

## **SUPPLY CHAIN ENVIRONMENTAL MANAGEMENT MATURITY IN A PULP AND PAPER COMPANY**

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### **KEYWORDS**

Supply Chain, Environmental Management, Paper Company

### **ABSTRACT**

In this research it was assessed the level of Supply Chain Environmental management (SCEM) maturity in a focal company of a pulp and paper supply chain. They were used semi-structured interviews in different companies of the supply chain to collect the data which was analysed through the use of qualitative data analysis software. To evaluate the SCEM practices, it was used Ferreira's (2014) model, which establishes 53 practices organized into 8 groups. It was verified that SCEM practices of internal environmental management type, operational ecodesign practices and operational waste reduction and risk minimization practices are fully adopted by the company. Furthermore, the evidence points to a process of evolution from the reactive and preventive levels to the proactive level, strategically establishing environmental principles and objectives to ensure business sustainability, and achieving competitive advantage and differentiation in the market. Finally, the adoption of practices involving customers and suppliers makes the process more effective and efficient and the role of the focal company is fundamental resulting from that coercive pressures that complement and extend the initial normative pressures.

### **INTRODUCTION**

The growing importance of Supply Chain Environmental Management (SCEM) is driven mainly by the gradual deterioration of the environment, reduction of natural resources, expansion of waste generation and increasing levels of pollution. In this context, manufacturing and production operations are responsible for waste generation, ecosystem rupture and depletion of natural resources (Beamon, 1999).

Managing this impact encompasses strategies to reduce carbon emissions and minimize waste and pollution throughout the supply chain from raw material extraction, including manufacturing, distribution, delivery to the customer, and ultimately recycling or reuse at the end of the product life cycle (Green Jr et al., 2012; Rehman and Shrivastava, 2011).

The search for better environmental management practices can be driven by environmental regulations (Lau and Ragothaman, 1997; Rehman and Shrivastava, 2011) or by incorporating environmental goals, policies and business strategies (Miles and Covin, 2000) and firms can be positioned at differentiated levels of environmental management maturity namely: reactive, preventive and proactive (Jabbour, 2015; Ferreira, 2014).

The objective of this research was to identify the level of maturity in environmental management of a focal company in a pulp and paper supply chain.

In this sense, this study is justified by the importance of the theme, especially regarding the incorporation by companies of ecological practices in the supply chain to promote environmental sustainability and consequently the improvement of social conditions and the preservation of natural resources.

### **LITERATURE REVIEW**

Environmental management is a set of initiatives to mitigate the impact of organizations' operations on the environment (Bansal and Roth, 2000), to eliminate or minimize negative environmental impacts (air, water and land pollution) and waste of resources (energy and materials), from the extraction of raw materials to the final use of the product or (Vachon and Klassen, 2008, Eltayeb et al., 2011).

Companies adopt SCEM initiatives influenced by government regulations, stakeholder pressure (clients and society), economic and environmental interests of companies (Hervani et al., 2005; Zhu et al., 2007) and to meet their social responsibility Kafa et al. (2013).

In this sense, institutional theory postulates that competitive organizational environmental alignment can be influenced by three institutional isomorphic pressures that are known as normative, coercive and mimetic pressures (Sarkis et al., 2011).

Coercive isomorphism occurs when there are pressures from organizations, such as the government, to adopt a certain type of structures and procedures, presenting a certain degree of submission (Dimaggio and Powell, 1983). Mimetic isomorphism occurs when, facing uncertainties in the environment and difficulties in the definition of their own strategies, companies mirror in other organizations (e.g., through competitive benchmarking) and have them as a model (Zhu et al., 2013). Normative isomorphism is related to rules, norms, professionalization, dissemination of knowledge by specialists and the definition of working methods, such as processes and management models, customer and market requirements (Dimaggio and Powell, 1983).

SCEM practices can be synthesized in practices of (i) planning (return on investment, internal environmental management, storage and green building); (ii) operational (waste reduction and risk minimization, reverse logistics and ecodesign) and (iii) communication, totaling 53 different practices according to Ferreira (2014).

