

Eco-control and corporate sustainability strategy

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Introduction

Over the last century, the important increase in population and rapid economic development has caused unintended ecological degradation and social disparities (Shrivastava, 1995c; Hart, 1995). Ecological problems, such as global warming, ozone depletion, deforestation and desertification, declining biodiversity, and toxic waste as well as the present social conditions around the world, such as child labor in Asia, workers' rights in North America and Europe, political upheaval in South America, and human rights violations in Africa, are just a few examples of the challenges that our world is facing today (Epstein, 2008). Recognizing the importance of these challenges, the Brundtland Commission has introduced the concept of sustainability for the first time. Defined as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987), the notion of sustainability integrates economic, environmental and social perspectives into the objective of developing a more equitable and wealthy world in which the natural environment and the cultural achievements are preserved for generations to come (Dyllick and Hockerts, 2002).

Since this role and responsibility imposed on corporations has been largely recognized (e.g. Porter and Van der Linde, 1995a; Shrivastava, 1995c; Porter and Kramer, 2011), organizations around the world face increasing pressure to reduce their ecological impacts and address social issues. The environmental and social regulations have become more demanding and restrictive (Vogel, 2003; González-Benito and González-Benito, 2006). Also, the costs associated with environmental and social aspects are rapidly growing (Parker, 1999). Fines and penalty costs are becoming more significant as well as the implementation of emissions, rights, carbon market and environmental tax increases for the more pollutant firms (Cook, 2009; MacKenzie, 2009). Moreover, the different stakeholders, such as the community, NGOs and investors, are putting more pressure on organizations to consider ecological and social aspects (Berry and Rondinelli, 1998; Henriques and Sadorsky, 1999; Buysse and Verbeke, 2003). Therefore, sustainability

concerns have become an important and unavoidable issue that organizations need to address.

Hence, the issue of whether companies should consider their social responsibility or the impact of their activities on their stakeholders is no longer up for discussion (Epstein, 2008). For them, the recurrent question has become how to improve environmental and social performance without compromising long-term profitability (Figge and Hahn, 2002; Epstein and Roy, 2001). Because they are pressured from shareholders to deliver profits, managers are faced with the challenge of managing the paradox of simultaneously improving social, environmental, and financial performance (Epstein, 2008). For more than fifteen years, there has been considerable debate in the literature about the positive or negative contribution of environmental and social performance on economic performance. Some scholars have questioned the positive impact of adopting sustainability strategies on organizational competitiveness (e.g. Walley and Whitehead, 1994; McWilliams and Siegel, 2000; Nidumolu, Prahalad et al., 2009). However, a growing body of literature has argued that these strategies could lead to an increase in economic performance (e.g. Burnett & Hansen, 2008; Russo & Fouts, 1997; Al-Tuwaijri et al., 2004; Wagner & Schaltegger, 2004; Henri and Journeault, 2010). For organizations, the adoption of a sustainability strategy may lead to organizational benefits (Bansal and Roth 2000, Paulraj, 2009) by creating a competitive advantage (e.g. Hart, 1995; Porter and Van der Linde, 1995a; Christmann, 2000; Porter and Kramer, 2006; López-Gamero, Molina-Azorín et al., 2009). However, although a consensus on the financial benefits of improving environmental and social performance seems to have emerged, the identification of the specific circumstances and conditions needed for organizations to reach this win-win situation remains an important and unanswered question for managers.

Also, stakeholder management and integration, one of the fundamental elements of sustainability performance (e.g. Hillman and Keim, 2001; Neely, Adams et al., 2002; Buysse and Verbeke, 2003; Unerman and Bennett, 2004; Steurer, Langer et al., 2005; Unerman, 2007; Delmas and Toffel, 2004, 2008), remains an important concern for

managers. Indeed, in the context of sustainability, companies must assume a broader role than simply delivering value to their shareholders if they want to succeed over time. The purpose of the corporation must be redefined to create shared value that enhances the competitiveness of the firm while simultaneously considering the social concerns and values of the community in which they operate (Porter and Kramer, 2011). In that case, the consideration of the needs and expectations of every stakeholder that influences and is influenced by the organization is essential to maximize corporate value (Barton, 2011). However, many questions arise when considering managing and integrating stakeholders: Which stakeholders should be considered? How can these stakeholders be best integrated within the organizational processes? When the expectations are often conflicting or diverging among stakeholders, how can they simultaneously be fulfilled and how can the needs of every stakeholder be satisfied? How and to what extent will the fulfillment of stakeholders' expectations and needs influence sustainability performance? All these questions represent important challenges for managers.

The development and implementation of sustainability strategies throughout firms represent another important challenge for managers (Epstein, 2008). Since the organization has to be transformed, redesigned, and restructured in order to achieve sustainability (Shrivastava, 1995c), the challenge resides in how the processes, structure, and systems should be adapted to support the corporate sustainability strategy and how this strategy can be translated into action within a complex organization (Epstein and Roy, 2001: p. 593). The literature has recognized the need for organizations to adopt a sustainability strategy to develop strategic tools which integrate environmental and social aspects into the core business of the firm and to link performance measurement to the strategic sustainability objectives of organizations (e.g. Dias-Sardinha, Reijnders et al., 2002; Figge, Hahn et al., 2002; Lämsiluoto and Järvenpää, 2008). Recently, the environmental management accounting field has argued that eco-control may represent one of these strategic tools that can be used to support a sustainability strategy (Schaltegger & Burritt, 2000). As a specific application of management control systems (MCS), eco-control refers to formalized procedures and systems that use financial and ecological information to maintain or alter patterns in sustainability activities. The eco-

control literature has thus far provided a conceptual description of the role of eco-control systems in supporting environmental management (e.g. Lothe, Myrtveit et al., 1999; Chinander, 2001; Epstein and Wisner, 2001; Figge, Hahn et al., 2002; Burritt, 2004) and has used case studies to illustrate this contribution (e.g. Meyssonier and Rasolofo-Distler, 2008; Morsing and Oswald, 2009). However, very few studies have specifically examined the role of eco-control in supporting a corporate sustainability strategy (notable exceptions include Marquet-Pondeville, Swaen and DeRongé (2008) and Perego and Hartmann (2009)). Hence, several important challenges remain overlooked when managers consider adopting eco-control systems to drive the sustainability strategy throughout the firm.

First, little is known about how organizations implement eco-control systems. Do organizations develop new control systems or do they adapt their existing ones? If the latter case is considered, which control systems will managers have to adapt to support the sustainability strategy? How will these systems be adapted to integrate environmental and social issues in order to support a sustainability strategy? How would managers adapt and which resources would be involved? To what extent and how might different eco-control systems interact to support the corporate sustainability strategy? So far, few answers have been provided to these important questions.

Another question resides in the ability of eco-control to support the sustainability strategy and simultaneously improve environmental, social and economic performance. So far, little insight has been provided into answering this question. Notable exceptions include Judge & Douglas (1998) and Wisner, Epstein, & Bagozzi (2006) that have found that the integration of environmental concerns into strategic planning contribute to environmental and economic performance. More recently, Henri and Journeault (2010) have found that the use of performance measurement systems as well as the integration of environmental concerns into the budget and incentives contribute to environmental and economic performance. So far, this literature has considered a direct influence of the adoption of eco-control on sustainability performance. However, it is doubtful that the simple fact of using eco-control systems will directly improve sustainability performance. The reality is

probably more complex than that. Hence, little insight has been offered to managers into how the influence of eco-control on sustainability performance is operationalized within the organization.

Moreover, it is commonly recognized that “management control systems (MCS) should be tailored explicitly to support the strategy of the business to enhance competitive advantage and encourage superior performance” (Langfield-Smith, 2007:753). However, considering the particularities of the corporate sustainability strategy, it is not clear if the eco-control systems will have the same role as has been observed globally in the MCS-strategy literature. Indeed, a sustainability strategy may not only be implemented to increase productivity and gain a competitive advantage, but also to increase corporate image and reputation (Wilmshurst and Frost, 2000; Bansal and Hunter, 2003; Cho and Patten, 2007). Hence, when the intentions are mainly to build corporate reputation and image, will managers implement eco-control systems in the same manner and to the same extent as when the intentions are to increase a firm’s productivity? Moreover, since it remains uncertain at a more global level, how the management control systems will behave in response to different types of strategies (Langfield-Smith, 2007; Dent 1990), the way that the eco-control systems will be implemented and will help to translate corporate sustainability strategic intentions into actions remain very important and unresolved questions.

Research questions

The aim of the present thesis is to provide insight into these very important challenges and questions by examining the role and contribution of eco-control to support a corporate sustainability strategy. this thesis examine more specifically four main research questions: (i) to what extent the eco-control systems may support the corporate sustainability strategy formulation, (ii) to what extent the eco-control systems may facilitate the deployment of this strategy within the organization, (iii) to what extent the eco-control systems may assist in the conversion of strategic intentions into actions and (iv) to what extent the eco-control systems may contribute to the improvement of the

environmental, social, and economic performance of the firm? This thesis considered both the passive and active view of eco-control. The passive view of eco-control refers to its traditional role of measurement and feedback while the active view of eco-control refers to a more dynamic role where these systems are used to send signals throughout the firms that contribute to focus organizational attention, to stimulate communication, and to motivate people and sustain their enthusiasm (Campbell & Yeung, 1991). Hence, eco-control systems are considered in this thesis not only as a surveillance mechanism but also as a liaison mechanism.

Adopting an approach by articles, this thesis proposes three papers to investigate these research questions. The aim of the first article, entitled “*The influence of eco-control on environmental and economic performance: A natural resource-based approach*” is to shed light on the second and fourth research questions presented above by examining the ability of eco-control to facilitate the deployment of sustainability strategy by fostering environmental capabilities and to contribute to the improvement of environmental and economic performance. The aim of the second article, entitled “*Levers of eco-control and environmental strategy*” is to investigate more specifically the third research question by examining the ability of eco-controls to translate environmental strategy into actions. Finally, the aim of the third article entitled “*Sustainability balanced scorecard: a conceptual framework*” is to shed light on the first research question by examining how the traditional management control systems could be adapted to support the corporate sustainability strategy formulation.

Methodology

As suggested in the title, the article “*Sustainability balanced scorecard: a conceptual framework*” adopts a conceptual approach. This paper builds on more than 200 articles from different streams of literature including accounting, management, marketing, operational and strategy. The two other articles of the thesis rely on an empirical approach. These papers are based on a survey that was administered to Canadian manufacturing firms. Two main reasons have justified the choice of a survey as

methodology for these articles. First, the aim of this thesis is to get a global vision of what is done in the field of eco-control and sustainable development in Canadian companies. Hence, the survey represents a good instrument to obtain data from a wider population. Second, structured questions are required to gather the data necessary to investigate the research question included within the two empirical papers of this thesis. Although it would have been possible to obtain these data through structured interviews, the number of respondents is potentially greater using a survey method, thus increasing the scope of the research. Using a total design method proposed by Dillman (1978), a mailing survey was administered to a random sample of Canadian manufacturing subunits or fully autonomous entities. A total of 249 valid questionnaires have been received, for a response rate of 17%.

The data provided by this survey were analyzed using the Structural Equation Modeling (SEM). SEM consists of a set of linear equations that simultaneously test two or more relationships among endogenous and exogenous variables (Bollen, 1989; Bollen and Long, 1993). This statistical technique was chosen for its ability to support the implicit vision of this thesis that considers that constructs have a relative and simultaneous influence on each other. By incorporating multiple traditional analysis techniques, such as path analysis, confirmatory factor analysis, regression analysis and simultaneous equations model, SEM represents a rigorous and reliable instrument that provides an adequate environment to measure and analyze the holistic approach and global view proposed in this thesis. Also, the SEM offers several benefits such as accounting for random measurement of error, controlling for some types of non-random errors, and allowing for a straightforward evaluation of convergent and discriminant validity (Blanthorne, Jones-Farmer, et al., 2006). Moreover, it includes benefits of other statistical approaches, such as Partial Least Square (PLS) without having their drawbacks (Ping, 2009). For example, most of PLS's strengths, including the possibility to measure nominal, formative, and collinear latent variables, the possibility to handle latent variables with poor psychometrics, and the capability of forecasting, are all covered by SEM. On the other hand, a PLS method has several negative points that SEM does not, such as the difficulty of interpretation of path coefficients that are not based on

covariance and the problem of reliance on bootstrap standard errors which are biased without correction. Finally, since the two empirical papers of this thesis rely on a mediation model, SEM tests for that kind of relationships between variables in a more straightforward manner than traditional methods (Baron & Kenny, 1986).

Theory

Although the management control systems research is mainly dominated by the contingency theory, the two empirical studies of this article rely on a mediation model to investigate the research questions. Hence, the aim of these studies is neither to examine if a different “fit” between the control systems and the strategy have an impact on the organization’s performance nor to compare the structure, control systems and process configuration of the more performing organizations with those of the less performing ones. Instead, the objective of these studies is to examine the ability of eco-control to convert the strategic intentions into actions and to deploy the strategy within the organization.

The later objective is more specifically investigated by relying on the Resource-based view theory (RBV) (Barney, 1991; Wernerfelt, 1984). This theory has over the years become one of the most important and influential streams of research in the field of strategy (Barney, Wright, & Ketchen, 2001; Hoopes, Madsen, & Walker, 2003). RBV theory advocates that the improvement of a firm’s performance requires the development of unique, valuable, inimitable and non-substitutable organizational capabilities. These organizational capabilities are characterized by complex, reliable, repeatable and distinct problem-solving routines that combine the unique resources of firms (Lengnick-Hall and Wolff, 1999; Peteraf and Barney, 2003). The fundamental assumptions of this theory is that incomplete factor markets allow resources and capabilities to be heterogeneously distributed among firms and to be imperfectly mobile (Barney, 1991; Peteraf, 1993; Barney, 2001). Hence, the development and maintenance of distinctive valuable capacities that are imperfectly imitable and substitutable contribute to the firm’s sustained competitive advantage that cannot be easily imitated by competitors (Barney, 1991; Amit

and Schoemaker, 1993). Applying the RBV theory in the environmental context, this thesis empirically investigates the ability of eco-control to foster environmental capabilities, which represent specific organizational capabilities, and the contribution of these environmental capabilities not only to economic performance, which build on the fundamental premise of the RBV theory, but also simultaneously to another specific level of organizational performance which is, in this case, environmental performance.

Definition of constructs

This thesis relies on several main constructs, including eco-control sustainability corporate strategy, stakeholders and environmental, social and economic performance. In order to facilitate the understanding of these different constructs, a brief description of each of them is presented next.

Eco-control

Eco-control systems are the application of financial and strategic control methods to environmental management (Schaltegger and Burritt, 2000; Henri and Journeault, 2010). Following the work of Simons (1990; 1995) on management control systems, eco-controls are defined as the formalized procedures and systems that use financial and ecological information to maintain or alter patterns in environmental activity. As for management control systems, eco-control systems include a large variety of systems, including performance measurement systems (PMS), budget, strategic planning or incentives that integrate environmental and social aspects. Among these different systems, this thesis mainly focuses on PMS. This choice is based on two main reasons. First, the literature has widely recognized PMS as a central element of environmental management in organizations (e.g. Tyteca, 1996; Figge et al, 2002; Schaltegger and Burritt, 2000; Epstein, 1994). Second, numerous studies have demonstrated that PMS are effective tools in strategic formulation and implementation and can contribute to environmental and organizational performance (e.g. Hoque and James, 2000; Baines and

Langfield-Smith, 2003; Ittner et al, 2003; Said et al, 2003; Henri 2006a; Henri and Journeault, 2009, 2010).

PMS include numerical measures that provide key information related to environmental issues (Henri and Journeault, 2008) and about the effectiveness and efficiency of environmental actions (Neely, Gregory et al., 1995). This thesis considers both the design and the use of PMS. The article *Sustainability balanced scorecard: a conceptual framework* examines how the balanced scorecard, a specific PMS framework, could be designed to support a corporate sustainability strategy. More specifically, this paper examines which groups of performance indicators should be included within a sustainability balanced scorecard, including performance indicators related the economic, environmental and social performance, as well as stakeholder management, internal processes and organizational capabilities. This article also provides a comprehensive review of the cause-and-effect relationships between these performance indicators in order to provide a better understanding of the sustainability balanced scorecard design. The two other articles of the thesis emphasize the use of PMS. Two different and complementarily definitions of PMS use are specifically examined. First, the article “*The influence of eco-control on environmental and economic performance: A natural resource-based approach*” examines the different purposes from which the PMS could be used. In that case, the use of PMS refers to the extent to which these systems are used by managers to monitor the progress and results of organizational activities, to support decision-making in all aspects of activities, and to focus attention on environmental issues from inside and outside the organization. Second, the article “*Levers of eco-control and environmental strategy*” examines two different ways that PMS may be used by the organizations, that is to say diagnostically or interactively (Simons 1990, 1995). The diagnostic use of PMS relies on a management-by-exception basis and refers to the utilization of critical information by the organization to monitor organizational outcomes and correct deviations from preset environmental standards of performance. The interactive use of PMS represents a regular and personal involvement of top managers in the decisions concerning the environmental activities of subordinates through an intensive use of environmental information by top managers and operating managers, an

active and frequent dialogue among top managers, face-to-face dialogue and debates, and a focus on strategic uncertainties.

Corporate sustainability strategy

Most of the literature has provided typologies of corporate sustainability strategy based on the environmental behavior of organizations (e.g. Ullmann, 1985; Hunt and Auster, 1990; Roome, 1992; Hart, 1995; Clarkson, 1995). Nevertheless, the definition of corporate sustainability strategy for this thesis builds on the environmental strategy definition provided by Stead and Stead (1995) and refers to the sustainability strategic posture that the organization chooses in order to gain a competitive advantage (Stead and Stead, 1995). According to the environmental management literature (e.g. Hart, 1995; Porter and Van der Linde, 1995a; Russo and Fouts, 1997; Dixon, Mousa, et al., 2005; Ambec and Lanoie, 2008), two main sustainability strategic postures may be adopted by organizations: internally- or externally-oriented. The goal of organizations that pursue a more internally-oriented sustainability strategy is to create a competitive advantage through cost reduction and productivity improvement (Hart, 1995; Shrivastava, 1995c; Stead & Stead, 1995; Christmann, 2000) while this goal is, for the more externally-oriented sustainability strategy, to create a market competitive advantage through the improvement of their corporate image and reputation (Hart, 1995; Russo and Fouts, 1997; Dixon, Mousa, et al., 2005). While internally- and externally-oriented sustainability strategy represents two strategic choices for the organization, they are not mutually exclusive. Organizations may decide to pursue both strategies at the same time with more or less intensity.

Different aspects of the corporate sustainability strategy are examined in the thesis. The third article of the thesis examined how the corporate sustainability strategy may be operationalized through the performance indicators included within the sustainability balanced scorecard and how different initiatives and actions undertaken by the organization may contribute to the realization of this strategy. The second article investigates the role of eco-control to convert the competitive environmental strategy, a

subset of sustainability strategy, into actions while the first article examines one possible avenue of the deployment of the environmental strategy within the organization through the environmental capabilities.

