Environmental management system implementation by SMEs: EU experience and perspectives

Vittorio Biondi, Marco Frey and Fabio Iraldo

IEFE - Institute for Energy and Environmental Economics, Environment Division
Università Commerciale L.Bocconi
viale Filippetti 9, I-20122 Milan
Tel. +39.2.5836.3820 - Fax +39.2.5836.3890
vittorio.biondi@uni-bocconi.it, marco.frey@uni-bocconi.it, fabio.iraldo@uni-bocconi.it

1. Environmental management systems and SMEs: moving the first steps

An ever-increasing number of Small and Medium Enterprises (SMEs) are gaining interest in environmental management systems (EMS). Today, eco-management standards are beginning to spread through the unbounded universe of medium, small and very small enterprises, which represent more than 80% of the total number of enterprises operating in Europe and are the true backbone of its industrial system. 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? This paper 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

---

1 This paper is the result of many research activities carried out by IEFE-Bocconi in the last years in the field of environmental management. Most of the data, information and suggestions contained in this paper refer to our experience as Co-ordinator of the European Commission DGXI pilot projects on EMAS, as well as to our direct experience in supporting SMEs for EMS implementation within three pilot projects conducted by our research group and promoted respectively by EC DGXI and EC DGXXIII. We would like to thank every EC representative whom we usefully co-operated with during these experiences. A first version of this paper was presented at the UNCTAD Expert Meeting on Trade and Investment Impacts of Environmental Management Standards, held in Geneva, Palais de Nations, October 29th - 31st 1997.
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 first part of this paper will depict the environmental management standard “state of the art”, paying particular attention to their diffusion among smaller enterprises: are there specific conditions or factors that may favour or hinder the adoption of these standards? In order to shed a light on this first question, a break-down analysis of the current data regarding companies adhesion to these standards is performed. According to this analysis, presumed crucial factors (as industrial sector and country of operation) turn out to be less effective than the size of the enterprise, in terms of personnel and resource availability. The outcome is a confirmation of the relevance of potential barriers for SMEs.

The paper “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. Our analysis relies on the available information and data regarding the pilot experiences under way throughout Europe on the diffusion of EMAS among small-and medium-sized enterprises. IEFE-Bocconi, in its role of co-ordinator of European Commission DGXI pilot projects on EMAS, had the opportunity to examine the experiences of many SMEs in carrying out on-site activities for an EMS implementation and to collect data and information relating to more than 500 SMEs involved. Suggestions (and connected “case-histories”) proposed in the following paragraphs are based on SME direct experience in implementing an environmental management system, regardless of the standard which the SME refers to. This paper actually aims neither at emphasising differences and/or incoherence between EMAS and ISO 14001, nor at seeking a common framework for the future application of the two schemes. Although we cannot ignore these differences (and reckon them when they concern SME specificities), we are mainly interested both in analysing SME attitude and approach towards the environmental management standards as a whole, and in pointing out constraints and opportunities linked to their application at a general level. Moreover, as we will see, experience has taught us that differences tend to fade the smaller is the firm involved.

A brief outline of the current situation of the two schemes is nonetheless necessary to acknowledge their diffusion among SMEs and to understand the relevance of “size” (dimension and resource availability) as a factor that can favour or hinder adoption.

2. State of the art in the adoption of EMS (searching for favouring factors)

In the first half of the year 1998 both EMAS and ISO 14001 have developed faster then ever.

Since EMAS was first applied, the situation throughout the European Union has been radically changing. EMAS became fully operational in April 1995, when the register opened, but until November 1995 only 17 sites entered the scheme. Since then registrations started to increase: at press time 1.787 sites have been registered in the scheme (see fig. 1).
Certifications according to ISO 14001 are rapidly growing too and will soon reach 5,000 units.

These numbers prove the undeniable success of environmental management standards among enterprises. As we said, a comparison between EMAS and ISO diffusion is out of the scope of this paper\(^2\). What we would like to propose instead is an analysis of the factors favouring the implementation of an EMS responding to the requirements of an external “official reference” (be it EMAS or ISO 14001), in order to comprehend what is the role and importance played by SMEs and how to improve conditions for their participation. From this standpoint, a distinction between EMAS and ISO would be useless to our purpose because, at the operational and practical level, enterprises face similar constraints and can benefit from almost the same improvement opportunities. Moreover, empirical evidence show that many enterprises are applying for both the schemes (this is happening with an estimated 50% of the multinational juggernauts involved) and/or are prone to use them as “cross-references” even if pursuing only one. Information collected by means of a questionnaire to DGXI project promoters confirms that 90% of the SMEs involved in the pilot actions on EMAS used BS7750 (at an earlier stage) or ISO 14001 (since this standard was published) as an additional support to the EMS implementation on site\(^3\).

