



ISO 14001 certified plants in Brazil – taxonomy and practices

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ABSTRACT

Research on taxonomies has helped in shedding light on similarities between firms in a particular group and differences between each group. However, few studies have analyzed how operations managers of manufacturing firms in emerging countries adopt diverse strategies of environmental management, with diverse operational practices and results. This study fills this gap by proposing a taxonomy for ISO 14001-certified plants, describing the differences for each group for a set of key variables related to internal and external perspectives. For this purpose, we conducted a survey of ISO 14001-certified manufacturing plants in Brazil, in a restricted set of industries including chemical, manufactured metal products, and electronics. A sample of 99 plants was analyzed using multivariate data analysis techniques, such as principal component analysis (PCA), cluster analysis, and analysis of variance (ANOVA). We have identified three clusters, according to their motivations to certification: internal focus, external focus, and holistic group. Internal focus companies are characterized by their emphasis on internal operations and resources. External focus companies deal with social pressure and institutions that regulate the environment. Holistic companies place high value on all motivation dimensions regardless if they are internal or external. We present an illustrative example related to the Holistic group. Companies in this group present a more efficient use of raw materials and inputs as well a higher integration with suppliers and external research and development (R&D) centers. This group combines external actions with internal results regarding environmental management. Thus, the results suggest that external integration and the improvement of internal processes efficiency allow a more integrated approach in environmental practices, resulting in better environmental performance. On the other hand, companies with the external focus strategy tend to have lower environmental performance and lower levels of operational practices linked to the environmental management.

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1. Introduction

Pressures from clients and society have led manufacturing companies to develop efforts and adapt their processes in order to reduce or eliminate the negative impact of their operations on the environment. Options such as cleaner production, environmental management systems, and pollution control systems have been used as tools to address these needs (Cervellini and Souza, 2009; Klassen and Whybark, 1999a). Environmental Management Systems (EMS), of which the ISO 14000 family of standards is an example (Gavronski et al., 2008), tend to impact mitigation and create conditions for sustainable operations, matching expectations

of stakeholders and a growing number of interested people (Cagno et al., 1999). Increasing interest in protecting natural environment against industrial pollution means that EMS and technologies related to sustainable operations are more than an option, becoming, in fact, an inevitable choice (Alberti et al., 2000). Factors such as environmental protection laws, increasing cost of raw materials energy production, and natural resources policies have impacted on companies' economic systems, which in turn affect companies' performance and competitiveness and demand revisions in management paradigms (Ferrer, 2008). The development and diffusion of EMS represent a significant part of this commitment to rethink conventional management wisdom (Cagno et al., 1999).

Numerous studies in the literature have investigated the major reasons for companies adopting EMS and corporate social responsibility practices (CSR) (Bansal, 2005; Bansal and Hunter, 2003; Fryxell and Szeto, 2002; Gavronski et al., 2008; Massoud et al., 2010; Oliveira et al., 2010; Zhu et al., 2007) and their impacts on

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firm performance (Cervellini and Souza, 2009; Heras-Saizarbitoria et al., 2011; Jacobs et al., 2010; McGuire et al., 1988; Melnyk et al., 2003; Montabon et al., 2007; Nawrocka and Parker, 2009). However, there are still knowledge gaps about the relationship among motivation for EMS implementation, environmental practices and results especially in companies located in emerging economies such as Brazil. More than 600 companies have been certified in the ISO 14001 standard in Brazil, according to the Brazilian Institute for Metrology (INMETRO). Past studies have looked at why companies in emerging economies such as Brazil adopted an EMS based in the ISO 14001 standard (Gavronski et al., 2008; Oliveira et al., 2010). In this study, we will use a taxonomy related to ISO 14001 motivations to identify strategic groups and compare the environmental operational practices and environmental performance between these strategic groups.

In operations strategy literature, several studies have tried to identify and understand how companies can be classified in terms of strategic decisions. Miller and Roth (1994) proposed a taxonomy of operations strategy based on the competitive priorities. Later replications of this taxonomy and other related studies were conducted by Menor et al. (2001), Frohlich and Dixon (2001), and Zhao et al. (2004). The *Journal of Operations Management*, in 2000, dedicated a special issue about companies' strategic configurations, with studies focusing on operations strategy's categories of decision. Most configuration studies gather data from developed countries. One exception is the work of Kim and Lim (1988), which used perceptual data from 54 Korean top managers to provide a numerical taxonomy of strategic groups. In the field of environmental and sustainable operations, very few studies attempted to find strategic groups of companies and environmental issues in developing countries. Klassen and Whybark (1999a,b) identified a numerical taxonomy in the developed United States. No study was found, though, about taxonomy of companies adopting ISO 14001 in developing countries. Thus, what are the strategic groups that emerge from motivation of companies in emerging countries, such as Brazil, to adopt ISO 14001? How different are these strategic groups in terms of environmental operational practices and environmental performance?