Environmental, social and economic performance

The definition of environmental, social and economic performance used in this thesis relies on the work of Adams and Ghally (2006) and of Dyllick and Hockerts (2002). Environmental sustainability refers to the non-depletion of natural resources (i.e. the consumption of natural resources at the rate below the natural reproduction, or at the rate below the development of a substitute), to atmospheric stability (avoid emissions beyond the capacity of the natural system to absorb and assimilate them), and to the protection of biodiversity and ecosystems. Hence, according to this definition, corporate environmental performance includes the levels of consumption of material, energy, and water, waste, noise, smell and odour emissions, air emissions, soil contamination, landscape damage, and biodiversity destruction. Social sustainability refers to adding value to the communities in which a firm or its different subsidiaries and plants operate by increasing human capital of individual partners as well as furthering the social capital of this community. It includes good working conditions, health and safety improvements for employees and the community, the protection of human rights, work force diversity, equity and fairness, and local economic development. Finally, economic sustainability refers to the generation of sufficient cashflow to ensure liquidity while producing a consistently above average return to firm shareholders. Economic sustainability can be reached through continuous profitability improvements that may occur through revenue improvements or cost reductions.

As described within the sustainability balanced scorecard proposed in this thesis, the goal of any for-profit organization adopting sustainability strategy is to minimize environmental and social impacts as well as to maximize economic performance. However, one of the most important challenges remaining for the firm is to determine what level of environmental, social and economic performance is considered to be a good

level or a right level of performance. While it may be easier for firms to establish what is a good level of economic performance by having clear measures from stock market prices, clear expectations from shareholders and possible benchmarking with annual statements, it appears to be less straightforward for environmental and social performance. Indeed, although governmental regulations may set the minimal level of environmental and social performance required by organizations, it becomes very difficult to determine if the environmental and social performance of a firm is good or not. This problem is mainly due to the difficulty to compare the environmental and social performance between different firms and the absence of standard reporting. Although the Global Reporting Initiative (GRI) has attempted to deal with this problem by proposing a standard set of sustainability performance indicators, very few organizations have so far adhered to this standard. Also, a recent study of Henri and Boiral (2011) has shown that, even for firms that used the GRI as reporting standard, the comparability between firms remains limited.

To overcome this problem, this thesis used a proxy measure to evaluate the level of environmental performance of organizations. In the article "*The influence of eco-control on environmental and economic performance*" uses an instrument developed by Sharma & Vredenburg (1998). The respondents were asked to indicate the extent to which environmental practices have led to various types of benefits (e.g. a reduction in material costs, increased productivity, better relationships with stakeholders, overall company reputation). Henri and Journeault (2010) have validated this instrument by demonstrating that it is significantly correlated with objective data obtained from the National Pollutant Release Inventory (NPRI)¹. In other words, the firms that reported having good environmental performance with this self-rated instrument are those that have fewer pollutants released in the NPRI. Hence, this instrument represents a good proxy of

¹ The National Pollutant Release Inventory (NPRI) is provided by the federal government of Canada. This database contains information on more than 300 pollutants released and transferred from individual facilities across Canada (air, water, land and injected underground and transferred off-site to disposal, treatment, sewage, energy recovery and recycling). While disclosure in this database is required only when release and transfer are above a certain level, only a few samples of our respondents are included within the database. Hence, this objective data cannot be used directly in this thesis to measure environmental performance. It was not possible to have access to other objective information on environmental performance.

environmental performance of firms and has the advantage to be easier to answer than if the respondents were asked to subjectively report their level of environmental performance.

Stakeholders

As mentioned previously, stakeholder management and integration is one of the fundamental elements of sustainability performance. A stakeholder is defined by Freeman (1984: p.46) as “any group or individual who can affect or is affected by the achievement of the organization’s objectives”. Stakeholder groups include, among others, employees, suppliers, shareholders, customers, investors, community, government and non-governmental organizations. This thesis examines two different aspects of stakeholders that may influence the sustainability performance of the firm: their integration and management and their role in a firm’s performance evaluation. The integration of stakeholders refers to the ability of the organization to establish trust-based collaborative relationships with a wide variety of internal and external stakeholders to efficiently integrate the requirements, expectations and perspectives of these groups into the firm’s decisions and practices in order to create a competitive advantage. The first article of the thesis investigates to what extent this capability may influence the environmental and economic performance of the firms. In the third article of the thesis relating to the sustainability balanced scorecard, this stakeholder integration is included within the initiatives and practices include in the internal processes perspective, which contribute to the sustainability performance of the firm.

This third article also introduces the role of stakeholders in the environmental and social performance evaluation of the firm. As mentioned previously, one of the most important challenges that organizations face when they adopt a sustainability strategy is to determine what level of environmental and social performance is considered to be the right level of performance. In fact, the acceptable level of performance could be set from the expectations of the stakeholders. For example, the right level of environmental and social performance could be the level from which the organization meets the

environmental and social regulations required by the government, responds to the expectations of green customers, meets the quiet and safe location required by the community or reaches the expected level of corporate social and environmental responsibility requested by the investors. This third article illustrated that meeting these expectations and requirements can contribute to economic performance by avoiding costs and increasing sales.

Thesis structure

The thesis is organized as follows. The first chapter presents the article “*The influence of eco-control on environmental and economic performance: A natural resource-based approach*”. The article “*Levers of eco-control and environmental strategy*” is presented in the second chapter while the third chapter presents the article entitled “*Sustainability balanced scorecard: a conceptual framework*”. Finally, this document ends with a concluding chapter that presents a summary of the main results of the thesis as well as its theoretical contributions and practical implications.

Chapter 1

The influence of eco-control on environmental and economic performance: A natural resource-based approach

Abstract

Although a growing body of literature has examined and demonstrated a direct influence of the adoption of eco-control on organizational performance, little is known about how this influence occurs within the organization. Building on a natural resource-based view, the aim of this study is to open this black box and examine the potential of eco-control to foster environmental capabilities and to analyze its impact on performance. Two research questions are investigated: (i) To what extent does eco-control support environmental capabilities? (ii) To what extent do the environmental capabilities act as mediators in the relationship between eco-control and environmental and the economic performance of the organization? Using survey-data from a sample of Canadian manufacturing firms, this study empirically investigates the ability of the use of environmental performance measurement systems (EPMS), as one component of eco-control, to support eco-learning, continuous environmental innovation, stakeholder integration, and shared environmental vision capabilities which in turn contribute to the firms' environmental and economic performance. The results show that the use of EPMS fosters environmental capabilities by providing information, focusing attention, and supporting decision-making, providing support for the role of eco-control systems to foster environmental strategic implementation within the firms. Also, this study finds that the use of EPMS does not directly contribute to environmental and economic performance, but rather indirectly through environmental capabilities. Hence, this study demonstrates that environmental capabilities may represent the missing link between the use of eco-control systems and the environmental and economic performance of the firm.

Keywords: Eco-control, natural resource-based view, environmental capabilities, environmental performance, environmental performance measurement systems

1.1 INTRODUCTION

The worldwide economic crisis and climate change are two major concerns for organizations at the moment. The question of how to conciliate these two issues has become fundamental. In practice and in theory, the economic impact for organizations developing sustainable products and processes has been at the heart of numerous debates. Although some managers and scholars question the impact of adopting environmental strategies on organizational competitiveness (e.g. Walley and Whitehead, 1994; McWilliams and Siegel, 2000; Nidumolu, Prahalad et al., 2009), a growing body of literature has argued that these strategies could lead to increased economic performance (e.g. Burnett & Hansen, 2008; Russo & Fouts, 1997; Al-Tuwaijri et al., 2004; Wagner & Schaltegger, 2004; Henri and Journeault, 2010). Certain authors have gone even further by arguing that the adoption of an environmentally-friendly strategy represents the key driver for creating value and stimulating innovation which are necessary to overcome the economic crisis (e.g. CEC, 2008; Clinton, 2009; Nidumolu, Prahalad et al., 2009). Hence, although a consensus on the financial benefits of improving environmental performance is emerging, the specific circumstances needed for organizations to reach this win-win situation remain to be identified.

Recently, the environmental management accounting (EMA)² field has shed some light on these important questions by arguing that eco-control may represent one of the mechanisms that can be used by firms to help them to take advantage of the potential benefits related to environmental performance (Schaltegger & Burritt, 2000). As a specific application of management control systems (MCS), eco-control refers to formalized procedures and systems that use financial and ecological information to maintain or alter patterns in environmental activity (Henri and Journeault, 2010: p.2). Among eco-control studies, some of them have empirically demonstrated that the adoption of eco-control practices can contribute to environmental and economic

² EMA refers to the identification, collection, analysis and use of financial and non-financial information to support management activities in order to maximize environmental and economic performance and to achieve sustainable business (Henri and Journeault, 2010; IFAC, 2005; Bennett & James, 2000; Bartolomeo et al. 2000).

performance. For example, Judge & Douglas (1998) and Wisner, Epstein, & Bagozzi (2006) have found that the integration of environmental concerns within strategic planning contribute to environmental and economic performance. More recently, Henri and Journeault (2010) have found that the use of performance measurement systems, including the integration of environmental concerns in the budget and incentives, contribute to environmental and economic performance.

However, although these studies have considered a direct influence of the adoption of eco-control on both environmental and economic performance, little is known about how the influence of eco-control on environmental and economic performance is operationalized within the organization. Indeed, all the elements that may intervene between these factors are unknown while they remain inside a black box. Hence, these previous studies have provided useful insights into the role of eco-control to support a win-win situation. However, the direct link between the role of eco-control and environmental and economic performance may be precipitated, or at least incomplete. In fact, it is doubtful that by simply using eco-control systems environmental and economic performance will improve. The reality is probably more complex than that.

Indeed, the Resourced-Based View (RBV) (Barney, 1991; Wernerfelt, 1984), one of the most important and influential streams of research in the field of strategy (Barney, Wright, & Ketchen, 2001; Hoopes, Madsen, & Walker, 2003), has advocated that the improvement of a firm's performance necessitates the development of specific organizational capabilities (Lengnick-Hall and Wolff, 1999). Hence, a central element of this perspective is that the development and the maintenance of organizational capabilities give organizations the capacity to create more value than the least efficient competitor (Lengnick-Hall and Wolff, 1999; Peteraf and Barney, 2003). In other words, unique capabilities create a competitive advantage which in turn leads to improved economic performance improvement. Following this view, the development of these capabilities may be one possible solution to the missing link between eco-control and environmental and economic performance.

However, two important questions emerge when considering this solution: (i) do organizational capabilities also contribute to environmental performance to support a win-win situation? and (ii) does eco-control foster organizational capabilities? First, applying the RBV in the context of environmental management, research in the Natural Resource-Based View (NRBV) has argued that environmental capabilities, a subset of organizational capabilities, are associated on the one hand with firms' sustainable development and management (Hart, 1995; van Kleef and Roome, 2007; Darnall, Henriques, et al., 2008), pollution prevention (Russo and Fouts, 1997), and proactive environmental strategy (Sharma and Vredenburg, 1998; Aragon-Correa and Sanjay, 2003; Darnall and Edwards, 2006; Aragon-Correa, Hurtado-Torres et al., 2008) and on the other hand with a competitive advantage and economic performance. Although this research has shed light on the operationalization of capabilities in a NRBV perspective, minimal support has been provided due to the lack of empirical evidence and replication. Moreover, although this literature may implicitly suggest that the development of particular capabilities by firms can contribute simultaneously to environmental and economic performance, no empirical evidence has been provided to support this argument.

Second, a recent study of Henri (2006a) has shown that MCS can support the development of firms' capabilities. This research has argued that the use of MCS can foster organizational capabilities by focusing attention on strategic priorities and stimulating dialogue. However, notwithstanding the work of Henri (2006a), few studies have thus far examined the influence of MCS on organizational capabilities. Furthermore, no attention has been specifically devoted to investigating the capacity of eco-control, as a subset of MCS, to support organizational capabilities in an environmental setting.

The aim of this study is to offer preliminary answers to these important questions by examining the potential of eco-control to support environmental capabilities and to analyze its impact on environmental and economic performance. More specifically, two research questions are investigated: (i) To what extent does eco-control support environmental capabilities? (ii) To what extent do the environmental capabilities act as

mediators in the relationship between eco-control and environmental and economic performance of the organization? These two research questions are tested empirically using survey methodology to obtain data from Canadian manufacturing industries.

The remainder of this paper is organized as follows. The first section presents a review of the NRBV, environmental capabilities and eco-control literatures. Thereafter, the presentation of the theoretical framework and the development of a set of hypotheses are presented. The next section presents a description of the survey design and a definition of the main constructs. The final section presents the theoretical contributions and practical implications.

1.2 THEORETICAL FRAMEWORK

1.2.1 Definition of constructs

Natural Resource-Based View and environmental capabilities

The resource-Based View has received considerable attention in the literature in last two decades (Acedo, Barroso et al., 2006). It has become one of the most dominant and widely accepted theories in the field of strategic management (Powell, 2001; Priem and Butler, 2001). This theory is based on the principle that idiosyncratic and valuable resources and capabilities controlled by a firm can provide a competitive advantage (Penrose, 1959; Rumelt, 1984; Wernerfelt, 1984; Barney, 1986; 1991). The fundamental assumptions of this theory is that incomplete factor markets allow resources and capabilities to be heterogeneously distributed among firms and to be imperfectly mobile (Barney, 1991; Peteraf, 1993; Barney, 2001). Distinctive valuable resources and capacities that are imperfectly imitable and substitutable contribute to the firm's sustained competitive advantage that cannot be easily imitated by competitors (Barney, 1991; Amit and Schoemaker, 1993). A central element of this competitive advantage is the development and the maintenance of organizational capabilities that are characterized by complex, reliable, repeatable and distinct problem-solving routines that combine the unique resources of firms involved to create more value than the least efficient competitor (Lengnick-Hall and Wolff, 1999; Peteraf and Barney, 2003).

Hart (1995) was the first author to apply RBV in an environmental context. He developed a conceptual framework of NRBV that attempts to explain the contribution of a proactive environmental strategy to the development of distinctive and valuable firm capabilities which in turn lead to the creation of a competitive advantage. Since this seminal paper, several other studies have conceptually examined the role of environmental capabilities to build a competitive advantage in an environmental perspective (e.g. Aragon-Correa and Sanjay, 2003; Husted and Allen, 2007). However, few studies have empirically attempted to support these theoretical frameworks. Three notable exceptions can be found in the environmental management and strategic literatures. First, Sharma and Vredenburg (1998) have found that proactive environmental responsiveness is associated with the emergence of environmental capabilities. Second, Christmann (2000) has investigated the effects of the three best environmental management practices, namely pollution prevention technologies, innovation of proprietary pollution prevention technologies and early timing, on cost advantage; she found a significant relationship only between innovation of proprietary pollution prevention technologies and cost advantage. However, she found that process innovation and implementation acted as complementary assets that moderated the relationship between best practices and cost advantage. Third, Aragon-Correa, Hurtado-Torres et al. (2008) have found that environmental capabilities influence the development of a proactive environmental strategy which in turn leads to better organizational performance. Hence, minimal support has been provided so far for the ability of environmental capabilities to help achieve a competitive advantage in a NRBV perspective. Moreover, less attention has been devoted to specifically investigating the contribution of environmental capabilities on environmental and economic performance.

This study investigated four of the most dominant environmental capabilities found in the NRBV literature: eco-learning, continuous environmental innovation, stakeholder integration and shared environmental vision. Each of these four capabilities has been recognized as unique, valuable, inimitable and non-substitutable capabilities that may contribute to the firm's competitive advantage. First, based on the definition of organizational learning of Fiol and Lyles (1985), eco-learning refers to the development

of ecological insights, knowledge and the associations between past ecological actions, the effectiveness of those actions, and future actions. Eco-learning is the process of change where organizations detect ecological problems and opportunities both within the organization and with the fit between the organization and its changing environment (Kloot, 1997). By improving environmental information within the firms at a faster rate than rivals do and by developing a path-dependent from unique interactions and activities over a long period of time, eco-learning is recognized as a difficult-to-imitate and to substitute capability contributing to the development of a sustainable competitive advantage (Sharma and Vredenburg, 1998; Henri, 2006a).

Second, continuous environmental innovation refers to the ability of firms to create new environmental ideas, products and processes (Hurley and Hult, 1998; Aragon-Correa, Hurtado-Torres et al., 2008). It is related to the entrepreneurial orientation, innovativeness and environmental strategic proactivity of the firm (Aragon-Correa, Hurtado-Torres et al., 2008). Hence, it encompasses the aptitude of firms to initiate strategic environmental changes in their policies and activities. Continuous environmental innovation is largely recognized as a critical factor needed to address both environmental and competitive issues (Hart, 1995; Porter and Van der Linde, 1995a; Hart, 1997). This competitive advantage is provided by constant corporate renewal which stimulates the development of invisible assets which allows organizations to remain a step ahead of their competitors (Itami, 1987; Hart, 1995; Sharma and Vredenburg, 1998).

Third, stakeholder integration refers to the organization's ability to establish trust-based collaborative relationships with a variety of internal and external stakeholders (Sharma and Vredenburg, 1998). A stakeholder is defined by Freeman (1984: p.46) as "any group or individual who can affect or is affected by the achievement of the organization's objectives". Therefore, stakeholder integration capability is related to the ability to coordinate functional groups within the firm and to efficiently integrate the requirements, expectations and perspectives of primary external stakeholders, such as investors, customers, and suppliers, and secondary external stakeholders, such as local communities, regulators, and non-governmental organizations (NGO), into a firm's

environmental decisions and practices (Clarkson, 1995; Hart, 1995). It involves the development of a collaborative relationship with stakeholders including joint problem solving, information sharing, and negotiations (Sharma and Vredenburg, 1998; Hillman and Keim, 2001; Hart, 1995). These firm-specific relationships can provide a sustainable competitive advantage by making up a socially complex, difficult-to-imitate and to substitute capability (Hart, 1995; Sharma and Vredenburg, 1998; Hillman and Keim, 2001; Aragon-Correa, Hurtado-Torres et al., 2008).

Fourth, shared environmental vision refers to the existence of collective values and beliefs about the organizational objectives and mission (Oswald, Mossholder et al., 1994). Shared environmental vision is related to the environmental vision of top management and its dissemination among all employees by close interaction and communication (Aragon-Correa, Hurtado-Torres et al., 2008). By establishing goal clarity and shared responsibility, it entails a shared vision of the importance and appropriateness of the firm's environmental objectives and that all the members of the organization may contribute to defining and achieving them (Aragon-Correa, Hurtado-Torres et al., 2008). Such a consensus is difficult to establish and maintain (Hart, 1995) and shared environmental vision is recognized as a unique firm-specific capability which helps firms to develop a sustainable competitive advantage (Hart, 1995; Aragon-Correa, Hurtado-Torres et al., 2008).

