	1272	1855	3378	6162	8668	12150	17307	20183	19800	23627
Central / South America	140	475	1220	1713	2989	5221	8972	10805	14409	13679
North America	2613	4915	10374	16980	25144	33550	45166	48296	50894	53806
Europe	37779	55400	92611	109961	143674	166255	190247	269332	269648	292878
Far East	1583	3091	9240	18407	29878	37920	56648	81919	126779	148573
Australia / New Zealand	3184	4628	10526	9478	12946	16751	25302	27299	28819	29204

Table 3. 3: ISO 9001 certificates number (worldwide) part 2 [23]

Overview							
Year	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
TOTAL	**497919**	**660132**	**773867**	**896929**	**951486**	**982832**	**1064785**
Africa / West Asia	20124	31443	48327	71438	78910	73104	77408
Central / South America	9303	17016	22498	29382	39354	39940	36551
North America	40185	49962	59663	61436	47600	47896	41947
Europe	242455	320748	377196	414232	431479	455332	500319
Far East	163061	220966	247091	300851	345428	356559	398288
Australia / New Zealand	22791	19997	19092	19590	8715	10001	10272

The above figure deomstrates the overview of the certification and guidance requirements of enviromental management system of ISO 9001. ISO 9001:2000 are generic requirements for management systems to be implemented in any business or any industry. They are applicable to processes that inter- taken to achieve uses its products or services. ISO 9001:2000 is applicable to processes that influence the quality of products or services and ISO 14001:2004 for processes influencing the environmental performance of the company [25]. Therefore, the above figure indicates that Europe is a major portion for the requirement for the environmental management system's implemntation. Certified companies can promote themselves in indicating that they are certified ISO 9001:2000 or ISO 14001:2004 through media such as business signs, advertisements vehicle fleet of the company, announcements or letters to the header. Many certification bodies authorize certified clients to use special logos, designed by their care, marked "company assured quality, "" quality assured " and variants. The mention refers to the standard definition of "insurance" which means a statement confirming that some something meets the requirements specified - such use is acceptable [26].

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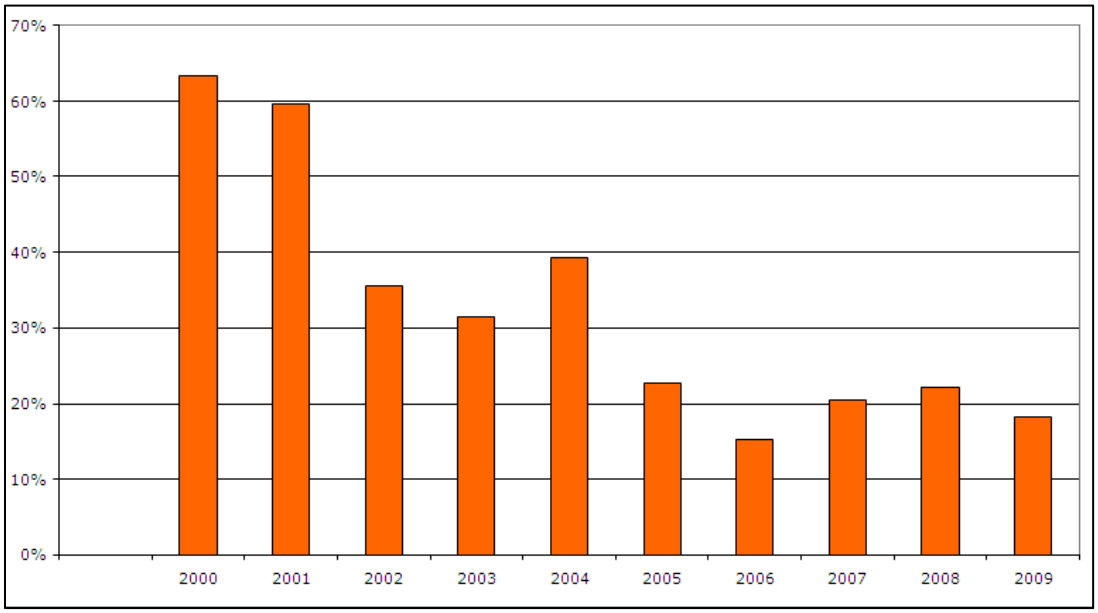

Figure 3. 2: ISO 14001- World Annual Growth in Percentage (%) [23].

The figure 3 represents the annual growth of Environmental Management system. It clearly shows that 2000 was the best year in terms of environmental management system's growth in which the percentgae was above 60% and in the year 2001 the percentage of growth touched the level of approximately 60%. The year 2002 did not depict any remarkable growth yet it was far more better than the year 2006. In 2002 it touched the level of 35% and in year 2003 the growth level was further reduced to 32%. Again in 2004, the graph shows the rise in growth level and got percentage of around 49%. But again in year 2006 the growth level came to around 15% and this has been considered as the least rise in level of environmental management systems growth in nine years. In the year 2007 the growth level touched the level of 20% and same happened in the year 2008 and 2009, in which the level arose to near 225 and 18% respectively.

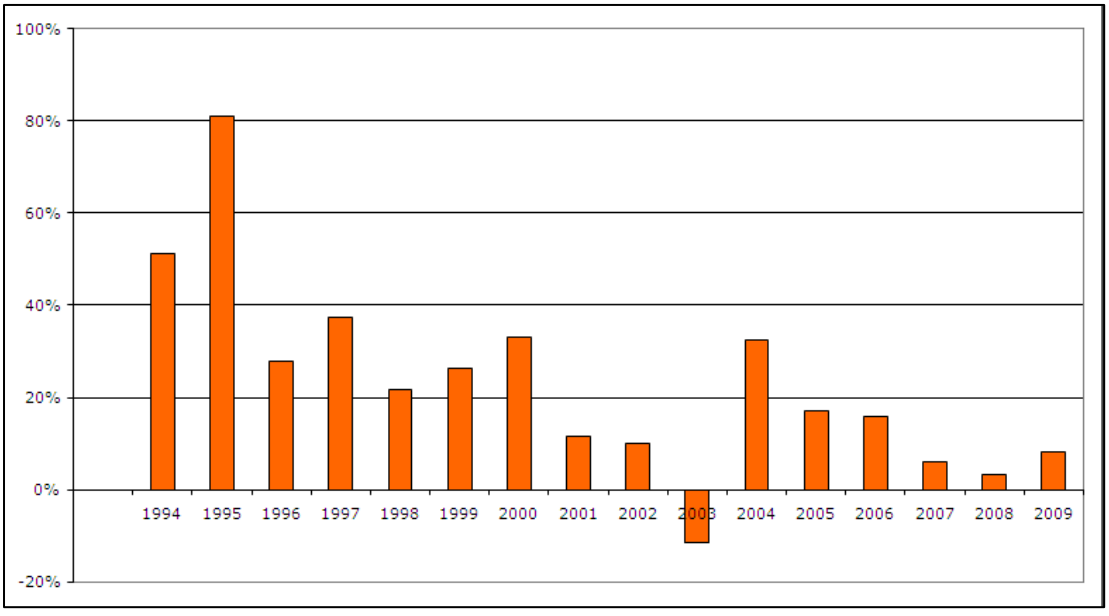

Figure 3. 3: ISO 9001- World Annual Growth in Percentage (%) [23].

From the above figure it can be seen what is the level of percetage in past few years. This will also tell use the results. It is claery indicated that in the 1994, the annual growth of ISO 9001 reached a level of around 50%. Whereas in year 1995, the growth level touched the peak. From he year 2000 and above, the annual growth of environmental management system got stucked. In 2003, the growth level had a twist and went below the negative line. In 2004, it was sharply raised to a pecentage of 36%. Later on, companies' performance were fluctuating, but the growth level did not go above 20%.

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4. ANALYSIS OF CURRENT EMS TRENDS

4.1 Worldwide Trends

A quick overview of the level of ISO14001 implementation for the past decade is shown below in figure 4.1. There has been a general growth over the top 10 countries that are implementing ISO14001. The highest number of certificates in 1999 was less than 5000 for the top country at the time in Japan; however, in 2009 the highest number of certificates was almost 60,000 [23]. China and Japan were the two highest countries that have risen in the past decade. Between 2006 and 2007 there has been a decrease in the ISO 14001 number of certificates because of the financial crisis, and the UK was one of the most affected countries. However, the top 3 countries having ISO14001 certificates were not affected by the financial crisis, China, Japan and Spain, respectively.

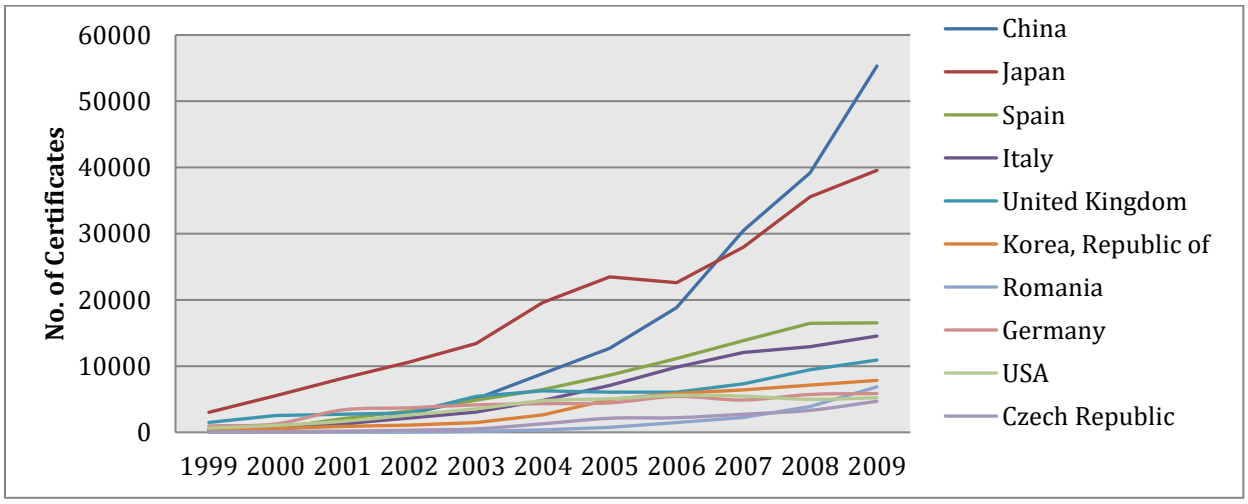

Figure 4. 1: Top 10 Countires implementing ISO14001 in the last decade [23].

