

We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

186,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.

For more information visit www.intechopen.com



Environmental Management System and SMEs: EU Experience, Barriers and Perspectives

Fabio Iraldo^{1,2}, Francesco Testa¹ and Marco Frey^{1,2}

¹*Sant'Anna School of Advanced Studies, Piazza Martiri della Libertà 33, 56127 Pisa,*

²*IEFE – Institute for Environmental and Energy Policy and Economics,*

Via Roentgen 1, 20136, Milano

Italy

1. Introduction

SMEs are defined as enterprises which employ less than 250 employees and which have an annual turnover not exceeding €50 million, and/or an overall balance sheet not exceeding €43 millions (European Commission 2003). There are some 23 million SMEs in the EU providing approximately 75 million jobs (66% of private employment and up to 80% in some industrial sectors such as textile, construction or furniture) (European Commission 2005). Moreover, micro enterprises¹ account for almost 93% of the total number of SMEs, 6% are small enterprises² and less than 1% are medium-sized enterprises. Small and medium-sized enterprises represent a large part of EU economy, being some 99% of all enterprises and 57% of economy value added (European Commission 2005), as such they also have a primary role to play in shifting the EU economy to more sustainable production and consumption patterns.

SMEs are active in a range of sectors across the EU: 22.2% in the service sector (i.e. business to business services); 20.4% in personal services (i.e. business to consumer services); 20% in retail distribution; 11.9% in manufacturing; 11.6% in construction; 8.1% in wholesale trade; 5.5% in transport and communication; and 0.2% in extraction and energy. The presence of SMEs in different economic sectors varies between Member States. SMEs are far from being a homogenous group. However they have a number of features in common, and do certainly encounter similar problems in relation to environmental compliance and performance.

Since they represent such a large percentage of economic activities, SMEs have a significant impact on the environment. The environmental problem does not fully emerge if one considers individual firms, although in some cases there can be significant impacts on local environments and communities exerted by a single SME, but pertains their combined and cumulative impact.

¹Within the SME categories, a microenterprise is defined as an enterprise that employs fewer than 10 persons, and whose annual overall turnover and/or annual balance sheet does not exceed EUR 2 million (European Commission 2003)

²Within the SME categories, a small enterprise is defined as an enterprise that employs fewer than 50 persons and whose annual overall turnover and/or annual balance sheet does not exceed EUR 10 million (European Commission 2003).

Source: Environmental Management, Book edited by: Santosh Kumar Sarkar, ISBN 978-953-307-133-6, pp. 258, September 2010, Sciyo, Croatia, downloaded from SCIYO.COM

Experience in applying and enforcing environmental legislation in the Member States has shown that it is too complex and burdensome for companies and public authorities to determine the detailed contribution made by SMEs to pollution (e.g. air pollution), in terms of the “environmental burden” from different types of pollutants (e.g. CO₂, SO_x, NO_x, etc.). The first and most relevant barrier is the inability to monitor the environmental performance of SMEs, owed to the lack of data (that in many cases does not even exist). There are many studies in literature attempting to provide ‘insights’ into environmental problems emerging from SMEs. These studies focus on specific environmental aspects. For instance, a recent report (Marshall 1998) estimated that SMEs account for 60% of total carbon dioxide emissions from businesses in the UK and concluded that there is substantial room for improvement in energy efficiency and emissions reductions to be carried out by these companies. Another survey carried out in France showed that SMEs are to be held responsible for 40-45% of all industrial air emissions, water consumption and energy consumption, as well as for 60-70% of industrial waste production (Daddi *et al.* 2010).

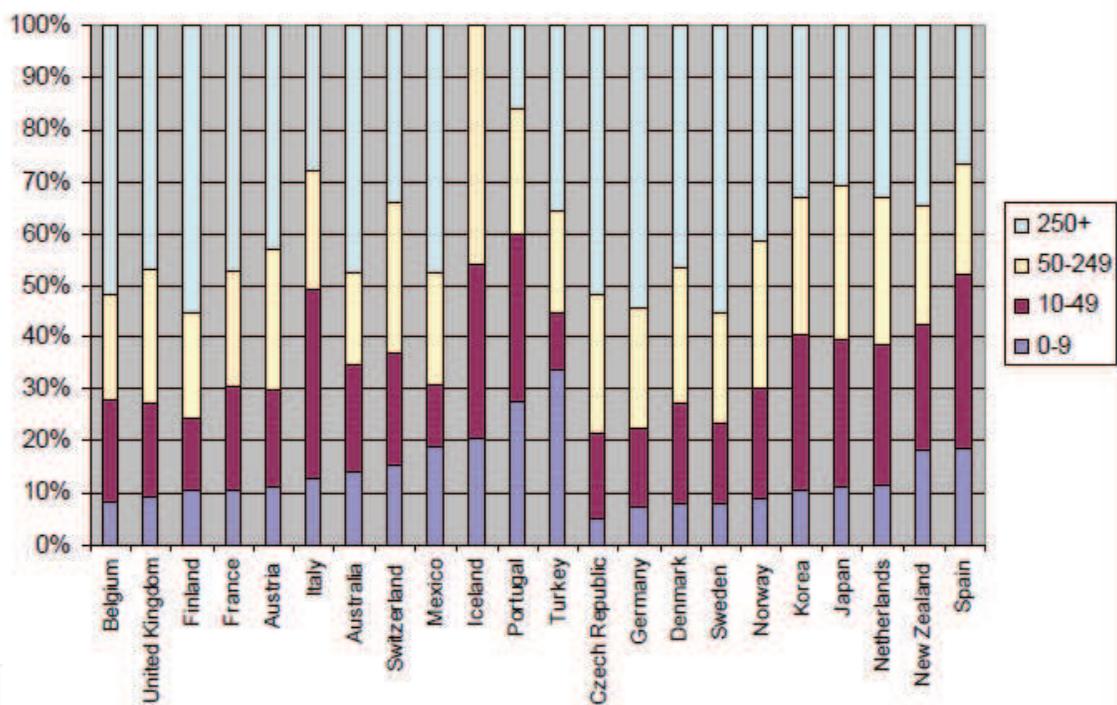


Fig. 1. Distribution of Employment by Firm Size Class, 1999 (Source: J.Labonne, 2006)

Although some smaller companies have taken the lead in managing their own environmental impacts in a well structured and effective way, the largest part of SMEs are still characterised by a lack of awareness on their environmental impacts and, especially, concerning the ways in which such issues can be effectively managed. A recent UK study (Netregs 2002) shows that only 7% of businesses in the UK believed they undertook activities that could harm the environment, but when prompted with a list of activities, this figure rose to 41%. This is a clear symptom of a low degree of knowledge by SMEs on what their environmental impacts can be. In many cases, SMEs are persuaded they do not have any impact at all on the environment. This emerges, for example, from a survey among Polish SMEs (Polish Environmental Partnership Foundation, 2007) emphasizing that 86% of the interviewees declare that their companies do not have a negative impact on the environment or that the impact was not significant at all.

Not only SMEs have a scarce knowledge on their environmental aspects, but the main problem is that most of them do not know enough about legislation applied on these aspects to ensure that they are compliant. The Institute of Directors (2006) carried out a survey reporting that members involved in sectors such as construction, mining, transport or manufacturing that are 'heavily exposed' to environmental regulation showed relatively low levels of awareness. It is quite surprising, for example, that 59% of members in manufacturing knew 'not much' or less of the environmental regulation applicable to their activities.

All the above mentioned studies show that low environmental compliance by SMEs is due to lack of knowledge and awareness of their own activities, ignorance of environmental legislation, lack of capacity to tackle their environmental impacts, and sometimes the excessive administrative and financial burden of environmental compliance. Compliance is further hindered by the perception that environmental protection is costly and has little benefit for the business.

Many studies show that the majority of SMEs have little awareness of their own environmental impacts and of how to manage them (IEFE *et al.* 2006). Moreover, literature emphasises that most SMEs are 'vulnerably compliant', since they are not always able to achieve an environmental performance that is high enough to ensure that they are complaints.

Where environmental legislation is applicable to SMEs, they tend to presume that they are complying and, as a result, full compliance is often the outcome of external action following an inspection, rather than an on-going process of checking that legal requirements are being met (Fairman & Yapp 2005). At the same time, SMEs often do not have the necessary legal and environmental expertise to cope with environmental legislation.

As European Commission has recently emphasized in the recent Program ECAP (Environmental Compliance Assistance Programme - EC COM(2007) 379), the implementation of an environmental management systems (EMS) and explicit designation of responsibility for environmental matters may have a much more positive influence on the environmental engagement of the company than a single inspection or compliance check.

The EMS is an increasingly diffused tool among organisations operating in different sectors, thanks to the drive and impulse coming from the voluntary certification schemes (such as EMAS and ISO 14001) in which they are mainly applied. These schemes provide a third-party guarantee of environmental "excellence", which is able to give an advantaged position (with respect to their competitors) to those organisations that, by adopting EMAS or ISO 14001, commit themselves to improve the environmental performance.

A wide range of evidences from existing studies analyze the benefits of EMS adoption (Patton & Baron 1995, Watson 1996, Van Der Veldt 1997, Aragon 1998, Madsen & Ulhoi 1999).

Just to mention one of these studies, Biondi *et al.* (2000) identify in a better legal compliance and in the capability of continuously monitoring compliance one of the most relevant benefits of EMAS registration. This benefit is also connected with other forms of EMS certification. (Hamschmidt *et al.* 2001).

The EVER study, carried out on behalf of European Commission, also provided very consistent outcomes, as far as this benefit is concerned (IEFE *et al.* 2006). According to the results of this study, in fact, formal EMS (such as EMAS) provide considerable benefits in the area of legal compliance: quite interestingly, the three most important benefits perceived by the interviewed EMAS-registered organisations are connected with the monitoring and

management of legal compliance. Greater awareness of regulatory requirements was identified as a fairly or important benefit by 70% of the EMAS adopters, better compliance by 69% of them and better planning of actions for legal and regulatory compliance by 67%. As we have emphasised, SMEs certainly have to struggle against their lack of resources and to fill a cultural gap as regards environmental matters. Several studies have highlighted the existence of several typologies of hindrances, heterogeneous in nature and forms, encountered by SMEs in the EMS implementation, such as internal or external, organisational or economic, general or category-specific (e.g.: SMEs), and so on. For instance, the cost of implementation and maintenance (in case of formal EMS implementation such as EMAS and ISO 14001), like external consulting and verification costs, seems to be a relevant barrier, especially for SMEs, where financial resources are more restricted (Biondi *et al.* 2000, Hillary 2004). Focusing on internal barriers, we can mention, for instance, the availability of management time, or the adequacy of human resources (e.g. personnel with proper skills, expertise and technical background (Biondi *et al.* 2000, Iraldo & Frey 2007). This is confirmed by the incessant call, emerging from many studies, of measures capable of simplifying and supporting the implementation and maintenance of EMSs by SMEs (e.g.: Ammenberg *et al.* 1999, Hillary 2004).

In the last years, an ever-increasing number of SMEs, are gaining interest in EMS. How are these SMEs facing the new challenge of environmental management? What difficulties and drawbacks do they have to tackle and what benefits and advantages should they expect from the implementation of an EMS?

The chapter aims at proposing some early answers to these relevant questions, that many SMEs are asking themselves before accepting the challenge. Managing the environmental aspects of their activities according to a systemic and preventive approach implies for most SMEs a considerable effort in terms of human, financial and technical resources, regardless of the specific industrial context or country in which they operate. Constraints and drawbacks as to resource availability could compromise SME participation in voluntary programmes, like the European Eco-Management and Audit Scheme (EMAS), as well as their adoption of the ISO 14001 standard. These kinds of voluntary schemes prove their efficiency and efficacy “on the field” by leading as many enterprises to a significant improvement of their environmental performance. This is the reason why, in order to correctly evaluate the implications of ISO 14001 and EMAS, we have to investigate their capability of involving SMEs.

The chapter “core” is the attempt both of evaluating these barriers on an empirical basis and of identifying favouring factors and efficient solutions to overcome them. Suggestions and indications for effective tools, feasible solutions, incentives, achievable benefits and advantages (which an improvement of ISO 14001 and EMAS diffusion among SMEs could base on) emerge from the first significant evidence ever gathered on EMS implementation by SMEs in Europe. A final focus will dedicate on networking approach called cluster approach and new opportunities for SMEs provided in the next version of EMAS Regulation (EC Regulation n. 1221/2009)

2. Barriers and constraints for SMEs

Barriers to EMS adoption are generally categorized into those that are external to the organization, and those that are internal (Milieu Ltd & Risk and Policy Analysis Ltd, 2009).