Rather than investigating on the implications for the SMEs of each scheme, we should ask ourselves if there are factors or conditions that can (by spurring the adoption of a third party certification) facilitate the diffusion of environmental management systems as tools to improve smaller enterprise environmental performances.

\(^2\) A significant contribution in clarifying the relationship between EMAS and ISO 14001 is expected to come along with the revision of the Regulation nr. 1836/93, which should be completed within 1998.

\(^3\) Since its recognition by Art.19 Committee, ISO 14001 has proved in-field to be a useful instrument in structuring an EMS according to EMAS requirements, especially for those part in which EMAS is not so detailed as to EMS specific characteristics. We strongly believe that an harmonisation between the two schemes will be necessary in the near future, in order to shun the risk of generating confusion and fear of excessive “normalisation” among SMEs.
Most analysts have searched for these factors focusing on the characteristics of the enterprises that have obtained certification according to ISO 14001 or registration under EMAS. One of the presumably most effective factor influencing the adoption of a standard is the country in which an enterprise operates. Data relating to sites participating in these schemes in the different EU Member Countries are usually shown to demonstrate the incidence of this factor on the enterprise attitude towards environmental management standards. Analysts are used to emphasise the considerable diffusion and success of BS7750 (and now increasingly of ISO 14001) in the UK and/or of EMAS in Germany in order to underline the relevance of country-related factors in stimulating the adoption of these schemes.

Let us consider, for example, the extraordinary success of EMAS in Germany. It is clear to the accidental reader that a lot of enterprises operating in that country have found participation in the EU scheme attractive and practicable. In February 1998, German sites represent 70% of all the sites registered under EMAS. What are the reasons, and eventually the favouring conditions, for this success?

It is undoubtedly true that German enterprises are traditionally in advanced posts on the environmental management frontier. Moreover, they have shown a growing interest in EMAS as the scheme was taking off. The German industry “environmental awareness” partially explains this situation, but it does not seem to be the only key-variable. In fact, all European enterprises seem to be interested in environmental management: for example, the pilot projects throughout the EU are involving (also thanks to the support they offer) hundreds of SMEs, regardless to the country in which they operate.

A deeper analysis of the EMAS development in Germany could explain if enterprises have been stimulated and facilitated to participate in the scheme also by factors other than national industry “proactive” environmental attitude. The federal institutional framework, for example, could have shortened the distance between institutions and industry, making the scheme closer to enterprises, participation procedures more accessible and information more available and focused on local characteristics. Local trade associations as well as Chambers of Commerce have certainly played a key role by directly supporting enterprises in EMAS implementation. The tight environmental legislation has traditionally forced enterprises to get used to a continuous compliance, so that now they are not afraid to open the site to an external verification or to disclose information regarding the site environmental performance to the public. The high level of environmental culture and awareness throughout Germany means that stakeholders and consumers are willing to encourage environment-friendly enterprises, attributing them a competitive advantage.

Analysts who emphasise German excellence should also note that data indicating the number of sites participating in EMAS per millions inhabitants of each Member Country show a marked gap between two bunches of countries: one including Germany and other Nordic Countries, another including the remnants (see fig. 2). If we consider the widespread diffusion of ISO 14001 in some other EU Countries (Great Britain, for example), the gap assumes a shape closer to that of a Southern European lag in the adoption of environmental management standards.
As to EMAS, for instance, differences between EU member countries regarding “institutional” development (Competent Bodies have not been created at the same time), industry environmental culture, technological level, social environmental awareness and consumer ecological sensitivity are, with no doubt, factors that heavily affect the enterprise choice to participate in the scheme. These factors have also relevant effects on the difficulties that the enterprise is going to face to achieve its environmental goals.

It is no surprise, then, if enterprises in some countries are more prone to participate in EMAS than in others. But this could happen (and is happening) also in different regions of the same country. The role and importance of a “territorial” support (from local governments, regional trade associations,...) has been briefly emphasised and will be analysed in depth in the following paragraphs: as the pilot project experience shows, this is a factor that strongly favours the implementation of an EMS. Because of a relevant and factual support at the local level, enterprises operating in a region could be more prone to adopt a standard, compared with other regions of the same country. This is particularly true for SMEs which, as we will see, have to rely on external support to fill the gap in terms of human, technical and financial resources.

The “context”, rather than the country, therefore seems to be a key-factor: meaning by that the institutional, industrial, social and competitive conditions in which a firm operates. But the context is more relevant the smaller is the enterprise. If, on the one hand, a multinational corporation often has a developed environmental culture, owns resources, receives stimuli from different national markets and stakeholders, on the other hand an SME approach to environmental management strongly depends on the specific and limited context with which it interacts. A significant example comes from Italy: the first SMEs to obtain an ISO 14001

![Fig. 2 Registered sites per million inhabitants](image-url)
certificate were strongly export-oriented firms, willing to spend this result on foreign markets (their “competitive context”).