Planning practices include external aspects such as the selection, evaluation and contracting of suppliers, cooperation with customers and suppliers, and participation in an eco-industrial park (Zhu and Sarkis, 2004); investment in the reduction of waste and the extension of product and material lives (Zhu and Sarkis, 2004); on the other hand, internal environmental management practices are related to the commitment of senior managers, multifunctional cooperation and ecodesign (Walton et al., 2008).

SCEM process practices encompass waste reduction and risk minimization, where products must be designed with compatible raw materials, parts and components for disposal and / or recycling (Zhu and Sarkis, 2004; Azevedo et al., 2011) and reverse logistics, which is the process of recovering the product from the point of consumption to the point of origin for reuse, recycling and remanufacturing.

Eco-design is a predecessor of all these practices, as it is closely related to environmental risk management, product safety, pollution prevention, resource conservation and waste management, foreseen in the design phase, when materials and processes are selected and the environmental performance of the product is largely determined (Lenvis and Gretsakis, 2001).

Finally, we have communication practices that aim to inform the company's social and institutional environment about the actions taken in favor of the environment which can be considered as an environmental commitment (González-Benito and González-Benito, 2006).

Assessing the adoption of SCEM practices we can define the level of environmental management maturity at three different levels: reactive, preventive or proactive (Ferreira, 2014). Also to Jabbour and Santos (2006) and Jabbour (2007), corporate actions in environmental management can be measured and translated into these maturity levels.

At the reactive level, there are a small number of practices implemented, generally imposed by restrictive environmental legislation, and are taken as an external cost and a legal problem. At the second level, designated as preventive, companies adopt a greater number of SCEM practices, and, at the proactive level, the adoption of a large number of practices is considered as one of the pillars to obtain competitive advantage and is explicitly included in the firm's strategy (Jabbour, 2015).

Thus, at the reactive level, there are a small number of SCEM practices, generally imposed by restrictive environmental legislation, and SCEM practices are seen as an external costs and a legal problem. At the second level, designated as preventive, companies adopt a greater number of SCEM practices and it is assumed that costs are lower when pollution generation and environmental problems are reduced. However, environmental issues are still not considered in the company strategy. At the proactive level, there is the adoption of a large number of SCEM practices considered as one of the pillars to gain competitive advantage and they are considered explicitly in the company's strategy.

Zhu and Sarkis (2004) found that the rate of adoption of SCEM practices was very low, however, contributing to environmental and economic performance (Green Jr. et al., 2012; Geng et al., 2017; Mitra and Datta, 2014), presenting quality management as a positive moderator.

Jabbour et al. (2015) identified quality management as an important antecedent for higher maturity levels of environmental management and the adoption of external SCEM practices that influence environmental performance. In relation to the size of the company, Zhu et al. (2008) concluded that Chinese large and medium-sized organizations are more advanced than small-scale organizations in implementing environmental practices, driven mainly by external pressures.

This path seems to be the most common, as stated by Zhu et al. (2005), Zhu et al. (2007), Ninlawan et al. (2010) and Rehman and Shrivastava (2011). Indeed, companies have increased their environmental awareness much more due to regulation and competitive pressures than to internal motivations.

Furthermore, Sharma (2014) states that high employee involvement helps in building healthy SCEM practices, especially when those employees have decision making roles. Also Jabbour et al. (2009) concluded that proactive environmental management related to external integration, requires the support of human resources at a strategic level. Testa and Iraldo (2010) stated that SEM practices are linked to the use of other management practices,.

## RESEARCH METHODOLOGY

In this research, a qualitative approach was adopted, with data collection through semi-structured interviews applied to seven managers of a focal company belonging to the pulp and paper supply chain, to two of its suppliers and one of its customers in the period from December 2017 to March 2018. The Nvivo software was used as an analysis tool for identifying and discussing the findings. To identify the adoption of each of the SCEM practices, a binary perspective was considered, i.e. whether the company adopted such practice (yes) or whether it did not and it was obtained evidence about the reasons and the process of adoption or non-adoption of such practices. We used the qualitative data analysis software for content analysis and institutional theory to understand and discuss the implications of the level of maturity of environmental management in the supply chain of the company.

