



Environmental management systems as an embedding mechanism: a research note

Environmental
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Abstract

Purpose – The purpose of this paper is to explore the interplay between strategy, environmental management systems and environmental accounting, and their role in improving environmental performance.

Design/methodology/approach – By engaging with organisations through field research, this paper analyses the aspects of the European Community's Eco-Management and Audit Scheme (EMAS), an environmental management system (EMS), that act as catalysts for change through the development of intangible assets that improve environmental performance. Evidence is collected from semi-structured interviews with environmental managers and management accountants from ten Spanish EMAS registered sites.

Findings – The embedding mechanisms of EMAS are considered. From the analysis, six valuable intangible assets for improving environmental performance were identified: awareness of employees; environmental knowledge, skills and expertise of employees; the commitment of managers; cross-functional coordination; the integration of environmental issues in strategic planning process; and, the use of management accounting practices. These intangible assets were used to define three levels of environmental embeddedness: primary, visible, and advanced.

Practical implications – This paper provides insights into the interface between environmental management systems and management accounting and the implications of this for organisational change and environmental performance.

Originality/value – This paper contributes to fieldwork research within the environmental accounting literature by engaging with organisations in addressing the question of how EMAS improves environmental performance. Furthermore, it demonstrates that involvement primarily of internal, but also external, participants enhances further development of EMAS.

Keywords Environmental management, Management accounting, Spain, European directives, Environmental regulations

Paper type Research paper

Introduction

According to Bebbington (1997) and Gray (2002), engagement involves an attempt to change or reform existing business practices. A substantial part of engagement research has concentrated on the development of corporate social disclosure (O'Dwyer

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et al., 2005). However, Parker (2005) remarked that a number of subject areas are still under-researched, including the environmental management systems and management accounting interface. Following recent fieldwork on social and environmental accounting (Adams, 2002; Larrinaga-González and Bebbington, 2001; Larrinaga-González *et al.*, 2001; O'Dwyer, 2002, 2003), this paper responds to calls (Adams, 2002; Gray, 2002; Parker, 2005) for engaging with companies through field research by addressing the question of how environmental management systems (EMS), rather than environmental reporting alone, improve environmental performance.

Standards that provide organisations with guidance on the development of an EMS include the European Community's Eco-Management and Audit Scheme (EMAS) and the International Standard ISO 14001 (Watson and Emery, 2004). Although all EMS standards stress the need for continuous environmental improvement, this paper focuses on EMAS which has a number of distinguishing features. First, EMAS organisations are required to make publicly available periodic environmental statements providing stakeholders with information on their environmental performance. Second, EMAS regulation stresses the importance of employee involvement and an open dialogue with the stakeholders for environmental management. Finally, EMAS also pays great attention to the indirect environmental aspects that can result from the interaction of organisations with third parties (EMAS, 2001, Annex 1.B; Commission Recommendation, 2001, Annex II-III).

By engaging through field research with companies that participate in EMAS, the aim of this paper is to explore the interplay between strategy, environmental management systems and environmental accounting, and their role in improving environmental performance. This paper explores the enabling properties of EMAS and whether or not it serves to internalise environmental issues and values that stimulate organizational change to improve environmental performance.

The remainder of the paper is structured as follows. The following section explains how EMAS could be conceived as an environmental embedding mechanism and outlines an embedding process consisting of catalysts for change and intangible assets. The next section explains the research method based on a qualitative study involving semi-structured interviews with environmental managers and management accountants in ten EMAS sites. This precedes the empirical analysis, which identifies several key intangible assets for environmental embeddedness derived from the four catalysts for change: training and awareness building; continuous environmental improvement; integrating stakeholders' interests; and, organisational learning. According to the presence and the usage of those intangible assets, three levels of environmental embeddedness are defined. The final section presents the conclusions and further research.

EMAS as an environmental embedding mechanism

EMSs, and particularly EMAS, are conceived here as an environmental embedding mechanism that disrupts the decoupling structures (see Llewellyn, 1994, 1998) that could allow organisational inertia in the face of pressing environmental demands. EMS could thus embed environmental issues and values to facilitate organisational change.

We explore this embedding process by suggesting that four catalysts for change produce intangible assets which lead to further development of the EMS and the

embedding of environmental issues and values in the organisation. The more the catalysts for change are promoted, connected and the synergy between them exploited, the more the EMS will produce intangible assets that enhance the embedding mechanism.

In order to fully appreciate why EMAS could potentially yield differential results with respect to the internalization of environmental issues, two points should be emphasised. First, as previously mentioned, EMAS organisations have to disclose their environmental performance. Second, EMAS regulation specifically highlights special issues relating to participant organisations: legal compliance, improvement of environmental performance, communication with interested parties and employee involvement (EMAS, 2001, Annex, I. B). Moreover, EMAS regulation stresses these aspects in order to further the continuous improvement in the environmental performance of organisations in the long run.