The NRBV literature provides conceptual and empirical support for the capacity of these four environmental capabilities to create a competitive advantage in an environmental perspective and several environmental management domains of literature have identified, in more a general manner, elements included within each of these capabilities as determinants of environmental proactivity and performance within the environmental management literature (e.g. eco-learning (Epstein and Roy, 1997; Nidumolu, Prahalad, et al., 2009), environmental innovation (Porter and Van der Linde, 1995a; 1995b), stakeholder collaboration and integration (Dechant, Altman, et al., 1994; Nidumolu, Prahalad, et al., 2009), environmental corporate values and top management leadership (Berry and Rondinelli, 1998; Bansal, 2003)). Hence, considering their potential ability to

contribute to environmental and financial performance, these four environmental capabilities are investigated in this study.

Eco-control

Different eco-control systems may be used by the organization, such as environmental performance measurement systems (EPMS), budget, and incentives (Henri and Journeault, 2010). Among these eco-control systems, the literature has largely recognized EPMS as a central element of environmental management in organizations (e.g. Tyteca, 1996; Figge et al, 2002; Schaltegger and Burritt, 2000; Epstein, 1994). Also, numerous studies have demonstrated that performance measurement systems are effective tools for fostering business capabilities as well as improving environmental and organizational performance (e.g. Hoque and James, 2000; Baines and Langfield-Smith, 2003; Ittner et al, 2003; Said et al, 2003; Henri 2006a; Henri and Journeault, 2009, 2010). Hence, the use of EPMS is specifically investigated in this study. EPMS encompass numerical measures that provide key information related to environmental issues (Henri and Journeault, 2008) and about the effectiveness and efficiency of environmental actions (Neely, Gregory et al., 1995). The use of EPMS refers to the extent to which these systems are used by managers to monitor the progress and results of organizational activities, to support decision-making in all aspects of activities, and to focus attention on environmental issues from inside and outside the organization.

1.2.2 Overview of the theoretical models

To provide answers to the research questions, two theoretical models, namely the basic and the revised models, are investigated in this study. These two models are presented in more detail next.

The basic model

Figure 1 presents a summary the basic model. Building on the work of Henri and Journeault (2010), this model examines the direct association between EPMS and environmental performance as well as the indirect association between EPMS and

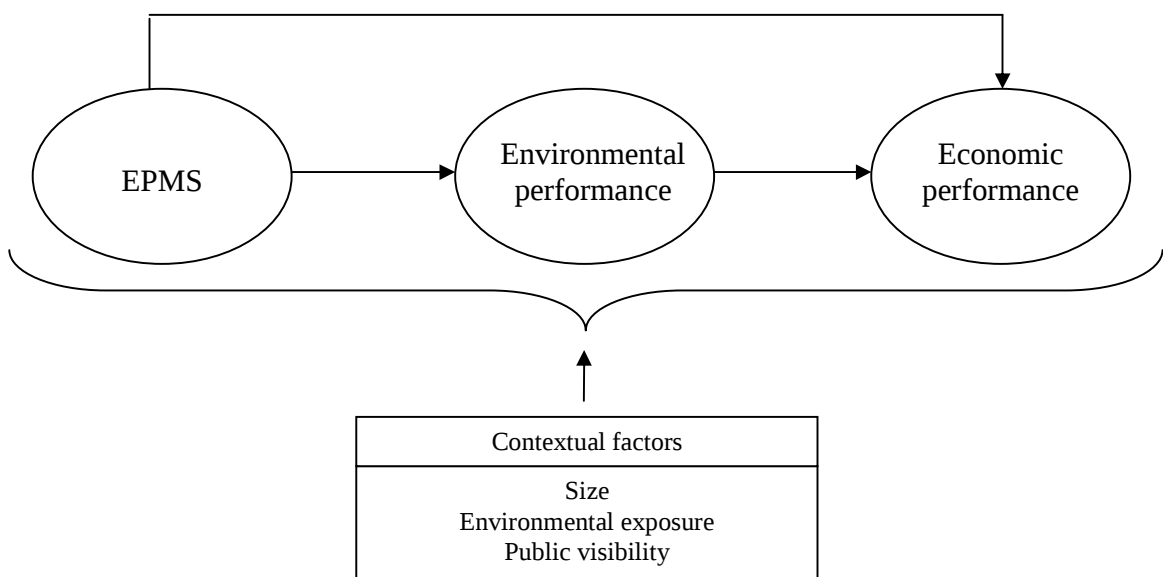
economic performance through environmental performance. First, Henri and Journeault have empirically shown that EPMS help foster environmental performance by providing feedback, providing information for decision-making, by focusing organizational attention, and by providing data for external reporting. More specifically, EPMS may provide feedback regarding the differences between environmental goals and outputs that facilitate learning about environmental issues. Also, by revealing cause-and-effect relationships among environmental operations, strategy and goals, or between environmental and organizational issues, EPMS represent sources of information that provide data to support decision-making. Moreover, EPMS may help focus organizational attention on environmental concerns by sending a clear message from top-management that environmental performance is important to the firm. Furthermore, EPMS may contribute to environmental performance when used to provide data for external reporting by allowing firms to respond to various stakeholder environmental needs and requests, influence the public's perception of the environmental operations of the organization and demonstrate that they are operating within the norms and values of society.

Second, Henri and Journeault have found that EPMS are indirectly associated with economic performance and a positive and significant relationship was found between environmental and economic performance. The authors also found that environmental performance contributes to economic performance by reducing costs and improving revenues. More specifically, they argued that despite initial investments that may increase costs in the short term, operating costs can be reduced by exploiting ecological efficiencies, such as waste reduction, energy conservation, materials reutilization, and life-cycle costs perspective. Also, superior environmental performance may reduce compliance and liability costs, reduce long-term risks associated with resource depletion, fluctuations in energy costs, product liabilities, as well as pollution and waste management. Moreover, it provides a basis for creating a competitive advantage and the opportunity to increase revenues by fulfilling the needs of "green" consumers. Lastly, superior environmental performance gives organizations the opportunity to improve

public relations and corporate image and gain social legitimacy which may contribute to economic performance.

Finally, this model includes size, environmental exposure and the environmental visibility of organizations as contextual factors in order to assess the uniqueness of different industries and types of firms. Environmental exposure refers to the firm's exposure to future environmental costs, while public visibility refers to exposure of the firm to public scrutiny (Al-Tuwaijri, Christensen et al., 2004). Links among the contextual factors and the EPMS, environmental and economic performance are included within the model.

Figure 1: Conceptual framework of the basic model

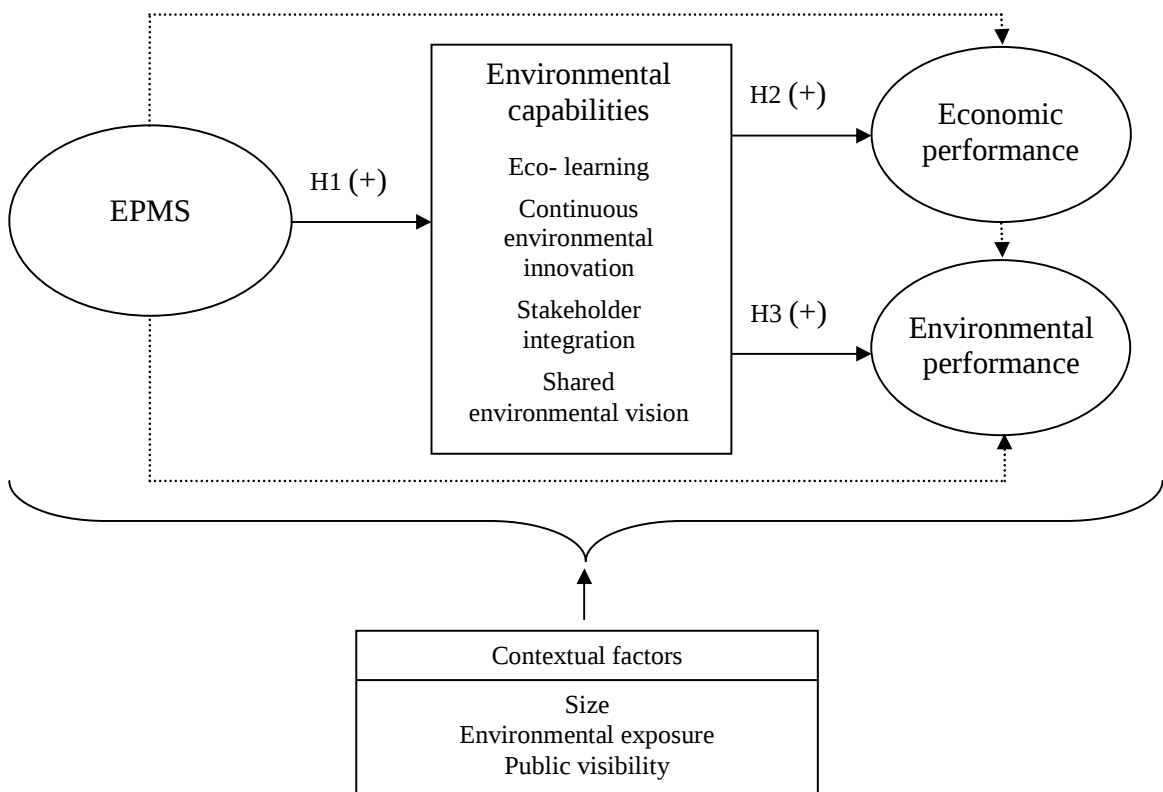


The revised model

Figure 2 presents a summary of the revised model. This revised model is based on the arguments that EPMS do not directly contribute to environmental performance, but rather indirectly through environmental capabilities. Hence, EPMS is expected to have a positive and direct influence on eco-learning, continuous environmental innovation, stakeholder

integration and shared environmental vision capabilities (hypothesis 1). Also, EPMS is expected to have an indirect and positive relationship on environmental performance (hypothesis 2) and economic performance (hypothesis 3) through environmental capabilities. Moreover, this model includes the relationships investigated in the first model as the control path (direct relationship between EMPS and environmental and economic performance, relationship between environmental and economic performance). Furthermore, as for the basic model, the revised model controls for size, environmental exposure the environmental visibility of organizations. Links among these contextual factors and the EPMS, environmental capabilities, environmental and economic performance are included within the model. The hypotheses development for this revised model is presented in the next section.

Figure 2: Conceptual framework of the revised model



1.2.3 Hypotheses development for the revised model

Relationship between EPMS and environmental capabilities

EPMS represent an informational framework that provides data and feedback related to environmental processes that help to foster environmental capabilities. While EPMS are largely recognized as being able to support the attainment of pre-established environmental goals and monitor deviations (Simons, 1990, 1995; Henri and Journeault, 2010), these feedback systems generate information about the level of success of the routines and processes embedded within environmental capabilities (Epstein, 1996b; Burritt, 2004). Moreover, this cybernetic feedback helps create the organizational skills and memory needed to repeatedly carry out productive activities without trouble (Ethiraj, Kale et al., 2005), which contributes to reinforced environmental capabilities. Also, by revealing cause-and-effect relationships among environmental operations, strategy and goals (Atkinson, Waterhouse et al., 1997; Chenhall, 2005), EPMS help managers support their strategic decision-making process and provide knowledge and understanding necessary to foster firms' capabilities (Teece, Pisano et al., 1997).

More specifically, EPMS can help support the eco-learning capability. First, by providing feedback regarding the differences between goals and outputs, allowing the correction of errors and the achievement of pre-set environmental objectives, EPMS facilitate adaptive, or single-loop learning (Argyris and Schön, 1978). Also, following the work of Simons (1995), it is argued that EPMS help organizations decide when the time is right to seize new environmental opportunities and strategic orientations. Hence, by offering a framework that supports dialogue and debate on the current results of the organization and encourages employees to search for new ecological opportunities and threats from a changing environment, EPMS offer an informational framework supporting generative, or double loop-learning (Argyris and Schön, 1978). Therefore, EPMS help support the eco-learning capability by ensuring that they continuously provide the right and adequate environmental information necessary to support both adaptive learning in order to attain pre-set organizational goals and generative learning which encourages emergent strategy management, new ideas and processes development as well as organizational change.

EPMS can foster the capability for continuous environmental innovation by providing information about environmental impacts, costs and benefits of products and processes and helping operating employees to execute continuous improvements in order to enhance environmentally-related aspects of such products and routines. Furthermore, EPMS provide an agenda and a forum for regular face-to-face debate and dialogue supporting the development of new environmental initiatives (Henri and Journeault, 2010). Following the work of Simons (1995), environmental cost reduction, the development of new green processes and products, and the adoption of new technologies can be fostered by creative and inspirational forces of EPMS. Therefore, EPMS plays a double role in fostering continuous environmental innovation capabilities by supporting continuous incremental improvements in green routines and products and by allowing more complex and fundamental changes via rethinking and reinventing such routines and products.

EPMS provide an effective framework to support the stakeholder integration capability. They represent a means to monitor, evaluate and improve the effectiveness of routines and products to meet the environmental expectations of internal and external stakeholders (Hart, 1995; Henriques and Sadorsky, 1996; Buysse and Verbeke, 2003; Sharma and Henriques, 2005; Husted and Allen, 2007). For example, EPMS may include the monitoring of regulations compliance in order to meet the requirements of regulators, the evaluation of green performance of processes and products throughout the value chain in order to satisfy the expectations of green consumers, and to control waste and emissions in order to ensure good relations with local community and non-governmental organizations (NGOs). Also, EPMS provide an agenda for exchange and debate about stakeholders' changing expectations and requirements and serve as a basis to support the establishment of a trust-based collaborative relationship with stakeholders involving joint problem solving, information sharing, and negotiations (Sharma and Vredenburg, 1998; Hillman and Keim, 2001). Moreover, by integrating and communicating key information through goal and objective setting about stakeholders' new requests and needs, EPMS can help rebuild and reconfigure processes and products to meet them. Hence, EPMS can foster stakeholders' integration capability by providing an agenda to exchange and

collaborate with stakeholders, by considering their new expectations in strategic decisions, by allowing process and product transformations necessary to integrate new requirements, and by ensuring their achievement with constant monitoring and corrective actions.

Finally, EPMS can help foster shared environmental vision capability. First, information provided by EPMS allows top managers to confirm their current vision or to rethink and transform it in order to face new environmental challenges and opportunities. Also, EPMS represent a framework to disseminate the environmental vision defined by top managers to all employees by setting and communicating goals and objectives throughout the organization. Hence, EPMS communicate a unified purpose and reason for being to all employees (Simons, 1995; Leuthesser and Kohli, 1997). In other word, EPMS promulgate the environmental strategic agenda to all employees, identify the scope of the business operation (Pearce and David, 1987: p.109), and help to direct attention to important matters (Ireland and Hitt, 1992: p.34). Therefore, EPMS promote collective unification within the organization (Campbell and Yeung, 1991: p.145; Palmer and Short, 2008: p.455) and help foster shared environmental vision.

In sum, EPMS represent an effective framework to support environmental capabilities. Formally stated:

Hypothesis 1a: EPMS are positively associated with eco-learning capability.

Hypothesis 1b: EPMS are positively associated with continuous environmental innovation capability.

Hypothesis 1c: EPMS are positively associated with stakeholder integration capability.

Hypothesis 1d: EPMS are positively associated with shared environmental vision capability.

Indirect relationships between EPMS and environmental performance through environmental capabilities

A growing body of literature has demonstrated that capabilities of eco-learning, continuous environmental improvement, stakeholder integration and shared environmental vision play an important role in proactively managing environmental issues (Hart, 1995; Sharma and Vredenburg, 1998; Aragon-Correa and Sanjay, 2003; Aragon-Correa and Rubio-Lopez, 2007). While environmentally proactive organizations are commonly recognized for improving their environmental performance by broadly integrating environmental issues within managerial functions and by having extensive involvement and commitment at all firm levels (Ullmann, 1985; Wartick and Cochran, 1985; Hunt and Auster, 1990; Roome, 1992; Henriques and Sadorsky, 1999), environmental capabilities may represent key factors needed to attain superior environmental performance.

More specifically, the capability for eco-learning involves the development of different interpretations of new and existing information resulting in the development of a new understanding of events (Fiol, 1994). Learning processes contribute to major reorientations that involve changed norms, values, and frames of reference (Argyris and Schön, 1978). Eco-learning capability provides key environmental information concerning the effectiveness of past environmental activities (Fiol and Lyles, 1985) promoting environmental awareness (Dechant, Altman et al., 1994) and supporting interpretation and decision-making (Daft and Weick, 1984; Ginsberg and Venkataraman, 1992; Ginsberg and Venkataraman, 1995; Kloot, 1997) of future deployment of processes, products and technologies in order to reach superior environmental performance.

Continuous environmental innovation capability promotes the creation of new environmental ideas, processes, and products necessary to improve environmental performance (Hart, 1995; Porter and Van der Linde, 1995a). This capability can lead to the adoption of greener operational practices, such as product and process redesign,

disassembly, substitution, reduction, and remanufacturing (Davenport and Short, 1990; Allenby, 1992; 1993; 1994; Dechant, Altman et al., 1994; Shrivastava, 1995c; UNEP, 2007; Henri and Journeault, 2009) contributing to the reduction of energy and material consumption, waste and emissions. Continuous environmental innovations can also lead to the development and adoption of greener technologies that can reduce environmental impacts (Shrivastava, 1995b; Klassen and Whybark, 1999; Allenby, 2000b).

Stakeholder integration capability represents an effective way of solving environmental issues and accomplishing environmental goals (Dechant, Altman et al., 1994; Hart, 1995). Environmental improvement may arise through the establishment of a collaborative relationship with various organizational stakeholders and through the integration of their requests and expectations within products and processes. For example, by establishing partnerships and alliances with suppliers, organizations can have access to greener components for their final product (Handfield, Walton et al., 1997) and be involved in an industrial ecological network allowing for the reduction of waste and emissions by closing the loops (Erkman, 1997; Allenby, 2000a). Also, the integration of customers' needs and expectations help the organization to identify environmental improvements that must be accomplished and can stimulate environmental innovation in order to reach these requirements (Freeman, 1974; Handfield, Walton et al., 1997). Furthermore, the establishment of a partnership and an agreement with the government can help organizations to receive financial and technical support to help improve their environmental performance (Dechant, Altman et al., 1994).

Shared environmental vision represents a key capability needed to generate the internal pressure and enthusiasm crucial for environmental improvement (Hart, 1995). To attain a high environmental performance, a critical mass of people throughout the organization who share a common vision and are empowered to act on this vision is essential (Dechant, Altman et al., 1994). Creating a consensus concerning the importance of environmental issues focuses organizational attention, clarifies environmental goals and shares the responsibility to achieve them (Aragon-Correa, Hurtado-Torres et al., 2008). Hence, shared environmental vision, a key capability, stimulates environmental actions

and commitment throughout the organization and thus improving environmental performance.

EPMS have been linked to eco-learning (hypothesis 1a), continuous environmental innovation (hypothesis 1b), stakeholder integration (hypothesis 1c), and shared environmental vision (hypothesis 1d) capabilities. It has been argued above that environmental capabilities are expected to have a positive influence on environmental performance. Thus, EPMS are expected to have indirect implications for environmental performance by contributing to environmental capabilities which in turn improve environmental performance. Therefore, the following hypotheses are proposed:

Hypothesis 2a: EPMS are indirectly associated with environmental performance through their contribution to eco-learning capability.