Information provided by the company of public and private nature was also used, in particular information provided by the sustainability report. The data collected were used to discuss the company's level of maturity in environmental management and especially the reasons and implications using the concepts of institutional theory. The focal company is among the four largest companies in Brazil in the paper and packaging paper segments. It has an environmental management department to meet all legal and organizational aspects, considering that the company holds the standards ISO 9001: 2008 certifications; ISO 14001; ISO 14064; FSC® - Forest Stewardship Council®; ISEGA and Anvisa.

## ANALYSIS AND DISCUSSION OF RESULTS

The company seeks to mitigate the environmental impacts arising from its activity, developing and executing programs that are in line with legislation and standards.

The company develops projects and initiatives that support this purpose namely, (i) the construction of a plastic recycling plant; (ii) treatment of HPB boiler ash; (iii) treatment of calcium carbonate; (iv) reduction and reuse of water; (v) Inventory of Greenhouse Gas Emissions (GHG); (vi) MDL effluent treatment; (vii) recovery of APP; (viii) environmental education; (ix) depollution programs; (x) ecological trails; (xi) ecological garden; (xii) limnological monitoring; (xiii) study of ichthyofauna.

It was observed that the focal company is strongly influenced by the legislation, whose evidence is supported by the analysis of the interviewees and from the sustainability reports. These influences are important to explain the first level of maturity.

At the intermediate level, in addition to complying with legislation, the focus becomes more operational, reducing pollution and waste and improving productivity (Cagno et al., 2005). At this level, the motivation for change can be driven by the normative pressures of external stakeholders (Zhu et al., 2013). By observing the company's SEM practices, it is possible to recognize that the various certifications demonstrate a concern to have aligned and adequate processes and products that meet regulatory requirements, ensuring that the final product meets the highest quality standards required by customers.

At the proactive level of environmental management, organizations have environmental management as one of the pillars to gain competitive advantage (Richards, 1997). The analysis of the interviews show that for the focal company, environmental issues are present in the company's strategy with clearly defined goals, accepted and followed by all, impacting in the entire supply chain, i.e. in terms of the upstream and downstream.

Regarding the adoption of SCEM practices, those more adopted by the company are: SCEM practices of internal environmental management type, operational SCEM ecodesign practices and operational SCEM waste reduction and risk minimization practices which are all fully adopted.

At an intermediate level are the practices of planning adopted at 89%, reverse logistics practices at 77%, communication practices at 75%, green building practices adopted at 71%, and planning practices related to the analysis of the return of investment in 67%. These results are presented in Figure 1.

