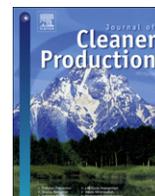


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# The use of indicators and the role of environmental management systems for environmental performances improvement: a survey on ISO 14001 certified companies in the automotive sector

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## ABSTRACT

The relationship between EMS implementation and environmental performances improvement is subject to increasing interest by international researchers but results obtained so far are not univocal. A critical issue is that ISO 14001 does not require companies to reach minimum levels of environmental performances (apart from legal compliance) nor does it supply methods to be used to measure continual improvement. A questionnaire-based survey on a sample of companies in NW Italy was carried out with the aim of investigating which operational performance indicators (according to ISO 14031) are used in their EMS, whether EMS implementation has contributed to an increased commitment towards environmental performance and what the entity of the achieved improvements is. The sample was made up of companies belonging to the same industrial sector (automotive) and with a consolidated EMS (ISO 14001 certified for at least three years).

Results highlight that various environmental aspects are monitored in the EMS by means of a rather large number of indicators, but the most detailed ones (relative indicators) mainly refer to aspects where performances improvement means cost reductions (waste management and use of resources). The EMS implementation increases the number of companies committed (mean increase: 108.7%), as well as the number of environmental aspects involved and determines higher investments towards environmental improvement. The quantification of the improvements achieved was only provided by a limited number of companies, but data show that EMS determined positive effects in the environmental performances, although with highly heterogeneous values, varying from +16.9% (use of resources) to +42.7% (releases to water).

For future research activities we recommend tailoring the sample of certified companies, limiting its scope to companies with a consolidated EMS and, where possible, to EMAS registered companies, in order to deal with publicly available validated data trends. Finally, in order to improve EMS efficiency, we recommend that companies carry out a specific design phase, in accordance with ISO 14031, aimed at identifying a proper set of indicators to adequately assess and monitor their environmental performances.

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## 1. Introduction

One of the key elements of the ISO 14001 international standard is the continual improvement of environmental performances, defined as “a process of enhancing the environmental management system in order to achieve improvements in overall environmental performance consistent with the organization’s environmental policy”

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(ISO, 2004). Continual improvement is the final outcome of the Plan-Do-Check-Act (PDCA) or Deming cycle, which is the core of Environmental Management Systems (EMS). The relationship between EMS implementation and environmental performance improvement is subject to increasing interest by international researchers but studies have not yet arrived at a clear conclusion; some outline that EMS implementation has led to improvements (Annandale et al., 2004; Anton et al., 2004; Arimura et al., 2008; Botta and Comoglio, 2007; Hilson and Nayee, 2002; Potoski and Prakash, 2005), while others show that the environmental performances of some companies have decreased, even without losing their certificate (Ammenberg et al., 2002; McDonach and Yaneske,

2002; Rondinelli and Vastag, 2000). The study of these relationships is complex as the continual improvement can be context dependent (Nawrocka and Parker, 2009) and related to several different aspects and issues, such as single environmental impacts, environmental costs reduction, improvement of the compliance to legal requirements, ethical aspects, etc. The outcomes of scientific research are not univocal because studies are often limited to the analysis of the relationship between environmental certification and improvement of single aspects of the overall environmental performance. For example, some studies tend to demonstrate a real link between ISO 14001 certification and specific environmental performance improvement: Radonjic and Tominc (2007) identified a relationship between ISO 14001 and improvement of working staff safety and reduction in emissions and energy consumption in the metal sector. In other studies no correlation, or even negative correlations, have been outlined: Barla (2007) verified that a sample of ISO 14001 certified companies belonging to the pulp and paper industry sector obtained a significantly lower reduction of BOD and TSS emissions than a sample of uncertified companies in the same production sector. Other studies (Ammenberg et al., 2002; Brouwer and van Koppen, 2008; Hammond et al., 1995) outlined that ISO 14001 only determines improvements in the initial implementation phase due to the efforts needed to issue the initial environmental review and to meet the baseline of compliance to existing regulations. Positive effects can even be absent once the certificate has been obtained (Ilomaki and Melanen, 2001; Moxen and Strachan, 2000).