Hypothesis 2b: EPMS are indirectly associated with environmental performance through their contribution to continuous environmental innovation capability.

Hypothesis 2c: EPMS are indirectly associated with environmental performance through their contribution to stakeholder integration capability.

Hypothesis 2d: EPMS are indirectly associated with environmental performance through their contribution to shared environmental vision capability.

Indirect relationships between EPMS and economic performance through environmental capabilities

Following a RBV, idiosyncratic and valuable capabilities controlled by a firm can provide a competitive advantage leading to improvements in economic performance (Penrose, 1959; Rumelt, 1984; Wernerfelt, 1984; Barney, 1986; Barney, 1991). Eco-learning, continuous environmental innovation, stakeholder integration and shared environmental vision have been recognized as distinctive, valuable, imperfectly imitable and substitutable capabilities and previous studies have provided empirical evidence showing that they contribute to the economic performance of the firm (Sharma and Vredenburg, 1998; Henri, 2006a; Aragon-Correa, Hurtado-Torres et al., 2008).

While EPMS have been linked to environmental capabilities (hypotheses 1a to 1d) and it has been argued above that these capabilities have a positive influence on economic performance, EPMS are expected to have indirect implications on economic performance by contributing to environmental capabilities. Therefore, the following hypotheses are proposed:

Hypothesis 3a: EPMS are indirectly associated with economic performance through their contribution to eco-learning capability.

Hypothesis 3b: EPMS are indirectly associated with economic performance through their contribution to continuous environmental innovation capability.

Hypothesis 3c: EPMS are indirectly associated with economic performance through their contribution to stakeholder integration capability.

Hypothesis 3d: EPMS are indirectly associated with economic performance through their contribution to shared environmental vision capability.

1.3 RESEARCH METHOD

1.3.1 Research design

Data were collected from a survey administered to a random sample of 1500 Canadian manufacturing firms from Scott's Manufacturing database. In this study, 'firm' is a fully autonomous entity or a subunit of a larger firm. In all cases, they appeared as separate entities in the database. Organizations with 100 employees or more, and reporting sales of over \$20 million were selected. These criteria are intended to ensure that organizations are large enough for organizational variables to apply (Miller, 1987), that environmental actions and that management control systems are sufficiently developed (Bouwens and Abernethy, 2000). The final sample comprised 1468 organizations (considering wrong addresses, organizations that moved, etc).

The questionnaire was first validated using a pre-test administered to six academics and five top managers. This pre-test confirmed the understanding of each of the measurement

instruments. Then, the questionnaire was sent to the CEO or another member of the top-management team (COO or senior vice-president) of each firm along with a letter explaining the purpose of the study and a self-addressed stamped envelope was included with the questionnaire. Two follow-up mailing were performed to guarantee a good response-rate four and ten weeks after the initial mailing. For each of these follow-ups, 1000 organizations were randomly selected from among the non-respondents.

A total of 249 usable questionnaires were received, for a response rate of 17%³. On average, firm size was 779 employees and the respondents had on average 13.8 years of experience working for their organization. Appendix 1 presents the profile of the respondents. Different analyses of the non-response bias were performed to confirm the validity of the data. Firstly, the comparison between respondents and non-respondents with respect to size, industry and geographical region did not reveal any significant differences. Moreover, the comparison between the first and last 10% of respondents (the latter being used as a proxy for the non-respondents) did not reveal any significant differences in the responses obtained for the main constructs of the study. Hence, it appears that non-response bias is not a major concern for this sample.

1.3.2 Measurement of constructs

All measures are drawn from existing instruments. Appendix 2 presents the instruments used to measure the main constructs. Descriptive statistics of the main constructs and correlation matrix are presented in Table 1. EPMS use was measured using an instrument developed by Bennett & James (1998) containing four items ranging on a seven-point Likert-type scale (1=not used at all, 7=used extensively). The respondents were asked to indicate to what extent their organization relies on environmental indicators to monitor internal compliance with environmental policies and regulations, provide data for internal

³ The sample size (n=249) as well as the statistical power (i.e. 0,99) of this study are well above the requirement proposed by the current literature (sample between 100 to 200 and statistical power over 0,80) (Bentler & Chou, 1987; Anderson & Gerbing, 1988; MacCallum, Browne, and Sugawara 1996). Also, this response rate is comparable to the one reported in similar recent studies (e.g. Moores and Yuen, 2001; Baines & Langfield-Smith, 2003; Lowe & Locke, 2005; Widener, 2007; Suddaby, Gendron, et al, 2009).

decision-making, motivate continuous improvement, and provide data for external reporting. A higher score indicates a greater use of EPMS by the organizations.

Table 1 Descriptive statistics and correlation matrix of the main constructs

	EPMS	Eco-Learning	Continuous env. innovation	Stakeholder integration	Shared env. vision	Env. perf.	Economic perf.
Descriptive statistics							
No. of items	4	3	3	3	3	12	3
Theoretical range	1-7	1-7	1-7	1-7	1-7	1-7	1-7
Minimum	1.00	1.00	1.00	1.17	1.00	1.00	1.00
Maximum	7.00	7.00	7.00	6.83	7.00	6.81	7.00
Mean	4.80	4.72	4.37	4.07	4.52	4.27	4.69
Standard deviation	1.57	1.29	1.35	1.34	1.31	1.27	1.18
Median	5.25	4.67	4.67	4.17	4.67	4.38	5.00
Correlation matrix (Pearson)							
EPMS	1						
Eco-learning capability	.519**	1					
Continuous env. innovation	.548**	.651**	1				
Stakeholder integration	.468**	.479**	.527**	1			
Shared env. vision	.572**	.474**	.480**	.419**	1		
Environmental performance	.512**	.548**	.573**	.534**	.470**	1	
Economic performance	.153*	.164**	.153*	.201**	.123	.220**	1

** Significant at the .01 level. * Significant at the .05 level.

Four different validated scales were used to measure environmental capabilities. Instruments developed by Hult (1998) and Burke (1989) and validated in several other studies (Hurley and Hult, 1998; Henri, 2006a; Widener, 2007) were respectively used to measure eco-learning and continuous environmental innovation. Shared environmental vision was measured using an instrument developed by Aragon-Correa, Hurtado-Torres et al. (2008). For each of these three instruments, respondents were asked to rate the extent to which the items related to each capability describe their organization (1=not descriptive, 7= very descriptive). Answers were measured using a seven-point Likert-type scale and average scores were computed whereby a higher mean score indicates a higher degree of eco-learning, continuous environmental innovation, and shared environmental vision. Stakeholder integration was measured using an adapted instrument developed by

Buyse and Verbeke (2003)⁴. The respondents were asked to rate, using a seven-point Likert-type scale, the level of attention that they devoted to eight different stakeholders when they manage their organization (1=no attention devoted, 7= very high attention devoted) whereby a higher score indicates a high degree of stakeholder integration.

Environmental performance was measured using an instrument developed by Sharma & Vredenburg (1998) and validated by Henri and Journeault (2010). Respondents were asked to indicate the extent to which environmental practices have led to various types of benefits (e.g. a reduction in material costs, increased productivity, better relationships with stakeholders, overall company reputation). The questionnaire contains thirteen items ranging on a seven-point Likert-type scale (1=no contribution, 7=very large contribution). An average score was calculated for the thirteen items and a higher score indicates a better environmental performance.

Economic performance was measured using an instrument including three indicators: (i) return on investment (ROI); (ii) operating profits, and (iii) cash flow from operations. The respondents was asked to indicate the performance of their organization over the past twelve months compared to their leading competitors based on a seven-point Likert-type scale (1=well below average, 7=well above average). A higher score indicates better economic performance.

Finally, the three contextual variables were measured as follows. Size was measured using the natural log of the number of employees. Environmental exposure was measured using the data from NPRI to identify low and high polluting industries⁵. Finally, public visibility was measured using ownership as proxy. Using a dichotomous variable, private

⁴ The initial instrument developed by Buyse and Verbeke (2003) includes fifteen different stakeholders. This study however includes only eight of these stakeholders. The literature has emphasized on the importance of their integration within the activities of organizations in order to contribute to improved environmental performance.

⁵ Data were collected from the National Pollutant Release Inventory (NPRI) provided by the federal government of Canada. This database contains information on more than 300 pollutants released and transferred from individual facilities across Canada (air, water, land and injected underground and transferred off-site to disposal, treatment, sewage, energy recovery and recycling).

firms are associated with low public visibility while public ones are associated with high visibility.

Appendix 2 presents the statistics of the measurement analysis for the initial and respecified models. An exploratory factor analysis shows that the environmental performance instrument includes two factors, which have been labelled *operational environmental performance* and *relational environmental performance* for the purpose of this study. Hence, a second-order confirmatory factor analysis (CFA) has been performed for this construct while first-order CFA has been performed for the other constructs (EPMS, eco-learning, continuous environmental innovation, stakeholder integration and shared environmental vision capabilities, and economic performance). Respecification was necessary for eco-learning (one item was deleted because of the presence of multicollinearity between the first two items), stakeholder integration (three items were deleted because of inadequate loading factors and R^2), and environmental performance (one item was deleted because of inadequate loading factors and R^2). After those respecifications, all constructs exceed the recommended cut-off point of 0.70 for the Cronbach Alpha and composite reliability (Nunnally, 1967; Fornell & Larcker, 1981), reflecting good construct reliability, and exceeding the recommended cut-off point of 0.50 for the variance extracted (Hair et al., 1998), confirming construct validity. Moreover, all constructs exhibit acceptable models of fit, as measured by three fit indices, namely NNFI (non-normed fit index), CFI (comparative-fit index), and RMSEA (root mean square error of approximation)⁶, reflect adequate R^2 , and all factor loadings are statistically significant ($p < 0.01$). Only the RMSEA of environmental performance construct is slightly above the threshold recommended ($0.124 > 0.100$). However the RMSEA exhibits good levels of CFI and NNFI indices and environmental performance is globally a good-fitting model. Lastly, the variance extracted from each individual construct exceed the squared correlation between latent constructs (Fornell & Larcker, 1981) and all the constructs exhibit adequate discriminant validity.

⁶ Those indices reflect two complementary types of indices (absolute fit and incremental fit measures) and they are among the most frequently reported. The threshold values recommended are (i) NNFI > 0.90 (Tabachnick & Fidell, 2001), (ii) CFI > 0.95 (Hu & Bentler, 1995), and (iii) RMSEA < 0.1 (Browne & Cudeck, 1993).

1.3.3 Data analysis

Structural equation modeling (SEM) is used to test the model. SEM consists of a set of linear equations that simultaneously test two or more relationships among endogenous and exogenous variables (Bollen, 1989; Bollen and Long, 1993). Data collected from the survey were analyzed with LISREL 8.72 and used a covariance matrix as an input matrix.⁷ To check the overall goodness of fit of a model in the presence of multivariate non-normal data, maximum likelihood estimates, which are robust to such violations, and multiple indices, are suggested (Bentler and Chou, 1987).

1.4 RESULTS

1.4.1 Structural equation model

Table 2 and 3 present the results of the structural equation model for the basic and revised model respectively in terms of path coefficients, Z statistics, number of iterations, proportion of variance (R^2), and goodness-of-fit indices. The models respect the recommended threshold mentioned previously. This globally indicates a good fit of the data to the model. No respecification was made to the initial models and no starting values were used.

After having controlled for environmental visibility, environmental exposure and size, the results of the basic model suggest a positive and significant direct relationship between EPMS and environmental performance (0.569; $p < 0.01$). Also, a positive and significant relationship is found between environmental performance and economic performance (0.235; $p < 0.01$), but no significant direct relationship is found between EPMS and economic performance. However, an indirect and positive indirect effect is found between EPMS and economic performance through environmental performance (0.118; $p < 0.05$). Hence, the results of the basic model suggest that the use of EPMS contributes to improved environmental performance which in turn influences economic performance. These results are in line with the findings of Henri and Journeault (2010).

⁷ The input matrices are available from the author upon request.

Table 2 Standardized results of the structural equation model for the direct model

Description of main paths			Direct effect		Intermediate variables	Indirect effect		Total effect	
			Path coeff.	Z statistics		Path coeff.	Z statistics	Path Coeff.	Z statistics
EPMS → Environmental performance			0.569	5.83***	-	-	-	0.569	5.83***
EPMS → Economic performance			0.023	0.28	Environmental performance	0.118	2.49**	0.141	2.05**
Environmental performance → Economic performance			0.208	2.77***	-	-	-	0.208	2.77***

Description of paths for contextual factors	Path coeff.	Z statistics	Description of paths for contextual factors	Path coeff.	Z statistics	Description of paths for contextual factors	Path coeff.	Z statistics
Env. visibility → EPMS	0.296	4.41***	Env. exposure → EPMS	0.050	0.82	Size → EPMS	0.115	1.72
Env. visibility → Env. perf.	-0.025	-0.42	Env. exposure → Env. perf.	0.060	1.16	Size → Env. Perf.	-0.015	-0.26
Env. visibility → Eco. perf.	0.127	1.85*	Env. exposure → Eco. Perf.	-0.086	-1.40	Size → Eco. Perf.	0.085	1.26

Dependant variables	R ²	Dependant variables	R ²	Dependant variables	R ²
EPMS	0.133	Environmental performance	0.319	Economic performance	0.099

Goodness-of-fit indices: $\chi^2(42) = 100.19$ $p < 0.001$; NNFI= .956; CFI=.972; RMSEA = .074				Number of iterations: 13	
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$				n=249	

Table 3 Standardized results of the structural equation model for the revised model

Hypotheses	Description of main paths	Direct effect		Intermediate variables	Indirect effect		Total effect	
		Path coeff.	Z statistics		Path coeff.	Z statistics	Path Coeff.	Z statistics
H1a	EPMS → Environmental performance	-0.051	-0.42	Env. Capabilities	0.714	5.48***	0.663	10.51***
	EPMS → Economic performance	-0.016	-0.10	Env. Capabilities/Env. Perf.	0.162	1.16	0.146	2.36**
	Environmental performance → Economic performance	0.203	1.85*	-	-	-	0.203	1.85*
	EPMS → Innovation	0.687	10.10***	-	-	-	0.687	10.10***
H1b	EPMS → Learning	0.722	10.26***	-	-	-	0.722	10.26***
H1c	EPMS → Stakeholders	0.596	7.95***	-	-	-	0.596	7.95***
H1d	EPMS → Vision	0.686	10.45***	-	-	-	0.686	10.45***
H2a	Innovation → Environmental performance	0.279	3.52***	-	-	-	0.279	3.52***
H2b	Learning → Environmental performance	0.244	3.09***	-	-	-	0.244	3.09***
H2c	Stakeholders → Environmental performance	0.299	3.95***	-	-	-	0.299	3.95***
H2d	Vision → Environmental performance	0.244	3.22***	-	-	-	0.244	3.22***
H3a	Innovation → Economic performance	0.080	0.77	Environmental performance	0.057	1.65	0.137	1.38
H3b	Learning → Economic performance	-0.064	-0.61	Environmental performance	0.049	1.58	-0.014	-0.14
H3c	Stakeholders → Economic performance	0.078	0.79	Environmental performance	0.061	1.69	0.139	1.53
H3d	Vision → Economic performance	-0.041	-0.42	Environmental performance	0.049	1.60	-0.008	-0.08

Description of paths for contextual factors	Path coeff.	Z statistics	Description of paths for contextual factors	Path coeff.	Z statistics	Description of paths for contextual factors	Path coeff.	Z statistics
Env. visibility → EPMS	0.300	4.43***	Env. exposure → EPMS	0.061	0.98	Size → EPMS	0.114	1.69
Env. visibility → Innovation	0.029	0.45	Env. exposure → Innovation	0.007	0.12	Size → Innovation	-0.164	-2.67***
Env. visibility → Learning	-0.064	-1.05	Env. exposure → Learning	-0.034	-0.64	Size → Learning	-0.021	-0.36
Env. visibility → Stakeholders	0.021	0.30	Env. exposure → Stakeholders	-0.065	-1.04	Size → Stakeholders	-0.155	-2.27**
Env. visibility → Vision	-0.008	-0.13	Env. exposure → Vision	0.023	0.42	Size → Vision	-0.142	-2.34**
Env. visibility → Env. perf.	-0.049	-0.92	Env. exposure → Env. perf.	0.075	1.60	Size → Env. Perf.	0.113	2.03**
Env. visibility → Eco. perf.	0.122	1.74	Env. exposure → Eco. Perf.	-0.083	-1.33	Size → Eco. Perf.	0.103	1.40

Dependant variables	R ²	Dependant variables	R ²	Dependant variables	R ²
EPMS	0.136	Stakeholders	0.341	Environmental performance	0.587
Innovation	0.457	Vision	0.445	Economic performance	0.111
Learning	0.485				

Goodness-of-fit indices: χ^2 (216) = 573.83 p < 0.001; NNFI= .945; CFI=.957; RMSEA = .078				Number of iterations: 15	
*** p < 0.01; ** p < 0.05; * p < 0.10				n=249	

However, when environmental capabilities are integrated in the relationships among EPMS, environmental and economic performance, the use of EPMS no longer contributes directly to environmental performance. Indeed, after having controlled for environmental visibility, environmental exposure and size, the results of the revised model show that the direct relationship between EPMS and environmental performance is not significant. Rather the results suggest a positive and significant indirect effect between EPMS and environmental performance through environmental capabilities (0.714; $p < 0.01$). This indirect effect is corroborated by the support of hypotheses 1 and 2. Indeed, a positive and significant relationship is found between EPMS and the four environmental capabilities (continuous environmental innovation: 0.687; $p < 0.01$, eco-learning: 0.722; $p < 0.01$, stakeholders integration: 0.596; $p < 0.01$, shared environmental vision: 0.686; $p < 0.01$) as well as a positive and significant relationship is found between the four environmental capabilities and environmental performance (continuous environmental innovation: 0.279; $p < 0.01$, eco-learning: 0.244; $p < 0.01$, stakeholders integration: 0.299; $p < 0.01$, shared environmental vision: 0.244; $p < 0.01$). These findings suggest that environmental capabilities act as mediators in the relationship between EPMS and environmental performance.

These findings suggest that the EPMS do not directly contribute to environmental performance, but rather indirectly through the environmental capabilities. Hence, the ability of the use of EPMS to provide information to managers about the progress and results of organizational activities, to support decision-making in every aspect of activities, and to focus attention on environmental issues does not contribute directly to improved environmental performance, but rather to foster continuous environmental innovation, eco-learning, stakeholders' integration, and shared environmental vision capabilities. This finding suggests eco-control systems play an important role to support environmental strategic implementation within the firm. Thereafter, these four environmental capabilities contribute to the improvement of environmental performance. More specifically, the eco-learning capability provides key environmental information concerning the effectiveness of

past environmental activities supporting the interpretation and decision-making of future deployment of processes, products and technologies in order to reach superior environmental performance. Continuous environmental innovation capability supports the creation of new environmental ideas, processes, and products necessary to improve environmental performance. Stakeholder integration capability improves environmental performance by the establishment of a collaborative relationship with various organizational stakeholders and the integration of their requests and expectations within products and processes. Shared environmental vision capability fosters the commitment, enthusiasm and consensus needed for environmental improvement.

