



A multicriteria method for environmental management system selection: an intellectual capital approach



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ABSTRACT

The adoption of environmental management systems has become more widespread among those firms looking to minimize their environmental impacts. Considering that firms have to select the optimal management system from a set of possible alternatives, this paper presents a novel decision-making approach based on the multicriteria method of analytic network process, in order to evaluate and prioritize the implementation of environmental management system alternatives in for-profit firms. Since several relevant intangible benefits are derived from the adoption of this kind of management system (such as enhancing employees' knowledge and skills, as well as improving corporate reputation), the method integrates and quantifies both financial and non-financial (intellectual capital) value creation criteria in order to identify the alternative that maximizes a firm's total market value. The proposed approach is empirically tested in a group of Spanish olive oil firms with a proactive environmental management orientation, and the results confirm the reliability of the proposed model. Furthermore, the empirical applications reveal that all the olive oil firms attribute great importance to the intangible elements when assessing environmental management systems. These results suggest that it is appropriate to take into account the intellectual capital value resulting from these kinds of management systems, during the decision-making process. The proposed method formalizes the evaluation process that firms already employ; these firms certainly take non-financial capital value creation elements into account, albeit in an intuitive way.

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1. Introduction

The different environmental behavior of firms has been described in the literature as a continuum ranging from passive or reactive strategies, that merely aim to comply with regulatory requirements and introduce some basic end-of-pipe solutions, to more advanced or proactive strategies (Murillo-Luna et al., 2011) that include voluntary practices for reducing environmental impact. Today, firms are discovering that a reactive approach does not produce optimal competitive results (Sambasivan and Fei, 2008) and many are adopting proactive environmental strategies.

Since Porter and van der Linde (1995) argued that environmental regulation could lead to win–win situations in which environmental performance as well as the private benefits of firms could be improved, most studies have linked firms' investment in environmental practices to competitiveness and to good financial performance (Link and Naveh, 2006; Lopez-Gamero et al., 2010).

As a consequence of the growing stakeholder pressure that firms are facing nowadays, the adoption of environmental management systems (EMSs) as frameworks for integrating corporate environmental protection policies, programs, and practices have become more widespread among both domestic and multinational companies around the world (Morrow and Rondinelli, 2002; Simon et al., 2012). EMSs tend to be based on international standards of reference; the most popular systems are the ISO 14001 and the Eco-Management and Audit Scheme (EMAS) created within the European Union. The latest available data from ISO in 2012 reveal that the number of ISO 14001 certificates awarded exceeded 285,000 worldwide (ISO, 2012). According to the data from the European Commission (2013), by the end of 2012 more than 8500 sites and 4400 organizations had registered under EMAS guidelines. Other

Abbreviations: EMS, environmental management system; ISO, International Organization for Standardization; EMAS, Eco-Management and Audit Scheme; ANP, analytic network process; IC, intellectual capital; AHP, analytic hierarchy process; FC, financial capital; HC, human capital; SC, structural capital; RC, relational capital; LLC, limited liability company; Coop, cooperative; CEO, chief executive officer; OHSAS, Occupational Health and Safety Assessment Series.

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companies are adopting major components of international standards without formally certifying them, thus avoiding the cost of certification by a third-party auditor (Morrow and Rondinelli, 2002).

The adoption of an EMS provides tangible or financial benefits as well as intangible or non-financial benefits to firms (Lo et al., 2012; Martín-Peña et al., 2014). These benefits have an impact on the two sources of for-profit firms' value creation: the *financial or book value* of the firm and the *intellectual or intangible capital value*, thus improving the firm's *market value*, as the latter is the sum of the former value components. First, the successful implementation of an EMS brings about significant improvement in resource-use efficiency (Gavronski et al., 2008), which increases the *financial or book value* of the firm. Second, the intangible or non-financial benefits derived from EMS adoption, such as the improvement in the company's reputation and image or the enhancement of employee motivation (Psomas et al., 2011; Martín-Peña et al., 2014), can lead to an increase in the organization's intellectual capital (IC) value.

It is in the last two decades that there have been a large amount of studies devoted to EMS. Most of the first studies focused on the effects these systems have on firms' environmental, operational and financial performance (Klassen and McLaughlin, 1996; Melnyk et al., 2003). Taking into account the full range of outcomes derived from EMS implementation there are also a large number of studies devoted to the development of frameworks and methods to support EMS decision-making, namely the evaluation and selection of different EMS alternatives. To this end, different approaches have been proposed, such as multicriteria techniques (see for example: Hui et al., 2001; Petroni, 2001; Sambasivan and Fei, 2008) or hybrid models combining mathematical programming and other methods (Tsai and Chou, 2009; Celik, 2009), all of them based on different sets of technical and economic criteria in order to support decision-making. However, none of these studies has been based on corporate finance theory and the assumption that the main objective when appraising investments in for-profit firms (such as the implementation of an EMS) is market value creation (Dayananda et al., 2002; Ross et al., 2007). Thus, there is a gap in the literature and a need for studies proposing evaluation techniques to support the selection of corporate EMSs by identifying the alternative that maximizes a firm's market value.