To a certain extent, the context (country, region, but even market and social relations) is a quite relevant factor for large companies, but absolutely crucial for SMEs.

The industrial sector in which an enterprise operates is often considered as another important factor in prompting and favouring participation in environmental management schemes. Let us analyse the industrial sector break-down of the sites registered under EMAS.

Registered sites belong to enterprises which operate in many different sectors. Taking a close look at the register, it becomes clear that participation in EMAS is to some extent related to the environmental “sensitivity” of the industrial sector. The same can be said for enterprises certified according to ISO 14001. This sensitivity can be measured in many ways (significant environmental impacts linked to products and processes, number and complexity of the relevant environmental laws, stakeholders’ awareness and their requests, diffusion and development of environmental management, etc...), but it is evident that the more a site operates in an “environmentally advanced sector”, the more it is motivated to adopt an environmental management standard. Moreover, enterprises operating in these sectors face considerably less difficulties in complying with the scheme requirements, because often they are used to eco-management. For example, in the last decade enterprises operating in the chemical sector usually find it natural to draft and publish the environmental statement (generally considered by enterprises as one of the most problematic step of the EMAS process), because they are used to communicating with the public. This is clearly a sectorial characteristic, deriving, for instance, from the previous experience in external communication that some chemical enterprises gained by participating in the Responsible Care Programme.

It is no surprise, then, if most of the sites registered in EMAS belong to industrial sectors with a high “environmental sensitivity” (see fig. 3). There are relevant exceptions, though. For example, refineries and tanneries, which are traditionally affected by ecological problems, and therefore have always been very careful in dealing with environmental aspects relating to their activities, are scarcely present in the list of the registered sites. According to some analysts, the distinction between traditional sectors and relatively “new” sectors could be another key for explaining EMAS success according to the sector of operation. Textile, wood, cork and other traditional sectors seem less interested in EMAS with respect to the chemical sector, rubber and plastic and others. But also this distinction turns out to be weak at a deeper analysis of the EMAS register. We have to notice, for example, the relevant exception of the food enterprises, which are very interested in EMAS probably because they cannot obtain the EU Ecolabel (which would be a powerful marketing tool with respect to final consumers).

---

4 We acknowledge that this is a rather obvious assertion, which can be made even trivial by adding that only industrial activities which imply significant environmental problems have become “environmentally advanced” in managing these problems.
Therefore, industrial sector does not seem to completely explain the enterprise willingness to participate in EMAS (not even at the operational level). When, in our role of coordinators of European Commission pilot projects on EMAS, we have examined the experience of hundreds of SMEs in carrying out on-site activities, we have not singled out significant sectorial differences in EMAS implementation. Moreover, we have found out that enterprises themselves do not attribute difficulties in implementing EMAS to the sector specificities. As we already emphasised, most of the enterprises that decided to participate in the scheme operate in sectors with a medium/high environmental “sensitivity”. Therefore only sectors really behind from the environmental point of view (that have never tackled environmental problems pertaining to their industrial activities) could be considered as EMAS-adverse. With the development of environmental legislation in all European countries, one could wonder if such sectors still exist.

Some cases, though, show that differences between sectors exist: but are they really sectorial differences?

First of all, sites operating in the textile sector (especially in the first phases of the production chain) are less present than expected among those registered under EMAS (see fig. 3). Traditionally, textile enterprises are SMEs and therefore, if not adequately supported, they face relevant difficulties in participating in EMAS. On the other hand, a significant number of sites operating in the automotive industry have been registered under EMAS. Also in this case, size seems to play a key role: it is large companies that usually operate in the automotive sector. So, if we take a closer look to registrations under EMAS, we realise that, beyond the sector “environmental sensitivity”, participation in the scheme is a matter of “size” (turnover and number of employees), that is of human, technical and financial resources, rather than of industrial sector. As with the country break-down analysis, once again the search for key-factors led us to the difference between large companies and SMEs.
Can we consider this difference as the most significant factor influencing the adoption of environmental management standards? By reading the EMAS register we can get a demonstration of the size importance. Large companies' maturity in environmental management, availability of resources and strategic leadership have helped them to be “first comers” in EMAS participation. These companies lead the list of registered sites and among them there are many multinational corporations operating world-wide. In addition to direct participation in the scheme, some of these companies are spurring EMAS diffusion by asking their suppliers to register their sites. As we will later see, this can be a powerful means to promote the adoption of environmental management standards by SMEs.

Large companies are front-runners in environmental management thanks, of course, to their financial, human and technical resources. The main problem for SMEs is in fact to find time and resources to devote to initiatives and programmes, like the improvement of the environmental performance, that do not guarantee a short-term return on expenses.