Also, as for the basic model, no significant relationship is found between EPMS and economic performance in the revised model, but a positive and significant relationship is found between environmental and economic performance (0.203; $p < 0.10$). However, no significant relationship is found between the four environmental capabilities and economic performance, failing to support hypothesis 3. These results show that neither the EPMS nor the environmental capabilities directly contribute to economic performance. Only their direct or indirect contribution to environmental performance may ultimately lead to economic performance improvement by creating a competitive advantage, through cost reduction or market differentiation. These findings suggest that specific management control systems (eco-control) or specific capabilities (environmental capabilities) may lead to a specific level of performance (i.e. environmental performance). At a more general level, this may suggest that management control systems and capabilities may not affect economic performance directly but indirectly by playing a role in improving other levels of performance (e.g., quality performance, manufacturing performance, etc.).

1.4.2 Sensitivity analyses

To validate the robustness of the main model, several additional analyses have been conducted. First, the revised model has been run with the four environmental capabilities regrouped into one second-order construct, namely environmental capabilities. The results remain qualitatively unchanged as all the results that were previously significant remain significant and the paths that were not significant remain unchanged. Interestingly, the R^2 of environmental performance is greater when the four environmental capabilities are regrouped into one construct than when they are separated (0.667 vs 0.587). Hence, this result suggests that the four environmental capabilities act in a synergic way to foster environmental performance. Second, the revised model has been run twice including only one dimension of environmental performance at a time (operational environmental performance and relational environmental performance). Again, the results remain qualitatively unchanged as all the results that were previously significant remain significant and the paths that were not significant remain unchanged.

To examine the potential influence of industry on the results, the revised model has been run with the environmental and economic performance variables operationalized as follows: the three composite indices of those two variables are adjusted for industry by subtracting the dominant two-digit industry average from their respective firm counterparts. The results remain qualitatively unchanged as all the results that were previously significant are still significant and the paths that were not significant remain unchanged. Only one exception occurs while no significant relationship is found between continuous environmental innovation capability and environmental performance.

1.5 CONCLUSION

The aim of this study was to examine the potential of eco-control to foster environmental capabilities and to analyze its impact on performance. Two research questions in particular were investigated: (i) To what extent does eco-control support environmental capabilities? (ii) To what extent do the environmental capabilities act as mediators in the relationship between eco-control and

environmental and economic performance of the organization? Using survey-data from a sample of Canadian manufacturing firms, this study empirically investigates the ability of the use of environmental performance measurement systems (EPMS), as one component of eco-control, to support eco-learning, continuous environmental innovation, stakeholder integration, and shared environmental vision capabilities which in turn contribute to the firms' environmental and economic performance. The results show that the use of EPMS fosters environmental capabilities by providing information, focusing attention, and supporting decision-making, supporting the role of eco-control systems to support environmental strategic implementation within the firms. Also, this study finds that the use of EPMS does not directly contribute to environmental and economic performance, but rather indirectly through environmental capabilities. Hence, this study demonstrates that environmental capabilities act as a mediator in the relationship between the use of eco-control systems and environmental performance, and that environmental performance act as a mediator between the environmental capabilities and economic performance.

This study contributes to the environmental-economic performance, eco-control, and NRBV literatures in a number of ways. First, this study contributes to the growing body of literature that has investigated the capability of eco-control systems to support a win-win situation, that is to say, to contribute simultaneously to the environmental and the economic performance of organizations. Furthermore, this study gets inside the black box and provides a more complete picture on how eco-control systems may influence organizational development in order to contribute to environmental and economic performance. Indeed, this study finds that the development of environmental capabilities may represent the missing link between the adoption of eco-control systems and their impact on both environmental and economic performance of the firm. More specifically, this study demonstrated that instead of directly influencing environmental and economic performance, the use of EPMS, as one component of eco-control, contribute indirectly to both performance by fostering eco-learning, continuous environmental

innovation, stakeholder integration, and shared environmental vision capabilities. More globally, this research provides insight into the role of management control systems to foster organizational capabilities by providing information, focusing attention and supporting decision-making.

Also, while very few studies have empirically examined the conceptual assumption of the NRBV literature that environmental capabilities may contribute to economic performance by creating a competitive advantage (e.g. Hart 1995; Aragon-Correa and Sanjay, 2003), this paper contributes to this literature by providing empirical evidence supporting the development of environmental capabilities, such as eco-learning, continuous environmental innovation, stakeholder integration, and shared environmental vision, contribute to environmental performance which in turn influence economic performance of the firms. More globally, this study contributes to the resource-based view literature by demonstrating that the adoption of specific capabilities, such as environmental capabilities, may contribute not only to economic performance, but also contribute simultaneously to another specific level of performance, such as environmental performance.

This study also has important implications for management practices by illustrating the potential of eco-control to improve both economic and environmental performance. The strategic importance for managers to adopt eco-control is emphasized by its capacity to foster environmental capabilities, such as eco-learning, continuous environmental innovation, shared environmental vision, and stakeholder management, which in turn contribute not only to create a competitive advantage but also contribute to environmental improvement. Hence, it gives a strong indication to managers that the adoption of these systems may represent a cornerstone to face the challenges created by the world economic crisis and the climate changes.

This study is subject to potential limitations that can also be considered as avenues for future research. First, four environmental capabilities have been analyzed in this

study. Future research could examine the investigation and the contribution of other environmental capabilities (e.g., organizational culture, environmental strategy proactivity, etc.). Second, this study has examined one eco-control system, namely the use of EPMS. Other eco-control systems, such as environmental strategic planning, environmental budget, and environmental incentives, could provide similar or different conclusions. Third, as for any proposed structural model, the potential existence of other structural models using the same data reflecting equivalent levels of fit may be problematic and constitutes a limitation of the current results obtained (MacCallum, Browne et al., 1996). Fourth, no clear evidence of causality can be established with survey data obtained from cross-sectional analyses. Rather the evidence must be considered consistent with theoretical arguments and predicted relationships. Fifth, this study is static because it does not incorporate the evolution of eco-controls and performance over time. Sixth, using the survey method to collect data creates a potential for bias due to common response. Seventh, the results of this study may not be generalized outside the scope of the current sample (i.e., small-to-medium sized manufacturing firms in Canada).

Chapter 2

Levers of eco-control and environmental strategy

Abstract

The aim of this study is to examine the ability of eco-controls to translate environmental strategy into actions. More specifically, this study investigated to what extent the four levers of eco-control are used to translate different competitive environmental strategies (internally-oriented vs externally-oriented) into various environmental practices (managerial and operational). This question is investigated using survey-data from a sample of 249 Canadian manufacturing firms. The results suggest that firms adopting an internally-oriented environmental strategy rely more intensively on the four levers of eco-control systems than organizations adopting an externally-oriented environmental strategy. Moreover, the results provide support for the synergic and complementary role of the four levers of control to translate strategic environmental intentions into environmental actions.

Keywords: environmental strategy, eco-control, levers of control, management control systems

2.1 INTRODUCTION

The adoption of an environmental strategy is considered important by a growing number of organizations. This trend may in part be the result of increasing concerns about climate change, greenhouse gas emissions, and biodiversity impoverishment, or the consequence of increasing pressures from stakeholders (Berry and Rondinelli, 1998; Henriques and Sadorsky, 1999; Buysse and Verbeke, 2003). However, this tendency may also be explained by competitive motivations where managers are becoming more aware of the economic benefits obtained from an improvement in environmental performance (e.g. Russo and Fouts, 1997; Al-Tuwaijri, Christensen et al., 2004; Wagner and Schaltegger, 2004; Burnett and Hansen, 2008; Henri and Journeault, 2010). Indeed, organizations that have adopted a competitive environmental strategy believe that their ecological responsiveness can lead to sustained competitive benefits (Bansal and Roth, 2000, Paulraj, 2009) by creating an advantage in terms of productivity or improved corporate image (e.g. Hart, 1995; Porter and Van der Linde, 1995a; Christmann, 2000; Porter and Kramer, 2006; López-Gamero, Molina-Azorín et al., 2009).

The aim of this study is to examine the ability of eco-controls to translate environmental strategy into actions. Eco-control systems are the application of financial and strategic control methods to environmental management (Schaltegger and Burritt, 2000; Henri and Journeault, 2010). Following the work of Simons (1987; 1990) on management control systems, eco-controls are defined as the formalized procedures and systems that use financial and ecological information to maintain or alter patterns in environmental activity. Overall, the literature that has empirically examined eco-controls remains limited. Most of this research rests on a conceptual description of the role of eco-control systems in supporting environmental management (e.g. Lothe, Myrtveit et al., 1999; Chinander, 2001; Epstein and Wisner, 2001; Figge, Hahn et al., 2002; Burritt, 2004; IFAC, 2005) or on case studies illustrating this contribution (e.g. Meyssonier and Rasolofo-Distler, 2008; Morsing and Oswald, 2009). Moreover, although empirical investigations of

the contribution of eco-controls to environmental performance has received growing interest (e.g. Judge and Douglas, 1998; Epstein and Wisner, 2005; Wisner, Epstein et al., 2006; Henri and Journeault, 2010), few empirical studies have specifically examined the link between environmental strategy and eco-controls that include the intermediate steps between the use of eco-controls and environmental performance (notable exceptions include Marquet-Pondeville, Swaen and De Rongé, 2008 and Perego and Hartmann, 2009).

Although it is widely recognized that “management control systems (MCS) should be tailored explicitly to support the strategy of the business to enhance competitive advantage and encourage superior performance” (Langfield-Smith, 2007:753), we can expect that organizations implementing a competitive environmental strategy will use eco-control systems to drive the implementation of the environmental strategy throughout the organization. Nevertheless, many important and unresolved issues arise regarding the potential relationships between the competitive environmental strategy and eco-controls. In fact, this particular strategy differs from other strategies that the organization may adopt, such as innovation, product differentiation, or quality (e.g. Daniel and Reitsperger, 1991; Ittner and Larcker, 1997; Davila, 2000; Bisbe and Otley, 2004). Indeed, unlike other strategies, the competitive environmental strategy may not only be implemented to review, transform, and adapt internal processes in order to increase productivity and gain competitive advantages, but also following external motivations that may be central for the organization. Indeed, the adoption of several other strategies, such as quality or innovation, may be motivated to meet customer expectations. However, the decision to integrate environmental aspects within the environmental strategy of a firm may be driven by the desire to fulfill expectations of a larger set, more diversified and influential external stakeholders, including customers as well, but also the community, non-governmental environmental organizations, regulators, the media, investors, and financial institutions (Clarkson, 1995; Buysse and Verbeke, 2003; Sharma and Henriques, 2005). This particular and powerful social influence may persuade organizations to adopt an environmental strategy to improve their

reputation, image and gain legitimacy (Wilmshurst and Frost, 2000; Bansal and Hunter, 2003; Cho and Patten, 2007). Hence, it is not always clear if the adoption of this externally-oriented environmental strategy is driven by real or illusive environmental intentions. Thus, considering this important aspect of the context of the competitive environmental strategy, do the eco-control systems have the same role that researchers have observed in the MCS-strategy literature? When the intentions are mainly to build corporate reputation and image, does the organization implement eco-control systems in the same manner as when the intentions are to increase the firm's productivity? Moreover, although it is not clear at a more global level how the management control systems will respond to different types of strategies (Langfield-Smith, 2007; Dent 1990), the manner in which the eco-control systems will be implemented and how they will help translate two different environmental strategic orientations (internally vs externally) into actions remain very important and unresolved questions.

The levers of control framework proposed by Simons (1990; 1991; 1994; 1995; 2000; 2005) provides a global and comprehensive framework to address the specific needs of the environmental strategy context. In the context of environmental management, the levers of eco-control framework includes four control systems, namely belief, boundary, diagnostic, and interactive. They are used to manage and transform the tension between predictable environmental goal achievement and creative environmental innovation into organizational benefits (Simons, 1995: p.ix). Hence, the levers of eco-control represent a complete set of control systems that may help the organization to realize its competitive environmental strategy. However, empirical research incorporating levers of control remains scarce and has mainly studied the diagnostic and interactive systems (e.g. Bisbe and Otley, 2004; Henri, 2006a; Naranjo-Gil and Hartmann, 2007). Consequently, the specific role of belief and boundary systems to transform strategy into actions remains overlooked. Simons argued that these systems can serve to communicate expectations and values throughout the organization and sustain employees and top managers' commitment. Considering the importance of these elements in the context of

environmental management, belief and boundary systems may play a central role in translating environmental strategy into actions. Moreover, while very few studies have examined all four levers of control, with the notable exception of Widener (2007), our understanding of how these four different eco-control systems interact to drive the competitive environmental strategy throughout the organization remains limited.

The aim of this study is to shed light on these issues by examining how the levers of eco-control systems are used to convert competitive environmental strategy into actions. More specifically, using survey-data from 249 Canadian manufacturing firms, this study empirically investigates the extent to which the four levers of eco-control are used to translate different competitive environmental strategies (internally-oriented vs externally-oriented) into various environmental practices (managerial and operational). This study contributes to the literature investigating the link between strategy and management control systems by illustrating that the specific context of the environmental strategy may provide different results than what has been found for other types of strategies. First, this study shows that the adoption of different types of strategy may influence not only the type of eco-control systems adopted by an organization, but also their level of deployment. Second, this study provides empirical support for the more essential and important role played by the levers of eco-control when strategic intentions are addressed more globally and widely at the managerial level than when those issues are addressed more locally at the operational level. Moreover, this study contributes to the levers of control literature by providing an illustration of how the levers of control framework can be applied to the environmental management context. Furthermore, it can provide a better understanding of the interdependence among levers of control by providing empirical evidence supporting the synergetic and complementary role played by each of the levers of eco-control in translating the strategic environmental intentions of the organization into tangible environmental actions.

The remainder of this paper is organized as follows. The first section presents the following concepts: competitive environmental strategy, levers of eco-control, and environmental practices. Next, a theoretical framework and the development of a set of hypotheses are discussed. The next section presents a description of the survey design and a definition of the main constructs. The results of our analyses are then presented and are followed by a discussion and the conclusion of this study.

2.2. THEORITICAL FRAMEWORK

2.2.1 Definition of constructs

Competitive environmental strategy

The competitive environmental strategy refers to the organization's recognition of the legitimacy and importance of integrating ecological factors when formulating organizational strategy in order to create a competitive advantage (Stead and Stead, 1995). According to the environmental management literature (e.g. Hart, 1995; Porter and Van der Linde, 1995b; Russo and Fouts 1997; Dixon, Mousa, et al. 2005; Ambec and Lanoie 2008), organizations may adopt an internally- or externally-oriented environmental strategy in order to create a competitive advantage.

First, the goal of organizations that pursue a more internally-oriented competitive environmental strategy is to create a competitive advantage through cost reduction and productivity improvement (Hart, 1995; Shrivastava, 1995c; Stead & Stead, 1995; Christmann, 2000). This strategy involves the reduction of waste at source leading to a better use of material and energy inputs (Young, 1991), the review and transformation of manufacturing processes to increase resource productivity and efficiency, the reduction of waste management costs and product liabilities (Shrivastava, 1995c), and the reduction of costs associated with fines and litigation fees (Ambec and Lanoie, 2008), as well as with environmental liabilities (Parkinson, 1992).

Second, the objective of organizations pursuing a more externally-oriented competitive environmental strategy is to create a market competitive advantage through the improvement of their corporate image and reputation (Hart, 1995; Russo and Fouts, 1997; Dixon, Mousa, et al., 2005). This strategy may contribute to increasing revenues and market share by satisfying the expectations of green consumers (Hart, 1995; Mainieri, Barnett et al., 1997), and gaining better access to certain markets, such as green purchasing requirements from the public sector or ISO 14001 organizations (Ambec and Lanoie, 2008).

While internally- and externally-oriented competitive environmental strategy represents two strategic choices for the organization, they are not mutually exclusive. Organizations may decide to pursue both strategies at the same time with more or less intensity. For example, an organization that reviews its processes to eliminate any toxic inputs and at the same time takes advantage of the corporate reputation and image improvement provided by these internal initiatives to offer and promote greener products to customers may have adopted both internal and external environmental strategic orientations.

In sum, organizations which adopt a competitive environmental strategy aim to create a competitive advantage through cost reductions and productivity and/or corporate reputation and image, which in turn may contribute to improving long-term profitability. In this study, it is argued that in order to reach these goals, levers of eco-control are needed to translate the competitive environmental strategy into environmental practices.

Levers of eco-control

As a subset of the levers of control framework of Simons (1990; 1991; 1994; 1995; 2000; 2005), the levers of eco-control consist of the integration of environmental aspects within four control systems: belief, boundary, diagnostic, and interactive. These four levers create a dynamic tension between environmental goal

achievement and creative environmental innovation and work together to provide an effective control environment. Globally, levers of eco-control are used to manage the inherent organizational tensions between unlimited opportunity and limited attention, deliberate and emergent strategy, and self-interest and the desire to contribute.

These four levers of eco-control may be separated into two categories. First, the levers of eco-control strategic domain include belief eco-control systems (hereafter belief systems) and the boundary eco-control systems (hereafter boundary systems) that are used to define the environmental strategic domain. A belief system is the explicit set of environmental definitions that managers communicate formally and reinforce systematically to provide basic values, purpose, and direction for the organization. In the context of eco-control, these systems include a vision and a mission statement, credos, and statements of purpose that integrate environmental aspects. Boundary systems are formally stated rules and codes of conduct that describe the actions that should be avoided by employees. In the context of eco-control, boundary systems include environmental checklists, codes of business, and operational guidelines.

The second category, the levers of eco-control strategic implementation, includes diagnostic eco-control systems (hereafter diagnostic systems) and interactive eco-control systems (hereafter interactive systems) that are used to formulate and implement environmental strategy. Diagnostic systems represent feedback systems that monitor organizational outcomes and correct deviations from preset environmental standards of performance. These systems report critical information based on deviations from initial environmental goals and allow managers to direct their attention to drivers that must be reviewed, monitored and corrected in order to realize the firm's intended environmental strategy. Diagnostic systems are used on a management-by-exception basis to ensure the achievement of intended environmental strategy. Interactive systems represent formal environmental information systems used by top managers to regularly and personally become

involved in the decisions concerning the environmental activities of subordinates. It is characterized by an intensive use of eco-control systems by top managers and operating managers, an active and frequent dialogue among top managers, face-to-face dialogue and debates, and a focus on strategic uncertainties (Bisbe, Batista-Foguet et al., 2007). The interactive systems are used to manage emerging environmental strategies and continually react to emerging threats and opportunities.