The reason behind this gap is that whereas the costs and financial benefits from the adoption of EMSs are immediate and measurable, some major benefits are intangible (Martín-Peña et al., 2014). Intangible benefits, those associated with the firm's improved intellectual capital, are difficult to measure in monetary terms, unlike financial capital benefits. Identifying and measuring intangible benefits represent critical aspects of the EMS decision-making process, yet the intangibility of intellectual capital has made it quite challenging to analyze and justify the investment in EMSs. The traditional capital budgeting methods (discounted cash flow techniques, such as net present value, internal rate of return, or payback methods) are difficult to use in justifying EMS investment because they only consider the direct monetary effects (financial capital flows) of investments and overlook the indirect effects on the firm's intangible elements (Götze et al., 2008). Thus, new appraisal methods are required to evaluate investments with substantial intangible outcomes, such as corporate environmental management systems.

The main objective of this paper is to provide for-profit firms with a decision-making approach for selecting the 'best' EMS alternative in terms of corporate finance, that is, the approach that maximizes a firm's market value. Three specific EMSs are considered in the evaluation model: 1) Certification to ISO 14001; 2) Certification to EMAS; and 3) Non-certified EMS. For this purpose, not only direct and financial benefits are included in the analysis, but also intangible and non-financial benefits associated with the

adoption of each EMS. The proposed approach is based on the multicriteria technique of the analytic network process (ANP) and categorizes EMS selection criteria into two main sets: *financial value* and *intellectual capital value*. The latter set is divided into three dimensions: human, structural, and relational capital values. This ANP model allows the quantification of both the financial and non-financial value creation by EMSs, enabling the selection of the alternative that maximizes value creation. This methodological approach is empirically tested using an illustrative case study for the selection of the best EMS alternative in a set of firms within the Spanish olive oil industry. Furthermore, through the case study analysis we will also validate the hypothesis that it is necessary to consider variations of intellectual capital assets when analyzing investments in EMSs because of the significant intangible benefits derived from their implementation.

The remainder of this paper is arranged as follows: Section 2 presents the theoretical framework of corporate environmental management systems. In Section 3, we briefly discuss the fundamental basis of value creation in firms. Section 4 introduces the proposed decision model to evaluate and prioritize a set of EMS alternatives. The empirical case study within the olive oil industry will be illustrated in Section 5 in order to test the applicability of the proposed decision framework. Finally, in Section 6 the conclusions are presented, and the original contributions made by this research are identified.

2. Corporate environmental management systems

Today, adoption of EMS constitutes one of the most important elements of corporate sustainability (Zobel, 2013). Among the diverse environmental management practices that firms have implemented in recent years (including cleaner production, eco-efficiency and life cycle assessment), EMSs have been the focus of much attention (Campos, 2012).

An EMS is a part of an organization's management system which aims to manage the environmental aspects related to its activities, products, and services. Its principal and ultimate objective is to improve the environmental performance of the organization, and it is based on the concept of continual improvement (Perotto et al., 2008). An EMS consists of a collection of internal policies, assessments, plans and implementation actions affecting the entire organization (Coglianese and Nash, 2001).

Facilities may adhere to different types of EMS standards. One of the main distinctions among EMSs is whether or not they are certified by an independent third-party auditor. The two most frequently used guidelines for EMS design and certification are the standard ISO 14001, proposed by the International Organization for Standardization, and the European standard EMAS (the basic structure of each one is shown in Table 1). The main difference between these two options is the requirement for EMAS-registered organizations to publish an "environmental statement" regarding their environmental performance. By contrast, organizations may also adopt *non-certified EMSs*, thus avoiding certification costs and having more flexibility in the degree to which environmental management is integrated throughout the organization (Darnall and Edwards, 2006; Santos et al., 2011). However, in order to consider the existence of a non-certified EMS in an organization, some essential steps (very similar to those in ISO 14001 implementation process) have to be carried out: setting environmental management goals and policy, characterizing operations, collecting and analyzing data, assessing environmental aspects of the operations and activities, and review and modification (Khalili and Duecker, 2013).

Two main theoretical approaches are found in the literature regarding what motivates leading companies to implement different environmental self-regulation initiatives in their

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