But the advantage of large companies in seizing the EMAS opportunity is also due to a cultural maturity that in the past brought them to take remarkable steps towards environmental sustainability. Large enterprises have often developed an environmental management system and they already perform environmental audits. We have already emphasised that in some cases they communicate through consolidated channels with the external stakeholders. In few words, these enterprises are already acquainted with environmental management in general, and therefore they find it easy to take a further step by participating in a voluntary scheme. This is the result of a strategic choice that few SMEs have at present made.

Why are SMEs lagging behind with respect to environmental management? Is it just a matter of lack of resources? What barriers and difficulties do they have to face in order to efficiently implement an EMS and obtain a third party recognition? What benefits could they gain by doing so and what stimuli and supports do they need?

These questions should be answered, because the diffusion of EMS among SMEs is an essential means to achieve better environmental performance at a global level. In order to make environmental management schemes an effective and fruitful incentive for smaller enterprises to implement an EMS, we should identify, acknowledge and find ways to overcome the barriers that up to now hampered a wide range of SMEs in efficiently pursuing this objective.

We will first consider these barriers and the constraints that might prevent SMEs from undertaking a process leading to the implementation of an EMS and, eventually, to participation in a voluntary scheme like EMAS and ISO 14001. In the fourth paragraph, we will then emphasise operational difficulties and technical drawbacks SMEs have to tackle once they have undertaken an EMS implementation process.

3. Barriers and constraints for SMEs

As we have emphasised, 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.

According to the empirical evidence collected within the pilot projects, financial costs are not the most relevant barrier for the participating SMEs. We can distinguish these 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, pilot project experience shows that many participating enterprises had already faced considerable investments in relation to environmental protection in the past, when the first important legal provisions for safeguarding the environment and the growing attention of public opinion on these topics first appeared. In the adoption of an EMS, therefore, most of their financial effort connected with “technical measures” regards the costs of equipment and the cost relating to plants management, control and maintenance more than the purchase of new equipment. Nevertheless, according to the results of a questionnaire, the investment in technology and plants is the third most significant cost deriving from participation in EMAS pilot projects, estimated at an average 15.91% of the total costs (and preceded by the cost related to performing the initial review - 20.09% - and the cost of the environmental manager time - 19.17% -). Moreover, the commitment to continuous improvement implies that plant investments should not be over with the registration under EMAS or the certification against ISO 14001, but instead means that environmental improvement must, from that moment on, be considered in all the decisions regarding investment and maintenance scheduling. Time was too short for the SMEs involved in the pilot projects to experience the “technological” cost of continuous improvement, but most of them were aware of (and worried about) its relevance for the future.

Costs sustained by the SMEs in structuring their EMS are to be considered the most significant financial effort. As we have seen, pilot project experience show that these costs should be mainly attributed to the initial environmental review activities. We will explain later in this paragraph that this cost is 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, according to the questionnaire results, whereas costs connected with personnel information and training as well as with environmental auditing (reported as specific items) were not considered relevant. The latter unexpected indication may result from the fact that few SMEs involved in the EC pilot projects had performed such activities at the time of the questionnaire. The EMS “degree of maturity” is in fact the 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 should consider the financial costs strictly connected with the adhesion to one of the voluntary standards we are considering. The pilot project experience does not
provide significant information on this issue, but an overview of the situation in Europe clearly indicates that this costs cannot be considered as relevant as the abovementioned ones.

The costs relating to EMAS registration, for example, are generally low, although this depends on each national Competent Body. In many countries (B, F, NL, UK, SP) no registration fee is at present required for enterprises entering the scheme, although in some of these countries this has to be considered an initial incentive for the development of the scheme, and a fee will probably be set in the future. In other countries the cost depends on site dimension and turnover, representing a positive attempt to knock down a financial barrier for SMEs. For example, in Germany the cost varies from 450 DM to 1725 DM.

By analysing in depth the EMAS pilot experiences, 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.

In the following paragraph we will see how these two constraints are the main responsible for the difficulties and drawbacks SMEs have to tackle in order to implement an EMS according to EMAS or ISO 14001. The description of the difficulties met by SMEs will emphasise that support and facilitation for these enterprises should aim at releasing these constraints.

4. 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 ecomanagement-targeted skills is the first constraint in terms of human resources 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. The troubles many SMEs participating in the pilot projects experience in fully understanding and satisfying some EMAS requirements (evaluation of the effects, definition of criteria for selecting significant aspects, measurement of continuous improvement, and so on...) is partially due to their lack of technical expertise in environmental management. The EMAS regulation revision should take into account SME need for further clarification and exemplification of some requirements.
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 overdimensioned with respect to an 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.

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.

The pilot project experiences have provided very interesting empirical evidence regarding these difficulties.