The number of certificates does not represent the actual percentage of the EMS increased in a country. Therefore, other factors should be added, the number of ISO14001 certificates as a percentage of the population of people (per capita), of Gross domestic product (GDP) and of the area of the county (km^2). These factors clarify the ratio of EMS certificates relatively to its standardization. Figure 4.2 shows number of certificates of a percentage of population. As the figure shows that China for example has the highest number of certificates but it has very poor number of certificates as a percentage of per capita because of the large number of population it has. On the other hand, Czech Republic has a low number of certificates compared with China but as a percentage of the population, and this applies to Sweden and Romania. However, the U.S. is weak at this particular factor and the UK can be considered as a country with an average percentage.

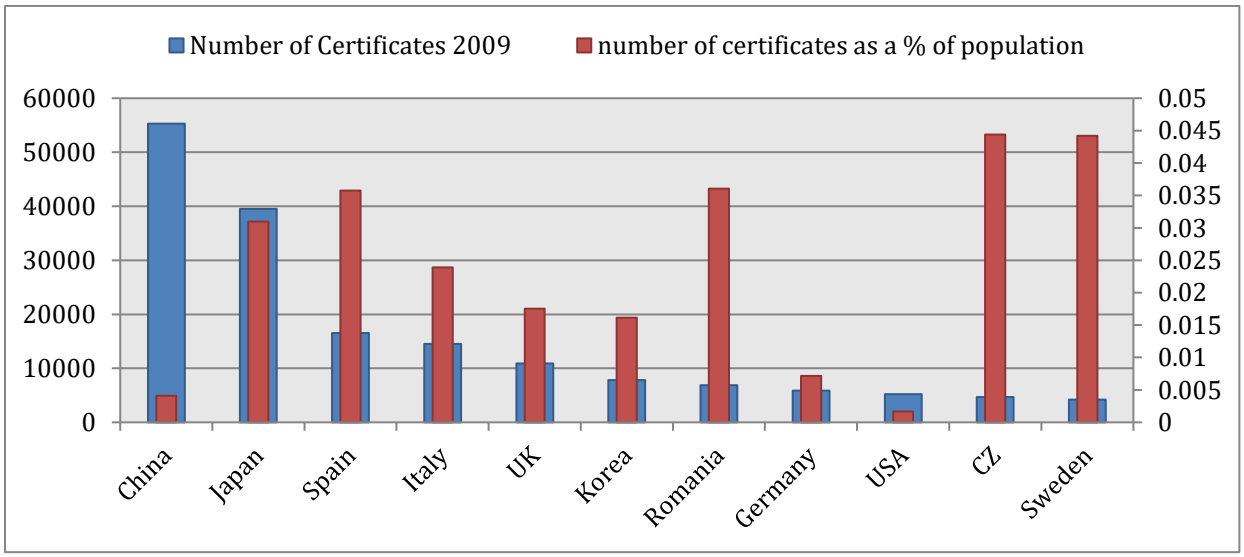

Figure 4. 2: ISO 14001 - Number of Certificates as a % of Population [23][27].

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Taking into account the factor of gross domestic product (GDP), which refers to the market value of each country. Chez Republic, Sweden and Romania have the top number of certificates as percentage of GDP with some variation.

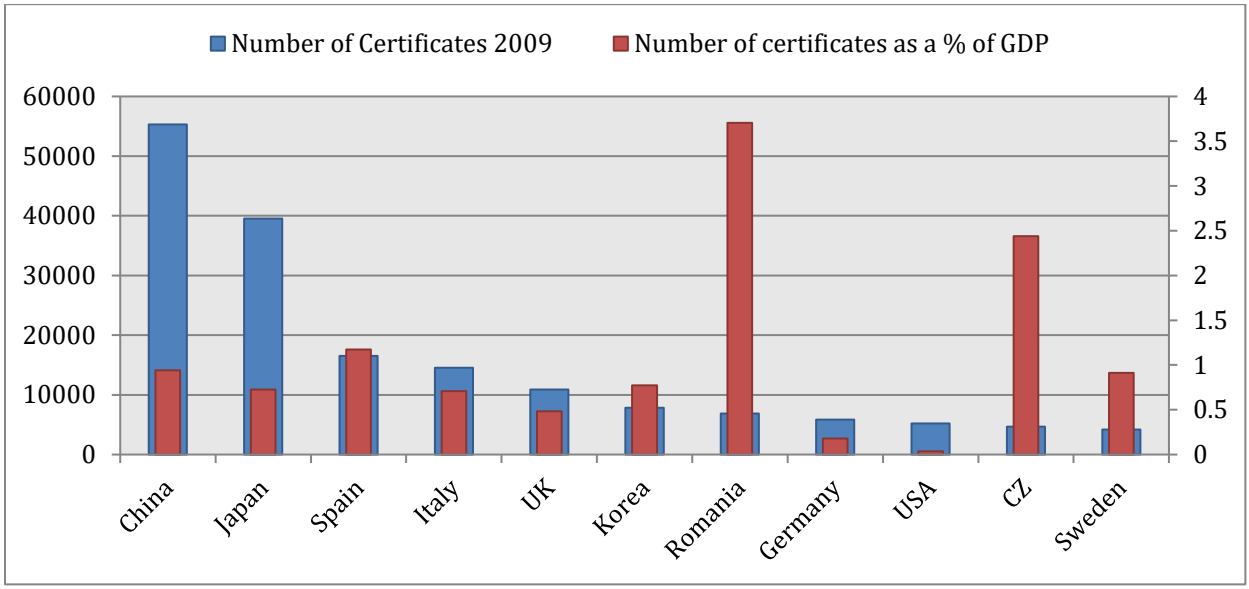

Figure 4. 3: ISO14001 - Number of certificates as a % of GDP [23][28].

On the other hand, the third factor, number of certificates as a percentage of area of the each country has a great deal of variation than the previous two factors. Japan, Korea and Chez Republic are in the top of the list here with small geographical areas compared with the other countries. Where as, for the countries with geographical area like China and the U.S. have even relatively smaller percentage in this factor. It is obvious that the number of certificates with respect to the geographical area will be in advantage to the countries with smaller small areas.

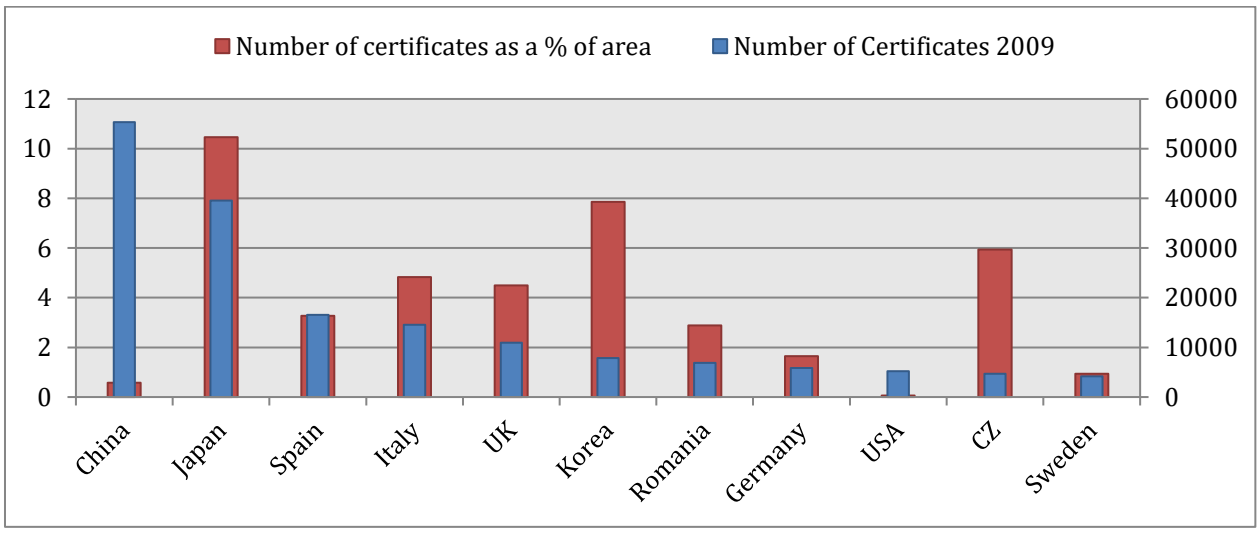

Figure 4. 4: ISO 14001 - Numner of certificates as a % of Area [23][27].

From figure 4.2, 4.3 and 4.4, it can be concluded all the 3 factors are connected with each other. The country that takes into account the 3 factors in a real consideration will get a better result with respect to the number of certificates as an overall percentage. Therefore, Chez Republic has the highest number of ISO 14001 certificates as an overall percentage of the three previous categories.

Figure 4.5 below, shows that the top 2 European countries that implement ISO14001 certificates are not the top ones at implementing EMAS certificates, Czech Republic and Romania, respectively. However, there are number of countries that are top in both EMAS and ISO14001 like Germany, Italy and Spain. This may be due to some organizations consider EMAS as a form of government interference and since prefer ISO14001 as it is non-government standard. Moreover, many

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promoting regulations to EMAS usage are in place in EU-15 countries but not in the new states, which will also have had access to EMAS for a shorter amount of time. The top country relative to population is Austria in general; the relative popularity in some states may be due to incentives offered to organizations operating there [29].