The present paragraph investigates the factors that prevent organizations from implementing an EMS.

Different “keys of interpretation” do exist for such a broad issue: indeed, barriers are heterogeneous in nature and forms: they can be broken down following different types of criteria, as hindrances can be either internal or external, organizational or economic, general or category-specific (e.g: SMEs), and so on.

This paragraph is structured in two sub-paragraphs, the first analyzing external barriers, and the second focusing on internal ones. However, in the analysis of the evidence emerging from the literature review we provide a broad, multi-dimensional picture of the issue, highlighting useful distinctions between organizational and economic, generic or SME-tailored barriers, etc.

2.1 External barriers

External barriers encompass a wide set of factors, ranging from the cost of implementation (and other economic factors) to the lack of support and guidance, from hindrances linked to the institutional framework and the verification/registration process to the lack of market recognition, and so on.

Most of the evidence gathered within the review of existing literature on these issues regards the relevance of economic factors, scarce customer awareness/interest and lack of recognition by public institutions as factors hindering the will of organizations to adopt an EMS and in particular a formal EMS such as ISO 14001 or EMAS .

The cost of implementation, for instance, seems to be a relevant barrier, especially for SMEs where financial resources are more limited (Hillary 1999, Biondi et al. 2000).

SMEs certainly have to struggle against their lack of resources and fill a cultural gap as regards environmental matters. At a first glance, the main problem for SMEs seems to be that of finding money to invest in the improvement of environmental performance. Therefore, costs connected with the implementation of an EMS and with the adoption of a voluntary scheme could represent a first kind of barrier for SMEs.

The widespread agreement over the importance of such a barrier is confirmed by many studies, like a survey on the uptake of EMAS and ISO 14001 (ISO, 2005) showing how the lack of financial resources (33%) and the costs of certification (23%) are among main barriers for the implementation of an EMS.

In detail, we can distinguish the financial costs basically in three categories: costs relating to the necessary technical measures for guaranteeing the improvement of environmental performance, costs relating to the EMS implementation and costs to be sustained for obtaining a third party certification.

As to the first cost category, we refer, only in the case of ISO 14001 and EMAS, to the costs that many participating enterprises have to face in order to comply with the environmental regulations that is a requirement of both schemes. Moreover, in the adoption of an EMS, most of SMEs’ financial efforts connected with “technical measures” regard the costs of equipment and the cost relating to plants management, control and maintenance. The commitment to continuous improvement implies that plant investments should not be over with the EMAS registration or the ISO 14001 certification, but instead means that environmental improvement must, from that moment on, be considered in all the decisions regarding investment and maintenance scheduling.

Costs sustained by the SMEs in structuring their EMS represents another significant financial effort. For instance Delmas (2002) states that “the annual cost of maintaining ISO

14001 is a more important constraint than are design and registration costs"; this might be an explanation of the "crisis" of certifications in some countries characterizing recent years, as many organizations drop EMSs as costs overweight benefits. These costs are often due to the lack of expertise and trained personnel capable of performing the necessary measurement and analyses, which implies the need to rely on external technicians and consultancies. Cost of management time is another relevant cost whereas costs connected with personnel information and training as well as with environmental auditing (reported as specific items) were not considered relevant. It is important to highlight that the EMS "degree of maturity" is a relevant variable which most influences the steps which the enterprise will have to take, and consequently the additional costs. A production site where a management system has already been structured and a systematic auditing activity is regularly performed (but this rarely is the case of an SME) will obviously have considerably lower costs compared to a site which has still to take some of the organisational-managerial steps required by EMAS or ISO.

Finally, we consider the financial costs strictly connected with the adherence to one of the formal voluntary standards such as ISO 14001 and EMAS.

The evidence gathered (Biondi *et al.* 2000, Cesqa & Sincert, 2002) suggests that external consulting and verification costs are those with a stronger impact on organizations, and are felt like a heavier burden compared to other costs such as those related, for instance, to the necessary modifications regarding production processes, or linked to product innovations (see Figure n. 2).

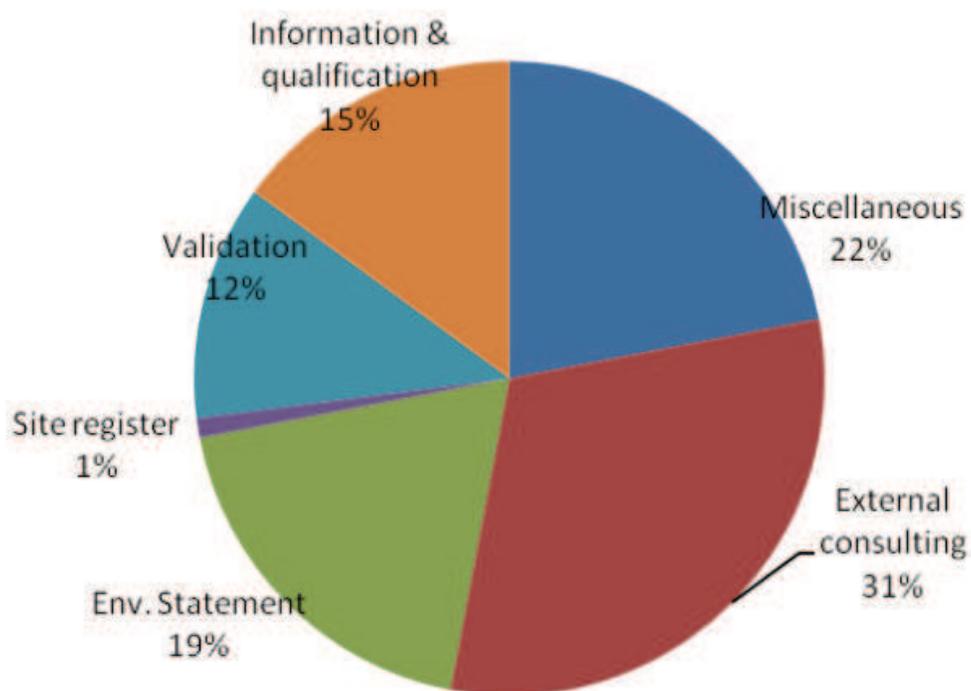


Fig. 2. Cost Categories for EMAS implementation

The costs relating to EMAS registration, for example, are generally low, although this depends on each national Competent Body. In some countries the cost depends on site dimension and turnover, representing a positive attempt to knock down a financial barrier

for SMEs. For example, in Italy the cost varies from 50 €, for small firms, to 1500€ , for large firms.

On the one hand, to give an idea of the financial resources required, we can mention the “EMAS toolkit” (European Commission, 2000), which provides figures with the average expenditures for different size-categories of organisations:

€ 10,000 for very small companies (< 10 employees)

€ 20,000 for small companies (< 50 employees)

€ 35,000 for medium companies (50 <250 employees)

€ 50,000 for large companies (> 250 employees)

On the other hand, studies on EMS costs (Hamschmidt & Dyllick 2001, Milieu Ltd & Risk and Policy Analysis Ltd, 2009) suggest that the above mentioned figures might be underestimated. The discrepancies in the outcome of different investigations are due to many factors, not least the fact that most organizations do not have a system for the accounting of environmental costs. The table below collected evidence from previous studies on the costs of EMAS implementation in different countries.

Size Country	Small < 100 emp	Medium < 500 emp.	Large >500 emp.	Average
Austria (BMUJF 1999)	109.000€	225.000€	153.000€	
Denmark (Kvistgaard, 2001)				62.000€
Germany (UBA 1999)	37.000€	84.000€	85.000€	59.000€
Switzerland (Dyllik & Hamschmidt, 2000)	56.000€	93.000€	322.000€	172.000€
Hungary (INEM 2001)	3.200€-6.2.00€	5.800€-11.000€	>11.000€	
EU member States (Ec, 2009) ³	21.000€-38.000€	17.000€-40.000€	38.000€-66.000€	26.000€-48.000€

Table 1. Studies on the costs of EMAS implementation

Moreover, the previously mentioned Cesqa Sincert study shows how the average annual investment for the implementation of an EMS amount to about 1,9% of sales revenue for SMEs, and 5,2% for larger organisations. The problem rises from the coupling of two factors like the relevance of the costs for a business activity and the uncertainty of their precise entity. This is consistent with the evidence emerging from the EVER study, which argues that one of the main problems faced by SMEs when considering the possibility of registering in EMAS is the existence of “a priori” undefined costs, mostly related to the implementation phase (IEFE *et al.* 2006).

One of the few variables that are indirectly “linked” to the evaluation of the costs of registration, that can be gathered from literature, concerns the time-length organizations take to implement or to maintain an EMS

³The second amount refers the first year cost; the first amount refers the yearly cost after the first year.

In a recent study on the costs and benefits of EMAS (Milieu Ltd & Risk and Policy Analysis Ltd, 2009), registered organizations were asked to indicate the number of person-days (of either their own staff or outside contractors) required to first implement EMAS. The range of responses was quite varied. External consultancy was used by most respondents to implement EMAS (59%). There may be a trade-off between the complexity of the EMAS system (lower in smaller organizations) and the expertise available (also likely to be lower in smaller organizations). The most time-consuming tasks for internal staff are the environmental review, EMS development and internal audit. A summary of the person days required to maintain and implement EMAS by each task is provided in Figures 3 and 4.

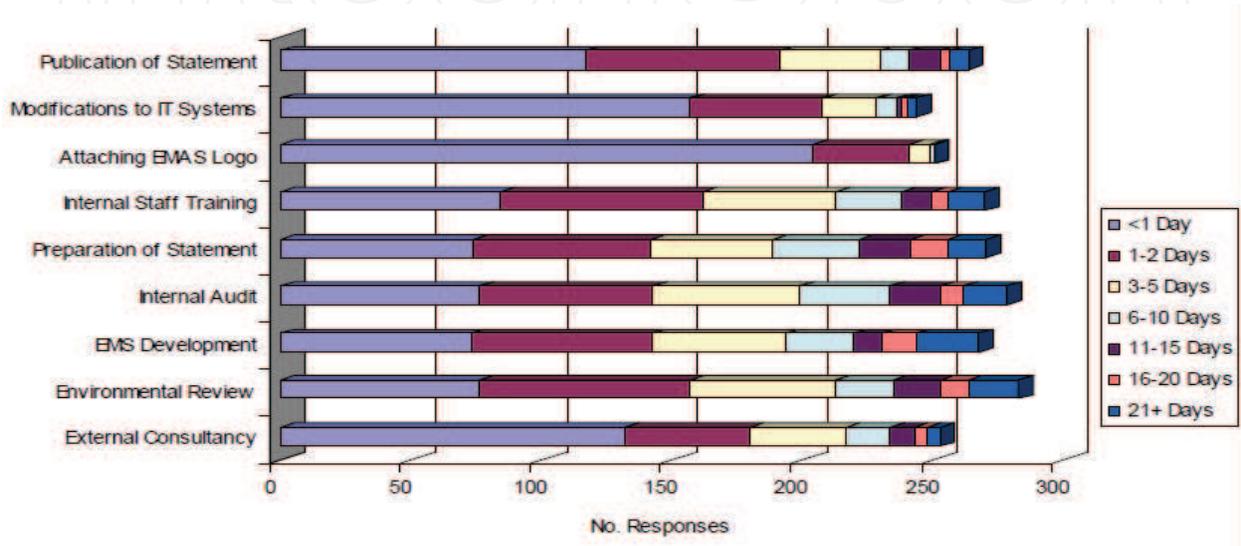


Fig. 3. Person Days to Maintain EMAS by Task (Source: Milieu Ltd & Risk and Policy Analysis Ltd, 2009)

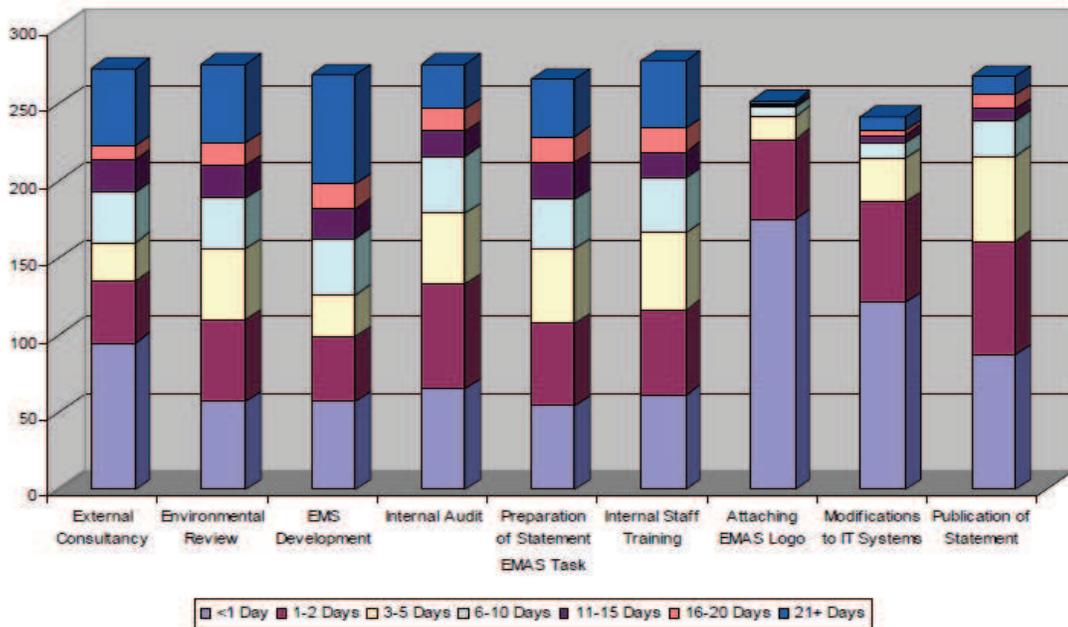


Fig. 4. Person Days to Implement EMAS by Task (Source: Milieu Ltd & Risk and Policy Analysis Ltd, 2009)

Focusing on EMAS scheme, but in some cases we can extend these considerations also to ISO 14001 certification, costs related to the implementation and maintenance of EMS, however, are not the only barriers singled out by the literature review, as most of the studies analyzed identify as main hindrances also the lack of customer interest and awareness (Kvistgaard et al. 2001, Brouhle 2000, DG Enterprise 2004), with the subsequent need to promote EMAS and its logo and the lack of recognition and positive rewards by public institutions (Carnimeo et al., 2002).