According to our questionnaire results, 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). The questionnaire results indicate that a relatively low level of difficulty is met by SMEs in implementing the environmental management system as well as the auditing activities. This is quite surprising, but has certainly to do with the fact that most pilot projects did not support the participating enterprises up to the EMS completion stage. SMEs that were not completely aware of their environmental situation at the beginning of the project, after the initial review clearly understand the amount of (financial, human and technological) resources they need in order to obtain EMAS registration: this is the reason why many enterprises involved in the pilot projects did not reach the EMS implementation, but stop after the initial review and (sometimes) after the definition of their environmental policy.

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. 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 involved in the pilot projects 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. 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. Moreover, we noticed a lack of information regarding both the environmental effects/impacts of alternative technologies and the most updated technological solutions (BAT or BATNEEC) to environmental problems relating to the specific industrial sector activity.

As we have seen, 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?

According to the questionnaire results, the two most diffused programmes in the pilot experiences regarded organisational issues: adapting the organisational structure to environmental management needs (scoring 3.18 on 5.00) and training of employees (3.07). The adoption of technical measures is a much less diffused programme (2.82). This result shows that firms are less confident with the organisational and managerial aspects of an EMS than with the technical ones. This is explained by the fact that in the past SMEs spent more resources in adopting technical (end of pipe) solutions than in rationalising their environmental management.

Even if answers to our questionnaire seem not to indicate relevant drawbacks in implementing the EMS and the auditing activities, an in-depth analysis of the documents and reports produced by those projects that reached the implementation stage (as well as our direct experience in supporting SMEs) confirm that difficulties exist for smaller enterprises. 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 participating in pilot projects 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 overdimensioned or too vague with respect to an SME practical needs. It should not surprise that the lack of technical knowledge and specialised personnel are indicated in the questionnaire as the two most important difficulties met by all SMEs relating to EMS implementation. 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. As we will see in the next paragraph, 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. SMEs participating in the pilot projects seem to realise this, since they indicate “documentation” as the third most significant drawback concerning the EMS.

As far as environmental performance is concerned, most of the gaps to be filled by the participating SMEs were of a cultural nature. Although SME managers proved to be sensitive and aware of environmental issues, we have reckoned a lag with respect to the way in which environmental aspects were managed by these enterprises. Up to now, they just responded to environmental law applications, but they have never managed in a systematic, programmed and self-controlled way their environmental performance improvement. In few words, they are not used to environmental management.

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 our experience, the environmental audit is the tool which the SMEs involved were less acquainted with. None of them had implemented such an extensive and analytical tool before in order to manage and control the environmental performance of their site. The most advanced SMEs regularly conducted some measurements on crucial environmental impacts only to check the continuous compliance with relevant environmental laws. Even if SMEs certified according to ISO 9002 standards were 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 meant for nearly all of them 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 firstly a “management tool” that enables the SME both to verify the EMS effectiveness and to identify improvement opportunities. Most of the SMEs involved became perfectly aware of the importance of this tool, but met many difficulties in implementing an adequate structure: owing to their lack of human and technical resources, they designed a simplified audit procedure and appointed an internal auditor that will presumably need to be supported by external expertise.

As we emphasised in the last paragraph, 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 abovementioned 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.

5. EMS implementation by SMEs: motivations and driving factors

In spite of the abovementioned difficulties, a significant number of SMEs have 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 experience of the EU pilot projects.

In our experience of European co-ordinator of pilot projects involving SMEs, we noticed a considerable commitment by these enterprises with respect to eco-management.

By means of our questionnaire, we investigated the driving factors spurring the enterprises to participate in EMAS. Results should not surprise: the need to comply with increasing legal requirements, the willingness to obtain competitive advantage and the need to satisfy requests by customers were indicated as the most effective drives, in decreasing order of relevance.

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.

The second and third drives should probably be attributed to the willingness to anticipate or to respond to the request of important customers. The answers to our questionnaire show, for instance, that the large majority of the SMEs involved are suppliers of multinational companies. As we have seen, 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, according to the questionnaire results. 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. On the other hand, the questionnaire results show that
relationships with the stakeholders seem to be quite good for all the SMEs involved, which would not risk to compromise them.

A last motivation should be mentioned, although definitely less emphasized than the others. Several SMEs joined the pilot action because they believed that EMAS represents a huge opportunity for them. This approach to environmental management standards is increasingly being adopted by SMEs the more they understand that these schemes require an organisational, 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 most relevant suggestion emerging from the pilot project experiences is the choice of many SMEs to implement a “slim” EMS, according to their possibilities and resources. This refers mainly to the aspects relating to documentation and formalisation of the system, but can be seen in every other step the SMEs took to adopt EMAS.

As to the organisational structure, for example, it clearly emerges that most SMEs have defined a straightforward and simple responsibility allocation: there is a management representative who has responsibility for defining the environmental policy, choosing objectives and targets and taking all the strategic decisions concerning environmental management and an “EMS responsible”, who has the operational responsibility to manage the EMS (and make it work effectively) and to guarantee that all the actions are taken by personnel to improve the environmental performance of the site. In addition to these two main levels of responsibility, often the responsibility of managing the relations with external stakeholders is attributed to a different management representative (for example to the administration office, because the latter is used to interact with local governments and control authorities). This “slim” organisational structure allows for relevant savings in management time.