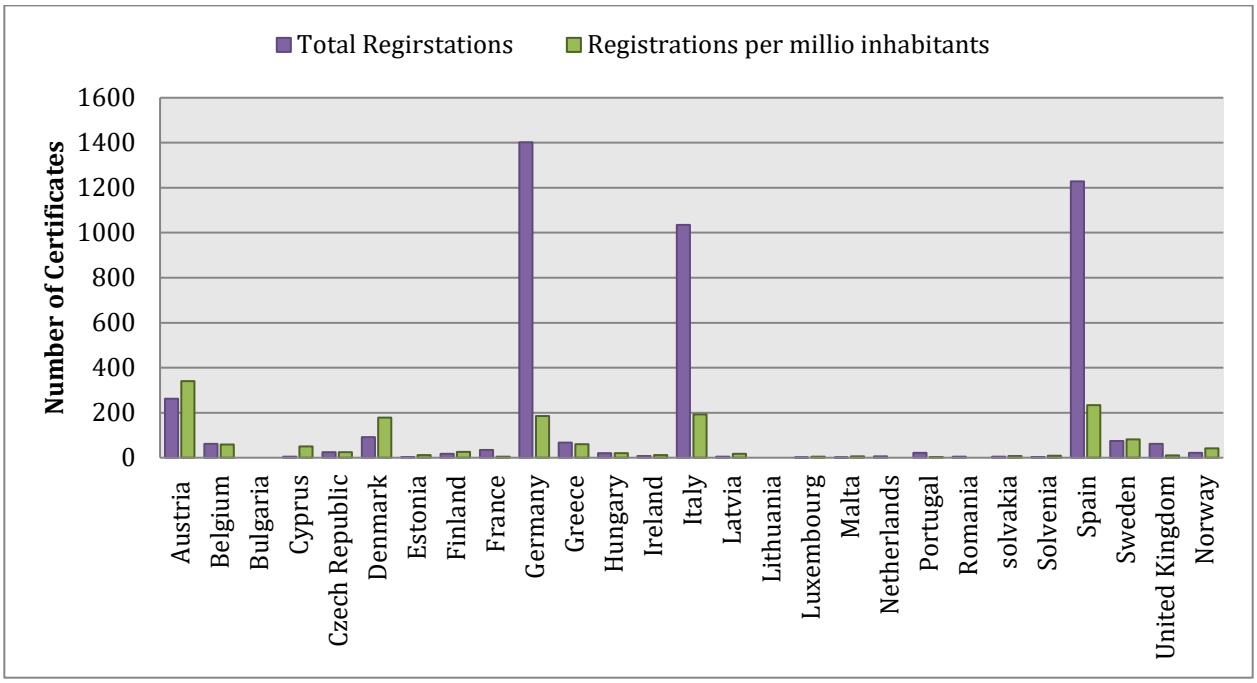

Figure 4. 5: EMAS- total regiestirations per million inhabitants 2011 [30].

Figure 4.6 shows the difference in number of certificates of ISO9001 and ISO14001 as a % of population. In addition, it is easier for a company that is using ISO9001 to implement ISO14001, as it is noticed in the figure below.

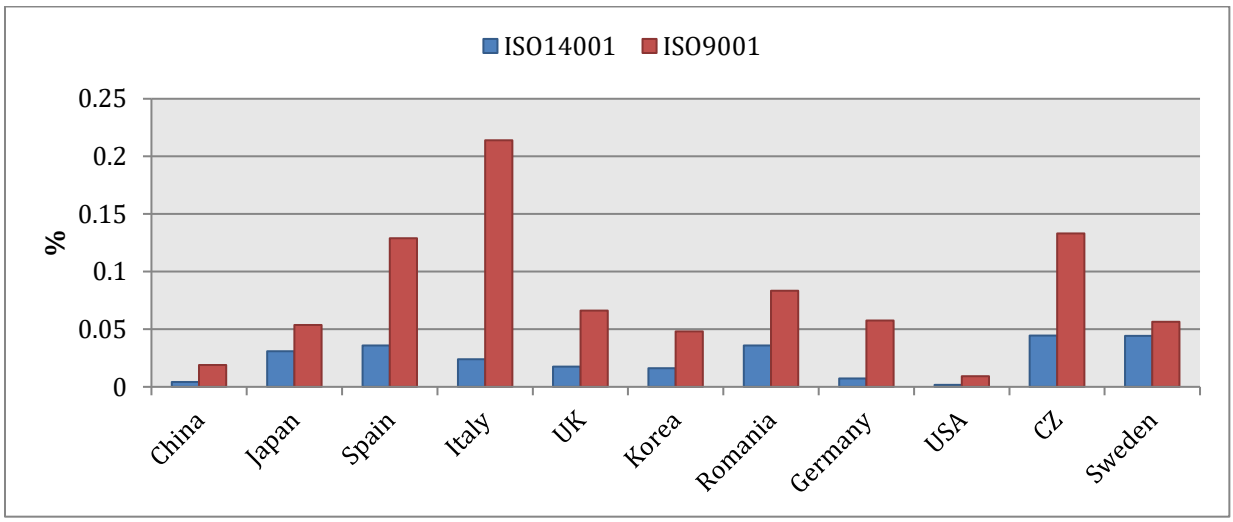

Figure 4. 6: comparison of ISO14001 and ISO9001 certificates as a percentage of population in the top 10 countries in 2009 [23][27].

4.2 Current Trends of ISO14001 and EMAS in the UK

Figure 4.7 illustrates the number of companies in the UK adopting ISO14001 and ISO9001. It is noticeable that both percentages are low, however ISO14001 certificates are relatively lower. Despite the fact that ISO9001: 2000 was established before ISO14001: 2004, ISO9001 is more general and focuses on the quality aspects unlike ISO14001 that focuses on the environmental aspects. It is obvious most companies want to improve their production's quality, as it will result in greater benefits. Where as, many companies are not concerned with the serious consequences of their activities on the environment, as much as they are concerned about redeeming the greatest revenues.

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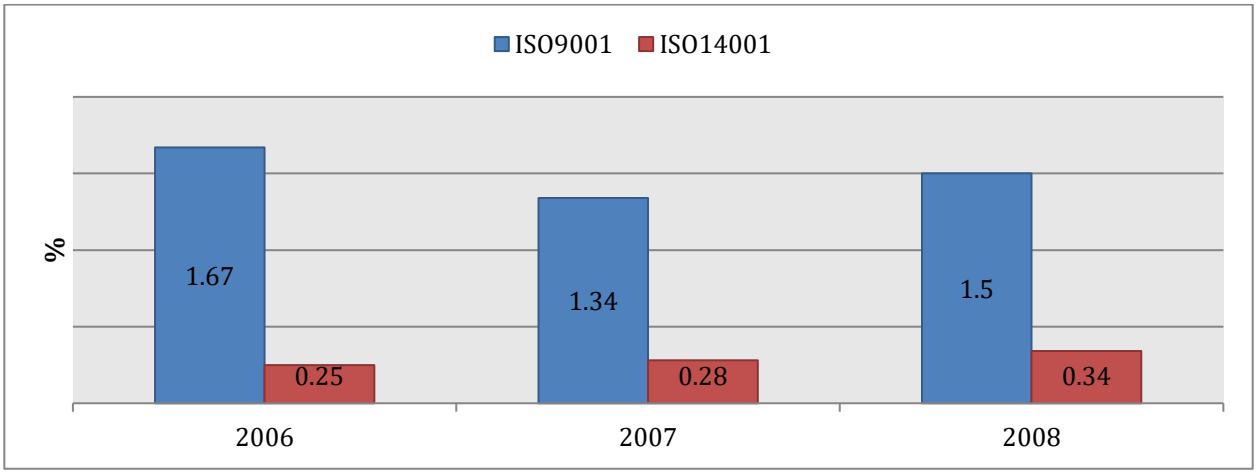

Figure 4. 7: Comparison of ISO14001 and ISO9001 certificates as a % of registered companies in the UK from 2006 to 2008 [23].

Figure 4.8 shows the very small percentage of registered companies in the UK. It is even smaller than the percentage of registered companies for ISO14001 in the UK.

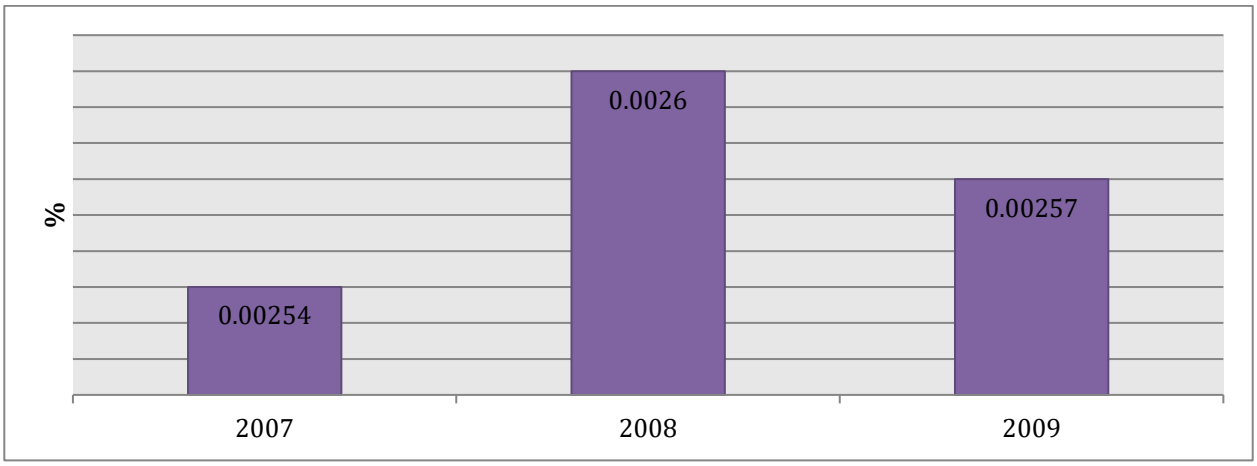

Figure 4. 8: EMAS Registration as a % of registered companies in the UK 2007-2009 [23].

4.3 Trends of EMS in the UK and Scandinavian Countries

The projects of 2010 and 2011 studied the trends in the UK and Scandinavian countries and determine the differences between them. Therefore, this study will be studied here in more depth. Scandinavian countries are considered of the high countries that have ISO14001 certificates as a percentage of the population. This is may be due to the shared history, culture and similar societal values, which mean all Scandinavian countries, are generally sharing the same adopted environment. Sweden has a very high percentage of ISO14001 certificates as a percentage of population and the rest of Scandinavian Countries are on the same bath as Sweden.

Figure 4.9 below, compares the number of ISO14001 certificates per country between the UK and the Scandinavian countries, Denmark, Finland, Norway and Sweden. Therefore, as comparing only the number of ISO14001 certificates, it is noticeable that the UK is in the lead and Sweden follows it from the Scandinavian countries.

Furthermore, Figure 4.10 shows the ISO14001 certificates as a percentage of registered companies and Sweden has the highest percentage. The UK still have higher percentage than Denmark, Finland and Norway, but the difference in ratio between the category in figure 8 and the category in figure 9 has massively decreased. The UK has more number of certificates than the three Scandinavian countries by 85%. However, although the UK has as well higher number of certificates as a percentage of registered companies than the three Scandinavian countries, but it has approximately twice as many per registered companies due to the UK having s greater amount of companies.