Therefore, this paper has two objectives. First, we obtain a numerical taxonomy that classifies the environmental operation strategies of manufacturing plants according to the major reasons for adoption of ISO 14001 by Brazilian companies. Second, we describe the differences among the strategic groups we obtained in the numerical taxonomy regarding environmental practices and results. To achieve our first objective, we rely on resource-based view (RBV) and institutional theories to conceptualize the major reasons Brazilian companies adopted such environmental management system. Following the recommendations from Bozarth and McDermott (1998), we have integrated operations strategy literature with the business strategy literature, by using such mainstream explanations (RBV and institutional), using the motivations to the ISO 14001 certification to classify manufacturing companies according to their environmental strategy.

From an academic perspective, our main contribution is to shed light on the strategic patterns followed by companies in emerging countries when adopting ISO 14001. By doing this, we provide a source for comparison with other related studies on companies from developed countries (Klassen and Whybark, 1999a,b). In this paper we present a numerical taxonomy of companies adopting ISO 14001 in emerging countries. Our work will identify and distinguish characteristics of groups of companies and serve as a basis for future studies also developing numerical taxonomies of ISO 14001 and other related EMS. From a social-level perspective, our contribution is to find out how companies in developing countries perceive and act when facing the social challenges related to caring

for the environment and natural resources. By revealing such characteristics of companies, decision makers in developing countries can design public policies to help companies achieving higher levels of environmental performance.

The next section introduces a brief review of the related literature. In the methodology section, we describe the major methodological procedures. Then, we present results in two parts: first we show the outcome from the survey, and second we present a qualitative case related to the proposed taxonomy. Finally, we discuss major findings, conclusions, and limitations of the study.

2. Literature review

2.1. Environmental management system and ISO 14001 certification

Environmental management systems can be viewed as operational management tools helping the development and execution of business strategies. Echoing Wheelwright (Wheelwright, 1984), Angell and Klassen (1999) argue that operations strategic decisions are developed through structural decisions (regarding facilities, capacity, process technology and vertical integration) and infrastructural decisions (related to human resources, quality systems and supply). In this sense, an environmental management system provides a set of tools able to establish changes through mechanisms and techniques ordered and is essential to improve performance and assist in identifying and managing environmental risks and obligations (Epstein and Roy, 1998). Moreover, a management system based on organizational accountability, management controls, and systems analysis and planning may have a higher degree of proactivity from the stakeholders (Klassen, 2001) and can be a tool to offset the costs of improving environmental performance and reduce the trade-off between competitiveness and legal compliance (Porter and van der Linde, 1995).

The international standard that allows an organization to obtain such an environmental management system certification is ISO 14001. ISO 14001 is the specification standard, part of a set of standards aimed at environmental management systems, called the ISO 14000 family. A company can obtain ISO 14001 certification for each site (manufacturing facilities or service facilities) by independent bodies. ISO 14001 standard also allows companies to seek continuous improvements based on the PDCA (plan-do-check-act) model (Angell and Klassen, 1999). Thus, this model, also known as the PDCA cycle, enables managers to establish a continuous improvement of its environmental impact. An environmental policy facilitates planning, implementation and operation, checking and taking corrective action and review of the management system, and provides guidance for the construction of a management system aimed at the achievement of environmental goals (Melnyk et al., 2003). The basic assumption of this approach is that by improving the manufacturing process, the company would develop better environmental management practices and improve their financial and operational performance, contrary to the traditional belief that environmental performance must be improved at the expense of the remaining performance dimensions (Jacobs et al., 2010; McGuire et al., 1988; Melnyk et al., 2003; Montabon et al., 2007; Nawrocka and Parker, 2009).

2.2. Classification schemes of environmental operations

Klassen and Whybark (1999a,b) proposed a typology of operations technologies employed by companies to address the following environmental activities: pollution prevention, environmental management system, and pollution control. In this context, the mission of operations is to create eco-efficient capabilities linked to these respective environmental activities. Other authors

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