Furthermore, for almost every SME involved it was impossible to appoint a full-time responsible for environmental management, whereas these tasks had to be assigned to a person responsible for other aspects, such as production, quality aspects, health and safety and so on. The SMEs considered this as another opportunity for saving time and money by integrating the EMS in the existing management system.

Another significant example of the EMS “slim” structure is given by the definition of procedures. SMEs usually operate through a simplified production process, which does not need to be ruled by many complex indications and instructions.

All the SMEs chose to avoid the risk of an overwhelming documentation, selecting an essential number of procedures and writing them in the most simplified and comprehensible way. As to the number of procedures, it is interesting to note that an SME decided to elaborate a procedure for the management and control of the whole production process, including in it all the environmental aspects and connecting a specific operational instruction where a more complex environmental activity had to be described (for example water consumption, waste management, or emergency plans). Another SME adopted quite the same criterion: only one “process management procedure” was the main reference for few operational instructions describing the main process phases and the related environmental
activities. Maintenance and emergency plans were in this case included in each operational instruction.

In smaller enterprises, employee tasks ought to be as simplified as the activities they perform within the process. In formulating procedures and job descriptions, the SME involved in the pilot projects usually referred to the personnel skills, training and knowledge of the process: since the enterprise is small (and the process is rather simple and employees are few), the practices are quite consolidated and most employees do not need to be supported by a highly formalised procedure to carry out the activities they are used to.

The need for detailed procedures instead emerged for activities which the personnel is not used to. For example, within EMAS pilot projects the SMEs paid particular attention to elaborating the procedures for the registration and evaluation of environmental effects, for internal and external communication and for environmental auditing.

Many SMEs are realising that “continuous improvement” is also a relevant opportunity. Since SMEs usually have not carried out significant improvement programmes up to the moment they decide to implement an EMS, they have wide margins for improving the environmental performance. Therefore, they are able to achieve satisfactory environmental objectives according to EMAS and ISO 14001 requirements with a moderate and reasonable effort.

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.

6. EMS positive implications and benefits for the SMEs

Empirical evidence emphasises 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. Some interesting suggestions emerge from the EMAS pilot projects.

First of all, we should consider what benefits SMEs do really perceive by implementing an EMS. Information collected through the questionnaire offer some answers. The benefits SMEs involved in the EMAS pilot projects are perceiving, although most of them have not obtained registration so far, are the following:

1. organisational and managerial efficiency (scoring an average 3.19 on a maximum of 5)
2. continuous monitoring of compliance (3.15)
3. improvement in the enterprise image (2.94)
Empirical evidence analysed during our co-ordination activity seems to confirm the relevance of these benefits.

The experience of many SMEs involved in the projects shows that by implementing an EMS they were able to raise the organisational and management efficiency of the whole company.

First, they improved 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 enabled employees to identify persons responsible to which refer to for environmental aspects and problems. This led SMEs to a more efficient, rapid and effective management of environmental risks.

Documentation represented a significant benefit also because SMEs, by writing procedures, rationalised and standardised their activities, improving their work efficiency and quality. In many SMEs the personnel have begun to perform their task-activities in a more correct and efficient way. They did it simply by following procedures and instructions that they previously ignored because these were not written and formalised. Training and information of personnel implied 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, pilot experiences show a further benefit deriving from the improvement in planning activities. In addition to acknowledging that SMEs involved were not used to systematically plan environmental measures and investments, our analysis of the projects indicates that these enterprises are now benefiting from the planning activities required by EMAS. By defining environmental objectives and programmes (and selecting appropriate resources), for instance, SMEs are learning to optimise their investment for technological improvement. A chemical SME involved in a pilot project had to upgrade the transportation device within its production process because it was too noisy. When the SME managers planned the investment for the new technology, they found out it enabled to speed up the process and to raise productivity of a 30%. On the other hand, many textile SMEs are evaluating the opportunity to adopt a “revolutionary” technological innovation (ink jet printing), which will allow for a higher productivity and flexibility, also on the basis of the better environmental performance it will guarantee, in sight of adopting an environmental management standard.

Finally, it has to be emphasized that some of the SMEs during the project began to perceive the potential benefits connected with an integrated management of quality and environmental issues, due to the possible synergies and utilisation of common tools.

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. SMEs
involved in the pilot projects in many cases experienced a real improvement in monitoring and managing compliance to environmental laws. It happened, for instance, that SMEs involved acknowledged a (previously unsatisfied) legal provision while defining the register of law requirements relevant for the site. The register, in particular, turns out to be a very useful tool that SMEs did not employ in ordinary business management before.