A critical point is that ISO 14001, apart from requiring full compliance to existing regulations, does not fix minimum levels of environmental performances that should be achieved and assessed annually in order to maintain the certification, and does not even provide specific requirements or operational methods to be used to measure continual improvement (Brouwer and van Koppen, 2008; Zobel, 2008). For this purpose a good reference is ISO 14031, a standard belonging to the ISO 14000 family (ISO, 1999), which gives guidance in the design and use of environmental performance evaluation by means of environmental performance indicators (defined as the “*specific expression that provide information about an organization’s environmental performance*”), but knowledge and explicit use of this norm in ISO 14001 certified companies is very limited (Brouwer and van Koppen, 2008; von Bahr et al., 2003).

However, certified companies are explicitly required by ISO 14001 to implement procedures to monitor and measure the key characteristics of their activities that can have a significant environmental impact (the so-called significant environmental aspects) in order to determine how the organization is managing the improvement of its environmental performance (Section A.5.1 of ISO 14001). Therefore environmental indicators must somehow be used in the EMS to support organizations to quantify and report their environmental performances, as they contribute to the compulsory significance evaluation of environmental aspects and supply quantitative information (Perotto et al., 2008). A recent study (Henry and Journeault, 2008) further supports this consideration, indicating that the implementation of indicators that can be related to the ISO 14031 standard is more evident in ISO 14001 certified companies.

From this point of view, a detailed analysis of the indicators used by ISO 14001 certified companies can reveal specific information on how environmental performance improvement is monitored in the EMS, i.e. which environmental aspects are kept under surveillance and which indicators are used for this purpose.

The operational indicators (OPI) used can then be categorized with reference to ISO 14031, according to the type of quantitative measures for their calculation, in direct indicators (DI; basic data or information; e.g. weight of total waste produced), relative

indicators (RI; data or information compared to or in relation to another parameter (production level, time, location or background conditions); e.g. fuel consumption/km driven) and indexed indicators (II; describing data or information converted to units or to a form which relates the information to a chosen standard or baseline; e.g. number of non conformities). The use of relative and indexed indicators instead of direct ones in the EMS can show a deeper insight by certified companies for the evaluation and monitoring of their environmental performance.

Finally, if such an analysis is focused on an EMS that has been consolidated over time (i.e. companies with an ISO 14001 certification since several years), some useful information on the entity of the environmental performances achieved during that period can then be gathered, in order to evaluate to what extent the EMS has contributed as a driver for continual improvement.

In this framework, the study presented in this paper is a questionnaire-based survey on a sample of companies belonging to the same industrial sector (automotive) and ISO 14001 certified for at least three years, with the aim of investigating (i) which operational performance indicators (classifiable as OPI according to ISO 14031) are used in the EMS to monitor environmental aspects and to assess continual improvement, (ii) whether the EMS implementation has contributed to an increased commitment and (iii) what the entity of the obtained improvements is.

## 2. Study design

### 2.1. Sample selection criteria

This study is based on a questionnaire survey conducted on a sample of companies selected according to the following characteristics:

- belonging to the same industrial sector (automotive)
- ISO 14001 certified for at least three years

Existing literature on EMS (see Nawrocka and Parker (2009) for a review of 23 studies connecting environmental performance to EMS) is mostly related to investigations carried out on very varied samples which cover different sectors and types of organizations (small enterprises, large industrial groups, public sector organizations, etc.) with a great variability of factors that could affect the outcomes of the research (e.g. different purposes for the EMS implementation, different environmental aspects, indicators and monitoring systems, etc.).

Therefore, in order to avoid such limitations, we focused on a specific industrial sector, the manufacturing of automotive components, which is well represented throughout the world and whose operational and management practices are generally based on established technical references that are not country specific but recognized by the international market (Sutherland et al., 2004). The automotive sector currently faces an increasing trend in environmental concerns and innovations towards sustainability (Orsato and Wells, 2007), especially from the point of view of producing cleaner cars with lower emissions (Zapata and Nieuwenhuis, 2010; Oltra and Saint Jean, 2009). This trend is mainly driven by the market and the evolving legal framework (Crotty and Smith, 2006) and is consequently reflected on the supply chain (Zhu et al., 2007; Brent and Premraj, 2007; Koplin et al., 2007; Simpson et al., 2007) and on the improvement of internal environmental management practices, especially by means of EMS implementation (Gonzalez et al., 2008; Gernuks et al., 2007; Brent and Premraj, 2007; Mohammadrezaie and Eskafi, 2007; Tikin, 2008; Singh et al., 2007).

Under this assumption, through the analysis of a sample of companies belonging to the same sector located in only one

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