The lack of public recognition and interest affecting EMAS (and its logo) is well known, and most studies and surveys are in line with such assumption (Ends surveyed that only 6% of respondents admit EMSs being the main environmental factor orientating purchasing habits). Obviously, scarce awareness means scarce market response.

This goes for all kinds of organizations, but is probably more tackling for SMEs, which have to put a greater effort to implement the scheme, due to their limited resources. Participants of a workshop on SMEs and EMAS arranged during the EVER project argued that *“an important proportion of SMEs who have invested the effort and resources to register in EMAS do not receive any relevant benefits or appreciation... and finally drop out with a negative impression of the scheme”*.

Brouhle (2000) goes a step forward analyzing the scarce level of EMAS knowledge that characterizes firms themselves, as well. He mentions a research study by UNI/ASU, establishing that over one quarter of executive managers did not know about EMAS (Freimann and Walther, 2001), and another study by the Institute for Research in Social Choices, which identified 33% who had no knowledge of EMAS and another one third who claimed to know it only partly.

As far as rewards provided by public institutions are concerned, such incentives can be either of regulatory nature or aiming to promote a wider uptake of the scheme through public procurement, funding support and technical and information support (IEFE *et al.* 2006). However, to date, the business community is particularly critical about the lack of external incentives.

The evidence emerging from the literature review clearly shows how in those national contexts (e.g: Germany in a first phase of the development of the scheme, Italy in more recent times) where the public sector is more keen on supporting the diffusion of EMAS through promotional campaign or incentives for registered organizations, the uptake of the scheme is much higher compared to other countries where such positive institutional framework does not exist. We can mention, for instance, a study carried out by De Leo (De Leo et al, 2003) on Italian and German sites. De Leo states that among chief reasons of the success of the German policy we have: i) an effective program of information and technical assistance to companies; ii) information to the public; iii) financial aid, iv) administrative simplification and deregulation.

In the abovementioned EVER study, the point of view of the organizations that are not participating in the EMAS scheme was analyzed in order to investigate the barriers preventing organizations from adopting EMAS. From the carried out interviews, it clearly appears how the role of public institutions is crucial: the lack of external incentives and the lack of recognition by the public institutions are perceived as the most relevant hindrances. Moreover, a scarce interest by consumers and the subsequent lack of competitive rewards is indicated as a strong barrier, as well, being this consistent with the findings of the literature review. The interview phase, however, provided some surprises, such as the scarce

importance given to the cost of implementation. Despite high costs associated with activities such as external consulting, most organizations suggested these being not the reason why non-participants decide not to implement EMAS.

2.2 Internal barriers

Analyzing the results mentioned in the previous paragraph, we can realise that the most significant barrier for SMEs is not the direct financial effort, but the indirect costs implied by, on the one hand, the deal of time that the management has to devote to the EMS implementation and, on the other, by the lack of human and technical resources that SMEs suffer when tackling environmental management problems. Time and knowledge therefore emerge as the most significant constraints. The smaller is the enterprise, the stronger time constraints seem to be. This is evident especially in those small firms where the management team has multiple roles and commercial pressures must take priority. The smaller is the enterprise, the higher is the probability an EMS cannot be implemented by relying only on internal expertise and technical capabilities.

Internal barriers can be defined as obstacles that arise within the firms and prevent or impede EMSs implementation or the adoption of EMSs (Hillary, 2004). They are a vast category, comprehending factors such as lack of resources (time and human capital), difficulties in the understanding and perception of the EMS scheme, drawbacks in its implementation process, the culture itself of organizations, and so on.

For instance, a first relevant hindrance met on the way for EMAS registration, according to the relevant literature (Biondi et al. 2000), is represented by the difficulties in effectively understanding the scheme and its requirements and identifying relevant environmental aspects. Indeed, it appears that many organizations are unable to accurately understand EMAS, especially as far as the Initial Environmental Review and the EMS are concerned, and to identify relevant aspects. The difficulties met in correctly identifying relevant aspects is highlighted by many studies (Hillary et al 1999, Hillary 2004). Zackrisson *et al.* (2000) shows that 49% of companies find it challenging to identify relevant environmental aspects, and more than 1 out of 4 fail to identify some significant environmental aspects. Moreover, it has been assessed by some studies that many companies evaluate the relevance of environmental aspects by the so-called "rule of thumb", and not by an objective and reproducible method (IEFE *at al.* 2006). The drafting and the diffusion of the EMAS statement represent other difficult requirements in the EMAS implementation process for many companies to understand and correctly implement. This is often due, especially as concerns SMEs, to a lack of competences and knowledge within the organization (Biondi et al., 2000).

However, other studies assert how this is not merely a matter of lack of competences. The problem can assume a different connotation: MacLean (2004) defines it a matter of "harmony" within an organization (e.g: interaction between business executives and EHS managers) on business priorities. No surprise if, given such situation, it is very difficult to set performance objectives and to hence recognize relevant aspects within EMAS to be dealt with.

The evidence collected also shows that another relevant internal barrier is represented by the lack of resources. It is clear that, besides financial resources, there are other resources that organizations need for the achievement and implementation of an EMS.

Among them, we can mention, for instance, the availability of management time, or the adequacy of human resources, being these personnel with proper skills, expertise and technical background (Kvistgaard *et al.*, 2001, Bonora & Sondermeijer, 2001).

This is, once again, felt as a relevant problem for SMEs. This is confirmed by the incessant call, emerging from many studies, for measures capable of simplifying and supporting the implementation and maintenance of EMSs by SMEs (e.g.: Ammenberg et al. 1999, Hillary 1999, Hillary 2004).

We can report, as one of the most recent example, the findings of the study carried out by the Strategic SME group (ISO, 2005) in which lack of time was identified as one of the top three most important barriers when implementing an EMS) by 36% of SME respondents. Secondly, the respondents identified lack of staff resources (31%) and thirdly lack of know-how in the enterprise (21%).

The lack of resources can be even worsened by the high demands of documentation. The risk is that of focusing all (limited) resources on documentation, instead of following and developing the environmental objectives and the environmental performance. Moreover, employees in charge of the EMS might feel demotivated believing the documentation requires too much of their time, and “instead of documenting the problems, they pretend not to see them” (Malmberg 2006).

A final internal barrier is “indirect” and can be identified in the fact that the implementation of an EMS might have backlashes, for instance, by disclosing certain “environmental non compliances” that had otherwise remained uncovered, with the subsequent legal proceedings and additional costs. Therefore, the fear of having to sustain higher costs, instead of saving money as a consequence of the implementation of the EMS, may prevent many firms from adopting EMAS, ISO 14001 or other similar systems. With this respect, the only empirical evidence is related to a non-EU context: a survey in the US on the uptake of ISO 14001, shows how 40% of firms consider potential legal penalties from voluntary disclosure as a constraint to the adoption of the EMS while other studies show even higher figures for such barrier (Delmas, 2002).

Focusing on EMAS, the recent study coordinated by Bocconi University (IEFE et al. 2006) supports the idea that barriers preventing organizations from joining EMAS are mainly external. The table below shows as none of the internal ones achieves a score higher than 3 both for EMAS adopters and non-adopters (The likert scale is from 1 - not at all important, to 5 very important). Only stakeholders signaled some internal barriers as moderately important.

3. Difficulties encountered by SMEs in implementing an EMS

If an SME decides to undertake actions and activities to implement an EMS, some constraints will undoubtedly hinder this process at the operational, technical and organisational levels.

The lack of eco-management-targeted skills is the first constraint in terms of human resources which SMEs have to face when they decide to implement an EMS according to EMAS or ISO 14001.

Understanding, interpretation and application of these standards is not always simple and easy, and sometimes requires a technical knowledge of environmental issues. For instance, the troubles many SMEs experience in fully understanding and satisfying some EMAS requirements (e.g.: evaluation of the effects, definition of criteria for selecting significant aspects, measurement of continuous improvement) are partially due to their lack of technical expertise in environmental management (Biondi et al. 2000).

Both EMAS and ISO 14001 were conceived to give indications for a correct implementation of an EMS to a wide range of enterprises, including very articulated and large

sites/organisations. This is the reason why their requirements tend to be as exhaustive and complete as possible, sometimes resulting too detailed, complex and over-dimensioned with respect to a SME. On the other hand, owing to the different kinds of enterprises they address to, neither EMAS nor ISO 14001 could have been tailored to the needs and specificities of each single site/organisation, leaving room for a flexible and agile implementation. This implies a lack of explanations, clarifications and details about what is exactly required to an EMS to work effectively and efficiently in specific conditions.

	Non participants	Stakeholders	Participants
Difficulties originating from the set up and functioning of the EMAS scheme	2,5	3,1	2,7
Difficulties in implementing the requirements	2,3	3,2	2,6
Difficulties related to disclosure through the Environmental Statement	2,2	3	2,3
Difficulties in involving, motivating or obtaining the commitment of personnel	2,2	2,6	2,8
Lack of human resources and competence	2	3,5	2,9

Table 2. The most relevant internal barriers (source: IEFE Bocconi et al. 2006)

If we consider these difficulties in understanding the standards together with the scarce human and technical resources of an SME, we can realise the kind of operational and practical difficulties these enterprises meet in applying EMAS or ISO 14001 to their site/organisation.

Usually, the most relevant difficulties met by SMEs in implementing an EMS are the initial environmental review and the definition of objectives and programmes. If we consider the whole process leading to participation in EMAS, these two difficulties are overcome only by the environmental statement (this is probably due to the scarce SME confidence with external communication tools).

Difficulties met during the initial review prove that SMEs usually have to make a great effort from the very beginning of the process leading to the implementation of an EMS. Most SMEs, in fact, have never carried out an accurate and complete analysis of the environmental effects connected with their activities. They have to focus on technical aspects before implementing an environment-targeted management framework.

Project experiences show that in many cases personnel operating in the SMEs involved is composed of specialised technicians who possess a very good knowledge of the production process (Biondi et al. 2000). These technicians are also aware of the main environmental problems connected with the process and are capable of managing them from the technical point of view. Relevant difficulties were instead encountered by SMEs as to *knowledge regarding environmental effects* and *availability of technical instruments* to perform all the necessary analyses. Even though several SMEs were acquainted with instruments and methodologies for environmental impact measurement and assessment, often *they did not have time and technical resources* to carry out an in-depth analysis on their own (Hillary, 2004). In order to obtain a complete environmental review, most SMEs relied on consultants that in the past used to support them in dealing with compliance with environmental legislation.

As we above mentioned, difficulties are encountered by SMEs also in defining their environmental policy and programmes. This was due both to the lag in environmental

culture previously described, and to the fact that SMEs are not generally acquainted with explicitly programming and planning in detail their activities, especially with respect to issues outside their “core-business” (like environmental ones). Fixing specific environmental objectives and defining programmes for achieving them is an entirely new way of operating in this field for many SMEs, and this causes practical difficulties: what is an environmental policy? What must it include? How should programmes be decided, formulated and drafted? What must they focus on?