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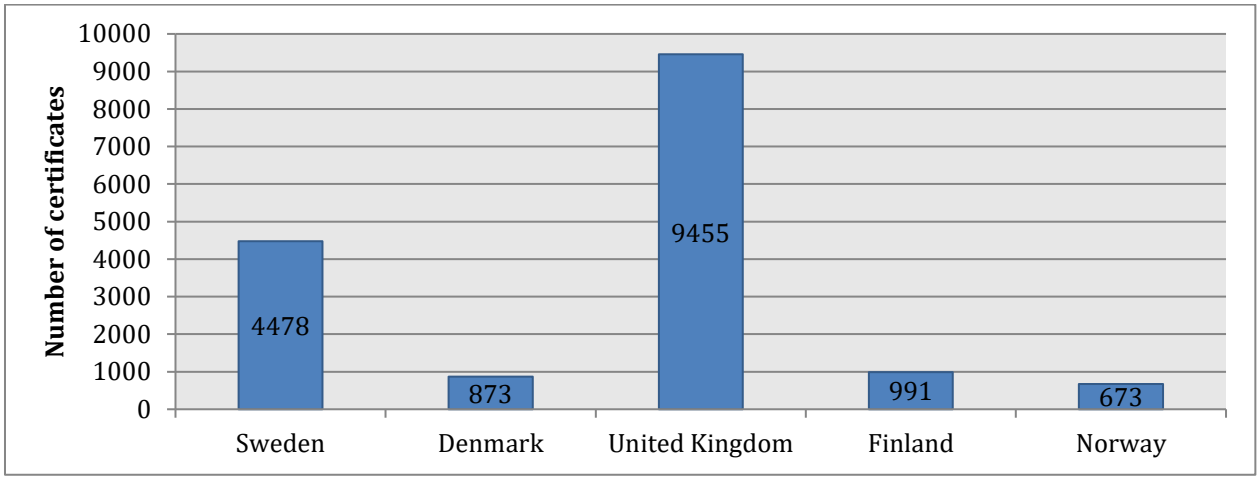

Figure 4. 9: ISO 14001- total number of certficates of the 5 countires [23].

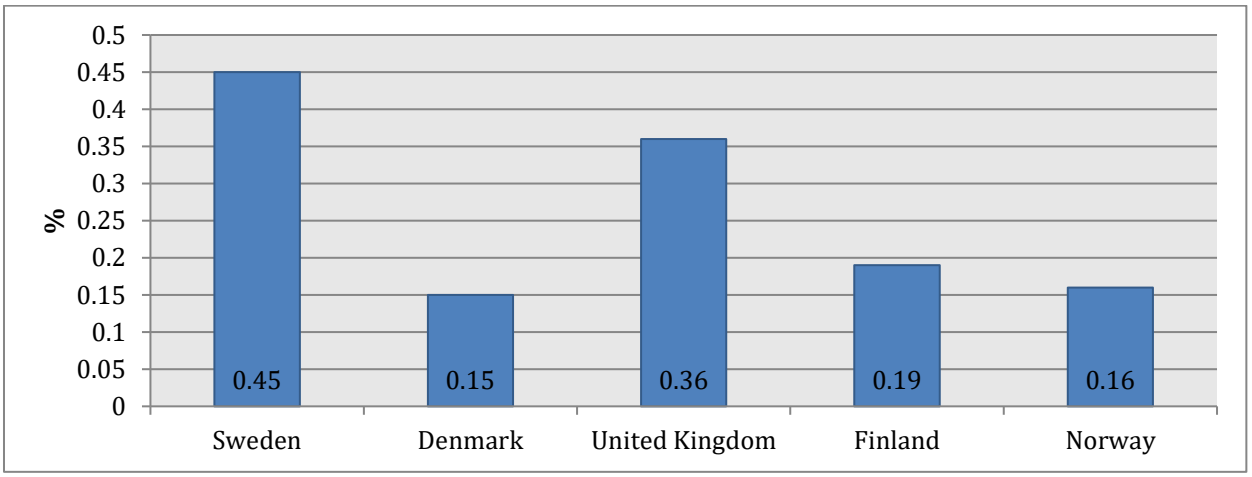

Figure 4. 10: ISO 14001- certificates as a percantage of regiestered companies [23].

Figure 4.11 illustrates that the UK and the Scandinavian countries had roughly close number of certificates of ISO14001 at 1999. Through along the period from 1999-2009 the number of certificates has been wide for the UK; especially in 2006 it had growth at a high level. Sweden was the best of the Scandinavian countries and has some improvement in its growth rate, not like the other 3 countries Denmark, Norway and Finland, their number of certificates growth was almost steady and remained constant over the decade [29].

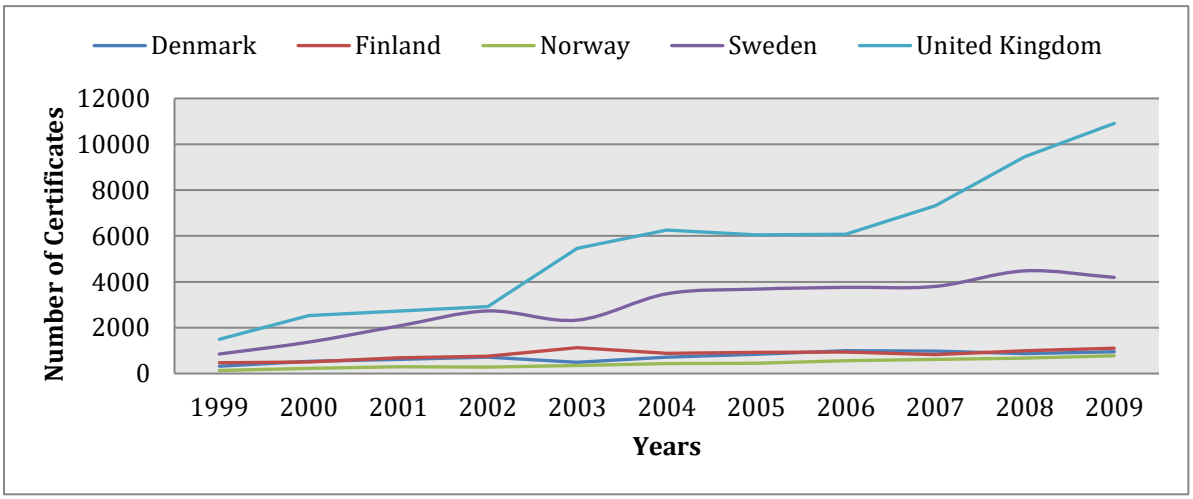

Figure 4. 11: ISO 14001- Growth in number of certificates from 1999 to 2009 [23].

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However, as figure 4.12 shows that Denmark has the highest number of certificates of EMAS per country over the UK and Scandinavian countries. This may be due to the Danish government having strong environmental reporting regulations. In addition, the number of EMAS certificates in the UK is relatively low. A possible reason may be that the UK companies prefer international status of ISO14001. As it was mentioned earlier, that the Scandinavian countries like Denmark, Norway, Sweden, etc. have the highest rates of EMS due to many different reasons and one of them is that the governments there interested in the uptake of EMS by small and large businesses and industries. On the other hand, the people there are more aware of the harmful effects and the processes that can impart how useful the EMS may be and what are all the pros and cons considering an EMS in their systems.

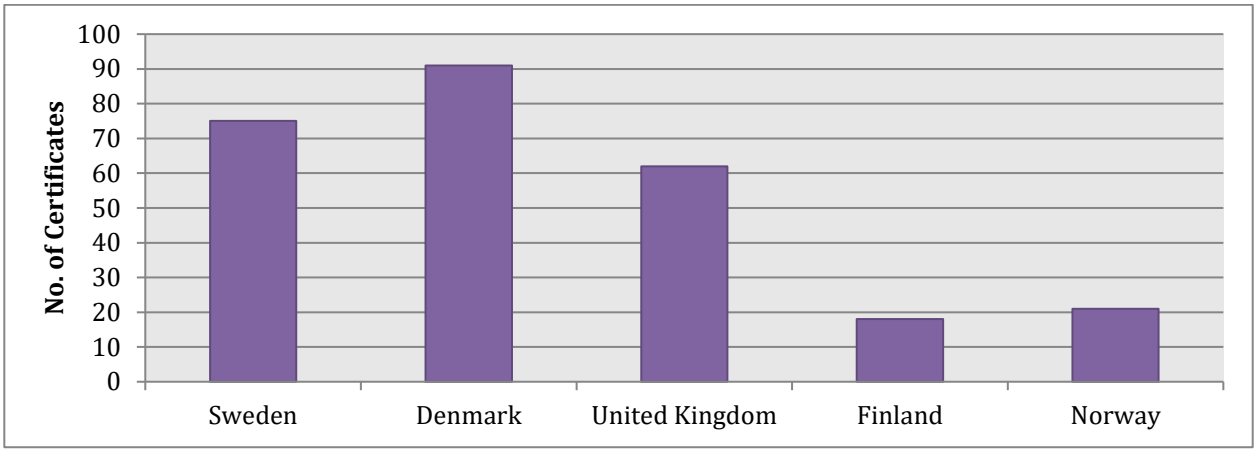

Figure 4. 12: EMAS total number of certificates [30].

Figure 4.13 shows EMAS certificates as a percentage of registered companies. It is relatively plausible for Denmark to have the highest percentage since it had the most number of EMAS certificates on figure 4.12 previously. The other countries mostly follow the same path of figure 4.12, which makes the UK further down than Denmark in adopting the EMAS certificates as a percentage of registered companies.

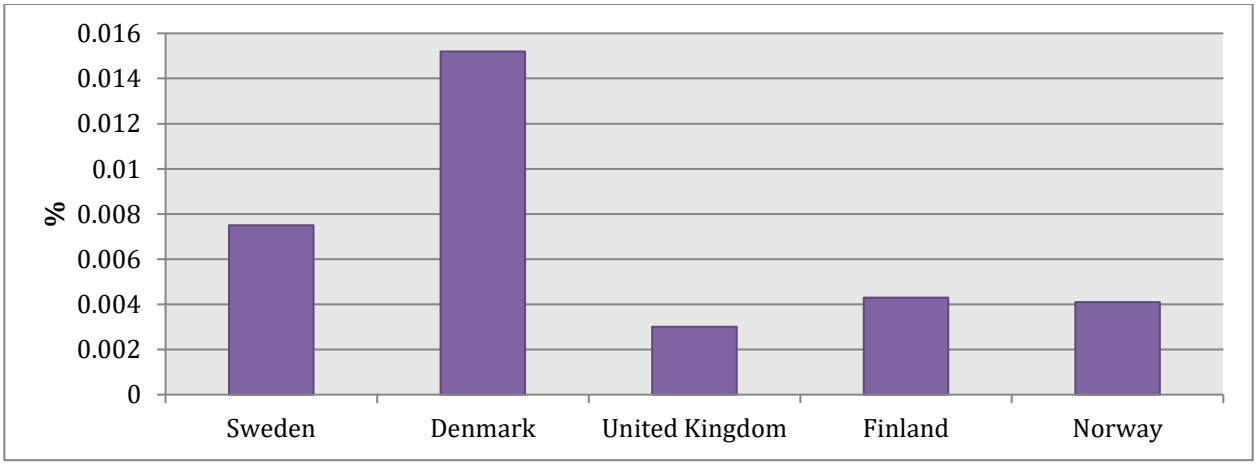

Figure 4. 13: EMAS certificates as a percentage of regiestered companies [30].