Different eco-control systems may be used diagnostically and interactively. In this study, the diagnostic and interactive uses of environmental performance indicators (EPIs) are specifically investigated. EPIs refer to the measurement of the interaction between the business and the environment (Olsthoorn, Tyteca et al., 2001) and represent numerical measures that provide key information related to environmental issues. They represent the quantification of the effectiveness and efficiency of environmental actions with a set of metrics (Neely, Gregory et al., 1995).

Two main reasons justify the choice of EPIs for this study. First, EPIs have largely been recognized as a central element of environmental management in organizations (e.g. Epstein, 1996a; Epstein and Bichard, 2000). Second, in the environmental management accounting literature, it has been argued that EPIs can be particularly useful to assess the environmental performance of the firm (e.g. Tyteca, 1996; Ilinitich, Soderstrom et al., 1998; Atkinson, 2000a; Veleva and Ellenbecker, 2000; Veleva, Hart et al., 2003; Dias-Sardinha and Reijnders, 2005; Henri and Journeault, 2010) and to manage environmental strategy (e.g. Dias-Sardinha and Reijnders, 2001; Porter and Kramer, 2006).

Environmental practices

A large body of literature has identified numerous environmental practices that organizations may implement to improve their environmental performance (e.g. Hart, 1995; Shrivastava, 1995c; Berry and Rondinelli, 1998; Sroufe, Narasimhan et

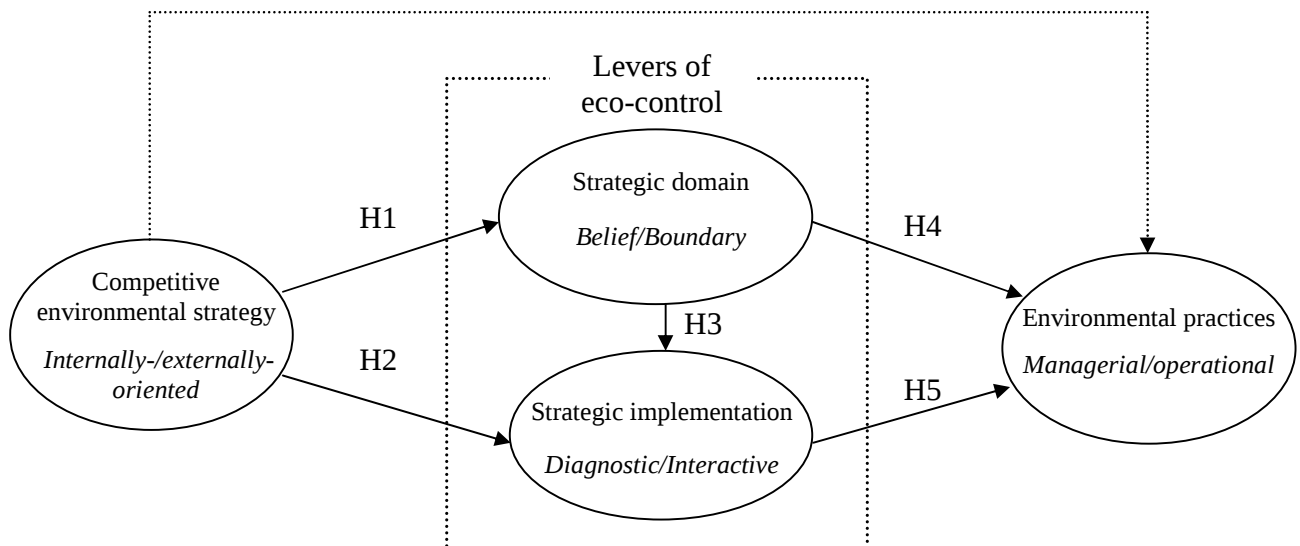
al., 2002; Lucas, 2009). This study focuses on managerial and operational environmental practices. The environmental practices of management refer to the integration of environmental initiatives into the executive and administrative processes. Such activities include, among others, environmental training, stakeholder consultations, environmental audits, life-cycle analysis, and environmental reporting. Operational environmental practices refer to the integration of environmental initiatives within the various phases of the product-process flow stage, i.e. from the extraction of raw materials through manufacturing and product and waste disposal (Hart, 1995; Handfield, Walton et al., 1997; IBEB, 1997). These practices include waste minimization and prevention activities at source, such as material substitution (e.g. Dechant, Altman et al., 1994; Shrivastava, 1995c; Nidumolu, Prahalad et al., 2009) and minimization of non-renewable resources (e.g. Dechant, Altman et al., 1994; Hart, 1995); optimization of manufacturing processes activities, such as materials reduction (e.g. Thierry, Salomon et al., 1995; Hart and Ahuja, 1996; Melnyk, Sroufe et al., 2003; Nidumolu, Prahalad et al., 2009), process modification (e.g. Davenport and Short, 1990; Dechant, Altman et al., 1994), and eco-design (e.g. Allenby, 1993; UNEP, 2007); and finally, activities associated with reducing the impact of product and waste disposal, such as product disassembly and recycling (e.g. Shrivastava, 1995c; IBEB, 1997).

2.2.2 Overview of the conceptual model

Figure 3 presents a summary of the theoretical model that reflects the relationships among competitive environmental strategy, levers of eco-control, and environmental practices. Internally-oriented environmental strategy is expected to be more positively associated with the belief and boundary systems (hypothesis 1) and with diagnostic and interactive systems (hypothesis 2) than the externally-oriented environmental strategy. It is also expected that the belief and boundary systems will have a positive and significant relationship with diagnostic and interactive systems (hypothesis 3). Finally, it is expected that the belief and boundary systems (hypothesis 4) as well as diagnostic and interactive systems

(hypothesis 5) will have a positive and significant relationship with managerial and operational environmental practices. Also, an extensive body of literature has suggested the implementation of environmental practices in response to the adoption of a competitive environmental strategy (e.g. Dechant, Altman et al., 1994; Porter and Van der Linde 1995b). Hence, the conceptual framework includes a direct control path between competitive environmental strategies and environmental practices. These expected relationships are discussed in more detail next.

Figure 3: Conceptual framework



2.2.3 Hypothesis development

Competitive environmental strategy and eco-control strategic domain

The adoption of a competitive environmental strategy may lead organizations to put environmental issues at the forefront of their many concerns. Since environmental aspects become one of their priorities, organizations will look for mechanisms to (i) communicate environmental priorities throughout the organization, (ii) focus

attention on the environmental priorities of the organization, and (iii) motivate employees and sustain their enthusiasm concerning these priorities (Hamel and Prahalad, 1989; Campbell and Yeung, 1991). Belief and boundary systems represent the mechanisms that can be used by organizations to translate competitive environmental strategy into clear directional and motivational guidelines for all employees.

First, as organizations become motivated to adopt a competitive environmental strategy, they will also communicate these environmental priorities and intentions to the entire organization. Belief systems are used to communicate a unified purpose to all employees (Simons, 1995: p.34). They are used to define and communicate its purpose (Leuthesser and Kohli, 1997). Conversely, boundary systems state rules and codes of conduct that communicate the actions that should be avoided by employees. Therefore, through the complementary use of belief and boundary systems, environmental “information, symbols, and rules are communicated and reinforced systematically” (Simons, 1995: p.57), promulgating the environmental strategic agenda to all employees. Moreover, by adopting a competitive environmental strategy, the organization recognizes the environmental values as being part of its business and wants to promote them throughout the entire organization. Belief systems include the core values that managers want subordinates to adopt (Simons, 1995: p.34), while boundary control systems set behavior limits, explaining which behavior is morally acceptable and respects organizational values (Campbell and Yeung, 1991). Therefore, belief and boundary systems consolidate environmental values over time and across employees (Pearce, 1982).

Second, as organizations adopt a competitive environmental strategy, managers will need to develop an active management process to focus organizational attention on environmental priorities. Belief and boundary systems work together to identify the scope of business operations (Pearce and David, 1987: p.109), and to help focus attention on what really matters (Ireland and Hitt, 1992: p.34). Belief systems

identify environmental values that should be adopted by all employees, while boundary systems restrict the scope of activities to be performed and, therefore, focus attention on environmental priorities identified by the firm. Both eco-control systems identify the way in which people behave, how they work together and how they pursue the environmental objectives of the organization (Campbell and Yeung, 1991). Hence, belief and boundary systems encourage collective unification within the organization (Campbell and Yeung, 1991: p.145; Palmer and Short, 2008: p.455) by promoting a sense of shared expectations among all levels and generations of employees (Pearce, 1982: p.24).

Third, organizations that adopt a competitive environmental strategy will seek to motivate employees and sustain their enthusiasm concerning these environmental priorities. The complementary use of belief and boundary systems creates positive tension that promotes commitment, empowerment, and motivation. Acting as symbolic and inspirational mechanisms (Westley and Mintzberg, 1989), belief systems can articulate and communicate a realistic, credible, and attractive environmental vision for organizations (Campbell and Yeung, 1991: p.145). They provide employees with guidance, motivation and inspiration to explore and search for new environmental opportunities, create, and exert additional effort to accomplish the environmental priorities of the firm (Simons, 1995). Boundary systems give employees the freedom and space to innovate and achieve environmental goals within a pre-defined area (Widener, 2007: p.759). Together, belief and boundary systems encourage employees to embrace the company's environmental priorities as their own (Ireland and Hitt, 1992; Collins and Porras, 1996) and motivate them to focus their energy on opportunity-seeking in the environmental domain (Simons, 1995: p.41).

In sum, the adoption of a competitive environmental strategy by the organization may influence the use of belief systems, such as their vision and mission, and boundary systems, such as their environmental policies and code of conduct, to communicate environmental intentions and values throughout the organization, to

focus attention on the environmental priorities of the organization, to motivate employees and to sustain their enthusiasm. However, the level of deployment of these eco-control systems will depend on the level of involvement and commitment of the firms to addressing environmental issues. The objective of an externally-oriented environmental strategy is mainly to improve corporate image and reputation in order to gain a competitive market advantage. Organizations may attempt to implement this strategy by focusing on impression management and on the modification of the societal perceptions of the firm (Neu, Warsame, et al., 1998; Bansal and Clelland, 2004). Nevertheless, it is also possible that firms undertake minimal internal environmental initiatives and changes. In that case, the level of internal involvement and commitment to environmental issues may remain limited. In contrast, although the objective of an internally-oriented environmental strategy is to gain a competitive advantage through cost reduction and productivity improvement, in order to implement this strategy, organizations should undertake environmental initiatives and actions that obligate employees and managers to become involved and require a high level of coordination. Thus, it is expected that the level of involvement and commitment of the firms to addressing environmental issues will be greater for the organizations that have adopted an internal environmental strategic orientation than for those that have adopted an external environmental strategic orientation. Consequently, all other things being equal, firms which adopt an internally-oriented environmental strategy will rely more on belief and boundary systems to communicate the environmental priorities of the organization, focus attention on these priorities and motivate employees to address them, than firms which adopt an externally-oriented environmental strategy. Formally stated:

H1a: The internally-oriented environmental strategy is more positively associated with the belief systems than the externally-oriented environmental strategy.

H1b: The internally-oriented environmental strategy is more positively associated with the boundary systems than the externally-oriented environmental strategy.

Competitive environmental strategy and eco-control strategic implementation

Environmental improvement may require an informative framework (i) that provides information about the current state of environmental management and impact within the organization, and (ii) supports the decision making process of managers by helping them to identify the steps that should be taken to support improved environmental performance. First, an information framework may be needed to find out information about the environmental impacts of the actual processes and activities of the organization and enlighten managers' decision making process concerning the actions that should be initiated in order to improve environmental performance. Hence, the deployment of EPIs and their diagnostic and interactive use represent this informative framework that could provide environmental information needed by organizations. More specifically, by collecting, measuring, controlling, and disseminating environmental information throughout the firms, the diagnostic use of EPIs allows the organization to become aware of and control its actual level of environmental performance. Used interactively, EPIs provide an agenda for exchange and debate about the accuracy and realism of the actual environmental information provided by EPIs, about what this information implies for the organization and about what could be done to improve environmental performance.

Second, eco-control systems may be necessary to support and facilitate the decision making process. More particularly, the deployment of EPIs and their diagnostic use may be necessary to set and communicate clear goals, provide shared language and assumptions about the steps that employees should take that will lead to further environmental improvement (Schein, 1986). Also, it may be necessary for organizations to use EPIs interactively to promote discussion and debate concerning the measures that should be used to improve environmental performance. By supporting the pooling of thoughts and ideas and providing an agenda for top managers and subordinates to exchange, debate and challenge them, the interactive use of EPIs assists in identifying the initiatives that should be taken to improve environmental performance (Sharma, Pablo et al., 1999).

In sum, recognizing the competitive advantage related to environmental performance, organizations may be more likely to rely on the diagnostic and interactive use of EPIs in order to supply the information necessary to provide an actual picture of the firm's environmental performance and to support managers' environmental decision making process. However, the intensity of use of EPIs will depend on the willingness of firms to really improve their environmental performance. It has been argued previously that the externally-oriented environmental strategy may be achieved without having undertaken significant environmental improvements. This could be accomplished by managing impressions and changing the firm's perception of society while the implementation of the internally-oriented environmental strategy necessitates environmental improvements to reduce costs or improve productivity. Hence, *ceteris paribus*, we can expect that the firm's willingness to improve environmental performance, and consequently the level of diagnostic and interactive use of EPIs, will be greater for organizations that have adopted an internally-oriented environmental strategy than for those that have adopted an externally-oriented environmental strategy. Formally stated:

H2a: The internally-oriented environmental strategy is more positively associated with the diagnostic use of EPIs than the externally-oriented environmental strategy.

H2b : The internally-oriented environmental strategy is more positively associated with the interactive use of EPIs than the externally-oriented environmental strategy.

Eco-control strategic domain and eco-control strategic implementation

The more focused and motivated managers and employees are to work to achieve environmental ideals, values, and priorities that organizations have communicated through the belief and boundary systems, the more organizations will place emphasis on developing critical environmental success factors in order to provide information and direction about tasks that should be performed by them (Otley, 1999; Widener, 2007). Thus, organizations will look to translate environmental

priorities included within belief and boundary systems into clear goals and objectives and look for mechanisms to communicate these planned goals and objectives downward to all employees. Also, they will search for mechanisms to measure and control the attainment of these planned environmental goals in order to assess the level of environmental performance (Otley and Berry, 1980) The diagnostic use of EPIs can represent these mechanisms by including critical environmental success factors determined by top managers and communicated downward to all employees. Their use provides information to managers and employees that gives the organization the confidence of knowing that their actions are aligned with the firm's environmental goals (Simons, 1995: p.59; Widener, 2007: p.761). Moreover, the diagnostic use of EPIs provides a framework allowing the organization to measure and control the achievement of planned environmental goals and objectives. Therefore, we can expect that the more the belief and boundary systems include environmental aspects, the more organizations will use EPIs diagnostically.

Also, the more environmental aspects become important priorities for the organization as reflected and communicated within the belief and boundary systems, the more likely these will become an important and recurring agenda for top managers. Also, the more top managers will be focused and motivated to address those environmental priorities, the more likely they will regularly and become personally involved in environmental decisions made by subordinates in order to ensure environmental goal achievement. In that case, they will work with operating managers and discuss in face-to-face meetings with them to interpret the information provided by EPIs, and to debate and challenge action plans proposed by operating managers. Also, in order to ensure the achievement of environmental priorities, top managers will more likely look for critical information included in EPIs concerning the effect of environmental strategic uncertainty on business environmental strategy (Simons, 1995: p.109). By doing this, they will search for potential threats and opportunities that may enhance or impair environmental objectives (Widener, 2007: p.761). Therefore, when belief and boundary systems

include more environmental aspects, it can be expected that organizations will be more likely to use EPIs interactively.

These arguments lead to the following hypotheses:

H3a: Belief and boundary systems are positively associated with the diagnostic use of EPIs

H3b: Belief and boundary systems are positively associated with the interactive use of EPIs

Eco-control strategic domain and environmental practices

Research in the area of organizational values shows that values influence behavior (e.g. Agle and Caldwell, 1999; Gond and Herrbach, 2006; Cambra-Fierro, Polo-Redondo, et al., 2008). This influence may happen through the ability of organizational values to help employees to discriminate, among the numerous signals received by organizations, and to choose only those that are relevant for them (Daft and Weick, 1984; Dutton, 1997). These values can change corporate identity and influence the way employees interpret and respond to these issues (Dutton and Dukerich, 1991). Hence, while the issues identified and labeled correspond to organizational values, employees are more likely to set this issue as a top priority on their agenda and undertake actions to respond to it. In other words, values shape organizational responses by influencing the issues that are identified, which appear on the organizational agenda, and which are associated with an organizational response (Bansal 2003: p.519).

It has been argued above that belief systems convey environmental values and consolidate them over time. These systems may also guide managerial and operational environmental actions. By communicating and focusing attention on the environmental priorities of the organization, and motivating behavior that is in line with those values, these systems help identify and label environmental issues and make these issues a priority for employees. Hence, these systems influence the

implementation of environmental practices used to respond to these issues (Bansal, 2003).

Past studies have also demonstrated that the adoption of a code of conduct can influence behavior (e.g. Schwartz, 2001; Ferrell and Skinner, 1988). Schwartz (2001) has argued that a code of conduct can influence employees' behavior (i) by clarifying what behavior is expected, (ii) by persuading employees to consult other organizational members to determine whether certain behavior is appropriate or not, (iii) by providing the opportunity to confirm whether behavior is acceptable or not to the corporation, (iv) by suggesting reflection and caution to employees before acting, (v) by allowing employees to challenge and resist non-acceptable requests, (vi) by leading employees to advise and convince others of their inappropriate behavior, (vii) by leading employees to contact the appropriate authority and report unwanted behavior, and (viii) by threatening employees with potential discipline.

Hence, although the environmental code of conduct and policies embedded within the boundary systems have the ability described by Schwartz (2001) to influence behavior by communicating the acceptable domain of environmental activities, by setting the limits of these environmental initiatives and actions, and by guarding against inadequate behaviors, boundary systems can foster managerial and operational environmental practices.

In sum, belief and boundary systems may influence the implementation of managerial and operational environmental practices by communicating the environmental strategic agenda and behavior that are expected by the organizations and by fostering employees' empowerment and commitment to pursuing the appropriate environmental initiatives and actions. These arguments lead to the following hypotheses:

H4a: Belief and boundary systems are positively associated with managerial environmental practices.

H4b: Belief and boundary systems are positively associated with operational environmental practices.

Eco-control strategic implementation and environmental practices

The diagnostic and interactive use of EPIs may influence the implementation of managerial and operational environmental practices (i) by managing the translation of environmental intentions into deliberate environmental actions and initiatives, and (ii) by stimulating the emergence of new environmental ideas, initiatives and actions. Each of these influences is discussed specifically next.