Four catalysts for change, derived from EMAS requirements, are considered in this respect: training and awareness building; continuous environmental improvement; integrating stakeholders' interests; and, organisational learning. Arguably, for the effectiveness of the environmental embedding process these catalysts should be developed and should interact in a mutually reinforcing way. But this research will highlight the important role of integrating stakeholders' interests focusing on "the involvement of internal stakeholders" for analysing EMS as an environmental embedding mechanism.

Training and awareness building allows organisations to provide employees the appropriate initial and advanced training that makes their active participation and involvement in the tasks related to the EMS possible. The literature suggests that employee involvement is an important driver for effective environmental management (Denton, 1999; Florida, 1996; Rothenberg, 2003). Training and awareness building may lead to improvements in the environmental knowledge, skills and expertise of staff, facilitate the adoption of a forward-looking and multifunctional approach, raise the managers' environmental commitment and encourage employees' involvement with environmental management.

Continuous environmental improvement allows organisations to specify new environmental goals and to define the means to achieve them, by exploring either new production alternatives or technology (Sharma and Vredenburg, 1998) and reducing waste and emissions (Hart, 1995). Thus, this may create opportunities to reduce inefficiencies, to go beyond the environmental legislation, to make new environmental investments, or to improve internal processes.

Integrating stakeholders' interests involves establishing trust-based collaborative relationships with a wide variety of stakeholders (Sharma and Vredenburg, 1998), so this contributes to organisations by taking into account the perspectives of a greater group of stakeholders (Hart, 1995). This may entail the establishment of an open dialogue with interested parties in order to share information, identify and prioritise stakeholders' environmental concerns and obtain inputs from key stakeholders into organisational decision making.

Organisational learning is defined as the development of insights, knowledge and associations between past actions, the effectiveness of those actions and future actions (Fiol and Lyles, 1985). This may promote changes to internal values, routines, and rules that represent collective learning (Sharma and Vredenburg, 1998). Learning within

organisations is related to behavioural outcomes based on shared ideology and understanding of the changes taking place (Daft and Weick, 1984; Fiol and Lyles, 1985; Starbuck *et al.*, 1978). Hence, these changes heighten cross-functional coordination and communication and facilitate the incorporation of environmental issues into organisational processes, procedures and activities, including those related to accounting.

We will argue that these catalysts for change lead organisations to create, develop, maintain and even increase significant intangible assets that enhance environmental performance. The evidence collected suggests the development of six intangible assets: awareness of employees; environmental knowledge, skills and expertise of employees; the commitment of managers; cross-functional coordination and communication; the integration of environmental issues in strategic planning process; and, the use of management accounting practices. Furthermore, we suggest that organisations could be placed in three different levels of environmental embeddedness – primary, visible, and advanced – according to the presence and the usage of these intangible assets.

Research method

Our research engagement involved semi-structured interviews with environmental managers and management accountants in EMAS companies. The primary purpose of the interviews was to gather descriptive data on environmental management activities and accounting practices as well as information on connections between both functions in order to identify intangible assets that improved environmental performance.

Specifically, ten Spanish EMAS registered sites[1] were selected covering the most represented sectors in the Spanish EMAS register and polluting industries. Most sites were also the first to be registered in their sectors. There were two reasons for focusing on sites instead of on organisations. First, the former EMAS regulation[2] exclusively allowed industrial companies to register sites, corporate registrations from all kind of organisations and entities of bigger or smaller size than sites become possible only after the new version of EMAS was enacted in April 2001. Second, managers at the site level would arguably be more able to provide detailed and first-hand data (see Table I for a reference to the selected sites).

Environmental managers selected for interview were the manager of the environmental department, with considerable environmental responsibilities; or, the person directly responsible for implementing and controlling the EMS. Additionally, management accountants were also interviewed with the aim of identifying possible connections and interactions between the accounting and environmental management functions.

Following Lillis (1999) an interview guide was designed to ensure completeness in covering the terms of reference of the study in each interview. The interview guide was drawn from a review of the literature on environmental accounting and environmental management accounting (Bartolomeo *et al.*, 2000; Bebbington *et al.*, 1994; Bennett and James, 1997, 1998; Bennett *et al.*, 2002; Burritt, 2004; Gibson and Martin, 2004; Rimer, 2000; Rogers and Kristof, 2003; Schaltegger and Burritt, 2000; Wilmshurt and Frost, 2001; Wycherley, 1997). The interview guide was designed to deal with different issues. First, it sought to identify current environmental management activities in the sites and the different areas or departments involved, as well as the managers' opinion about the effect of accountants' commitment on environmental management and in which activities they considered accountants should be involved. Second, the interview