The last benefit emphasised by the questionnaire results is a further confirmation to another drive for EMS adoption. Although few SMEs participating in the pilot projects have completed the process leading to EMAS registration, for many of them company image improvement is an important perceived benefit. This means that both SMEs registered under EMAS already perceive benefits in terms of image and those who are not feel sure they will gain a competitive advantage by being among the “first comers”. For these SMEs, relations with customers were the principal motivations to participate in EMAS, so they probably expect to exploit these opportunity for improving their competitiveness.

But an analysis of pilot project experiences demonstrates that SMEs involved are also convinced of the benefits possibly deriving from communicating EMAS registration to local control authorities. For some SMEs involved in one of the projects, public presentation of the environmental statement has been an opportunity to initiate very positive relations with the local authority (in one case, the village Mayor was impressed by the enterprise effort to improve its environmental performance). Some SMEs hope that this improvement can bring about a simplification in the procedures required for authorisations (for example, for widening the production capacity of the site).

As we have seen, owing to the lack of stimuli and drives for an open communication strategy towards external stakeholders, relations with the local communities are not yet perceived as an immediate benefits of EMAS participation. Even in cases where the relationship with the local community was difficult (emission of smell was identified as a significant environmental effects because of the inhabitants complaints), the SME involved preferred to directly interact with local government and did not inform the local community about its participation in the EU pilot action.

According to the questionnaire results, economic benefits are not a relevant issue for SMEs participating in the pilot projects. Although this result was to some extent expected, we would like to mention some specific cases of SMEs that were able to gain economic benefits from the EMS implementation. We identified these few cases by examining reports and documentation produced by project promoters. The reader should be aware that this cases are not diffused in the pilot project experiences and are dealt with hereby only as examples of excelling environmental management.

The only economic benefits to be significantly diffused are those obtained by optimising the use of resources (saving raw materials, energy, water... or by recycling waste). Several food-processing SMEs involved in the projects have been able to save a relevant percentage of water consumption thanks to the implementation of programmes aimed at improving this environmental effect. Another documented benefits was obtained by some textile SMEs in a programme for dye reduction which yielded a considerable saving in the cost of auxiliary materials. Saved energy for heating water in plants and equipment is a significant economic benefits that some SMEs obtained after improving energy management
(this benefit is typical of those SMEs who have never implemented an energy saving plan, like many of the larger companies did).

Some benefits emerge also from waste management. Many SMEs (especially those working with organic substances) have experienced ways and opportunities to reuse their waste for fertilisation or for the production of pet-food. A last benefit to be mentioned can be gained thanks to the attitude of many SMEs operating in the same industrial sector and in the same neighbours (see paragraph 7) to share technical resources. When they are located in the same area, for instance, SMEs operating in the ceramic tile industry often utilise a common equipment for recycling their waste (broken tiles) in order to recover the used material. This equipment would be too expensive for a single SME, which would not be able to reach this recycling performance on its own.

We did not acknowledge any case of measurable economic benefits emerging from an improvement of the SME competitive position.

7. Co-operation: a key word

In order to gain these benefits, many SMEs are developing solutions and means to overcome their hindering constraints. In this paragraph we would like to focus on what we consider the most effective way to facilitate EMS implementation by SMEs: promoting and favouring co-operation.

Co-operation emerges from the DG XI pilot experiences as the most important fostering factor for EMAS diffusion among SMEs. We firmly believe that this key-factor can prove its efficacy also in ISO 14001 application. SMEs can co-operate with three different actors: other enterprises, public institutions and local communities.

7.1 Co-operation with other enterprises and trade associations

It seems to be very effective to encourage several kinds of co-operation between enterprises in implementing an EMS. Working by group, for example, emerges from the pilot experiences as a useful and efficient way of adopting EMAS in SMEs, especially when they need to tackle similar or common problems. Operating by networks enables SMEs to exchange information and experiences and share resources.

This happens to be particularly effective between: SMEs operating in the same industrial sector and SMEs operating in the same region. In the first case, enterprises collaborate by identifying the effects of identical environmental impact factors and by finding technological solutions to be applied to similar production processes and products, as well as by defining organisational structures suitable for a common production cycle (purchasing, production, organisational and distribution activities are quite similar). In the second case 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, ...) without worrying about sharing information with a direct competitor (as occurs in the first case).
The pilot projects undoubtedly show that forms of co-operation between SMEs allow for considerable synergies and cost reductions. Some promoters created a network among participating SMEs in order to favour information and experience diffusion and possibly to define and apply common solutions to similar environmental, technical and/or organisational problems. These promoters have stimulated the SMEs involved in the network to collaborate in identifying and investigating similar environmental aspects connected with the site production processes and/or with the common area of location, in this way helping each other for the initial review. Other promoters have proposed common training courses for employees of different SMEs, saving resources and time. In order to achieve a higher effectiveness and impartiality in performing the environmental audits, within few pilot projects “peer auditing” was performed. By creating a common audit team the SMEs involved were able both to save time and money, and to provide their specialised personnel with wider experience and better technical skills.