Figure 4.14 shows the growth of EMAS certificates from 1999 to 2009. Norway started at a higher base than the others; however, it decreased between 2002 and 2006 and had the lowest level of growth at the end of 2009. There was a rapid increase at the beginning of the period for Denmark, Sweden and the UK. Sweden and Denmark reached the peak in 2002 and started the decrease again at the same period as Norway. The UK has a steady level of growth along the decade and Finland continued to rise at a steady rate throughout the whole decade [31].

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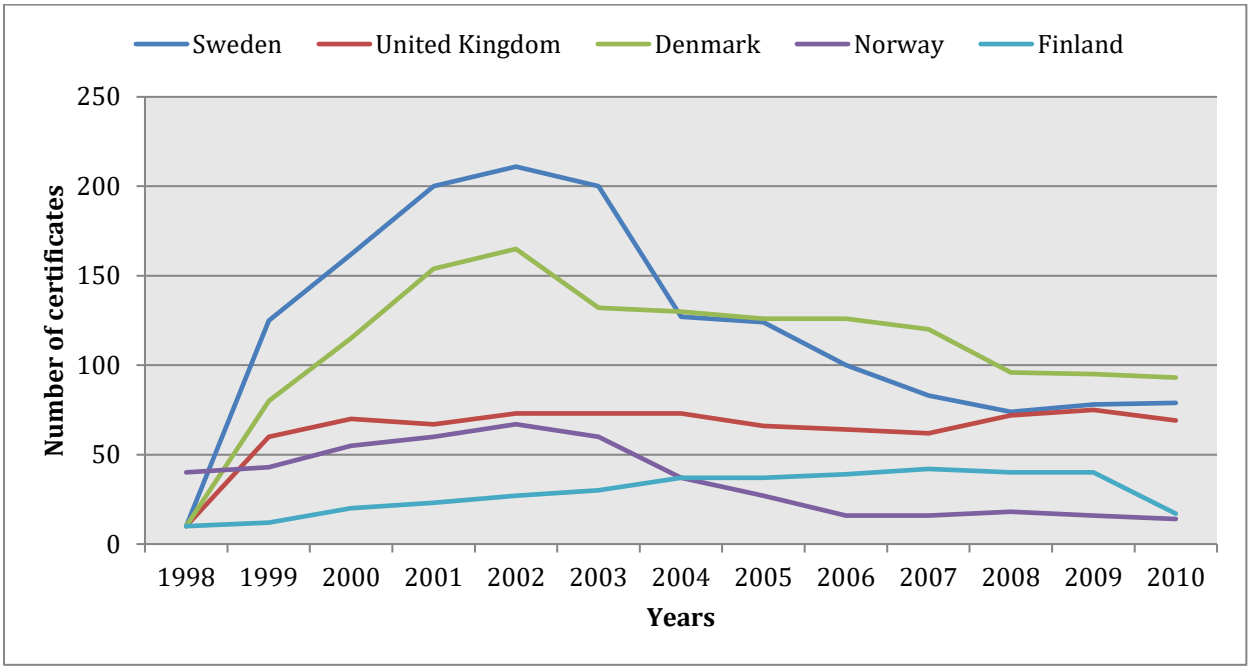

Figure 4. 14: EMAS number of certificates growth from 1998 to 2010 [30].

5. DISCUSSION

5.1 Current Trends and Drivers of EMS Implementation in the UK

In 2008, the Manufacturers Organization (EEF) published a report of a survey about measuring the environmental performance that was run through 562 manufacturing companies [32]. However, 562 are relatively small number in comparison with the total number of the companies in the UK and may not give a very accurate image [33]. However, the report sheds the light on various aspects concern the implementation of EMS.

Figure 5.1 below illustrates major the environmental concerns in the UK. Resource efficiency, waste management and energy to use are currently the three top priorities at the current time. For example, waste management is one of the major aspects that most of people are well aware of. As the UK has one of the highest percentages of waste in Europe, and recycling seems to be the most successful and plausible solution to reduce this high percentage, implementing ISO14001 would help to organize the process of recycling and make it more efficient.

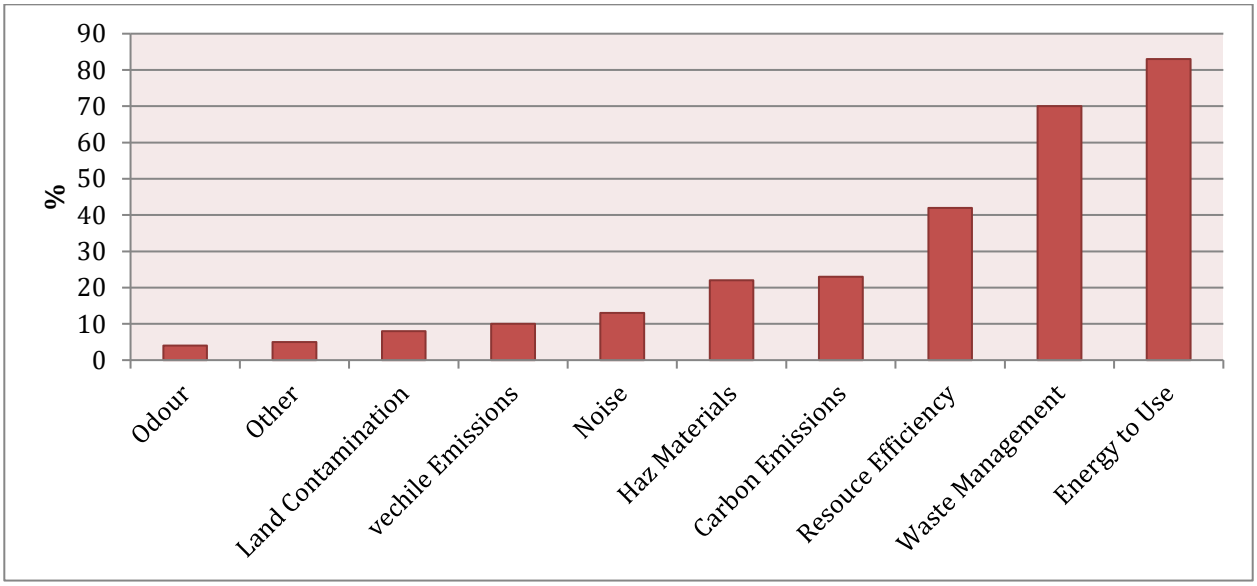

Figure 5. 1: Environmental concerns by priority [32].

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Figure 5.2 shows the factors that contribute to improve the environmental performance. The top four factors are legislation, adhering to EMS, customer requirement and board level support. It is clear that legislation play a major role in environmental performance. Thus, it is the government responsibility to set regulations that provide framework for environmental liability. It is also indicated that adhering to EMS is a strong driving factor so that it is suggested for the management to ensure that all individuals are aware of the environmental policy.

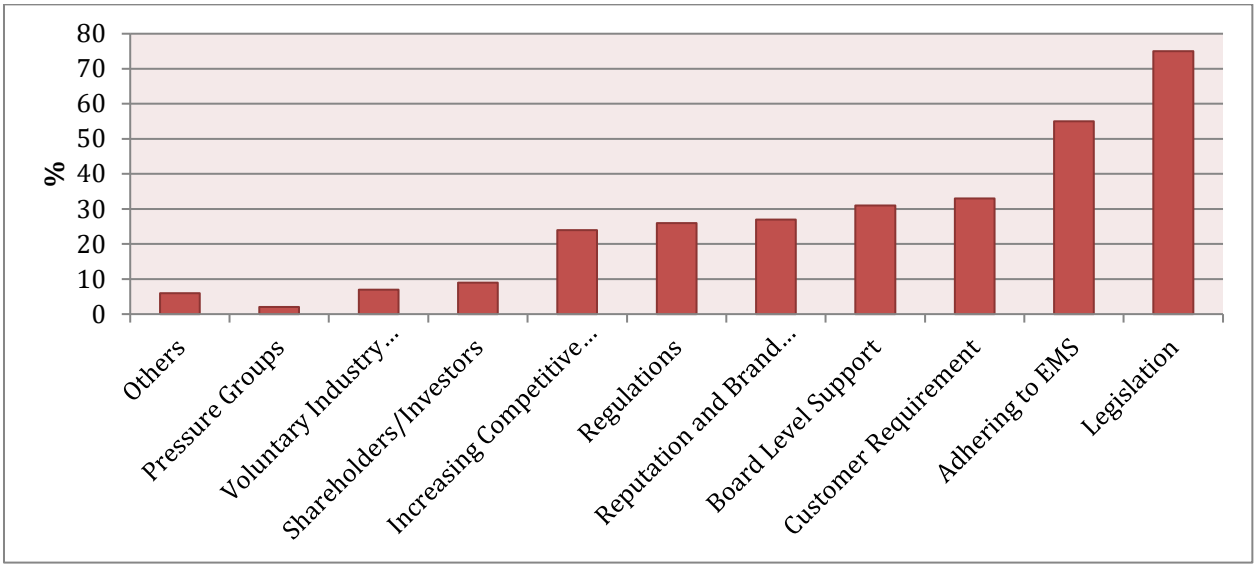

Figure 5. 2: Factors driving improved environmental performance [32].

Figure 5.3 illustrates the different approaches of companies in adopting EMS. The survey divided the companies according to the number of employees into small, medium and large. The figure indicates that 70% of the large sized companies adopted ISO 14001 in addition to 45% of medium sized companies. That makes a total of 40% of the companies compiled with ISO 14001. EMAS, on the other hand, was not a popular approach among the companies. It is not surprising that small companies are likely to have NO environmental management systems. However, some of them tended to adopt an internal EMS owing to the high cost of accredited EMS. Overall, this figure shows that the majority of companies are aware of the importance of EMS implementation.