There is no doubt that, from the organisational point of view, most SMEs are lagging behind with respect to the eco-management frontier. Small enterprises often have neither a quality system nor a defined and formalised management system, so they have to start from scratch in structuring their EMS. The little confidence they have with formalisation in general and, in particular, with management tools like procedures, operational instructions, working protocols, registers, reporting instruments and, finally, with an “advanced” tool like auditing, often prevents SMEs from implementing an efficient, useful and “handy” EMS. The existing references for structuring an EMS (such as EMAS and ISO 14001) may result too detailed and complex for an SME. As we have seen, they may also result over-dimensioned or too vague with respect to an SME practical needs. These enterprises need clearer indications for defining a simple and agile organisational structure that enables them to easily manage the environmental aspects of their activities. According to the new indication included in the new revision of EMAS Regulation (EC, 2009), the only way for SMEs to effectively undertake the implementation process is understanding that they can satisfy ISO 14001 and/or EMAS with a “slim” EMS, tailored to their features. An “overwhelming” documentation of the EMS, for instance, can be a burden (and not a support) for SMEs, and therefore can be the hardest difficulty at the implementation stage. Finally, the environmental audit usually implies a great effort for a small enterprise that may not possess the technical expertise and capability to perform such an activity. According to evidence emerged in the literature, the environmental audit is the tool which the SMEs involved were less acquainted with. Even if SMEs certified according to ISO 9001 standards are quite familiar with the audit tool, they previously applied it strictly to quality management and encountered relevant difficulties in applying it to environmental performance. Introducing the environmental auditing in these SMEs means a radical change in the management of their environmental aspects. They had to shift from a “spot” and compliance-targeted check to a systematic, continuous and improvement-targeted control, conceived to be a “management tool” that enables the SME both to verify the EMS effectiveness and to identify improvement opportunities.

A last drawback is the uncertainty surrounding the effects of external communication and, for EMAS, the Environmental Statement diffusion to the public. SMEs are not used to conduct activities for continuously interacting with the stakeholders and often consider the environmental aspects as a delicate and “confidential” matter. They generally have normal or good relations with public authorities, but SMEs are afraid the local community can negatively react to information regarding potential or real damages to the environment. This is the reason why SMEs are rather sceptical (when not scared) about diffusing such an information with the Environmental Statement. Strictly connected with the above-mentioned drawback is the difficulty SMEs find in writing the Statement, selecting its contents and choosing a format that can satisfy the stakeholders’ expectations, without generating worries and preoccupation.

4. EMS implementation by SMEs: motivations and driving factors

In spite of the abovementioned difficulties, a significant number of SMEs has been able to register their sites under EMAS and/or to obtain certification according to ISO 14001. In fact, many SMEs are positively responding to environmental management voluntary schemes as long as they develop.

What reasons are motivating these enterprises to implement an EMS and to seek a third-party recognition of their efforts? In this paragraph we will try and identify the main motivations that may prompt a small enterprise to take this steps towards a sound environmental management, despite the relevant constraints and barriers. In the next paragraph we will analyse the benefits that SMEs can achieve by implementing an EMS, basing on the main finding emerging in the literature.

Scholars have identified several factors that could induce an organization to adopt an EMS (either certified or not), and other “pro-active” environmental strategies. In efforts to increase resource productivity while abating costs, an EMS could be adopted to bring about rationalization in the use of inputs (resources) such as energy and raw materials, and at the same time, to reduce outputs such as waste (Khanna & Anton, 2002). Moreover, the adoption of an EMS can improve the reputation and image of a company and, consequently, its relations with customers, investors, local communities and other stakeholders (Biondi *et al.*, 2000; Bansal & Roth, 2000; Khanna & Anton, 2002; Bansal & Hunter, 2003).

Research findings also demonstrated that the regulatory obligations and other external pressures may stimulate pro-active behaviour at a managerial level and induce the implementation of an EMS (Darnall *et al.* 2008; Gavronski, *et al.*, 2008). In a recent study, Darnall *et al.* (2008), relying on aspects of institutional theory and on a resource-based view of the firm, determined that institutional pressures (i.e. regulatory, market and social pressure), resources and capabilities (i.e. employee commitment and environmental R&D) both encourage a more comprehensive EMS adoption. Moreover, overcoming information asymmetries (King *et al.*, 2005) and complying with increasing legal requirements (Biondi *et al.*, 2000), represent other specific determinants

A first indication drawn from the literature review regards the extreme heterogeneity of factors “driving” companies towards EMSs (and, specifically, towards EMAS). These vary significantly in connection with different aspects, like the size of the organization (SMEs vs large companies), its sector (e.g: manufacture vs Public Administration), the national or regional contexts, and so on.

For instance, drivers can be either economic/strategic or “environment-led”; they can deal with the internal sphere of an organization (e.g: optimization of organizational activities), or be “external” such as the desire to gain a competitive advantage or benefit from fiscal/normative incentives and facilitations.

The following table summarizes some of the motivations behind the adoption of EMS that have been identified in literature.

The evidence gathered by researchers shows that economic and strategic drivers seem to prevail in spurring companies towards the EMS adoption in particular formal EMS such as EMAS. We can mention, for example, the outcome of a German UBA research (Clausen *et al.*, 2002): economic and competitive motivations (such as energy/resources savings, better image, etc.) are very important.

As far as EMSs are concerned, the Best Project (DG Enterprise, 2004) stresses that the reasons for adopting an EMS (including EMAS) mostly encompass other strategic factors, not directly linked to competitiveness or the market response, such as the hope to get benefits

from local authorities: public recognition, material advantages (cheaper insurance, easier access to finance, privileges in public procurement), regulatory relief/deregulation and so on (even when these benefits are not available yet).

Reduction of environmental impacts
Savings from energy and resources consumption
Image improvement
Legal compliance
Satisfy requests by customers
Obtain competitive advantages
Regulatory and monetary incentives (de-regulation, tax relief)
Better organization and management of activities
Keeping up with competitors
Improve relationship with stakeholders and local communities
Better risk management
Satisfaction of requests from corporate headquarters
Improve rating in access to public funding and procurement procedures

Table 3. Motivation of EMS adoption

In addition, Perkins and Neumayer (2004) agree that the cost-reductions, benefits and profitability of EMAS are major drivers, but he adds that they are unlikely to be the only ones, as firms often adopt organizational innovations for managers' quest for external legitimacy, and specifically, the need to conform to widely held beliefs of rational and efficient management practice. Hence, the participation in EMAS is likely to be shaped by two sets of factors: those influencing the financial costs, benefits and profitability of the scheme, and "ideational forces" such as the requirements of external stakeholders.

Moreover, Anton *et al.* (2004) found that also the prevention of "negative" strategic factors is often a powerful driver for EMS adoption (in particular EMAS and ISO 14001), such as liability threats and pressures from consumers, investors and the public.

Even if the prevalence of economic and strategic factors is a general trend characterizing most studies, there are cases where also environmental aspects seem to play a crucial role. As an example, we can cite a survey carried out on French EMAS registered organizations (Schucht, 2000): the results, reported below, evidence how the improvement of environmental performance is regarded as the main motivation for EMAS adoption, more important than improvement of image, legal compliance and so on.

As reported by the relevant literature on environmental reporting and EMAS statements (e.g.: Grafé 1996, Gorla & Iraldo 1998, Jones *et al.* 1999, etc.), the willingness to communicate with the stakeholders can be a powerful driver for EMAS participation. Some of the analyzed studies put an emphasis on the fact that, in some cases, EMAS has been preferred over ISO 14001 thanks to the possibility to use and diffuse credibly validated environmental information (Gorla & Iraldo 1998).

The analysis of existing evidence was not limited to the (however prominent) EU context, being for instance inclusive of the uptake of the ISO standard and its drivers in different contexts such as the US and China (Fryxell and Szeto 2002, Delmas 2002 etc.), for comparative purposes.

As in the case of EMAS for the EU context, it emerges that economic and strategic drivers play a key-role, even if their relative importance varies according to the study, the geographical context, etc.

For instance, the main drivers for Iso-certification in China (Fryxell and Szeto 2002) were reported to be to ensure regulatory compliance, to enhance the firm's reputation, and to improve environmental performance, in that order, while motivation to achieve cost reductions is less emphasized.

A key finding emerging from the literature review is that of the prevalence of "external" drivers over "internal" ones.

For instance, we can report the Cesqa Sincert research, carried out in 2002 in Italy: main motivations for the uptake of ISO are image improvement and legal compliance (53% and 55% of respondents, respectively, rate such drivers as "very important"), while a better organization and rationalization of activities is regarded as less important (Cesqa & Sincert, 2002).

Again, Hamschmidt & Dyllick (2001) asserts that the principal driver for the uptake of an EMS (including EMAS) is external (enhancement of the corporate image), while internal factors such as the systemization of existing activities and risk minimization follow in lower positions. Focusing on SMEs, there is a lot of evidence on the analysis of drivers of EMS adoption (Biondi et al. 2000, Goodchild 1998, ISO 2005, etc), most of which is gathered in a 1999 and 2004 studies by Ruth Hillary.

It emerges that one of the driving forces spurring SMEs towards EMAS and other EMSs is the specific request of important and large customers, as small firms are more dependent on precise demands by clients representing an important share of their activities (Testa & Irado, 2010). Moreover, other important drivers emerging in most of the studies and research being analyzed regard legal compliance, improvement of public image and the possibility of benefiting from special funding or incentives from the legislation and the Public Administration. Overall, external and economic/strategic factors maintain their prevalence even in the "sub group" of SMEs.

Most SMEs are aware that maintaining a continuous compliance to environmental legislation is problematic and implies a great managerial effort. This is particularly true in countries where environmental aspects are dealt with in a relevant number of legal provisions, applied at different levels (national, regional, local...). Moreover, environmental laws are subjected to frequent and sudden updating and tightening, which are difficult to keep up with for SMEs. In fact, these enterprises are often cut off from flows of information regarding these issues. Finally, SMEs face problems in "translating" environmental legislation requirements at the operational level, as well as in understanding their implications for the site/organisation activities. Many SMEs involved in the pilot projects believe that an EMS can be, first of all, *a useful instrument to manage, control and monitor the legal compliance*.

According to Biondi et al. (2000) other drivers should probably be attributed to the willingness to anticipate or to respond to the request of important customers. International behemoths are increasingly asking suppliers to guarantee for the environmental efficiency of their activities by adopting an environmental management standards. The relationship

between “proactive” large companies and supplier SMEs represents one of the most powerful springs for favouring the diffusion of EMS. This is already happening in many industrial sectors and in many countries. In Italy, for example, one of the first SMEs to move towards EMAS in the food-processing sector was prompted to do so by its main customer (the Swiss retailer MIGROS).

Potential improvements of the relations with the stakeholders are not a relevant motivation (Biondi et al. 2000). This is probably due to the fact that SMEs are not eager to adopt a communication strategy towards external stakeholders and, consequently, they do not consider this as an environmental improvement opportunity. Small enterprises are not used to diffuse to the public information regarding potential or real environmental impacts. Symmetrically, local communities still lack in stimulating SMEs to communicate on these issues. The bottom line is that few SMEs decide to adopt an active communication strategy, for example by diffusing the environmental statement foreseen by EMAS, because they are afraid to provoke alarmism.

A last motivation should be mentioned, although definitely less emphasized than the others. Environmental management standards is increasingly being adopted by SMEs the more they understand that these schemes require an organizational, technical and financial effort which is proportioned to the needs and possibilities of the enterprise. For example, small enterprises do not need to highly formalise the EMS procedures and prepare a wide and detailed documentation, and they can decide the “speed” and the stages of the continuous improvement according to its innovation capability.

The driving factors described in this paragraph can convince an SME to undertake the implementation of an EMS. There are some benefits which are not evident when this decision is taken, but may emerge “ex-post”, once the first actions to improve environmental management are carried out. We should emphasise these benefits to make SMEs realise and correctly evaluate all the opportunities connected with a sound environmental management. Once SMEs will be aware of benefits, these could become a powerful incentive to adopt an environmental management standard.

5. EMS positive implications and benefits for the SMEs

Empirical evidence emphasizes that relevant benefits and possible advantages for smaller enterprises can be achieved by implementing an EMS. Diffusing the experience on benefits and advantages that result from the adoption of an environmental management standard is the only way to promote SMEs participation.