Site	Activity sector	First register	Description
AA	(74) Other business activities	2001	An environmental consultant company recently founded
BB	(40) Electricity, gas, steam and hot water supply	2001	All sites and locations of the company are under single registry
CC	(21) Manufacturer of pulp, paper and paper products	1999	CC production centre belongs to a large corporation, vertically integrated
DD	(27) Manufacture of basic metals	1999	The first corporate production centre; which has just suffered an important employment cutback, as a consequence of the strategy of the parent company
EE	(74) Other business activities	2002	An environmental consultant company recently founded
FF	(23) Manufacture of coke, refined petroleum products and nuclear fuel	1999	The first CP production centre; CP is a large corporation, vertically integrated
GG	(23) Manufacture of coke, refined petroleum products and nuclear fuel	1999	CP production centre; CP is a large corporation, vertically integrated
HH	(31) Manufacture of electrical machinery and apparatus n.e.c.	1999	The first HH production centre; HH belongs to a large multinational corporation with develops multiple activities
II	(24) Manufacture of chemicals and chemical products	1999	The first II production centre; II company has experienced a notable growth in recent years
JJ	(24) Manufacture of chemicals and chemical products	1997	The first JJ production centre; JJ company is a CP subsidiary

Table I.
Brief references to the sites

guide addressed whether environmental information was included in accounting practices and whether such information could be incorporated into other accounting practices. Finally, the interview guide aimed to identify initiatives implemented to increase staff involvement in environmental management related to awareness, training, or rewards. The interview guide was used flexibly and did not imply posing the questions in a particular order (Lillis, 1999).

Letters requesting participation in the study were only sent initially to environmental managers. They were interviewed between April and May 2004. At the end of each interview, we provided environmental managers with two copies of a questionnaire, asking them to complete and return one to the researchers and to hand over the other to the head of the management accounting/control function. The questionnaire included the same questions as the interview guides. After having received all the completed questionnaires, we contacted and interviewed the management accountants by the end of 2004 and the beginning of 2005. Additionally, in some cases we also carried out unplanned interviews with other employees. All the interviews were between 45 minutes and two hours in duration, and confidentiality was assured prior to each.

Different information was used to supplement interviews, including the questionnaires, documents and observation during the visit to the sites. First,

background information was obtained by studying the most recent environmental statements and external information available from each site. Second, most managers allowed access to internal documents such as company newsletters, EMS procedures and registers, environmental indicators, investment appraisal forms, or operational budgets. We were also given access to the management information systems and allowed to walk around the installations. Finally, follow-up contacts were made by telephone or e-mail after the interviews to ask for further information and explanations (see Table II for reference to the data collection).

Data analysis is an on-going process in field research where data collection and analysis are necessarily interrelated (McKinnon, 1988). With few exceptions, all the interviews were tape recorded and transcribed verbatim. The transcripts involved close, repeated listening to recordings which often revealed previously unnoticed recurring features (Silverman, 1993). Notes were taken during and immediately after each interview. Furthermore, all available data related to each site was outlined and entered in separate files. Like all other forms of data analysis, the analysis of qualitative data involves processes of reduction or summarisation, classification and interpretation (Lillis, 1999). The three broad sections of the interview guide were used initially to analyse the interview transcripts. During this first phase a coding scheme was developed to highlight the emerged themes. Based on the procedure outlined by Miles and Huberman (1994), each transcript was reorganised and summarised in accordance with these emerging themes and entered in separate text files. Relationships between the themes were also analysed and, in conjunction with the supplementary information, field notes and other available data, initial findings were outlined.

Analysis and discussion

In exploring the participation of environmental management and accounting in the embedding of environmental issues and values in the organisation, we have suggested the importance of four catalysts for change (derived from the characteristics of EMAS) that lead to the advancement of intangible assets that enhance environmental performance. As the narrative will evidence, several intangible assets are more specifically linked to particular catalysts for change. However, this research also suggests that intangible assets are the result of the overall interaction of these catalysts. The subsequent analysis is articulated around the abovementioned catalysts for change. It also suggests three different levels of environmental embeddedness according to the presence and usage of intangible assets.

Training and awareness building

As required by any EMS, EMAS organisations must identify training needs, so that all employees, whose work may have a significant impact on the environment, receive appropriate training. Every site we visited had an environmental training programme although there were numerous differences among them. Apart from updating the technical and specific environmental knowledge of plant floor workers, all employees were likely to receive general training on plant environmental policy, recycling and pollution prevention:

We pay too much attention to training, without thinking about expenses. I think we have quite a good level of environmental awareness amongst our workers. Otherwise, the EMS would not work nor would the factory (FF: environmental manager).