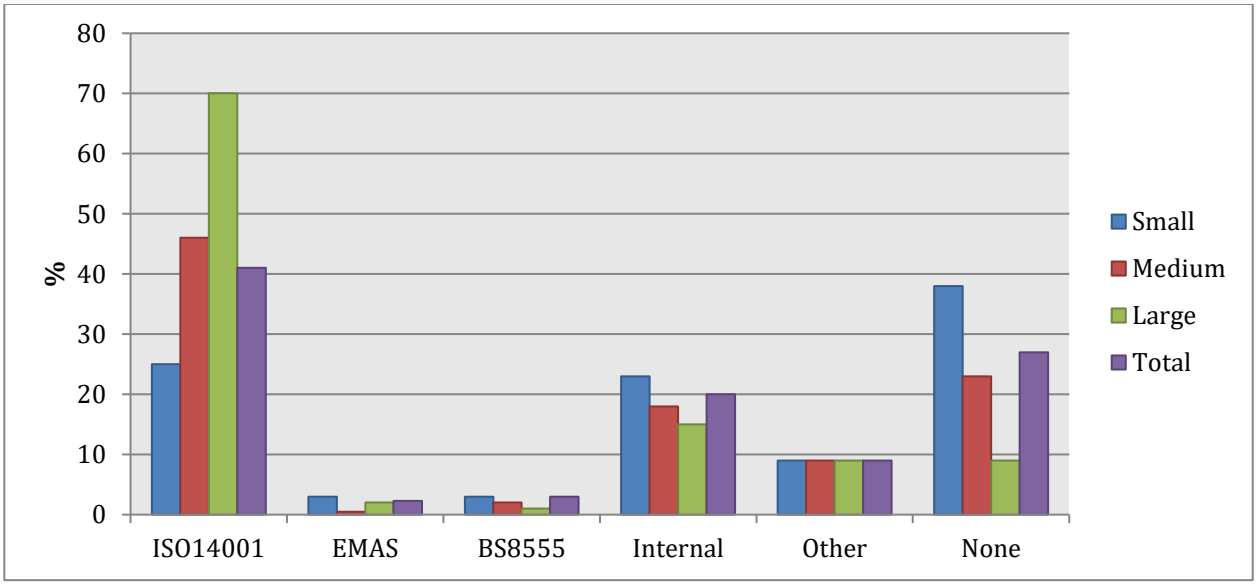

Figure 5. 3: Operating Environmental Management Systems [32].

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Figure 5.4 illustrate the future anticipated investment in environmental improvement performance with respect to the company size. It is shown the majority of companies are increasing their investments, which will consequently influence the rest of companies to follow the same path. As stated in figure 5.2, the customer requirements are pushing the companies to implement EMS. This justifies the intention of the companies to increase their investment in EMS implementation.

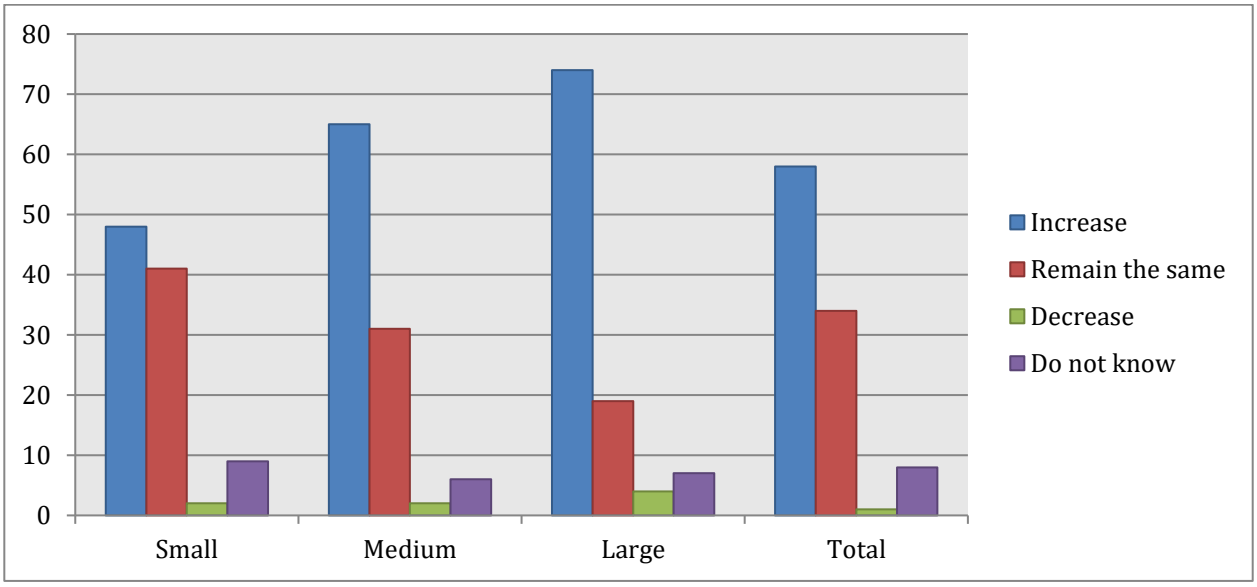

Figure 5. 4: Future anticipated investment in environmental improvement performance by company size [32].

Figure 5.5 shows the main barriers of improving the environmental performance in a company. Main barrier is the limited time of management. Implementing EMS initially requires lots of time and efforts, which may not be appealing for the management. The second barrier is the profit margins. Most companies have poor understanding of the long-term benefits of EMS. They are concerned about the cost of initial implementation and maintenance rather than the EMS benefits of money saving and greater cash flow.

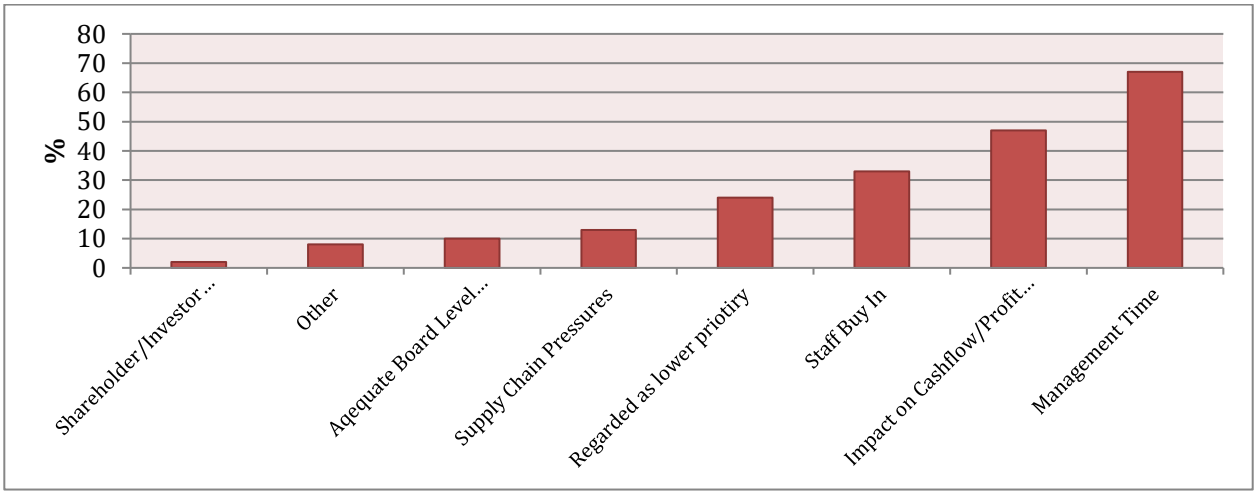

Figure 5. 5: Barriers that improve environmental performance [32].

The report also mentioned that the small companies did not show enthusiasm to respond and support to the survey. This could be due to the lack of the quality of information provided.

5.2 The Differences in the Uptake of ISO 14001 and EMAS

In order to show the differences between the uptake of ISO 14001 and EMAS, a qualitative analysis must be conducted along with quantitative. The organization defines the suitable system according to a set of criteria. Example is shown below.

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1. Easy to start implementation
2. Costs are relatively low
3. Benefits are relatively high
4. Environmental performance are continuously improved
5. Legal compliance
6. Implementation process is easy to be control
7. Easy to get assistance
8. Good accreditation system
9. Compatible with other systems
10. Easy to diffuse

Figure 5. 6: Criteria of suitable EMS

Of course each system of ISO 14001 and EMAS has its advantages and disadvantages. The implementation and maintenance costs of EMAS are relatively higher than ISO 14001. EMAS reporting system i.e. environmental statement accounts for 19% of the total cost of implementation [34]. For maintenance, EMAS requires a regular audit every 3 years and verification of statement annually [18].

Looking at the environmental performance improvement, EMAS is better than ISO 14001. EMAS strictly emphasizes on environmental aspects and requires continual improvement while ISO 14001 has no such requirement [35].

Currently, ISO 14001 is the most popular EMS in the UK. The low costs of implementation make it more affordable and hence more favorable among companies. Also owing to the fact that ISO 14001 is recognized by most of countries unlike EMAS, which is unfamiliar by non-EU countries [36]. However, ISO 14001 has a higher risk of conflicting with legal regulations than EMAS.

All in all, choosing the suitable system requires a comprehensive consideration of the characteristics of each system as well as the purpose of the organization of EMS implementation. For big enterprises, small part of the UK business, EMAS is a good choice while for SMEs ISO 14001 is satisfactory.

5.3 Environmental Management Systems for SMEs

EMS is equally important for SMEs as it is for the big companies and the big industrial units. According to ENDS report, SMEs make up 99% of the UK business [37]. They generate around 60% of commercial waste. In other words, their contribution to the pollution incidents in England and Wales alone is estimated to be 80% [38]. This impact must also be catered while the consideration of the protection of environment from harmful effects. Most SMEs lack of awareness of the need of EMS due to the absence of the pressure of drivers such as customer. In this matter, government and local authorities should exert greater pressure on SMEs to influence them to adopt EMS. Special packages are available in the market for those organizations such as the EMASeasy, which has been discussed previously.