The experience of many SMEs shows that by implementing an EMS they are able to raise the organizational and management efficiency of the whole company (Biondi et al. 2000). For instance, they improve the capacity of managing and controlling their environmental performance, by continuously monitoring their activities (by means of procedures and operational control), systematically registering and evaluating environmental effects and periodically verifying the effectiveness of the whole system (auditing). A second relevant benefit emerges from a better definition of responsibilities and tasks, achieved through the definition of formal documents (charts, job descriptions): this enables employees to identify persons responsible to which refer to for environmental aspects and problems. This can led SMEs to a more efficient, rapid and effective management of environmental risks. Documentation represents a significant benefit also because SMEs, by writing procedures, rationalising and standardising their activities, improve their work efficiency and quality.

Training and information of personnel implies benefits in terms of efficiency, too. By improving the skills and raising the awareness of the personnel, SMEs can obtain positive management results. A clear and diffused example of this kind of benefits is what happens to SMEs implementing a waste management programme. Even if these SMEs have been pursuing waste separate collection before implementing an EMS, they obtain positive results (and connected economic benefits) only when they adopt procedures and adequately train personnel to behave correctly.

As to management efficiency, a further benefit deriving from the improvement in planning activities (Iraldo et al. 2009).

Moreover, as we have seen, one of the most effective drives towards EMS implementation is the possibility of using this management tool as a support for pursuing legal compliance. These considerations rely on a wide range of evidences from existing studies that analyze this kind of benefit of EMS adoption. Just to mention one of these studies, Biondi *et al.* (2000) identify in a better legal compliance and in the capability of continuously monitoring compliance one of the most relevant benefits of EMAS registration. This benefit is also connected with other forms of EMS certification. Hamschmidt et al. (2001), for instance, state that legal compliance is perceived as a relevant benefit deriving from ISO 14001 certification (59% of the sample), ranking at the second place right after the systematisation of existing environmental activities.

The EVER study, carried on behalf of European Commission, also provided very consistent outcomes, as far as this benefit is concerned (Iefe Bocconi *et al.* 2005). According to the results of this study, in fact, formal EMS (such as EMAS) provide considerable benefits in the area of legal compliance: quite interestingly, the three most important benefits perceived by the interviewed EMAS-registered organisations are connected with the monitoring and management of legal compliance. Greater awareness of regulatory requirements was identified as a fairly or important benefit by 70% of the EMAS adopters, better compliance by 69% of them and better planning of actions for legal and regulatory compliance by 67%.

Although this internal benefits can represent a relevant stimulus for encouraging SMEs to adopt an EMAS, we think that a real diffusion of this tools will be possible if adopters can achieve also competitive benefits.

The general impression deriving from the analysis of the evidence emerging from previous studies is that EMS adoption, and in particular certified EMS, is actually able to exert a positive influence on competitiveness, even if the effective relevance in supporting it is not certain.

The variety of perspectives and levels of analysis at which the concept of competitiveness may be considered complicates the formulation of an univocal definition of competitiveness, both at a theoretical and political level.

At the firm level, competitiveness implies that companies are able to produce goods and services more efficiently and/or effectively than their competitors. A strong competitive performance is achieved by relying on some "competitive factors", often with a particular focus on process productivity and the efficient use and/or access to strategic inputs. Jenkins (1998) states that, "*a firm is competitive if it can produce products or services of a superior quality or at lower costs than its domestic and international competitors. It is therefore synonymous of a firm's long-run profit performance and its ability to compensate its employees and provide superior returns to its owners*". A recent paper for the International Energy Agency defines competitiveness at the firm level as "*The ability to maintain and/or to expand [a] market position based on its cost structure*" (Reinaud, 2005).

Regarding the analysis of the key variables affecting competitiveness as well as the ways to measure them, we may distinguish two major approaches:

- The first one tries to investigate the *drivers of the competitiveness* (e.g. the resource productivity at firm level, the degree of internationalization at sector level).
- The second approach focuses on the *external effects of the competitive success* (e.g. the market performance measured by market share; the turnover growth rate; the financial performance measured by ROI or EBTIDA).

At the *level of firms/plants*, competitiveness indicators relate to various aspects, such as the ability to sustain market shares, to sustain independent existence on the market or to sustain “normal” levels of profitability and returns. At the firm level, *productivity* is the key variable, simply defined as the “*measure of output per unit of input*”. Productivity aims at measuring the efficiency with which production is carried out; in other words, the ratio between the outputs and inputs that make production possible (raw materials, labour, capital etc). Many studies identify as an optimal measure of productivity the *Total Factor Productivity*, that is a synthetic measure of how firms are organised, structured, use technology and are managed (for example: Jaffe and Palmer, 1997; Dofour *et al.*, 1998; Berman and Bui, 2001).

In the following section, we analyze the main evidence emerging from literature on the effect of EMS adoption on the different measure of competitiveness.

The introduction of an EMS should enable an organization to identify opportunities for the better management of resources, including saving in raw materials and energy in the supply chain of an organization, or in the reuse or recycling of resources. Such steps reduce consumption and in turn reduce the operating costs of that organization (Milieu Ltd & Risk and Policy Analysis Ltd, 2009)

Most of the literature agrees on the benefits provided by EMS adoption, in particular by EMAS registration, in terms of cost savings. In a relatively recent review of existing studies on the issue (Clausen *et al.* 2002), most of the works taken into consideration show that EMAS implementation supports firms competitiveness, thanks especially to the lower costs they can obtain.

Cost savings are relevant not only in general terms, but also in comparison with other benefits deriving from the EMAS registration. We can mention, for instance, a study (Imperial College *et al.* 1998) showing how cost reduction is actually the main benefit associated with the implementation of the scheme.

Also the studies that more generically deal with EMSs (and not EMAS-specific) show how cost savings represent one of the main dimensions on which the certification supports competitiveness (Petrick *et al.* 1999). Indeed, it appears that all kinds of EMSs do actually spur competitiveness of firms as they operate as cost-cutting measures, especially as far as some issues like greater energy efficiency and reduced resource consumption are concerned. We can mention, as an example, a study carried out in 2001 (Hamschmidt *et al.*, 2001), showing how 50% of Swiss ISO-certified companies perceive cost reduction as a relevant benefit deriving from the implementation of an EMS.

Regarding the promotion of innovation at firm level, EU environmental policy has the broad aim of influencing the innovation process and technological development within firms in favor of cleaner techniques and technologies responses (Hilliard *et al.* 2003). The underpinning idea is that the adoption of environmentally friendly techniques and technologies, concerning the take-up of methods improving the productivity of resources, will overcome the traditional trade-off between increased competitiveness and enhanced environmental protection.

The findings emerging from literature that show a positive relation between EMS, or certified EMS and innovation, are mainly anecdotal but just few empirical researches found generalizable results (Clausen *et al.* 2002).

For instance, with reference to the direct effects of EMAS adoption on competitiveness, a recent European study (Rennings *et al.* 2006) investigated the impact of the different characteristics of this EU Scheme on technical environmental innovations and economic performances in Germany, by analysing data from a unique dataset of EMAS-registered sites. The study identifies a weak relationship between EMAS and some indicators of market success. However, a positive impact on the increase of turnover and exports is found, especially when a company is able to achieve significant learning by adopting EMAS. Hence, the authors conclude that a better linkage between environmental management and innovation management could improve competitiveness.

Furthermore, a recent study by Iraldo *et al.* (2009), based on a sample of 100 interviewed organizations investigated whether or not an EMS implemented within the EMAS Regulation has an effect on firm performance both from an environmental and a competitive point of view. The econometric analysis shows a positive impact of well-designed environmental management system on environmental performance and, as a consequence, on technical and organizational innovations.

The fact is that a simple EMS adoption, even if complying with a third part designed standard, such as ISO 14001 or EMAS, does not per se assure an improvement of competitive performance. The relation is neither direct nor “automatic”, but it depends on the effects of the EMS on the organisation environmental performance. In other words, if only an EMS achieves the aim for which it was designed, or the continuous improvement of environmental performances, a positive effect on firm competitiveness could be attained.

Another dimension of competitiveness potentially affected by EMS adoption refers its “direct” indicators such as market shares, increased sales and revenues and improved market position.

The findings emerging from the literature are consistent with the idea that only part of the above-mentioned benefits support a concrete improvement of the competitiveness of EMAS organizations. It seems like the main benefits are either immaterial (such as a better image) or linked to the internal sphere of the company (e.g: lower costs or better management and rationalization of activities), and not directly linked to the market response.

Indeed, even if there is evidence that the implementation of an EMS does actually result in an increase of competitiveness (Feldman 1997, Bonifant *et al.* 1995, Hart *et al.* 1996), many other studies focus on the lack of market pull as a relevant hindrance on the way of an effective exploitation of EMAS competitive capabilities (Kvistgaard *et al.* 2001).

To mention some example of a positive relation between EMAS and market response, Hamschmidt *et al.* (2001) shows how 28% of Swiss companies only experienced an improvement in their market position as a consequence of EMS adoption, while some of the previously investigated benefits, such as legal compliance or activities’ rationalization, are far more important.

6. Co-operation: a key word

Networking and cooperation between organisations emerges from several studies and empirical evidences as one of the most important factors fostering the diffusion of formal EMS (such as EMAS). Many authors (*inter alia.*: Biondi *et al.* 2000, Hillary 2004) emphasise

that working with groups of companies is a useful and efficient way of adopting EMAS particularly for SMEs. Moreover, the European Commission has recently confirmed the key role of networking for overcoming the constraints and barriers for EMS adoption between SMEs (European Commission 2007). The Commission has, in fact, highlighted its commitment to promote and encourage the use of EMAS in industrial clusters or districts of SMEs, using specific cluster- or supply chain-oriented approaches, because these approach can reduce consultancy and audit/verification costs for SMEs, and facilitate additional knowledge-sharing and experience exchange amongst participants.

The effectiveness of the networking approach particularly emerges between organisations operating in the same sector (such as the industrial sector, but even service sectors like tourism or public institutions operating at different levels) and between organisations operating in the same region (or territorial area).

In the first case, enterprises can co-operate by identifying and assessing similar environmental aspects and by finding technological and operational solutions that can be applied to similar production processes and products, as well as by defining organisational structures suitable for the same kind of production cycles. In the second case, co-operation is facilitated by the 'physical contiguousness' and there are synergies both in improving the environmental impact on the same local eco-system, and in interacting and communicating with the same stakeholders (local population, authorities, etc..).

In some experiences, a network has been created among SMEs within a 'cluster', in order to foster information exchange and experience diffusion and to define and apply common solutions to similar environmental, technical and/or organisational problems, or to share environmental management resources (Iraldo & Frey, 2007). A specific kind of co-operation within a cluster of organisations takes place in the supply-chain: when a large customer, for example, is willing to support small suppliers in the EMS implementation process, then all the smaller organisations involved in the supply chain can benefit greatly from networking. This approach proved to be effective in some Member States as Germany ("Konvoi" approach), Spain (co-operation in the tourism supply chain), Nordic Countries (Denmark and Sweden) but in particular in Italy by means of the so-called APO "Ambiti Produttivi Omogenei", it has shown a real effectiveness in promoting the environmental compliance of SMEs.

The Italian experience is particularly relevant also from the methodological point a view. An operational path was, in fact, outlined and experimented by several industrial clusters. It consists in several steps that lead the firms belonging to the same cluster and their local stakeholder in the implementation of an environmental management system at the cluster level, mirroring the main requirements set by the Regulation EC/761/2001 for individual organisations.

The **initial step** is the set up of an EMS Promotion Committee at cluster level. This Committee is composed both of public (e.g.: Province or Municipalities) and private (e.g.: trade associations, NGO, enterprises, firms managing public infrastructure as sewerage and purification system) actors and is in charge of defining the strategic guidelines for the cluster environmental policies and of implementing some "common resources", in order to guarantee a coordinated and integrated management of environmental issues within the Cluster.

The **second step** is the Initial Environmental Review referred to the Cluster. This review enables to identify the most relevant and critical environmental aspects for the cluster and the its specific production. The aim of the Environmental Review of the Cluster is to support

the involved organisations to identify and assess their own environmental aspects, according to EMAS Regulation and ISO 14001 standard.

As a **third step**, the Promotion Committee defines and shares a Cluster environmental Policy, becoming a reference for the EMS policies of all the SMEs involved in the cluster. The Environmental Policy of the cluster sets the guiding principles and general priorities based on the most significant environmental aspects and impacts, resulting from the previous review. From the Cluster Policy a collective and co-operative Environmental Programme and relating improvement objectives and targets are defined in each cluster, pursuing the principle of continuous improvement.