Site	Function	First contact	Questionnaire respondents	Interviewees	Visit duration (minutes)	Follow-up contact
AA	Environmental manager	×	×	×	45	
BB	EMS coordinator		×	×	210	×
	Manager of the environmental dept	×		×		
	Project manager			×		
	Manager of planning dept		×			
	Member of planning dept					×
CC	Environmental manager (former)	×		×	190	×
	Environmental manager (current)		×	×		
	Manager of management and control dept		×	×		
	Member of management and control dept			×		
DD	Environmental manager Environment and safety coordinator	×	×	×	270	
	Controller		×	×		×
EE	Quality and environment coordinator	×	×	×	60	×
	Accountant		×			×
FF	Environmental manager	×	×	×	390	×
	Other members of environmental dept			×		
	Controller		×	×		
GG	Environmental manager	×	×	×	210	×
	Manager of management dept		×	×		
	Member of management dept			×		×
HH	Environmental manager EMS and Safety coordinator	×	×	×	420	×
	Controller		×	×		×
	Purchase manager			×		
II	Environmental manager	×	×	×	300	
	Quality manager			×		
	Controller		×	×		×
JJ	Manager of the EQH&S dept	×		×	210	
	EMS coordinator		×	×		×
	Member of EQH&S dept			×		
	CFO		×	×		

Table II.
References to the data collection from the visits

There is always a less aware department, but we spend much time on enhancing environmental awareness and involvement among service functions based on good environmental practices, for example. . . . Although you always think that it is not enough, we have made a great progress (BB: EMS coordinator).

These training programmes facilitated employees' ability to understand data on material use and to identify possible areas of improvement, so it was not only the technical knowledge of environmental issues, but also the environmental management expertise of employees that represented important intangible assets for running the EMS and continually improving the environmental performance. Furthermore, on CC, DD, FF, GG, and JJ sites, plant floor workers and members of staff were trained as environmental auditors in order to accomplish the required internal environmental audits. Training and awareness building has enhanced the development of environmental knowledge, skills and expertise of employees.

In addition to training, appropriate mechanisms for awareness building such as suggestion-book systems, project-based group works, or environmental committees should be used in EMAS (EMAS, 2001, Annex I.B.4). In fact, there were different participation programmes in most manufacturing plants, some of which were particularly successful. Through suggestion-book systems, for example, the sites endeavoured to engage their plant floor workers with the EMS and embed environmental issues in the activities of the organisation. As HH and GG environmental managers explained:

As a way to involve the whole personnel, we use a suggestion book through which employees put forward ideas they think can improve our EMS . . . Although the number of suggestions is not very high, it is an effective way to give them a voice in environmental management (HH: environmental manager).

The best proposals are awarded and we use the occasion to organise an annual formal meeting. The factory director always attends and even the corporation director sometimes . . . We endeavour to share this event with all employees with the aim of enhancing their involvement (GG: environmental manager).

As a result of training and awareness building, two main intangible assets seem to emerge: the awareness of employees, and the environmental knowledge, skills and expertise of employees. The development of these intangible assets is identified in all sites studied. Both intangible assets are a driving force for embedding environmental issues and values in the organisations, developing further the EMS and allowing the continuous improvement of environmental performance. Additionally, they lead to keep the EMS alive and fresh, avoiding becoming bureaucratic (Commission Recommendation, 2001, Annex II).

Continuous improvement in environmental performance

EMAS organisations must be able to demonstrate that they provide for legal compliance with environmental legislation. Furthermore, they should have procedures in place that enable the organisation to meet these requirements on an ongoing basis. Therefore, an essential feature for all EMAS organisations is to promote continuous improvement in environmental performance. However, in addition of going beyond compliance, the ability for technological innovation and research has to be taken into account as it enables industrial organisations to focus their attention on the gradual implementation of pollution prevention technologies[3] as a strategic policy. The importance of this will vary depending on the sector. As Thornton *et al.* (2003) stated, in capital-intensive, highly competitive, mature, and heavy industries, most large improvements in environmental performance are linked to expensive investments in

new technologies which have been made compulsory by the periodic tightening of regulatory licenses.

Managers from industrial sites admitted that instead of simply complying with environmental regulation they aimed to go beyond compliance because they believed their future viability depended upon it. Two representative quotes from the interviews follow:

We have a forward-looking approach. In addition to complying with legislation, we think ahead to future regulation that might affect us and also to newly available technologies (CC: former environmental manager).

At present, we are introducing some mechanisms which are not a legal requirement yet, but we know it will be in a few years. We prefer to make little investments in advance instead of making a large one (JJ: member of EQH&S department).

All industrial sites have made investments in environmental assets which require a greater quantity of capital investments and represent key physical assets for improving environmental performance as shown in their environmental statements. CC, DD, II, and JJ sites have specifically underlined the relevance of investing on the best available technologies and the best environmental practices.

Some managers stated that environmental issues had to be incorporated into capital investment decisions in order to stay ahead of legislation or maintain continuous environmental performance improvement:

Environmental issues have a strong impact on investment projects and long-term planning. We are forced to implement the best available technologies and continuous improvements of environmental performance in line with the company's long-term strategic objectives (CC: former environmental manager).