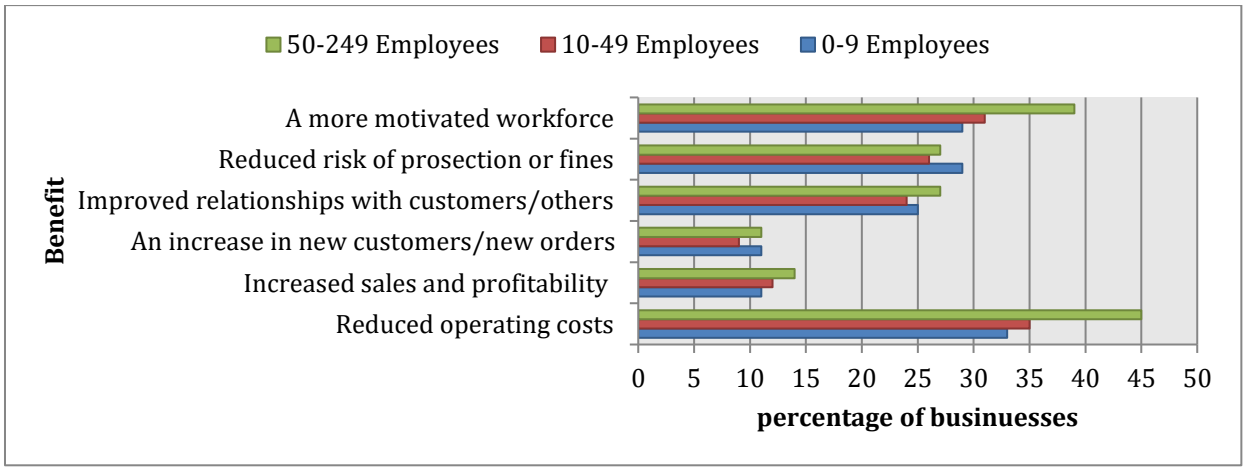

Figure 5. 7: Benefits of environmental improvement to SMEs [37].

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Figure 5.7 basically shed light on the benefits of environmental improvements to SMEs. SMEs are very important to be taken into consideration as they can play a vital role in the development of the whole world in terms of the usage of EMS and improving the future of the environment. In addition, this figure shows that the large companies can increase their benefits by reducing operating cost. It also shows that small companies are would do better if they reduced the risk prosecution because they are more likely to face financial risks than the large companies.

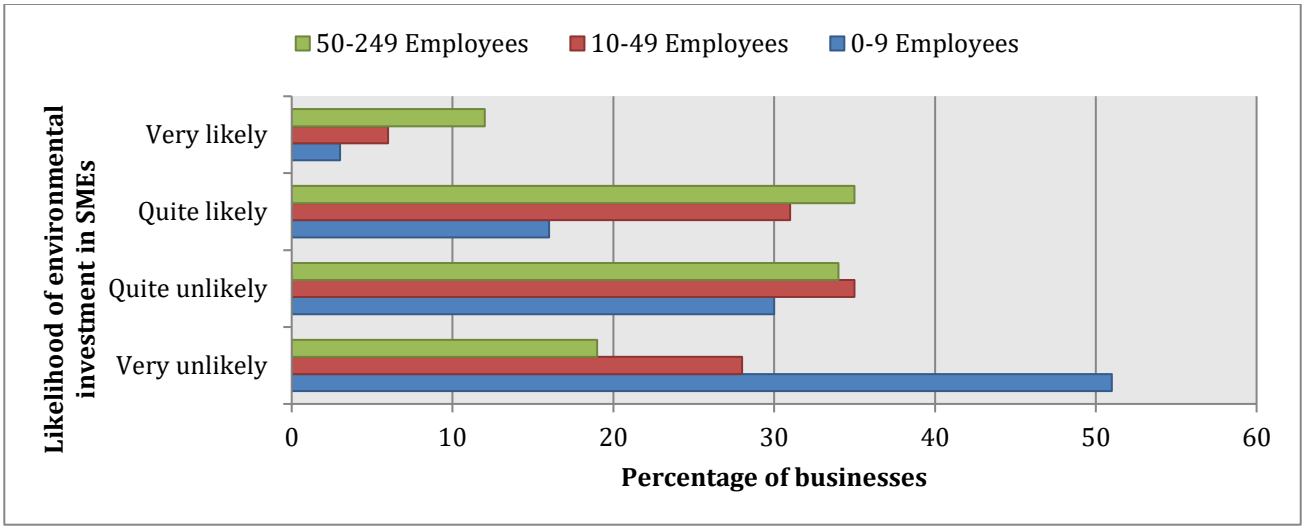

Figure 5. 8: Likelihood of environmental investment in SMEs [37].

Figure 6.8 figure shows the likelihood of environmental investment in SMEs and it provides us with the information that how much SMEs are expected to invest in environmental management systems [23]. This survey shows that although many SMEs are aware of the benefits of improving the environmental performance, there is still some resistance to invest in changes.

5.4 Case Study: Kyoto Protocol

A study into Kyoto protocol adoption in the United States illustrates an example of the negative environmental impact when the role of government in promoting EMS is absent.

Some protocols were sponsored by the United Nation to reduce the global warming through the use of greenhouses and EMS. The goal of these protocols is to achieve the stabilization of the greenhouse gas emission that is concentrated in the atmosphere. The Kyoto protocol was held on December 1997 in Kyoto, Japan. In September 2011, 191 countries and states that were participating the Kyoto protocol signed and ratified the protocol. However, few countries including the U.S. did not ratify this protocol as it could cause economic hardship to the country. In December 2011, the Montreal Protocol was adopted to protect the Ozone Layer. Although 196 states ratified it, the United States did not change their attitude [40].

How do Greenhouse Gases occur?

The main reason of the climate changes and global warming is due to the greenhouse gas emissions from the human activities, mainly in the industry, manufactory and fossil fuel combustion.

What does the Kyoto Protocol require?

It requires a 7-year plan, to reduce the greenhouse emissions by legal-binding targets in the world. As a start it should be reduced by 5% below the levels of 1990 [40]. This goal can be achieved when countries impose a greenhouse emissions control on the main pollution sources in each country. As a result of that, polluters would seek alternative and renewable energy sources that are less harmful to the Eco-system. Examples include wind and solar energies [41].

What is the United States history with the Kyoto Protocol?

Although president Bill Clinton signed the agreement of the protocol in 1997, the U.S. Senate did not approve it because it is considered as a threat to the US economy [40]. In 2000, president W. Bush promised in his campaign to regulate the level of pollution in the States and ratify the Kyoto Protocol. However, in 2001, he withdraws the US from the Protocol. He

described is as " too costly and an unrealistic and ever-tightening straitjacket". Furthermore, the white house claimed that millions of job would be lost as a result of signing the agreement of the Kyoto Protocol [42]. Despite the former US Federal government attitude towards Kyoto protocol, president B. Obama has attempted to apply some Kyoto Protocol objectives on a local basis [43]. The US population makes up 5% of the world's population, yet their greenhouse gas emission accounts for 25% of the total world's emission [41].

5.5 The Relevance

This example is particularly relevant in the case of promoting EMS. As the US is an industrialized country, it consumes great amount of energy. In 2010, approximately 85% of the energy consumed in the US was through the combustion of fossil fuels. The remaining 15% came from other energy sources such as hydropower, biomass, nuclear, wind, and solar energy. The vital influencing factor of this trend is the growing domestic economy [44]. President Bush said in one of his speeches "*Keeping America competitive requires affordable energy. And here we have a serious problem: America is addicted to oil*" [45]. In order to enable the economic growth to proceed in a sustainable manner, the US rejected Kyoto Protocol owing to the fact that it may harm their economy.

In this matter, utilizing EMS offers a credible tool that gives a jump-start to the countries on the management of greenhouse gas emissions [46]. It has been discussed previously, legislation is the main driver of promoting EMS and here comes the government role to impose regulations to control the environmental impact of human activities and provide framework for environmental liability. As drivers to measure, the petroleum-based economy of the U.S. would be affected with EMS implementation. Hence, it did not set any strict laws to prevent the environmental damage. Consequently, there will be no tendency for the American organizations on all sectors to develop EMS. In this context, Tony Blair said, "*Without the biggest economies being part of the framework to reduce carbon dependence, we have no earthly chance of success"*[47].

6. CONCLUSION

6.1 Summary

This dissertation provided an overview of environmental management systems (EMS). It studied the penetration and impact of environmental standards in the UK industry. Most of the enterprises choose ISO 14001 or EMAS to develop their own EMS. The requirements of implementation and the key benefits of the two standards have been mentioned. A quantitative analysis of the trends of uptake in the UK and worldwide was carried out. After that, the dissertation underlined the major drivers, barriers and key differences of each standard.

6.2 Findings

The general mechanism of developing EMS is based on the plan-do-check-act cycle model. Each stage of the process has certain requirements regarding environmental aspects, legal aspects and organization's performance and additional aspects. The benefits can be categorized in two sets; environmental benefits and organizational benefits. The second set includes improving the financial sector and public image of the organization.

It was found out that Scandinavian countries have the highest number of EMS certificates in relation to population, GDP, area and number of registered companies. However, it was shown that the trend of uptake of EMS worldwide is still very low. Certificates of ISO 14001 represent only 0.45% of the companies in Sweden. In the UK, 0.36% of registered companies adopted ISO 14001 whereas 0.004% adopted EMAS.

ISO 14001 is currently the most popular system in the market place. This may be due to its affordable costs of implementation and maintenance as well as its international status. Unlike EMAS, it is only recognized by EU-countries and it requires additional costs of reporting and auditing that frightened most SMEs.

Major barriers of EMS implementation are:

- Economical barriers. Implementing EMS is considered a threat to some economies, due to its associated economical burdens, and thus it prevents countries from taking some bold steps and actions toward reducing the damages to the environment caused by the industrial activities. There are many examples where countries with strong economies are frightened of supporting the adoption of EMS.

- Lack of awareness. A poor understanding of the serious impacts of the industry on nature and human health is considered a major barrier. Moreover, the lack of awareness among companies of the fundamental role of EMS in improving the environmental performance and moving the UK business towards sustainability is another barrier of promoting EMS among companies.

- Other minor barriers are present due to the narrowed vision of the management of the organizations. These include the management time and costs of implementation, certification and maintenance.

6.3 Conclusion

In conclusion, each standard has its own advantages and limitations. Identifying the most suitable system depends very much on the organization's purpose of implementing EMS. Different companies may adopt different EMS according to the characteristics of their business.

6.4 Recommendations:

The dissertation came out with the following recommendations regarding the uptake of EMS in the UK:

- For primary industrial sector in the UK, EMAS could be an appropriate choice. It requires strict measures in environmental performance evaluation in legal compliance and auditing cycle. Therefore, it results in a better environmental performance than ISO 14001.

- For SMEs, ISO 14001 would be satisfactory considering their limited budget. Also, for SMEs, there is a need of eco-mapping clusters and the approach of Acorn. EMAS easy offers applicable packages for these approaches.