Once the Cluster Programme and the shared environmental objectives and targets have been adopted and recognised, by means of a sort of “Cluster Environmental Management System”, the Promotion Committee, on a voluntary basis, provides the local SMEs with many resources and procedures that can be shared and collectively exploited at the cluster level. For instance it provides organizations with continuously updated guidelines and indications on how to identify and have access to the applicable legal requirements related to their environmental aspects (e.g.: a legal requirement register was published, including a list of relevant sources, periodical updates on newly introduced laws and requirements, etc.) and to determine how these requirements apply to their environmental aspects.

The **last step** concerns external communication initiatives and tools. By means of these initiatives and tools, interested parties, stakeholders and general public are continuously informed on significant environmental aspects, policy, programmes, objectives and targets, activities and resources for environmental management in the cluster and how these change over time. The relevant information is provided by means of an environmental report concerning the whole area or cluster.

As we above-mentioned, the cluster approach developed in some Italian experiences could be an useful tool to overcome the difficulties of SMEs in the adoption of EMAS and ISO 14001 and, therefore, to enable SMEs to use these EMSs for improving their legal compliance. Partnership approaches among SMEs appear to be highly successful, combining the respective expertise of both public and independent organizations, but are rarely applied effectively owing to lack of initiative, coordination and incentives. EMAS registration has proven its effectiveness in improving the environmental compliance of the local SMEs, as ascertained by the European Commission (2007). In particular, the “cluster approach” has shown that some of the key-elements of EMAS can be further developed and strengthen in the territorial dimension, so to empower the local small and micro companies’ capabilities to effectively and efficiently manage environmental issues and, consequently, guaranteeing compliance. In the most recent years, many experiences concerning the so-called “cluster application” of EMSs have been carried out in Italy. Some of these initiatives originated by EU-funded projects (e.g.: “PIONEER” Life project, “ESEMPLA” Interreg III C project – subproject ECOSIND, PHAROS Life project, “SENOMI” Life project in Lombardy) and others have been financed by Regions (ISO 14001 for seaports in Liguria, EMAS for the chemical district in Lazio, EMAS cluster of tannery district in S. Croce sull’Arno). Local initiatives have been carried out, too. Many industrial clusters have been engaged in experiences concerning the implementation of a “cluster approach” to Environmental Management Systems and proved that these can be an effective way to promote, carry out, diffuse and strengthen legal compliance among SMEs. Some of them already achieved a sort of “cluster based” certification/registration promoted by the Italian government by means of the EMAS Competent Body (“EMAS APO” by the Italian EMAS Competent Body) others are still developing this path. Actually, the industrial clusters that obtained EMAS “cluster

registration” (EMAS APO) in Italy are: the Chemical cluster of Ravenna (Emilia Romagna Region); the Chair District of Livenza (Friuli Venezia Giulia Region); the Agropastolar cluster of Nuoro (Sardegna Region); the Tanning District of Vicenza (Veneto Region); the Ham production cluster of San Daniele (Friuli Venezia Giulia Region); the Dolomiti National Park - tourist cluster of Belluno (Trentino Alto Adige Region) and the Paper industrial cluster of Capannori (Tuscany Region). Many SMEs operating in these clusters achieved individual EMAS registration thanks to the support provided by the cluster common resources and support initiatives, described in the previous paragraph.

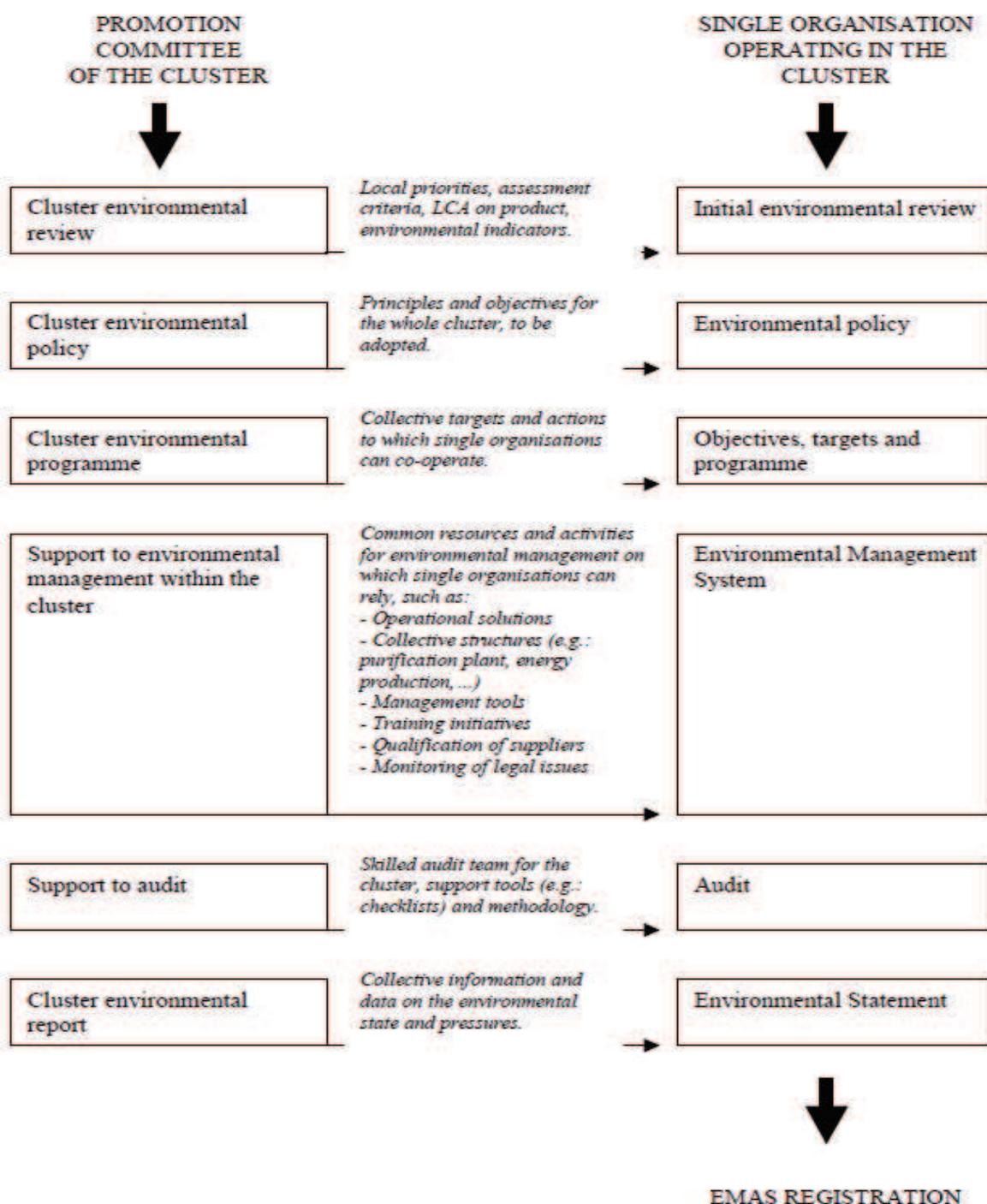


Fig. 5. Methodological steps of the cluster approach (Source Iraldo & Frey 2007)

Among these experiences, one of the most innovative has been the paper-producing territorial cluster of Capannori (Province of Lucca). This Cluster developed its cluster approach thanks to a Life-Environment project, the PIONEER project - "Paper Industry Operating in Network: an Experiment for EMAS Revision", completed in May 2006. The methodology of the PIONEER project encompassed the implementation of the different steps foreseen by the EMAS Regulation at the cluster level, so to create a common basis for tackling the local environmental problems and supporting all the individual organisations operating in the cluster that intended to use collective resources to achieve an individual EMAS Registration. The project produced interesting results in terms of a high participation in EMAS by a relevant number of organisations (22). Many tools have been developed during the project to facilitate the adherence to EMAS of the SMEs. An example is the "register of environmental legal requirements", applied to the companies located in the cluster. Each organisation can download the register for free and use it as a part of its own EMS. In this way the SMEs have a facilitated access to the management of environmental compliance. Furthermore, many training initiatives are carried out in the cluster to improve the capacity of the local organisations to effectively manage environmental issues and comply with the relevant legal requirements.

At the international level, an interesting initiative is the Swedish "Hackefors Model". The initiative was developed by a private company, Altea AB, which firstly applied it to the district it belonged: the Hackefors district. The target audience is a cluster of SMEs. Usually, participating companies belong to the same sector of industry or to the same company group. The model originated in the Hackefors industrial district in Sweden in 1997 and is a network approach to EMS implementation. All participating companies appoint an environmental manager; together these form the EMS group. From this group a steering committee is selected and a central co-ordinator appointed. The co-ordinator is responsible for the network and the common parts of the EMS, including common documentation. The co-ordinator acts as a hired and shared environmental manager of the group. A motivated and well-trained co-ordinator appears essential for the success of the approach. Each SME develops its own EMS, although a large part of the documentation is identical for all companies (the EMS manual). Centralised handling and steering of many of the EMS documents saves the SMEs much of the administrative work. The approach involves monthly meetings with "homework", training for environmental managers and employees as well as dedicated enterprise visits. This model has been reproduced in 40 different clusters in several other Swedish regions, and in 2004 the number of firms being certified to ISO 14001 as a result of this model were 600.

7. The new EMAS Regulation: opportunities and incentives for SMEs

By publishing the Regulation of the European Parliament and of the Council 1221/2009/CE in the Official Journal on 22nd December 2009, the Community institutions have complied, in extremis, to the public commitment taken on many occasions to complete the second review of EMAS by the year 2009. The new Regulation expressly repeals the earlier 761/2001/EC (EMAS II), but also the Commission Decision 2001/681/EC, which contains guidelines for its implementation; the Decision 2006/193/EC laying down rules on the use of the logo, as well as two accompanying Recommendations (2001/680/EC and 2003/532/EC) thus summarizing the official text of all the requirements for its implementation.

The Regulation, called EMAS III, entered into force on 11th January 2010, becoming immediately binding in its entirety and directly applicable in the Member States. A transitional period is envisaged, according to which the organizations that have registered based on the 2001 Regulations will continue to figure in the EMAS register. Therefore, since the next check expected the verifiers should assess if the organizations registered comply with the new requirements. If the verification of a registered organization is expected before 11 July 2010, the date may be extended for six months, by agreement between the environmental verifier and the competent bodies.

However, a so strict system determines the demand for registered organizations to know and apply in the shortest time possible the innovations provided by EMAS III. For a correct interpretation of the innovations introduced by the new Regulation, it should first be understood that it meets targets for significant expansion of the numbers of EMAS, on the one hand, and to strengthen the credibility and the guarantees offered by the registration, on the other.

According to the preliminary studies (first of all the "EVER Study - Evaluation of the EMAS and Ecolabel for their Revision), it emerged the failure to achieve the potential of the scheme especially in terms of its circulation, with reference in particular to difficulties of adherence by the organizations of small and very small size, and to the lack of advantages and benefits arising from the application of EMAS.

7.1 Simplification for small organizations

As anticipated, one of the main objectives of the review process has dealt with the enlargement of the number of the adhering organizations. To achieve this, the changes introduced were designed primarily to break down the barriers to registration for the organizations of small dimensions which, notably, represent a majority target than larger enterprises (SMEs account for 99% of European companies and generate 57% of value added products).

A major change concerns the duration of certificates and the frequency of audits for SMEs. Article 7 provides that a small organization may require the competent body to extend the maximum period of three years of registering up to four years, and the annual frequency of surveillance for up to two years provided that the verifier confirms that they have complied with the following conditions:

- There are no significant environmental risks;
- The organization does not plan significant changes (see previous note);
- The organization does not contribute to significant environmental problems at local level.

Small organizations could thus reduce the regular audit by the accredited verifier from 4 (3 "monitoring annual" checks and 1 renewal) to 2 (1 'annual monitoring' verification and 1 for renewal), with consequent and significant cost savings.

We wish to underline, nonetheless, that small organizations receiving the extension must prepare and submit annually their updated environmental declaration, although not validated, to the competent body.

The new Regulation also proposes specific recommendations to monitoring small organizations, providing, under art. 26, that the verifier should accept exemptions and exceptions to the conventional structure of an environmental management system based on written procedures and formalized organizational procedures, enhancing rather typical

aspects of the realities of smaller businesses, such as: direct communication and informal multifunctional staff (who covers more functions, environmental and otherwise), training provided through coaching in the workplace and, above all, limited documentation. Other simplifications for SMEs are encompassed as support and incentives, as treated below.