We need to know that we have to carry out some environmental investments to eliminate [environmental impacts] ... To continue to produce, there is no choice but to include environmental issues within the strategic planning (JJ: CFO).

As the interviewees noted, the development of mechanisms for continuous improvement facilitates the integration of environmental issues in the strategic planning process and the use of management accounting practices, such as capital budgeting or investment appraisal, for environmental management:

If only financial criteria were taken into account, environmental or social projects would have never been accepted. They have a strategic purpose (FF: environmental manager).

For example, if the environmental department knows that a new law is to be passed in two years that requires installation or modification of something, they will have to include it among their department goals to become incorporated into the long-term planning (FF: controller).

A rate of return is not always needed for environmental investments. Sometimes we use qualitative reasons such as legal requirements ... (II: environmental manager).

If an environmental awareness exists like here, it is easier. We can define a longer period, 10 or 20 years. In addition, the rate of return is not the only factor to consider, but satisfied employees or local communities, for example (II: controller).

As managers pointed out, financial reasons are not the only criteria for capital investment decisions and the integration of environmental issues in management accounting practices has facilitated the accomplishment of specific environmental projects.

The exploration of continuous improvement as a catalyst for change underlines the emergence of two significant intangible assets: the integration of environmental issues into strategic planning process; and, the use of management accounting practices for environmental management. These intangible assets have only been evidenced in industrial sites, although their relevance varies across the sites. This analysis also highlights the internal mechanics of how environmental issues are embedded in organisational activities through a structural constraint as seems to be the need of continuous improvement in environmental performance in industrial sites.

Integrating stakeholders' interests

Although the literature has traditionally focused on the integration of external stakeholders' interests (Owen *et al.*, 2000, 2001; O'Dwyer *et al.*, 2005), this research tries also to explore the integration of internal stakeholders' interests as a critical mechanism for embedding environmental values in the organisation.

The literature suggests that the integration of external stakeholders' interests enables organisations to make progress on the disclosure of environmental information and accountability. EMAS requires organisations to promote an open dialogue with interested parties – authorities, suppliers, customers, or local communities – and to disclose environmental information. The BB, CC, DD, FF, GG and JJ sites adopt an “open-door” policy and undertake various initiatives aimed at reducing tension with the local community, such as sponsoring environmental activities, providing grants for environmental projects and holding meetings with or receiving visits from schools and associations. Most of these initiatives are usually included in the environmental statements with the aim of raising the visibility of the organisation's environmental commitment and as an easy means of enhancing its environmental reputation. This may raise doubts over the credibility of establishing stakeholder accountability, as opposed to merely aiding the process of stakeholder management (Owen *et al.*, 2000). Furthermore, managers from BB, CC, FF and JJ sites referred to other activities, such as participation in congresses, working groups, or seminars, in order to gather new ideas, get feedback, share experiences and knowledge, or provide information on their environmental results. It could be argued that most of the sites have intended to integrate stakeholders' interests merely by focusing on the environmental statement, which may be insufficient for meeting stakeholders' needs, especially concerning the provision of reliable information (Bouma and Kamp-Roelands, 2000).

Although our earlier discussion questions the sincerity of integration of stakeholders' interests it is also true that EMAS calls for the integration of stakeholders' interests, and that this call is reinforced through insistence on the identification of indirect environmental aspects (EMAS, 2001, Annex VI; Commission Recommendation, 2001, Annex III). EMAS organisations are required to integrate external perspectives into their processes by adopting a life cycle approach (Hart, 1995), improving not only their own environmental performance but also the performance of suppliers and customers. For example, CC, a pulp and paper mill with a high environmental impact, adopts a life cycle approach and focuses on both suppliers

and customers. As regards customers' concerns, CC has modified its product packing to facilitate customers' environmental management, as explained in the 2003 environmental statement. With regard to local suppliers and contractors, the environmental manager stated:

To minimise our negative effects on the natural environment, it is necessary to take into account the whole process and to think about our suppliers. For that reason, we force all of our suppliers of services to have the three management systems, quality, environmental, and safety, certified. . . . At first, they saw some problems but later they became more involved in environmental issues and their environmental management improved too (CC: former environmental manager).

Moreover, since its principal suppliers hold a forest management certificate, CC has a Chain of Custody Certificate^[4] that provides evidence that the product originates from certified, well-managed forests, and verifies that these products are not mixed with products from uncertified forests at any point in the supply chain. The environmental manager added:

As our product has a recognised environmental quality, specific technical data on the production process is supplied to some customers, such as the level of sulphur and oxidised nitrogen emissions, in order to enable them to apply for the European Eco-Label (CC: former environmental manager).

Therefore, the integration of external stakeholders' interests through a life cycle approach seems thus to generate a critical intangible asset that foster the embedding process through the augmentation of environmental knowledge of employees directly involved with external stakeholders.