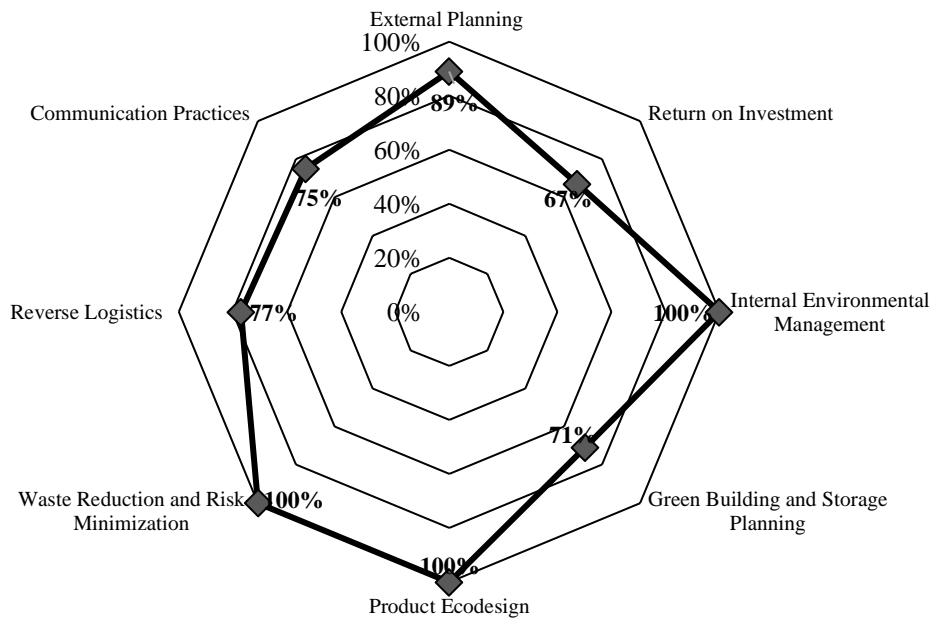


Figure 1: Supply Chain Environmental Management Practices adopted by the company

In addition to the adoption of SCEM practices, Jabbour (2010, 2014) and Jabbour et al. (2015) consider that factors such as top management support, organizational structure, interface among other areas, environmental objectives, inclusion of environmental management strategies and environmental focus, demonstrate the level of maturity in environmental management. Evidence on these factors was found after the analysis of the data using Nvivo software, demonstrating that for the period 2018-2027, the company is strategically even more aligned, from top management to the bottom of the company and highly committed to SCEM.

According to Ferreira (2014), the number of SCEM practices increases as the organization evolves towards a higher level of maturity in environmental management, and at the proactive level, companies adopt a considerable number of SCEM practices, incorporating continuous improvement actions, technological and environmental innovation, collaboration within the company, with customers and suppliers, culminating in the increase of financial gains, company's image and environmental management results.

The company adopts SCEM practices that demonstrate the cooperation with suppliers and customers for environmental objectives; optimizes the production process with the reduction of the extraction of natural resources and less consumption of raw materials and inputs; minimizes the environmental impact of waste; adopts green building practices; communicates with its markets and partners and all organizational levels are committed to the SCEM.

From the perspective of institutional theory, it appears that coercive isomorphism was the main motivator for initiating the process of environmental compliance because the law is very strict, as well as punishments. In addition, customer demands on the quality of the products, what is also related to the legislation, influence the SCEM strategy of the company, which in turn pushed similar actions in the upstream and downstream, from which results less polluting products and services, with lower financial and resource costs.

## CONCLUSIONS AND OPPORTUNITIES FOR FURTHER RESEARCH

SCEM can be viewed as a process of evolution from the reactive and preventive levels to the proactive level, strategically establishing environmental principles and objectives to ensure business sustainability, and achieving competitive advantage and differentiation in the market. In this study, the focal company adopts 85% of the 53 SCEM practices, with 100% adherence to the practices of internal environmental management, practices of waste reduction and minimization of risks and ecodesign, much as a consequence of the determination of the current leaders and the legacy left by its founder, since according to history, one of its principles was based on the preservation of the environment (i.e. suggesting a kind of normative isomorphism). Indeed, the institutional theory offers a good framework to understand this process and the reasons that justify it. Typically, normative pressures are voluntary and do not have a dominance role comparing to mimetic and coercive pressures what makes this case also interesting from a theoretical perspective.

In terms of environmental management, the company meets all the requirements of the legislation and has the initiative to ensure that these are fulfilled in the chain as a whole. The strategic positioning of the company is a determining factor for such environmental maturity, directing internal and external actions with specific goals that consider the entire supply chain, being established at the proactive level but with space for innovation and continuous improvement.

In summary, this research contributed to demonstrate that the use of SCEM practices in a proactive maturity level, increases the level of competitiveness of companies, contributing to cleaner production, reuse and recycling of products. Furthermore, the involvement of customers and suppliers creates a win-win environment, where the effort for new solutions generates gains to the entire supply chain.

This research contributed to demonstrate that proactivity in environmental management contributes to raising the level of competitiveness of the companies of the entire supply chain, also contributes to enhance the process of continuous improvement and reduces costs, encourages cleaner production, the reuse and the recycling of products. The adoption of practices involving customers and suppliers makes the process more effective and efficient, as it generates a win-win environment, where the effort for new solutions generates gains that can be distributed by all the companies involved. Nevertheless, the role of the focal company is fundamental resulting from that coercive pressures that complement and extend the initial normative pressures.

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