Another kind of co-operation between enterprises can take place within the supply-chain. As we have seen, one of the most relevant motivations for SMEs to implement an EMS is the request of a large customer. If the latter is willing to support small suppliers in the EMS implementation, then all the enterprises involved can greatly benefit from the co-operation. A large enterprise can be so interested in ISO 14001 or EMAS, that the effort of supporting the supplier SMEs is balanced by the advantages in terms of better environmental management and image improvement. One of the DGXI projects was promoted by a Spanish large firm (Iberdrola) which involved many small suppliers in the pilot action. The results of this project were undoubtedly positive for all the SMEs involved. In order to facilitate this kind of co-operation, for instance, it could be foreseen that a large enterprise (according to EU definition) provides support to a minimum number of small suppliers in order to confirm its registration under EMAS or ISO 14001 certification.

Evidence collected by analysing the pilot experiences shows that there has been a strong co-operation between SMEs involved in the same project, but weaker with other enterprises (e.g.: neighbours). This emphasises that there needs to be a catalyst that promotes and favours co-operation. During the pilot projects the promoters played this role. In other cases the catalyst could be an external actor. We want to emphasise how, in these cases, co-operation with trade associations can be useful and fruitful.

By means of the questionnaire, the promoters were asked if they had initiated any form of co-operation with social groups within the project activities. Trade associations turned out to be a usual partner: they have been directly involved in more than 50% of the projects, at a national or at a local level, with positive results especially as regards relations with the enterprises. We have noticed, in fact, that trade associations are able to considerably spur enterprise commitment and participation both by increasing their knowledge and awareness on environmental issues, and by providing specialised technical support for project activity implementation. Trade associations support activity is so effective and useful because they have experience and knowledge of the specific sector and they are considered by SMEs as an “industrial” actor (not implying problems of controlled-controller situations).

5 This incentive obviously would not work for an SME, for which (in addition to the lack of resources) the EMAS/ISO indication regarding the opportunity of evaluating the supplier environmental management performance already represents a technical and operational difficulty.
7.2 Co-operation with public and private institutions

The diffusion of EMS and environmental management standards is an opportunity for institutional innovation: local agencies, voluntary consortia, centres of excellence, etc. are useful tools for removing the barriers to the diffusion of environmental management systems. It is neither easy nor immediate to implement these initiatives, but we think that in the long run they will represent the primary means to lead SMEs to implement sound environmental management and to help them to adopt a standard. This is particularly important considering the development of local, regional and national Agencies for the Environment throughout the European Union.

Public institutions will undoubtedly play a key-role in EMAS diffusion at all geo-political levels. In this perspective, especially local institutions have the great opportunity of favouring EMAS adoption by means of voluntary agreements (Germany has offered the first example) with enterprises operating in their region or area. Not surprisingly, 65% of the pilot project promoters have been collaborating with institutional and/or governmental organisations (moreover, some are partners of the project leader).

Another significant percentage of projects (around 40%) have involved standardisation and/or certification institutions. Support and technical advice from these institutions is important for helping enterprises to achieve registration under EMAS or certification according to ISO 14001.

7.3 Co-operation with local communities

Communicating and interacting with external stakeholders is an essential aspect of an EMS. We have noticed very positive results in those pilot projects that have involved co-operation initiatives with the local community. As we have seen, for some enterprises involved in one of the projects, public presentation of the environmental statement has been an opportunity to initiate very positive relations with the local authority. Moreover, sometimes enterprises involved in DG XI pilot projects have been a point of reference for all the local actors, since they were the only ones to have information and knowledge about new environmental management tools. This could be an important basis on which an enterprise can begin to co-operate with local population and associations interested in EMS diffusion. Environmentalist associations are already beginning to facilitate this kind of co-operation at the local level in many European countries.

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, drawing important suggestions from the DGXI pilot project experiences: 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 can be useful that both the voluntary schemes are revised to include measures aimed at facilitating and simplifying adhesion by SMEs, taking into account their specificities and needs described above.

When we asked pilot project promoters what could be done - in their opinion - for fostering and facilitating the diffusion of EMS among SMEs, they answered that 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

Other interesting suggestions were: 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 pilot projects 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, organisational 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.

From this point of view, the ongoing work of ISO working group on Environmental Performance Evaluation (ISO 14031) has to be considered with great interest.
Bibliographical references


Biondi V., Meredith S. (1997) ‘Motivating mechanism and policy options in the diffusion of environmental technologies within SMEs in the electroplating industry: preliminary findings of a European project”, proceedings of the 7th International Forum on Technology Management, Kyoto, November 3rd - 7th