As argued above, we aim to explore the role of the integration of internal stakeholders' interests in the process of environmental embeddedness. It could be argued that open dialogue with internal stakeholders allows the sharing of information among different departments and functions, and the gaining of additional feedback for use in decision making. Arguably, this internal process is facilitated by structural drivers, such as interdepartmental environmental committees and internal accountability relationships.

Environmental committees identified in some cases (FF, GG, HH and JJ) are formed by department managers and shop floor managers, together with the environmental managers or the EMS coordinator. Environmental issues are discussed at higher instances periodically, and such discussion gradually involves more people. This committee has the responsibility to aid in controlling and reviewing the EMS and to set environmental objectives, as demonstrated in the EMS manuals consulted. Although cases CC, DD, EE and II do not have a formal environment committee, top managers meet at least annually to deal with environmental responsibilities. Finally, in cases AA and BB there is a lower level of interaction and involvement of managers and environmental responsibilities are confined to the relation between the environmental manager and the top manager.

Apart from the interdepartmental environmental management committee, the involvement of internal stakeholders was facilitated by accountability relationships. Some interviewees remarked that environmental issues were discussed during the management control meetings. In that case, the environmental manager reports environmental indicators to the management accountant. These indicators are

subsequently included in the management report submitted to the management control meeting led by the plant manager:

In fact, management control function does it [supply environmental information for decision making] . . . With this report [the monthly management accounting report], the plant manager knows if something goes wrong. Depending on the situation, he will ask the environmental manager for further explanation (FF: controller).

In cases FF, DD and JJ, the head of the department where the environmental unit is located attends the management accounting meetings. Similarly, in CC the environmental manager, who reports environmental information to the management accountant, also attends the management control meeting.

In all cases the environmental managers report on environmental issues to top management. For that purpose, all environmental managers have designed an environmental scorecard through which key environmental indicators can be readily monitored and used for control and external reporting purposes. The environmental statement is the usual channel to report to external stakeholders as well as to employees. Interestingly, the environmental manager of DD is involved in developing an online environmental scorecard:

It is made for senior management's use, so the plant manager and production manager glance at these indicators every morning and know how things are going (DD: environmental manager).

The overall analysis of the cases indicates that although there is a widespread use of environmental scorecards, they are considered in the cases as environmental management, rather than accounting, tools. This finding echoes Adams and Harte's (2000) broad definition of accounting, which includes any account given, whether financial, quantitative, or discursive, and is not restricted to the activity of accountants.

Focusing on the connections between the environmental management and the management accounting functions, accountants' involvement in environmental issues was limited, as suggested by Adams (2002). However, some evidence in GG and II suggests a role for accounting in encouraging the involvement of other managers:

In any case, the participation of the administration department [in the environmental management] is always interesting. There is no doubt that this participation facilitates the monitoring, the elaboration . . . and the involvement of other departments (GG: environmental manager).

I really think that within every company the accounting function has the numbers which help people to become aware of [environmental issues] . . . but here we have already integrated environmental issues into accounting systems (II: controller).

Additional evidence of interactions between different accounting and other organisational functions found in most cases will be presented in the next section, along the lines of the discussion of organisational learning.

The analysis of the integration of internal participants' interests suggests the emergence of important intangible assets such as the commitment of managers, as well as a cross-functional communication among them, the discussion of environmental issues at higher instances and the use of environmental scorecards for decision making or control purposes.

This field research suggests that the stimulus for integrating internal stakeholders' interests generates critical intangible assets that foster the environmental embedding process:

- the environmental knowledge and expertise of managers;
- the commitment of managers;
- the cross-functional coordination and communication;
- the integration of environmental issues in strategic planning process; and
- the use of management accounting practices.

Organisational learning

Organisational learning is the process of improving actions through better knowledge and understanding (Fiol and Lyles, 1985), implying changes to internal values, routines and rules. Through organisational learning organisations can stimulate the incorporation of environmental issues into business functions, processes, and procedures, as well as heighten cross-functional coordination and communication.

Organisational learning benefits from the process of socialisation that stems from training, helping to transcend adversarial attitudes. As evidenced in different sites (CC, DD, FF, GG and JJ), workers from different organisational functions and levels are trained as environmental auditors to improve their environmental knowledge and skills. Through the conduct of internal environmental audits, a greater number of employees become involved in environmental tasks. This also enabled cross-functional relationships and a better understanding of the environmental activities carried out within the facility:

As all departments have several environmental auditors, for internal environmental audit purposes, we try to take them in turns so that they meet people from other functions and know what is done in the plant (JJ: manager of EQH&S department).

In the examined cases the role of the environmental unit, responsible for environmental management and control, is crucial for the management and dissemination of environmental knowledge. The functions of the environmental unit include in all the cases the assistance to line managers, fostering cross-functional coordination and communication:

The environmental department collaborates with line departments in designing, carrying out, and controlling all projects (CC: former environmental manager).