7.2 Environmental management system requirements

The new Regulation aims EMAS registration as a culmination of a journey towards excellence in the field of environmental management, against which other forms of certification may represent intermediate steps. There are many innovations that realize this vision.

First, the EMAS III continues to be based on the environmental management system introduced by ISO 14001, but complements specifically a distinctive set of requirements, starting by strengthening the mechanism to ensure compliance with environmental legislation.

The attention towards this aspect emerges promptly in many aspects of the new Regulation. Article 2, for example, defines for the first time compliance with regulatory obligations, such as full implementation of the obligations applicable to the organization being certified, including the requirements contained in permits. Furthermore, it clarified that the initial environmental review (no longer occasional, but explicitly referenced in the text as a compulsory part of the EMAS registration) has to provide not only a comprehensive framework of obligations under applicable law, but also describe how the 'organization works to ensure compliance. The Regulation states that organizations submit material or documents certifying compliance with all applicable legal requirements in environmental matters.

The focus on regulatory compliance is also apparent from the requirements of the duties of the Internal Auditor, among which it is particularly emphasized the need to assess the management system for compliance, and also compared to the policy and the organization's environmental program in relation to the applicable legal requirements. It then explicitly states that the internal audit must be designed to also respect the laws.

The continuous emphasis on ensuring regulatory compliance of the EMAS applicant organizations has led the author of the new Regulation to include all over again the "legal requirements and limits of the authorization" even in the non-exhaustive list of environmental aspects to be considered in the EMAS process. See Annex I, Section 2 (in addition to the use of additives and processing aids, as well as semi-finished). It is clear that such integration is dictated by the Commission's desire to emphasize the importance of compliance itself, rather than the idea that this really represents an environmental aspect, an aim which is methodologically misleading with respect to the same definition of the feature ("Element of the activities, products or services of an organization that has, or may have an impact on the environment"). The presence of regulatory burdens, however, can and should reasonably be used as a criterion to assess the significance of a particular aspect (such as, moreover, indicated in Annex I, Section 2), and to understand how to handle it (think of the requirements contained in permits to emissions into the atmosphere or to the regulatory provisions relating to waste).

To counterbalance the considerable effort required to organizations in terms of concrete security and sustaining regulatory compliance, art. 32 of the new Regulation introduces the request to Member States to offer assistance in fulfilling their regulatory obligations, in terms of ease of access to information related to these obligations, and activation of

communication channels (e.g. to obtain clarification) among the organizations interested in EMAS, and the authorities responsible for such obligations. This role can be played directly by the competent organizations or other entities of support appropriately identified by Member States.

In this respect, there is an immediate connection with the Program of Assistance to regulatory compliance for SMEs (ECAP) of the European Commission, that as a curious sleight of hand, indicates precisely in the EMAS one of the most effective tools to support small organizations in keeping up to date on (and fulfilling) legal requirements.

With regard to new management system, there should also be noted that the new Regulation combines in a single annex (Annex II) system requirements derived from ISO 14001 and the additional information which the organizations implementing EMAS should take into account (previously included in an annex), thus improving the effective integration and, at the same time, highlighting the distinctive characteristics of the EMAS process.

In addition to the role played by the initial environmental analysis, and to importance for regulatory compliance, for continuous improvement and widespread communication and transparency (as hereinafter specified), Annex II gives special attention to training and to the involvement of the organization's personnel, whose active participation continues to be a prerequisite and a vital resource, both to the functioning of the system and to improving environmental performance.

By this logic, as well as extend the provisions contained in the former Annex IB, Section 4, the new text makes it, in fact, mandatory part of the guidelines related to participation of employees as part of EMAS, as already suggested by the Recommendation 2001/680/CE .

The innovations quoted above are accompanied by brief clarifications on the environmental management system, that is in its practical implementation by many verifiers throughout the EU were well established by experience (which probably inspired changes to the Rules). Just think of the need in view of the first registration, to plan and launch, but not to complete, an audit program (at least about the most significant environmental impacts), and to make at least a review of the leading role.

7.3 Reference documents

An important innovation in introducing EMAS III regards the reference documents, being documents that describe best practices for environmental management that is, the most effective means by which an organization may apply a management system able to produce the "best environmental performance in specific economic and technical conditions", besides those indicators that best measure these benefits in a given sector. The Commission will develop these reference documents, with the primary objective to promote the homogeneous implementation of best management practices.

The use of reference documents is not compulsory but, if available, organizations should at least take into account what they reported, both in the deployment of their management system, and in preparing the environmental declaration. Besides, the verifiers are also required to use them as a benchmark to evaluate the effectiveness of a system, especially for the evaluation of the organization's environmental performance. These facts show that organizations may well justify a failure to properly align to what has been reported in the reference documents applicable to their business sector.

Originally, in the intention expressed by the European Commission in the "Explanatory Memorandum" (the strategic lines of the revised EMAS), the reference documents should be

also "intersectorial" and refer to the methodological and operational aspects of the scheme under further consideration. This would fill some obvious gaps of the new Regulation, and to provide guidance that, although expected by many, it is in fact ignored.

Consider the issue of "indirect" environmental elements, very complex for some sectors, which EMAS III offers only a confirmation about approaches already established in the practice implementation of many Member Countries. On the one hand, the regulation confirms the interpretation that the indirect aspect is what "comes from the interaction of an organization with third parties", and that it can be "influenced by them, to a reasonable extent". However, it also demands that the same organization assesses the significance of this aspect, by considering how much influence it can exercise on them.

On the other hand, it simply states that for those organizations that are not part of the industrial sector, as local governments or financial institutions, it is essential that they consider the indirect aspects related to their main activity and, that in this case, an environmental analysis and management procedures limited to its structures, are absolutely insufficient.

Another aspect on which much is expected, especially after the enactment of Guide Lines in 2005, regards the integration of the EMAS management system with the size of products and of services belonging to an organization. On this issue, innovations compared to EMAS II are almost untraceable: we find evidence about the size of the product among the skills that auditors should have, while it is reported verbatim the "life cycle" between the indirect aspects of Annex I and, finally, in the group of elements to consider when evaluating the significance of environmental aspects we have the following: design, development, manufacturing, distribution, maintenance, use, reuse, recycling and disposal of products of the organization.

7.4 Tools and incentive mechanisms

Innovations that relate more directly to implementing the requirements of EMAS by the organizations concerned, have been accompanied also by a set of important changes introduced by the new Regulation concerning the role and responsibilities of others actors involved in the scheme: the competent bodies, the States, verifiers, etc.. From an in-depth reading about the innovations planned for these subjects, it emerges that some actions (under their responsibility) that could have very positive implications on individual organizations. It is essentially a set of measures of support, encouragement and promotion of EMAS, aimed at increasing membership to the scheme to facilitate and make more obvious and tangible benefits associated with certification. See Table 3 for a more detailed examination of these measures, in the following paragraph we simply highlight some of the main keys issues.

First, the review clearly shows its intention to "empower" the Member States concerning the initiatives to support EMAS: from the request to introduce incentives for certified organizations, such as access to funding or tax relief (although it is advice able to link it to the ability to demonstrate a real improvement in environmental performance by the beneficiaries); to the obligation to develop and implement ways to simplify legislation for certified organizations, to the full enhancement of EMAS in terms of legal rules, control and management of tendered contracts and public procurement.

Second, a series of innovations designed to encourage and facilitate the completion of the course EMAS, relying on other forms of interim certification or feeding it through cooperation and networking.

On the one hand, the Regulation requires Member States to propose a staged approach to organizations, and initiates an interesting procedure for the recognition by the European

Commission (on proposals of the Member States themselves), of "other" systems of environmental management in conformity, in whole or in part, to the requirements of EMAS. If the European Commission will recognize the equivalence between "another" system of management (national or regional) and the new Regulation, the organizations that already adhere to (and that are certified in accordance with) it, should not refer to the relevant requirements of further verification, because they will be automatically considered compliant in the first EMAS registration.

On the other hand, the new Regulation proposes the approach, also known as "Cluster EMAS", which was developed mainly in Italy, thanks to considerable supportive work by the Committee Ecoaudit-label, of Apat (today Ispra) and by the Network Descartes/CARTESIO (promoted by the Regions Emilia Romagna, Lazio, Lombardy, Liguria, Sardinia and Tuscany). Once more, however, there are positive and negative aspects of it: although there is a recognition of the effectiveness of the cluster approach (which in the Italian version is translated as the more restrictive term of "districts"), and the request to Member States to encourage its development, it should be noted that it is not expected to be a real cluster registration (as it envisaged the Explanatory Memorandum), thus in the text are missing those useful, albeit meager, operating instructions introduced in the Decision 681 / 2001/EC that has been repealed.

As already noted, this type of methodological shortcomings may eventually be filled by specific reference documents.

8. Conclusions

In the authors' intention this paper represents the attempt to identify solutions, tools and incentives for SMEs to overcome constraints and difficulties they experience by implementing an EMS. Removing potential barriers and reinforcing economic incentives should be main targets in order to allow for a wide diffusion of EMS among SMEs.

Some methods and possible instruments have been dealt with in this paper: working by group seemed to be a good way to diffuse information and to share implementation costs; technical, organisational and managerial support given by local actors (local governments, trade associations...) is to be considered very useful to effectively help smaller enterprises; training courses for managers and technicians were very precious in deepening the environmental awareness within companies; the publication of handbooks, guidelines and manuals, seemed to be generally appreciated by firms.

The further development of environmental management schemes (like EMAS or ISO 14001) is going to play a crucial role in stimulating and favouring the implementation of EMS by small enterprises. To this purpose, it was useful that the new EMAS Regulation has include measures aiming at facilitating and simplifying adhesion by SMEs, taking into account their specificities and needs described above.

The increased adoption of EMS between SMEs highlights as the achievable benefits are overcoming the initial obstacles that make this tools hard for organizations with small dimensions. The awareness of own environmental impact and the compliance with environmental regulation represent the main results achieved by means of an EMS.

On the contrary, the analysis emphasizes that there are some factors that make a SME fitter than others to adopt an EMS: for instance the level of internationalization, the position on the supply chain, working in industrial sector with significant environmental impacts and so on.

Which further initiatives could be should be requested to policy maker for fostering and facilitating the diffusion of EMS among SMEs?

According with the findings emerged in the literature the most successful activities would certainly be:

- technical support to SME personnel
- financial support and/or economic incentives for SMEs
- simplification of EMAS (and ISO 14001) requirements and/or guidelines targeted to SMEs
- training initiatives for SME internal personnel
- possibility for a whole homogeneous industrial area (e.g.: an industrial district), and not just for a single enterprise, to obtain an environmental certification

Another interesting tools refers measures for favouring networking and co-operation and methods and tools for measuring, evaluating and comparing environmental performance.

The last suggestion deserves a final comment. Many SMEs showed the opportunity of identifying common environmental performance indicators (EPIs), so that firms can use them to select and measure their most significant environmental effects. In fact, many firms are familiar with legal compliance as the only environmental performance indicator. Moreover, the development of indicators for measuring the environmental, organizational and managerial performance of the environmental management systems could help verifiers in evaluating enterprise capacity to achieve continuous improvement of their environmental performance. This could give an answer to the general concern regarding the potential diversification of criteria used by verifiers and certifiers in analysing environmental management systems. The development of EPIs could also support the definition of best available technologies for each industrial sector: this is an important goal in the perspective of the implementation of the IPPC directive.