Further recommendations:

- Government and local authorities should participate by sponsoring projects to fund SMEs and establish local clusters. They should apply more strict laws to improve the environmental performance of the country. Government plays the dominant role in driving and encouraging the organizations to enhance their performance to minimize the adverse environmental impacts and develop EMS.

- Effective communication has a tendency to improve the environmental conditions. A strong communication network can be used as strong advertising tool. It would bring valuable advancement in promoting EMS. A good communication, if established between the people knowing the advantages and disadvantages of EMS, can share their ideas and views. In this manner, people will be more aware of the benefits of EMS and more alert of the damage of human activities, which could lead to voluntary adoption of EMSs.

- If EMS is promoted among large Multi-National Enterprises (MNEs) by EU, this action has a tendency to bring valuable changes in the whole system, as this will consequently put pressure on more companies and businesses to implement EMS and follow the directions of these systems.

6.5 Further work

To improve the results of this dissertation, it is advisable to:

1. Use different methodology to enhance the quality of obtained information such as interview and questionnaire.
2. Carry out a detailed qualitative comparison of all criteria between the different available standards.
3. Pay attention to the suitability of each standard among different industrial and business sectors according to their impact on the environment.

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APPENDIX - A

Additional information used in the analysis

A.1 Data Tables

Source: CIA. The WORLD FACTBOOK. [Online]. Retrieved from https://www.cia.gov/library/publications/the-world-factbook/rankorder/2119rank.html.

Table A.1. 1

Country	Population	GDP -million $	Area-Km^2
China	1,343,239,923	7,298,147	9,640,005
U.S.	313,847,465	15,094,025	9,526,468
Japan	127,368,088	5,869,471	377,930
Germany	81,305,856	3,577,031	357,114
Italy	61,261,254	2,198,730	301,336
South Korea	48,860,500	1,116,247	99,828
Spain	47,042,984	1,493,513	505,370
Romania	21,848,504	189,776	238,391
Czech Republic	10,177,300	215,265	78,865
Sweden	9,103,788	538,237	450,295
United Kingdom	62,008,048	2,417,570	242,900
Denmark	5,557,709	333,238	43,094
Finland	4,924,800	266,553	338,424
Norway	5,375,400	483,650	323,802

Table A.1. 2 EMAS certificates for the UK and Scandinavian countries From Thuesen, N. (2011). The Use of Environmental Management Systems in the UK. Requested from EMAS 11/2010.

Country	Sweden	Denmark	United Kingdom	Finland	Norway
Large	28	15	26	15	6
Medium	23	35	16	2	3
Small	12	33	8	1	8
Micro	7	8	3		4
Unclassified	5	0	9		
Total Certificates	75	91	62	18	21
Company	1,000,000	600,000	2,100,000	416,000	513,000

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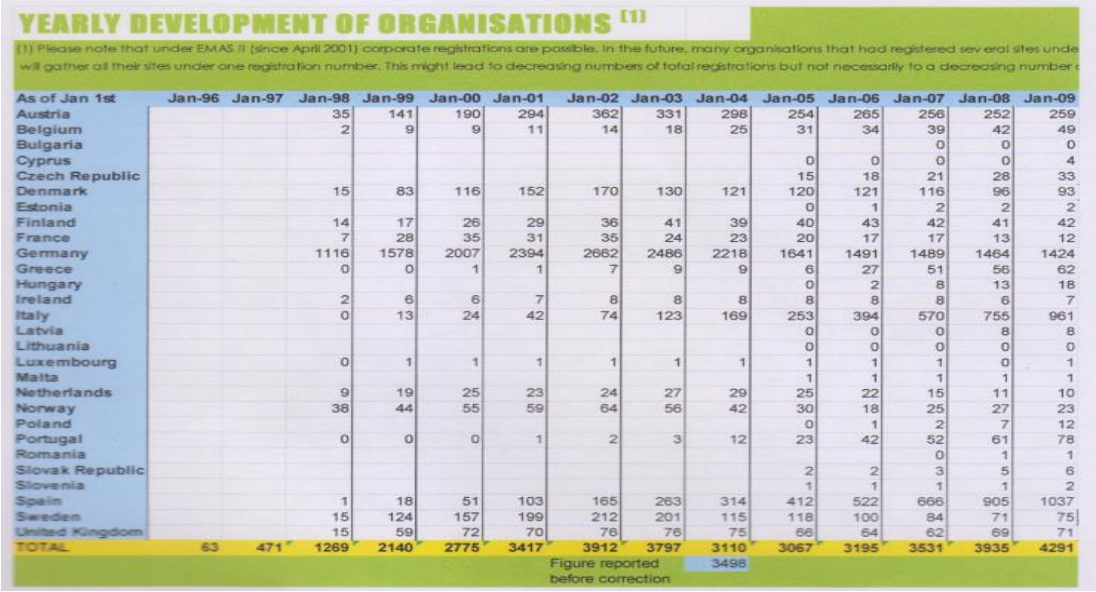
Table A.1. 3 EMAS From Thuesen, N. (2011). The Use of Environmental Management Systems in the UK. Requested from EMAS 11/2010.



YEARLY DEVELOPMENT OF ORGANISATIONS [1]

(1) Please note that under EMAS II (since April 2001) corporate registrations are possible. In the future, many organisations that had registered several sites under will gather all their sites under one registration number. This might lead to decreasing numbers of total registrations but not necessarily to a decreasing number

As of Jan 1st	Jan-96	Jan-97	Jan-98	Jan-99	Jan-00	Jan-01	Jan-02	Jan-03	Jan-04	Jan-05	Jan-06	Jan-07	Jan-08	Jan-09
Austria			35	141	190	294	362	331	298	254	265	256	252	259
Belgium			2	9	9	11	14	18	25	31	34	39	42	49
Bulgaria												0	0	0
Cyprus										0	0	0	0	4
Czech Republic										15	18	21	28	33
Denmark			15	83	116	152	170	130	121	120	121	116	96	93
Estonia										0	1	2	2	2
Finland			14	17	26	29	36	41	39	40	43	42	41	42
France			7	28	35	31	35	24	23	20	17	17	13	12
Germany			1116	1578	2007	2394	2662	2486	2218	1641	1491	1489	1464	1424
Greece			0	0	1	1	7	9	9	6	27	51	56	62
Hungary										0	2	8	13	18
Ireland			2	6	6	7	8	8	8	8	8	8	6	7
Italy			0	13	24	42	74	123	169	253	394	570	755	961
Latvia										0	0	0	8	8
Lithuania										0	0	0	0	0
Luxembourg			0	1	1	1	1	1	1	1	1	1	0	1
Malta										1	1	1	1	1
Netherlands			9	19	25	23	24	27	29	25	22	15	11	10
Norway			38	44	55	59	64	56	42	30	18	25	27	23
Poland										0	1	2	7	12
Portugal			0	0	0	1	2	3	12	23	42	52	61	78
Romania												0	1	1
Slovak Republic										2	2	3	5	6
Slovenia										1	1	1	1	2
Spain			1	18	51	103	165	263	314	412	522	666	905	1037
Sweden			15	124	157	199	212	201	115	118	100	84	71	75
United Kingdom			15	59	72	70	76	76	75	66	64	62	69	71
TOTAL	63	471	1269	2140	2775	3417	3912	3797	3110	3067	3195	3531	3935	4291
							Figure reported before correction		3498					

Table A.1. 4 CO_s Emissions from Fossil Fuel Combustion by Fuel Consuming End-Use Sector (Tg or million metric tons CO_2 Eq).[44].

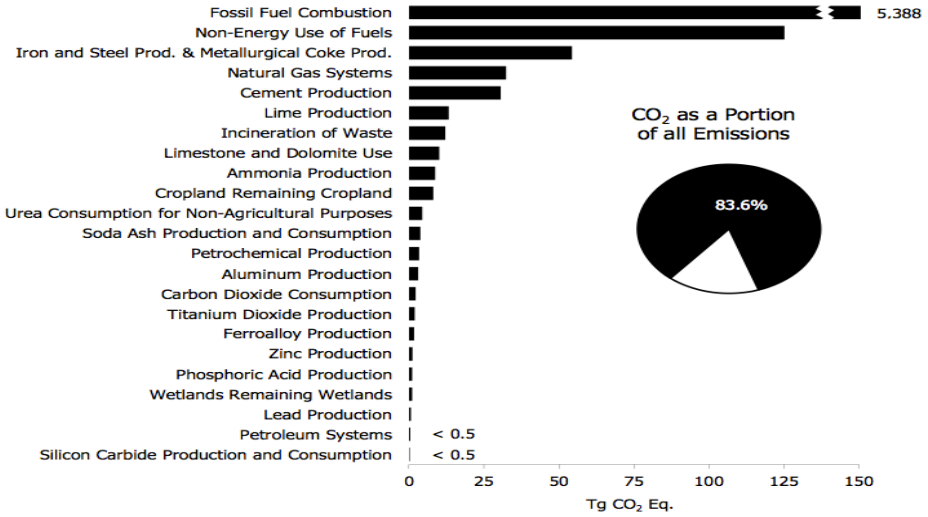


Figure A.1 1: 2010 sources of CO_2 Emissions [44].

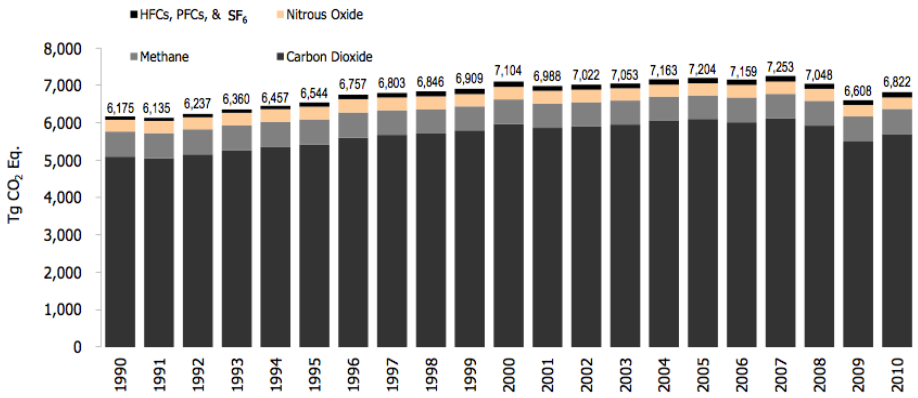


Figure A.1 2: U.S. Greenhouse Gas Emissions by Gas [44].