We mainly provide advice and assistance to line management (FF: environmental manager).

With regard to daily operations with little environmental impacts, we only provide technical assistance and advice to line departments in particular situations when they ask us about something (BB: manager of environmental department).

The interplay between technology and management control seems to play an important role in organisational learning in the cases examined. In this vein, the use of information systems within organisations brings about organisational learning processes, allowing operational efficiency, cross-functional relationships and even enhancing organisational transparency:

This [the change in the accounting system to explicitly identify the environmental costs] helped us because we have a more detailed control over our environmental activities (DD: environmental manager).

In EE the embedding of environmental issues in accounting procedures facilitates control function and the co-ordination between accounting and environmental management:

We had a mechanism to monitor and control our number of working hours per external projects [customer services], but different tasks not related to any current customer could not be included. Recently, internal activities such as customer offers or proposals and environmental management tasks have been incorporated. Now, we can account for the time spent on environmental management and it is transferred to accounting. Thus, there is a link between accounting and environmental management (EE: quality and environmental coordinator).

But, more importantly, the introduction of environmental issues in accounting procedures unfolds a multiplying effect in the general process of environmental embedding. Claims for an explicit identification of environmental costs in cases EE, DD, FF and GG make environmental issues more visible and raises environmental awareness inside organisations:

I think we have taken steps to extract the environmental information more easily. We have made progress but we want to attain more detailed and accurate environmental information (FF: environmental manager).

We are working with the accounting unit to define and implement a modification in the cost system to facilitate our access to the environmental information and the development of environmental reports (GG: environmental manager).

The cases examined revealed a mutual reinforcement between organisational learning processes, the dissemination of environmental responsibilities across the organisational structure and the construction of accountability systems. As a result, all line managers are somehow accountable for environmental impacts caused by the activities of their units. These accountability structures are reflected in budgets, as the environmental budget is partially allocated to line departments:

We have fought a lot for applying internally the famous polluter-pays principle; we have claimed that every unit "pays" for its waste (FF: environmental manager).

The environmental unit budget is very small, most of environmental costs correspond to production units (DD: environmental manager).

The above is a description of the contribution of organisational learning and management accounting in the micro-process of environmental embedding.

To summarise these arguments, the analysis of organisational learning illustrates the emergence of important intangible assets that, arguably, foster the environmental embedding process:

- the awareness of employees;
- the environmental knowledge, skills and expertise of employees;
- the commitment of managers;
- the cross-functional coordination and communication;

- the integration of environmental issues in strategic planning process; and
- the use of management accounting practices.

Levels of environmental embeddedness

The assessment of EMAS as an environmental embedding mechanism may be accomplished through the consideration of several indicators of environmental embeddedness. We will use the intangible assets, stemming from the catalysts for change analysed above, as an heuristics for the assessment of environmental embeddedness. According to the presence and the usage of these intangible assets, we will argue that three different levels of environmental embeddedness could be defined (see Figure 1).

A first level of embeddedness, corresponding to primary embeddedness, is based on the need to keep the EMS alive, assuring a minimum level of continuous environmental performance improvement. Two main intangible assets assure this primary level of embeddedness: the awareness of employees and the environmental knowledge, skills and expertise of employees. These intangible assets are present in all the cases, although with different intensity. AA, BB and EE sites can be placed among this level. Nevertheless, the primary embeddedness of both AA and EE can be partly justified by two reasons: their limited impacts of their activities, as an environmental consultancy and their small number of employees. Although the BB site initially appears to be a proactive company, the analysis of the catalysts reveals the presence of only the two basic intangible assets and a certain level of interaction with external stakeholders.

A second level of embeddedness, visible embeddedness, may be characterised by a further influence of environmental issues over organisational structures and strategies. In addition to intangible assets found in the primary level, sites included in this category make intensive use of three key intangible assets: the commitment of managers; cross-functional coordination and communication; and, the integration of

PLACEMENT OF SITES AMONG THE LEVELS OF EMBEDDEDNESS		Indicators of environmental embeddedness				
		Awareness of employees	Environmental knowledge, skills and expertise of employees	Commitment of managers	Cross-functional coordination and communication	Integration of environmental issues in strategic planning process
Levels of embeddedness	Primary	AA, BB, EE				
	Visible	CC, DD, GG, HH, II				
	Advanced	FF, JJ				

Figure 1.
Levels of environmental embeddedness

environmental issues in strategic planning process. These three intangible assets are considered to be core indicators for this level of embeddedness.