First, following Mintzberg, Ahlstrand and Lampel (1998: p.189), the organization may achieve its competitive environmental strategy by focusing on controls that allow organizations to convert their environmental intentions into deliberate environmental actions. The diagnostic use of EPIs can contribute to the implementation of deliberate managerial and operational environmental practices by reporting critical information based on preset goals, by communicating this information throughout the organization, and by directing attention to drivers that must be achieved (Simons, 1990; 1995). It allows for the coordination of the resources necessary to implement environmental actions (Simons 1995: p.72-73) and to ensure “that these resources are used effectively and efficiently in the accomplishment of the organizations’ goals” (Anthony, 1965: p.17). Based on the cybernetic model of control (Hofstede, 1978), a diagnostic use of EPIs provides information about environmental goals, compares outcomes with these preset environmental objectives, provides feedback information to managers about any variances with intended environmental plans, and allows for corrective actions (Simons, 1991: p.49). This feedback provided by the diagnostic use of EPIs influences work behavior and helps organizations monitor and coordinate the implementation of deliberate managerial and operational environmental practices (Merchant, 1982; Flamholtz, Das et al., 1985; Simons, 1990).

Second, EPIs can also be used interactively to stimulate and guide the emergence of new environmental ideas, initiatives and actions (Simons 1990; 1991; 1994; 1995). The interactive use of EPIs acts as a tool to facilitate dialogue throughout the organization and to signal the environmental priorities of top managers to all employees. Indeed, used interactively, the information provided by the EPIs represents an important and recurring agenda for top managers. Also, top managers are involved personally and regularly in the decision making activities of their subordinates and information generated by the EPIs is interpreted and discussed in face-to-face meetings. In this way, the interactive use of EPIs guides and fosters the development of managerial and operational environmental initiatives and innovation by stimulating and orienting opportunity-seeking as well as by promoting curiosity and experimentation throughout the organization (Dent, 1990; Bisbe and Otley, 2004). Since the interactive use of EPIs helps to break down the functional and hierarchical barriers that restrict the flow of information (Abernethy and Lillis, 1995; Abernethy and Brownell, 1999) and fosters the dialogue, exchange and debate between organizational actors of different or identical hierarchical levels, this use also stimulates the development of new environmental ideas and initiatives. Consequently, the interactive use of EPIs contributes to the emergence of innovative managerial and operational environmental actions which may differ from what was initially planned.

In sum, the combination of diagnostic and interactive use of EPIs may influence the implementation of managerial and operational environmental practices by managing deliberate environmental actions through measurement and feedback and by assisting in the emergence of new environmental initiatives through organizational attention focusing, communication and dialogue. These arguments lead to the following hypotheses:

H5a: The diagnostic and interactive use of EPIs are positively associated with managerial environmental practices.

H5b: The diagnostic and interactive use of EPIs are positively associated with operational environmental practices.

2.3 RESEARCH METHOD

2.3.1 Research design

Data were collected from a survey administered to a random sample of 1500 Canadian manufacturing firms from Scott's Manufacturing database. In this study, 'firm' is a fully autonomous entity or a subunit of a larger firm. In all cases, they appeared as separate entities in the database. Organizations with 100 employees or more, and reporting sales of over \$20 million were selected. These criteria are used to ensure that organizations are large enough for organizational variables to apply (Miller, 1987), that environmental actions and that management control systems are sufficiently developed (Bouwens and Abernethy, 2000). The final sample comprised 1468 organizations (considering wrong addresses, organizations that moved, etc).

The questionnaire was first validated using a pre-test administered to six academics and five top managers. This pre-test confirmed the understanding of each of the measurement instruments. Then, the questionnaire was sent to the CEO or another member of the top-management team (COO or senior vice-president) of each firm along with a letter explaining the purpose of the study and a self-addressed stamped envelope was included with the questionnaire. Two follow-up mailings were performed to improve response-rates four and ten weeks after the initial mailing. For each of these follow-ups, 1000 organizations were randomly selected from among the non-respondents.

A total of 249 usable questionnaires were received, for a response rate of 17%⁸. On average, firm size was 779 employees and the respondents had on average 13.8 years of experience working for their organization. Appendix 1 presents the profile of the respondents. Different analyses of the non-response bias were performed to confirm the validity of the data. Firstly, the comparison between respondents and non-respondents with respect to size, industry and geographical region did not reveal any significant differences. Moreover, the comparison between the first and last 10% of respondents (the latter being used as a proxy for the non-respondents) did not reveal any significant differences in the responses obtained for the main constructs of the study. Hence, it appears that non-response bias is not a major concern in this sample.

2.3.2 Measurement of construct

All measures are drawn from existing instruments. Appendix 2 presents the instruments used to measure the main constructs. Descriptive statistics of the main constructs and correlation matrix are presented in Table 4. Competitive environmental strategy is measured using an adaptation of an instrument developed by the European Business Environmental Barometer (EBEB)⁹. Respondents are asked to indicate to what extent the integration of environmental aspects within firm activities are motivated by cost reduction or market differentiation concerns measured by ten items. A higher mean score indicates that organizations are more

⁸ The sample size (n=249) as well as the statistical power (i.e. 0,99) of this study are well above the requirement proposed by the current literature (sample between 100 to 200 and statistical power over 0,90) (Bentler & Chou, 1987; Anderson & Gerbing, 1988; MacCallum, Browne, et al., 1996). Also, this response rate is comparable to the one reported in similar recent studies (e.g. Moores and Yuen, 2001; Baines & Langfield-Smith, 2003; Lowe & Locke, 2005; Widener, 2007; Suddaby, Gendron, et al, 2009).

⁹ Originally, the instrument developed by the European Business Environmental Barometer (EBEB) had three items related to the market: sales, market share and new market opportunities. In order to better seize the constructs analyzed in this study, two items were added to measure market motivations: responding to the needs of customers and selling new technologies. In the same manner, six items have replaced the original two items that measured cost reduction motivations: cost saving was replaced by energy consumption, material consumption, waste management, fines and litigation, liabilities cost reduction in order to specify where cost reduction occurs; productivity has been replaced by increasing production efficiency in order to clarify this item.

motivated to integrate environmental issues in order to improve their competitiveness.

Levers of eco-control are measured using four instruments developed by Widener (2007) and adapted to the environmental context. First, belief systems encompass four items that measure the extent to which environmental values are integrated in the mission statement and communicated to employees. Second, boundary systems are measured using four items that assess the extent to which the organization uses a code of conduct and mechanisms to communicate environmental behavior and actions that should be avoided. For both instruments, a higher mean score indicates a greater use of belief and boundary systems. Third, diagnostic systems are measured using eleven items whereby respondents were asked to indicate the extent to which their organization relies on environmental performance indicators to track progress towards environmental goals, monitor environmental results, compare environmental outcomes to expectations, and review key environmental measures. Fourth, interactive systems are measured using six items whereby respondents were asked to indicate to what extent top managers and operating managers are involved and pay day-to-day attention to environmental indicators. For both instruments, a higher mean score indicates a greater diagnostic or interactive use of EPIs.

Table 4 Descriptive statistics and correlation matrix of the main constructs

	Internally-oriented env. strategy	Externally-oriented env. strategy	Belief systems	Boundary systems	Diagnostic systems	Interactive systems	Managerial env. practices	Operational env. practices
Descriptive statistics								
No. of items	4	4	4	4	11	3	6	6
Theoretical range	1-7	1-7	1-7	1-7	1-7	1-7	1-7	1-7
Minimum	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Mean	5.23	4.38	4.61	4.28	4.38	4.54	4.38	4.54
Standard deviation	1.16	1.52	1.36	1.45	1.48	1.12	1.48	1.12
Median	5.38	4.75	4.75	4.43	4.50	4.67	4.50	4.67
Correlation matrix (Pearson)								
Internally-oriented environmental strategy	1							
Externally-oriented environmental strategy	0.407**	1						
Belief systems	0.410**	0.260**	1					
Boundary systems	0.270**	0.288**	0.612**	1				
Diagnostic systems	0.460**	0.288**	0.630**	0.581**	1			
Interactive systems	0.379**	0.233**	0.540**	0.524**	0.726**	1		
Managerial environmental practices	0.378**	0.254**	0.637**	0.614**	0.760**	0.611**	1	
Operational environmental practices	0.510**	0.278**	0.386**	0.327**	0.449**	0.408**	0.449**	1

* Significant at the .01 level.

Environmental practices are measured using two instruments. First, an adaptation of an instrument developed by Melnyk, Sroufe and Calantone (2003)¹⁰ is used to measure operational environmental practices. Second, the managerial environmental practices are measured using an adaptation of an instrument developed by Aragorn-Correa (1998)¹¹. For both instruments, respondents were asked to indicate what environmental practices are implemented within their organizations. A higher mean score indicates a greater implementation of environmental practices.

Confirmatory factor analyses (CFA) were performed for all the constructs of this study. Appendix 2 presents the statistics of the measurement analysis for the initial and respecified models. Respecification was necessary for the internally-oriented environmental strategy (two items were removed because of inadequate factor loadings and R^2), interactive systems (three items were removed because of inadequate loading factors and R^2), and managerial environmental practices (one item was removed were removed because of inadequate factor loadings and R^2). Respecification was also necessary for the diagnostic systems since the items included within the instrument showed high levels of multicollinearity. Hence, following the recommendation of Grewal, Cote, et al. (2004), composite indices were used to regroup the items and eliminate the multicollinearity effect. The single-factor method was used to compose the composite indices¹². After those

¹⁰ Among the sixteen original items of the Melnyk, Sroufe and Calantone' instrument (2003), the implementation of several of these items may differ from one industry to another due to the specific aspects of the activities. For example, prolonging the use of a product may be possible in the appliance industry while it may not be possible in the food industry. This dissimilitude may create an industry effect, while the implementation or not of this operational practice may be due in large part to the type of industry. Hence, in order to reduce this industry effect, six of the sixteen original items were used in this study because they are more susceptible to be largely implemented in any kind of manufacturing organization.

¹¹ As for the reason invoked for the operational environmental practices, the instrument used in this study includes four of the twelve original items of the Aragorn-Correa' instrument (1998). Also, based on recent research that has developed environmental practices frameworks (e.g. Sroufe, Narasimhan et al., 2002; Lucas, 2009), three other items were added (environmental emergency response procedures, publication of environmental reports or voluntary disclosure of environmental performance information, consultation with local environmental groups and plant neighbors on environmental issues) in order to provide a more comprehensive measurement of this construct.

¹² The VIF value for each of the items measuring the diagnostic construct varied between 4 and 9. While these results exceed the recommended threshold of 4, they indicate a problem of

respecifications, all constructs exceed the recommended cut-off point of 0.70 for the Cronbach Alpha and composite reliability (Nunnally, 1967; Fornell & Larcker, 1981), reflecting good construct reliability, and exceeding the recommended cut-off point of 0.50 for the variance extracted (Hair, Anderson et al., 1998), confirming construct validity. Moreover, all constructs exhibit acceptable models of fit, as measured by three fit indices, namely NNFI (non-normed fit index), CFI (comparative-fit index), and RMSEA (root mean square error of approximation)¹³, reflect adequate R², and all factor loadings are statistically significant ($p < 0.01$). Lastly, since the variance extracted from each individual construct exceeds the squared correlation between latent constructs (Fornell & Larcker, 1981), all the constructs exhibit adequate discriminant validity. Hence, this confirms that every latent construct measured in this study is composed of two dimensions that converge to form a second-order construct (e.g. belief and boundary systems converge to form the eco-control strategic domain).

2.3.3 Data analysis

Structural equation modeling (SEM) is used to test the model. SEM consists of a set of linear equations that simultaneously test two or more relationships among endogenous and exogenous variables (Bollen, 1989; Bollen and Long, 1993). Data collected from the survey were analyzed with LISREL 8.72 and used a covariance

multicollinearity for these data. The multicollinearity refers to the existence of substantial correlation among a set of independent variables. In the case of diagnostic items, the multicollinearity does not represent a problem when the sample is large and the reliability indices (.967) and explicatory power (.668) are high. However, the presence of multicollinearity impedes the adequate convergence of items in one latent variable, as reflected by weak goodness-of-fit of the diagnostic model (NNFI: .894; CFI: .906; RMSEA: .233). One way to correct this issue is by grouping items in composite indices. The advantage of this method is that the composite indices preserve all the significance of the content. This study uses the single-factor method to form composite indices. In this method, all items are subject to a factor analysis in which a single-factor solution is specified. The items are then paired based on their resulting factor loadings: the item having the highest factor loading is paired with the item having the lowest loading. This process is repeated until all items have been assigned to composites.

¹³ Those indices reflect two complementary types of indices (absolute fit and incremental fit measures) and they are among the most frequently reported. The threshold values recommended are (i) NNFI > 0.90 (Tabachnick & Fidell, 2001), (ii) CFI > 0.95 (Hu & Bentler, 1995), and (iii) RMSEA < 0.10 (Browne & Cudeck, 1993).

matrix as an input matrix.¹⁴ To check the overall goodness of fit of a model in the presence of multivariate non-normal data, maximum likelihood estimates, which are robust to such violations, and multiple indices, are suggested (Bentler and Chou, 1987).

2.4 RESULTS AND DISCUSSION

2.4.1 Structural equation model

Table 5 presents the results of the structural equation model in terms of path coefficients, Z statistics, number of iterations, proportion of variance (R^2), and goodness-of-fit indices. The model respects the recommended threshold mentioned previously. This globally indicates a good fit of the data to the model. No respecification was made to the initial model and no starting values were used. In order to provide a better understanding of the interrelationships between the constructs of the model, indirect and global effects are also reported in Table 5.

First, internally-oriented environmental strategy is positively and significantly associated with belief systems, (0.414; $p < 0.01$), diagnostic systems (0.322; $p < 0.01$), and interactive systems (0.188; $p < 0.05$) while no significant relationship is found between externally-oriented environmental strategy and these three eco-control systems. This result provides support for the hypotheses 1a, 2a, and 2b by showing that firms adopting internally-oriented environmental strategy rely on belief, diagnostic, and interactive systems to a greater extent than organizations adopting an externally-oriented environmental strategy. However, the results do not support hypothesis 1b. Indeed, similar positive and significant relationships are found between the two different competitive environmental strategies, internally-oriented (0.197; $p < 0.01$) and externally-oriented environmental strategy (0.209; $p < 0.01$) and boundary systems. Also, a positive and significant total effect (direct and indirect

¹⁴ The input matrices are available from the author upon request.

Table 5 Standardized results of the structural equation model

Hypotheses	Description of path	Direct effect		Intermediate variables	Indirect effect		Total effect	
		Path coeff.	Z statistics		Path coeff.	Z statistics	Path Coeff.	Z statistics
H1a	Internally-oriented env strategy → Belief systems	0.414	5.29**	-	-	-	0.414	5.29**
	Externally-oriented env. strategy → Belief systems	0.117	1.56	-	-	-	0.117	1.56
H1b	Internally-oriented env strategy → Boundary systems	0.197	2.56**	-	-	-	0.197	2.56**
	Externally-oriented env. strategy → Boundary systems	0.209	2.71**	-	-	-	0.209	2.71**
H2a	Internally-oriented env strategy → Diagnostic systems	0.322	5.02**	Belief/boundary systems	0.219	4.82**	0.541	7.80**
	Externally-oriented env. strategy → Diagnostic systems	-0.039	-0.67	Belief/boundary systems	0.113	2.78**	0.074	1.13
H2b	Internally-oriented env strategy → Interactive systems	0.188	2.46*	Belief/boundary systems	0.212	4.19**	0.400	5.03*
	Externally-oriented env. strategy → Interactive systems	-0.016	-0.23	Belief/boundary systems	0.120	2.82**	0.104	1.36
H3a	Belief systems → Diagnostic systems	0.372	6.25**	-	-	-	0.372	6.25**
	Boundary systems → Diagnostic systems	0.333	6.38**	-	-	-	0.333	6.38**
H3b	Belief systems → Interactive systems	0.326	4.56**	-	-	-	0.326	4.56**
	Boundary systems → Interactive systems	0.391	6.03**	-	-	-	0.391	6.03**
H4a	Belief systems → Managerial env. practices	0.142	1.99**	Diagnostic/interactive syst.	0.228	4.58**	0.370	5.24**
	Boundary systems → Managerial env. practices	0.264	3.93**	Diagnostic/interactive syst.	0.213	4.45**	0.477	7.34**
H4b	Belief systems → Operational env. practices	0.146	1.75	Diagnostic/interactive syst.	0.038	0.86	0.184	2.62**
	Boundary systems → Operational env. practices	0.059	0.77	Diagnostic/interactive syst.	0.051	1.13	0.110	1.78
H5a	Diagnostic systems → Managerial env. Practices	0.530	6.85**	-	-	-	0.530	6.85**
	Interactive systems → Managerial env. practices	0.094	1.33	-	-	-	0.094	1.33
H5b	Diagnostic systems → Operational env. practices	-0.048	-0.56	-	-	-	-0.048	-0.56
	Interactive systems → Operational env. practices	0.172	2.07*	-	-	-	0.172	2.07*
	Internally-o. env. strategy → Managerial env. practices	0.061	0.87	Four levers of eco-control	0.435	6.22**	0.496	5.97**
	Externally-o. env. strategy → Managerial env. practices	-0.067	-1.13	Four levers of eco-control	0.121	2.15*	0.054	0.70
	Internally-o. env. strategy → Operational env. practices	0.475	5.37**	Four levers of eco-control	0.115	2.43*	0.590	7.37**
	Externally-o. env. strategy → Operational env. practices	0.038	0.55	Four levers of eco-control	0.044	1.71	0.082	1.17
Dependant variables				R²	Dependant variables		R²	
Belief systems				0.229	Interactive systems		0.425	
Boundary systems				0.119	Managerial environmental practices		0.713	
Diagnostic systems				0.539	Operational environmental practices		0.454	
Goodness-of-fit indices: χ^2 (293) = 968.53 p < 0.001; NNFI= .947; CFI=.956 RMSEA = .087 ** p < 0.01; * p < 0.05								Number of iterations: 17 n=249

through belief and boundary systems) is found between the internally-oriented environmental strategy and the diagnostic (0.541; $p < 0.01$) and interactive use of EPIs (0.400; $p < 0.01$) while no significant total effect is found for the externally-oriented environmental strategy.

These findings suggest that firms that adopt an internally-oriented environmental strategy rely more extensively on levers of eco-control than organizations that adopt an externally-oriented environmental strategy. More specifically, firms that adopt an internally-oriented environmental strategy deploy the four levers of eco-control to communicate environmental intentions, focus attention on these priorities, sustain enthusiasm, support decision-making, and foster goals achievement. On the other hand, organizations adopting an externally-oriented environmental strategy rely mainly on codes of conduct and policies to communicate the environmental behavior that should be avoided by employees to preserve the firm's corporate image and reputation. Overall, the deployment of levers of eco-control by the externally-oriented firms remains limited. This conclusion concerning organizations that adopt an externally oriented strategy and have a limited use of eco-control systems is supported in legitimacy theory that argues that the primary objective of organizations that integrate environmental aspects within their strategy is to improve corporate image and reputation as well as to gain social legitimacy. Unfortunately, these organizations may seek to achieve this objective without having necessarily fully deployed this strategy within the organization and really addressed the environmental issues in question.