9. Reference

- Ammenberg J., Börjesson B., Hjelm O., (1999). Joint EMS and Group Certification . A cost-effective route for SMEs to achieve ISO 14001., *Greener Management International* 28, Winter 1999, p. 23-31.
- Anton, W., Deltas, G., Khanna, M. (2004): "Incentives for environmental self-regulation and implications for environmental performance". *Journal of Environmental Economics and Management* 48. pp. 632-654.
- Aragon J.C., (1998). Strategic proactivity and firm approach to the natural environment. *Academy of Management Journal*. 41, pp. 556-567
- Bansal, P., Roth, K. (2000). Why companies go green: A model of ecological responsiveness, *Academy of Management Journal*, 43. pp. 717-736
- Bansal, P., Hunter, T. (2003). Strategic explanations for the early adoption of ISO 14001, *Journal of Business Ethics* 46. pp. 289-299
- Berman, E. and Bui L.T.M. (2001), Environmental regulation and productivity: evidence from oil refineries. *The Review of Economics and Statistics* 83, pp. 498-510
- Biondi, V., Frey M. and Iraldo F., (2000). Environmental Management Systems and SMEs, *Greener Management International*, Spring, pp. 55-79.
- Bonifant B.C.; Arnold M.B.; Long F.J. (1995) Gaining competitive advantage through environmental investments. *Business Horizons* 38, pp. 37-47

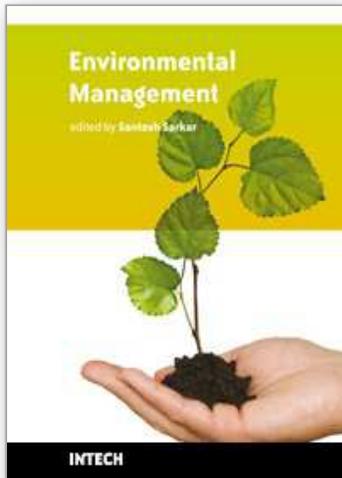
- Bonora C., Sondermeijer I. (2001). Il sistema di gestione ambientale: la formazione lungo tutto l'arco della vita lavorativa per una gestione qualitativamente coerente del sistema ambiente nella piccola e media impresa. Istituto per il Lavoro, Bologna
- Brouhle K. (2000). Information sharing devices in environmental policy: the EU Ecolabel and EMAS. Working paper series 721 European Union Center, University of Illinois.
- Carnimeo G, Frey M, Iraldo F. (2002) Integrated product policy at the company level: how to create synergy between the product dimension and the environmental management system (published only in Italian). Milano: FrancoAngeli, 2002.
- Cesqa & Sincert (2002), Indagine sulla certificazione ambientale secondo la norma UNI EN ISO 14001; risultati indagine Triveneto.
- Clausen, J., Keil, M., Jungwirth, M. (2002). The State of EMAS in the EU: Eco-Management as a Tool for Sustainable Development - Final Report for European Commission, European Community; Brussels.
- Daddi T, Testa F, Iraldo F. (2010). A cluster-based approach as an effective way to implement the ECAP (Environmental Compliance Action Program): evidence from some good practices, *Local Environment* 15(1), pp. 73-82
- Darnall N, Henriques I, Sadorsky P. (2008). Do Environmental Management Systems Improve Business Performance in an International Setting?, *Journal of International Management* 14, pp. 364-376
- Delmas, M. (2002) The diffusion of environmental management standards in Europe and in the USA: an institutional perspective, *Policy Sciences* 35 (1), pp. 91-119
- DG Enterprise (2004). Public Policy Initiatives to promote the Uptake of Environmental Management Systems in Small and Medium-Sized Enterprises. Final report of the Best Project Expert Group. Brussels
- Dufour, C., Lanoie P. and Patry M. (1998). Regulation and Productivity, *Journal of Productivity Analysis* 9, pp. 233-247.
- European Commission (2003). Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises C(2003) 1422.
- European Commission (2005). Staff Working Document, The activities of the European Union for small and medium-sized enterprises (SMEs), SME Envoy Report, COM(2005) 30 final.
- European Commission (2007). Communication from the Commission to the Council, the European Parliament, the European economic and social Committee and the Committee of Regions "Small clean and competitive - A programme to help small and medium-sized enterprises comply with environmental legislation, COM (2007)379 final
- European Commission (2009). Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC
- Fairman, R., Yapp, C., (2005). Making an impact on SME compliance behaviour: An evaluation of the effect of interventions upon compliance with health and safety legislation in SMEs, Kings College London for the Health and Safety Executive, Research Report

- Feldman I. (1997). *The Future of Eco-Management*. American Society for Quality Control: Milwaukee.
- Freimann, J. and Walther M. (2001). The impacts of corporate environmental management systems: a comparison of EMAS and ISO 14001, *Greener Management International* 36, pp.91-103
- Fryxell G.E and Szeto A (2002), The influence of motivations for seeking ISO 14001 certification: an empirical study of ISO 14001 certified facilities in Hong Kong, *Journal of Environmental Management* 65 , pp. 223-238
- Gavrinski, I., Ferrer, G., Paiva, E.L. (2008). ISO 14001 certification in Brazil: motivations and benefits, *Journal of Cleaner Production* 16, pp. 87-94
- Goodchild E (1998). The business benefits of EMS approaches. Salford: Salford University,.
- Gorla N., Iraldo F. (1998). La comunicazione ambientale d'impresa: uno studio sulle dichiarazioni EMAS. *Economia delle fonti di energia e dell'ambiente* 3, pp. 49-83
- Grafé A. (1996), Study on Emas environmental statements, Final Report to European Commission DG XI, Bruxelles.
- Hamschmidt J., Dyllick T., 2001. "ISO 14001: profitable? Yes! But is it eco-effective?", *Greener Management International*, 34, pp. 43-54
- Hart, S.L., Ahuja, G. (1996). Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance, *Business Strategy & the Environment* 5, pp. 30-37
- Hillary R. (2004). Environmental management systems and the smaller enterprise, *Journal of Cleaner Production* 12, pp. 763-777
- Hillary, R. (1999)., Evaluation of study reports on the barriers, opportunities and drivers for small and medium sized enterprises – the adoption of environmental management systems Report for DTI Envirodoctorate 5th October, 1999, NEMA, London
- IEFE Bocconi, Adelphi Consult, IOEW, SPRU, Valor & Tinge, (2006). EVER: Evaluation of eco-label and EMAS for their Revision – Research findings, Final report to the European Commission – Part I-II, DG Environment European Community; Brussels. available from www.europa.eu.int/comm/environment/emas.
- Imperial College of London, IEFE Bocconi, ISO14001 Solutions (1998), An Assessment of the Implementation Status of Council Regulation (No 1836/93) Eco-management and Audit Scheme in the Member States (AIMS-EMAS), Final Report Project No. 97/630/3040/DEB/E1, European Commission Dg Environment, Brussels
- Iraldo F, Frey M. (2007). A cluster-based approach for the application of EMAS *Working Paper M&I 03* (2007), MAIN Laboratory Sant'Anna School of Advanced Study
- Iraldo F, Testa F and Frey M. (2009) Is an environmental management system able to influence environmental and competitive performance? The case of the eco-management and audit scheme (EMAS) in the European union, *Journal of Cleaner Production* 17 , pp. 1444-1452
- ISO, (2005) ISO, The Global Use of Environmental Management System by Small and Medium Enterprises: Executive Report by ISO/TC207/SC1/Strategic SME Group, ISO, Geneva.
- Jaffe AB, Palmer K. (1997). Environmental Regulation And Innovation: A Panel Data Study, *The Review of Economics and Statistics* 79 MIT Press, pp 610-619.

- Jenkins R. (1998), Environmental Regulation and International Competitiveness: A Review of Literature and Some European Evidence, United Nations University Institute for New Technologies.
- Jones K., Alabaster T., Hetherington K. (1999), "Internet-based environmental reporting: current trends", *Greener Management International*, n. 26, pp. 69-90
- Khanna, M., Anton, W.R.Q. (2002). Corporate environmental management: regulatory and market-based incentives. *Land Economics* 78. pp. 539-558
- King, A., Lenox, M., Terlaak, A. (2005). The strategic use of decentralized institutions: Exploring certification with the ISO 14001 management standard, *Academy of Management Journal*, 48: pp. 1091-1106.
- Kvistgaard, M; Egelyng, H.; Frederiksen, B.S.; Johannesen, T. L. (2001): Miljøstyring og Miljørevision i danske virksomheder. København.
- Labonne J. (2006). A Comparative Analysis of the Environmental Management, Performance and Innovation of SMEs and Larger Firms. Final Report for the European Commission, Directorate-General Environment. Available from http://ec.europa.eu/environment/sme/pdf/final_report_sme_en.pdf
- MacLean R. (2004). Getting the most from your EMS, Manager's Notebook, Environment Protection March. Available from <http://eponline.com/Articles/2004/03/01/Environmental-Management-Systems-Part-2.aspx?Page=1>
- Madsen H., Ulhoi J. P., (1999). Industry and the environment: a Danish perspective. *Industry and the Environment*, 22, pp. 33-37.
- Malmborg, A. 2006. ISO 14001 in Uruguay - Problems and Opportunities: 3 - 46, Final Thesis, Master Programme in Business Administration, Swedish University of Agricultural Science, available from <http://ex-epsilon.slu.se:8080/archive/00000582/01/examensarbete.pdf>
- Marshall, C.(1998). Report for HM Treasury Economic Instruments and the Business Use of Energy, The Stationary Office, London.
- Milieu Ltd and Risk and Policy Analysis Ltd, (2009). Study on the Costs and Benefits of EMAS to Registered Organisations. Final Report for DG Environment of the European Commission under Study Contract No. 07.0307/2008/517800/ETU/G.2.
- Netregs (2002) How Green are Small Businesses? Netregs benchmarking Survey of Environmental Awareness
- Patton D., Baron P.J., (1995). Factors influencing companies response to environmental responsibility. *Eco-management and auditing*, 2, pp. 41-46
- Perkins, R. and Neumayer, E. (2004). Europeanisation and the uneven convergence of environmental policy: explaining the geography of EMAS. *Environment and Planning* (22), pp. 881-897
- Petrick, J. A., Scherer R. F, Brodzinski J.D., Quinn J. F. and Ainina M. F. (1999). Global Leadership Skills and Reputational Capital: Intangible Resources for Sustainable Competitive Advantage," *Academy of Management Executive*, 13, pp. 58-69.
- Polish Environmental Partnership Foundation, Multimedia Communications, Regional Business Initiative of the British-Polish Chamber of Commerce, (2007). LIFE project "Integrated environment management for polish small and medium enterprises through environment manager internet tool", Final Report. available from: www.czystybiznes.pl

- Reinaud J. (2005) Industrial Competitiveness under the European Union Emission Trading Scheme, International Energy Agency, Information Paper (February)
- Rennings K, Ziegler A, Ankele K, Hoffmann E. (2006). The influence of different characteristics of the EU environmental management and auditing scheme on technical environmental innovations and economic performance, *Ecological Economics* 57 pp. 45- 59
- Schucht S, (2000). The implementation of the Environmental Management and Eco-Audit Scheme (EMAS) 'Regulation in France', RP 2000-B-2, Centre d'Economie Industrielle, Ecole Nationale Supérieure des Mines, Paris
- Testa, F., Iraldo, F. (2010) Shadows and lights of GSCM (Green Supply Chain Management): determinants and effects of these practices based on a multi-national study, *Journal of Cleaner Production*, doi:10.1016/j.jclepro.2010.03.005
- Van Der Veldt, D. (1997). Case studies of ISO14001: a new business guide for global environmental protection. *Environmental Quality Management*, 7, pp. 1-19
- Watson, S. A. (1996). The business implications of implementing ISO 14001. *Environmental Quality Management*, 6, 51-62
- Zackrisson, M., Enroth M. Widing A. (2000) Environmental management systems - paper tiger or powerful tool. Assessment of the environmental and economic effectiveness of ISO 14001 and EMAS. Industrial Research Institutes in Sweden IVF Research Publication 00828, Stockholm

IntechOpen



Environmental Management

Edited by Santosh Sarkar

ISBN 978-953-307-133-6

Hard cover, 258 pages

Publisher Sciyo

Published online 12, August, 2010

Published in print edition August, 2010

There has been a steady increase in anthropogenic pressure over the past few years due to rapid industrialization, urbanization and population growth, causing frequent environmental hazards. Threats of global environmental change, such as climate change and sea level rise, will exacerbate such problems. Therefore, appropriate policies and measures are needed for management to address both local and global trends. The book 'Environmental Management' provides a comprehensive and authoritative account of sustainable environmental management of diverse ecotypes, from tropical to temperate. A variety of regional environmental issues with the respective remedial measures has been precisely illustrated. The book provides an excellent text which offers a versatile and in-depth account of management of wide perspectives, e.g. waste management, lake, coastal and water management, high mountain ecosystem as well as viticulture management. We hope that this publication will be a reference document to serve the needs of researchers of various disciplines, policy makers, planners and administrators as well as stakeholders to formulate strategies for sustainable management of emerging environmental issues.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Fabio Iraldo, Francesco Testa and Marco Frey (2010). Environmental Management System and SMEs: EU Experience, Barriers and Perspectives, Environmental Management, Santosh Sarkar (Ed.), ISBN: 978-953-307-133-6, InTech, Available from: <http://www.intechopen.com/books/environmental-management/environmental-management-system-and-smes-eu-experience-barriers-and-perspectives>

INTECH
open science | open minds

InTech Europe

University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
Fax: +385 (51) 686 166
www.intechopen.com

InTech China

Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821

© 2010 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike-3.0 License](#), which permits use, distribution and reproduction for non-commercial purposes, provided the original is properly cited and derivative works building on this content are distributed under the same license.

IntechOpen

IntechOpen