This set of intangible assets is present in cases CC, DD, FF, GG, HH, II and JJ. CC, DD, GG, HH and II sites can be placed in the second level. The integration of environmental issues in strategic planning process and in management accounting practices, through the incorporation of environmental issues into capital investment decisions, derive from technological innovation and research (CC, DD, II), or from the interest in going beyond legislation (GG, HH). Cross-functional coordination and communication is facilitated by different means: the development of the internal environmental audits (CC, DD, GG); the environmental assistance to line managers provided by the environmental staff (CC); the use of technology – which also improved the environmental awareness by raising the control and visibility of costs (DD, GG); and, interdepartmental environmental committees (GG, HH). All these mechanisms enhance the commitment of managers.

A third level of embeddedness would correspond to advanced embeddedness. This level is characterised by the existence of intangible assets that guarantee the integration of environmental issues over time. In addition to the use of intangible assets identified in lower levels, sites placed in advanced embeddedness evidence a higher commitment of managers and a more advanced use of management accounting practices to deal with environmental issues. A higher degree of commitment of managers representing all functions, as well as the emerging use of cost systems, capital budgeting, scorecards and other management accounting practices to deal with environmental issues reinforce the long-term embedding process. Only FF and JJ sites could be included in the advanced level. Although there are arguments (outlined above) to situate FF and JJ in “visible embeddedness”, it has to be emphasised that a higher level of commitment of managers has been reached in these sites. This implies formal and informal interactions between different functions that enable the sharing environmental information which stimulate the use of management accounting practices for further embeddedness.

Conclusions

This paper has explored how four catalysts for change that stem from EMAS could enable, through the creation of different intangible assets, the embedding for environmental issues and values in organisations. These catalysts are: training and awareness building; continuous environmental improvement; integrating stakeholders’ interests; and, organisational learning. Further, this field research illustrates the implication of management accounting in this process of environmental embedding.

The exploration of training and awareness building has suggested two critical intangible assets for environmental embeddedness: the awareness of employees, and the environmental knowledge, skills and expertise of employees. From the analysis of continuous environmental improvement, two intangible assets have emerged: the integration of environmental issues in the strategic planning process and the use of management accounting practices. Five key intangible assets are evidenced from the analysis of integrating stakeholders’ interests and organisational learning: the environmental knowledge, skills and expertise of employees; the commitment of managers; the cross-functional coordination and communication; the integration of environmental issues in strategic planning process; and the use of management

accounting practices. Evidence gathered in the field study suggests that the more the catalysts for change are promoted, connected and the synergy among them exploited, the more the EMS will produce intangible assets that favour the embedding process and consequently enhance the improvement of environmental performance.

According to the presence and the usage of these intangible assets, three different levels of environmental embeddedness have been defined. A first level relates to primary embeddedness which is based on the need to assure a minimum level of environmental performance improvement in the long run. A second level corresponds to visible embeddedness, where most of the sites are placed, as they have a further influence of environmental issues over organisational structures and strategies. The third level refers to an advanced embeddedness, which is characterised by the existence of intangible assets that guarantee the integration of environmental issues over time. Only two sites are placed at this level. It has also to be underlined that sites that evidence a more sophisticated use of management accounting practices – favouring visibility, control and decision making – show a more solid EMS.

Although this study does not intend to generalise, our findings could be used to help to identify key intangible assets that contribute to improve the environmental performance in other organisations. Thus, further research should analyse drivers of environmental embeddedness in other organisations. Furthermore, as our study has focused on environmental managers and management accountants, more analysis of the engagement of internal stakeholders by interviewing other management functions, could be undertaken. In this sense, possible connections among other organisational functions leading to reinforce the engagement of internal parties could be found. Additionally, this study has identified the more advanced use of management accounting practices as a key intangible asset for further environmental embeddedness and improved environmental performance. Therefore, more research should be conducted to further illustrate the use of particular management accounting practices and their contribution to improve environmental performance.

Notes

1. According to EMAS (2001), “site shall mean all land at a distinct geographic location under the management control of an organisation covering activities, products and services. This includes all infrastructure, equipment and materials” (Art. 2, t).
2. Council Regulation (EEC) No. 1836/93 of 29 June 1993 allowing voluntary participation by companies in the industrial sector in a community eco-management and audit scheme. This decision was published in the Official Journal L 168 page 1 on 10 July 1993.
3. EMAS defines prevention of pollution as “the use of processes, practices, materials or products that avoid, reduce or control pollution, which may include recycling, treatment, process changes, control mechanisms, efficient use of resources and material substitution” (Art. 2, b).
4. Sustainable forestry management is a series of practices ensuring that the economic exploitation of forested areas is carried out following a range of environmental and social criteria. There are two main systems for the certification of sustainable forestry management: first, Programme for the Endorsement of Forest Certification schemes (PEFC), and second, Forest Stewardship Council (FSC). Both also make it possible to certify the sustainability of the custody chain of wood products. Custody chain is the series of stages involved in the process of manufacturing our wood based products, from the forest until it reaches the consumer (Sustainability Report 2005 of CC Corporation).

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