Moreover, the results show that the two environmental strategic orientations have a positive and significant indirect effect on the diagnostic (internally-oriented: 0.219; $p < 0.01$, externally-oriented: 0.113; $p < 0.01$), and interactive use of EPIs (internally-oriented: 0.212; $p < 0.01$, externally-oriented: 0.120; $p < 0.01$) supporting the mediating role of belief and boundary systems in this relationship. However, this mediation effect is stronger for the internally-oriented environmental strategy than for the externally-oriented environmental strategy. The indirect effect of the

competitive environmental strategy on the diagnostic and interactive use of EPIs through the belief and boundary systems provides support for hypotheses 3a et 3b. As expected, the results reflect a positive and significant relationship between the two components of eco-control strategic domain, belief and boundaries systems, with the diagnostic (belief: 0.372; $p < 0.01$, boundary: 0.333; $p < 0.01$) and interactive use of EPIs (belief: 0.326; $p < 0.01$, boundary: 0.391; $p < 0.01$).

Taken together, these results suggest that the more organizations communicate, focus attention, and motivate employees to achieve environmental priorities, the more firms will use EPIs diagnostically to set environmental goals, to measure and control their achievement and the more they will use EPIs interactively whereby top managers regularly and personally involve themselves in subordinates' environmental decisions to ensure the achievement of environmental priorities. Hence, firms adopting an internally-oriented environmental strategy will deploy belief and boundary systems which in turn, will influence the diagnostic and interactive use of EPIs. However, the sole deployment of boundary systems by the externally-oriented firms is insufficient to influence the adoption of diagnostic and interactive use of EPIs.

Moreover, the results provide support for hypothesis 4a. Indeed, positive and significant relationships are observed among the two components of eco-control strategic domain, namely belief and boundaries systems, and managerial actions (belief: 0.142; $p < 0.01$, boundary: 0.264; $p < 0.01$). However, hypothesis 4b is not supported based on the absence of a significant relationship between the belief and boundary systems and operational practices. Also, the results indicate a positive and significant indirect effect between the belief and boundary systems and managerial practices (belief systems: 0.228; $p < 0.01$, boundary systems: 0.213; $p < 0.01$) through the diagnostic and interactive use of EPIs, supporting the mediating role of diagnostic and interactive systems in this relationship. These results suggest that although the presence of environmental aspects within the mission and code of conduct of the organization may influence the implementation of managerial

environmental practices, a more complete set of eco-control systems greatly contributes to the implementation of managerial environmental practice and is a prerequisite to the implementation of operational environmental practices.

These findings are corroborated by the partial support found for hypotheses 5a and 5b. Indeed, the results show that the diagnostic use of EPIs is positively and significantly associated with managerial environmental practices (0.530; $p < 0.01$) while no significant relationship is found with operational environmental practices. In contrast, a positive and significant relationship is found between the interactive use of EPIs and operational environmental practices (0.172; $p < 0.05$) but not with managerial environmental practices. These results suggest that while top managers are more closely linked to the managerial environmental practices, a management-by-exception provided by the diagnostic use of EPIs may be sufficient to monitor and control these activities. In contrast, the operational environmental practices represent more technical and complex actions and top managers are in general more distant from these practices. Consequently, the interactive use of EPIs is more appropriate while extended communication, exchange and debate between top managers and technical subordinates are required to promote the importance of environmental issues and to choose the appropriate operational environmental actions and initiatives that should be taken to address these issues.

Finally, concerning the control paths between competitive environmental strategy and environmental practices, no direct relationship is found with the exception of the relationship between internally-oriented environmental strategy and operational practices where a positive and significant association is found (0.475; $p < 0.01$). However, positive and significant indirect effect is found (through the four levers of eco-control) between internally-oriented environmental strategy and managerial (0.435; $p < 0.01$) and operational practices (0.115; $p < 0.05$). Four main findings emerged from these specific results.

First, the positive and significant direct and indirect (through the four levers of eco-control) relationships found between the internally-oriented environmental strategy and operational practices suggest that while organizations seek to reduce the costs of their operation, they may undertake, as a first step, local operational environmental initiatives in order to take advantage of “low hanging fruit” environmental improvements. However, once these easy improvements are completed, further environmental enhancement may require formal control frameworks such as levers of eco-control systems in order to get the information feedback necessary for decision-making, to facilitate communication and to increase coordination among different departments of a firm.

Second, although the levers of eco-control play a significant role to translate environmental strategic intentions into operational environmental practices, this role is more important and essential when the intentions are translated into managerial environmental practices. Indeed, the results show that 87.7% of the global effect between internally-oriented environmental strategy and managerial environmental practices is due to the mediation effect of the levers of control while this indirect effect represents only 19.5% in the case of the relationship between internally-oriented environmental strategy and operational environmental practices. Hence, these findings suggest that the levers of eco-control are particularly useful to foster environmental initiatives when environmental priorities are widened throughout the organization and addressed at a more global level than when such actions are undertaken more locally at the operational level.

Third, since no total effect is found between externally-oriented environmental strategy and environmental practices (direct and indirect relationships through the four levers of eco-control), it supports the conclusion that levers of eco-control play a limited role in this strategic setting.

Fourth, taken with the previous findings, the positive and significant indirect relationships found in this study (i.e., the mediation role of the four levers of eco-

control in the relationship between competitive environmental strategy and environmental practices; the mediation role of belief and boundary systems in the relationship between competitive environmental strategy and the diagnostic and interactive use of EPIs; the mediation effect of the diagnostic and interactive use of EPIs in the relationship between belief and boundary systems and environmental practices) illustrate the essential and complementary role of each of the four levers of eco-control to translate strategic environmental intentions into environmental actions.

2.4.2 Additional and sensitivity analyses

To provide an additional assessment of the complementary and synergetic role of levers of eco-control in the translation of the competitive environmental strategy into environmental practices, an additional analysis was performed by regrouping the four levers of eco-control into one second-order construct, namely levers of eco-control. The results are presented in Table 6. This model respects the recommended threshold mentioned previously.

Table 6 Standardized results of the structural equation model for the aggregated model

Description of path	Direct effect		Intermediate variables	Indirect effect		Total effect	
	Path coeff.	Z statistics		Path coeff.	Z statistics	Path coeff.	Z statistics
Internally-oriented env strategy → Levers of eco-control	0.470	6.20**	-	-	-	0.470	6.20**
Externally-oriented env. strategy → Levers of eco-control	0.126	1.73	-	-	-	0.126	1.73
Levers of eco-control → Managerial env. practices	0.951	12.49**	-	-	-	0.951	12.49**
Levers of eco-control → Operational env. practices	0.339	4.63**	-	-	-	0.339	4.63**
Internally-oriented env. strategy → Managerial env. practices	-0.018	-0.29	Levers of eco-control	0.447	5.68**	0.429	5.23**
Externally-oriented env. strategy → Managerial env. practices	-0.073	-1.34	Levers of eco-control	0.120	1.72	0.047	0.60
Internally-oriented env. strategy → Operational env. practices	0.416	5.16**	Levers of eco-control	0.159	3.85**	0.575	7.21**
Externally-oriented env. strategy → Operational env. practices	0.038	0.56	Levers of eco-control	0.043	1.62	0.081	1.14
Dependant variables		R ²	Goodness-of-fit indices: χ^2 (305) = 833.38 p < 0.001 NNFI= .960; CFI=.966 RMSEA = .076 Number of iterations: 113 ** p <0.01; * p <0.05				
Levers of eco-control		0.291					
Managerial environmental practices		0.846					
Operational environmental practices		0.461					

n=249

A positive and significant relationship is found between the internally-oriented environmental strategy and the levers of eco-control (0.470; $p < 0.01$) while no significant relationship is found between externally-oriented environmental strategy and the levers of eco-control. Also, a positive and significant relationship is found between the levers of eco-control and managerial (0.951; $p < 0.01$) and operational environmental practices (0.339; $p < 0.01$). Similar to the main model, only the association between internally-oriented environmental strategy and operational practices is positive and significant while no significant association is found for the other relationships between competitive environmental strategy and environmental practices. Looking at the indirect effect, the results show positive and significant indirect effects between internally-oriented environmental strategy and managerial (0.447; $p < 0.01$) and operational environmental practices (0.159; $p < 0.01$) while no significant indirect effect is found between externally-oriented environmental strategy and environmental practices. Moreover, the results show that the R^2 of the managerial environmental practices is greater (0.846 vs 0.713) when the model regroups the four levers of eco-control in one construct than when the model disaggregates the levers of eco-control in four components. However, the R^2 of the operational practices construct (0.461 vs 0.454) found in the aggregated model is only slightly greater than the R^2 found in the main model.

These findings support the view that firms adopting an externally-oriented environmental strategy are not deploying extensively eco-control systems within the organization. Also, the results provide support for the mediating role of levers of control to translate internally environmental strategic intentions into environmental practices, the effect being greater for managerial rather than operational environmental practices. Moreover, this analysis confirms the complementary role of the levers of eco-control found in the main model and suggests, more specifically, that the synergic use of the four levers of eco-control fosters the conversion of internal environmental strategic intention into managerial actions.

To test for endogeneity issues, the main model has been run including three contextual variables. Size, stakeholders pressure and environmental visibility are used to control for

the potential specificities of eco-control systems and environmental practices¹⁵. This model includes the links among the contextual factors and the two environmental strategic orientations (internally- and externally-oriented), the four levers of eco-control (belief, boundary, diagnostic, and interactive systems) and the two categories of environmental practices (managerial and operational). All the results found in the main model remain unchanged, the only exception being that no significant relationship is found between belief systems and operational environmental practices.

To examine the potential influence of industry on the results, the main model has been run with all the variables operationalized as follows: the three composite indices of variables are adjusted for industry by subtracting the dominant two-digit industry average from their respective firm counterparts. The results remain qualitatively unchanged as all the results that were previously significant are still significant and the paths that were not significant remain unchanged.

2.5 CONCLUSION

The aim of this study was to examine the ability of eco-control to translate environmental strategy into actions. More specifically, it empirically investigates the extent to which the four levers of eco-control are used to translate different competitive environmental strategies (internally-oriented vs externally-oriented) into various environmental practices (managerial and operational). Using survey-data from a sample of Canadian manufacturing firms, the results suggest that the firms adopting an internally-oriented environmental strategy rely more intensively on the four levers of eco-control systems than for the organizations adopting an externally-oriented environmental strategy. Also, the results show that the four levers of eco-control play a synergic and complementary

¹⁵ Size was measured using the natural log of the number of employees. Second, stakeholders' pressure was measured using an instrument developed by Buysse and Verbeke (2003) where respondents rate the influence of sixteen different stakeholders on decisions related to environmental management within the organization (1=no influence at all, 7= very strong influence) whereby a higher score indicates a higher degree of stakeholder influence on organizations. Finally, public visibility was measured using ownership as proxy. Using a dichotomous variable, private firms are associated with low public visibility while public ones are associated with high visibility.

role to translate strategic environmental intentions into environmental actions. This role is particularly effective to translate internally environmental strategic intentions into managerial environmental actions.

This study contributes to the environmental strategy, eco-control, and levers of control literature in numerous ways. First, this study illustrates the role of eco-control to translate environmental strategy into actions. More specifically, this research empirically demonstrates that different eco-control systems regrouped within the levers of control of Simons contribute to converting internal environmental strategic intentions into managerial environmental actions. Belief and boundary systems provide a framework to translate the environmental strategy into actions by conveying environmental values and expected behavior as well as by reinforcing them over time. Diagnostic and interactive systems influence the development of environmental practices by managing deliberate environmental strategy through the measurement and feedback and by stimulating emerging environmental strategy through dialogue, debate and communication.

Also, this study contributes to management control systems literature by illustrating that the specific environmental strategy context may provide different results than what has been found for other types of strategies. First, this study shows that the adoption of different types of strategy may influence not only the type of eco-control systems adopted by an organization, but also their level of deployment. Second, this study provides empirical support to the more essential and important role played by the levers of eco-control when strategic intentions are addressed more globally and widely at the managerial level than when those issues are addressed more locally at the operational level.

Moreover, this study provides an illustration of how levers of control framework can be applied to the environmental management context. This research also enhances our comprehension of the interdependence among levers of control by providing empirical evidence supporting their interrelation. More specifically, by demonstrating the synergetic and complementary role played by each of the levers of eco-control to

translate the strategic environmental intentions of the organization into tangible environmental actions, this study provides empirical support to the fundamental conceptual assumption of the levers of control framework that mentioned that “the power of the control levers does not lie in how each is used alone but rather in how they complement each other when used together” (Simons, 1995: p.153).

This study has also important practical implications for management practices. Considering the increased importance of environmental management within organizations, managers should be aware of the importance of integrating environmental aspects within their control systems in order to contribute to the transformation of environmental strategy into environmental actions. More specifically, this study provides empirical evidence supporting the notion that the integration of environmental aspects within mission, vision, code of conduct, and policies contribute to communicating environmental intentions and values throughout the organization, to focus attention on the environmental priorities of the organization, and to motivate employees and sustain their enthusiasm to monitor actions. Also, the diagnostic and interactive use of EPIs allows managers to translate their environmental intentions into environmental practices by measuring, monitoring and controlling the deliberate environmental actions as well as by stimulating and contributing to the emergence of new environmental ideas and initiatives.

This study is subject to potential limitations in terms of internal and external validity. First, this study investigated one dimension of eco-control strategic implementation, namely the diagnostic and interactive use of EPIs. The diagnostic and interactive use of other types of eco-control, such as environmental strategic planning, budget, or incentives may lead to different results. Second, as for any proposed structural model, the potential existence of other structural models using the same data reflecting equivalent levels of fit may be problematic and constitutes a limitation of the current results obtained (MacCallum, Browne et al.,1996). Third, no clear evidence of causality can be established with survey data obtained from cross-sectional analyses. Rather the evidence must be considered consistent with theoretical arguments and predicted relationships. Fourth, this study is static because it does not incorporate the evolution of eco-controls

and performance over time. Fifth, using the survey method to collect data creates a potential for bias due to common response. Sixth, the results of this study may not be generalized outside the scope of the current sample (i.e., small-to-medium sized manufacturing firms in Canada).

Chapter 3

Sustainability balanced scorecard: a conceptual framework

Abstract

Organizations are increasingly recognizing the importance and benefits of formulating a sustainability strategy that incorporates environmental and social responsibilities. However, the simultaneous integration of the economic, environmental and social aspects remains a major concern for organizations. The Sustainability Balanced Scorecard (SBSC) represents one of the most promising strategic tools to help organizations face these challenges and support their sustainability strategy. Research on SBSC is still in its infancy and suffers from a lack of dissemination and it is dominated by working papers. Moreover, this research has provided unclear, incomplete and even contradictory SBSC frameworks and has provided little knowledge about how environmental and social aspects interact with the other key performance indicators encompassed within the balanced scorecard to support a corporate sustainability strategy. The aim of this study is to address these issues and limitations by developing a more complete and comprehensive SBSC conceptual framework that supports a corporate sustainability strategy. More specifically, this study proposes a SBSC design for profit-seeking manufacturing firms. Also, building on theoretical arguments and empirical findings provided by more than 200 articles from, among others, management, operation, marketing, and strategic literatures, this study provides a theoretical overview of the cause-and-effect relationships between the different perspectives and performance indicators included in the SBSC.

Keywords: sustainability balanced scorecard, environmental performance, social performance, sustainability strategy

3.1 INTRODUCTION

The importance of sustainability issues for corporations has been emphasized in the literature (e.g. Shrivastava, 1995c; Hart, 1997; Rondinelli and Berry, 2000). Indeed, a growing number of firms view environmental and social aspects as strategic (Dias-Sardinha, Reijnders et al., 2007). According to a several recent surveys organizations report that sustainability practices will be essential or very important to their company's strategic mission (Pricewaterhouse Coopers, 2002; Barton, 2011; MIT Sloan Management Review and The Boston Consulting Group, 2011). For these managers, addressing environmental and social issues represents a source of competitive advantage (Dechant, Altman et al., 1994; Hart, 1995; Porter and Van der Linde, 1995a; MIT Sloan Management Review and The Boston Consulting Group, 2011) and a source of long-term value creation (Porter and Kramer, 2006, 2011; Barton, 2011). Therefore, a growing number of organizations recognize the importance and benefits of formulating a strategy that incorporates environmental and social responsibilities (Epstein and Roy, 2001).

However, the strategic integration of the economic, environmental and social performance and the simultaneous improvement of these three perspectives remain a major concern for organizations (Figge, Hahn et al., 2002). For them, the difficulty is no longer whether or not to implement sustainability, but how (Epstein and Roy, 2001; p. 586). The recurrent questions for many managers are how to improve environmental and social performance without compromising the long-term profitability of the organization and how to translate sustainability strategy into action and promote this action throughout a complex organization (Epstein and Roy, 2001: p. 593).

In order to face these challenges, the literature has discussed the importance of developing strategic tools that integrate environmental and social aspects with the core business of the firms and that link performance measurement to the strategic sustainability objectives of organizations (e.g. Dias-Sardinha, Reijnders et al., 2002; Figge, Hahn et al., 2002; Lämsiluoto and Järvenpää, 2008). The Sustainability Balanced Scorecard (SBSC) has been identified as one of the most promising strategic tools used to help organizations support their sustainability strategy (Schaltegger and Wagner, 2006).

Building on the Kaplan and Norton's balanced scorecard (Kaplan and Norton, 1992, 1993, 1996a; 1996b, 1996c, 2000, 2001a, 2001b, 2004a, 2004b), the SBSC is the integration of the three pillars of sustainability into a single performance measurement system (Figge, Hahn et al., 2002). The SBSC literature has argued that this management tool may support the successful implementation of corporate sustainability strategies by formulating a hierarchical system of strategic objectives derived from the business strategy. Goals and indicators are then identified for each of these objectives, forming a multidimensional set of sustainability-oriented metrics that are interrelated through cause-and-effect relationships (Moller and Schaltegger, 2005). These self-reinforcing indicators jointly contribute to translating strategy into actions by measuring the accomplishment of corporate sustainability strategy (Epstein and Wisner, 2001). SBSC supporters have argued that this framework may help managers analyze the drivers of sustainability, the actions that they can take to improve sustainability, and the likely consequences on environmental, social, and financial performance (Epstein and Roy, 2001). Moreover, this framework helps focus attention on sustainability issues, encourages behaviors that are consistent with a sustainability strategy, supports the development, the management and the evaluation of the firm's processes, encourages firms to communicate their sustainability vision, values and strategy throughout the organization and provides feedback and information for sustainability decision-making (Malmi, 2001, Dias-Sardinha, Reijnders et al., 2007; Lämsiluoto and Järvenpää, 2008).

Although a growing body of literature has recognized the interest and benefits of SBSC to support corporate sustainability strategies (e.g. Johnson, 1998; Bieker, 2002; Figge, Hahn et al., 2002; Lämsiluoto and Järvenpää, 2008), the literature in this domain is still in its infancy (Bieker, Dyllick et al., 2001; Hockerts, 2001; Van der Woerd and van den Brink, 2004). This research is largely dominated by working papers and therefore its dissemination is limited. Moreover, several SBSC frameworks have been proposed in the literature (e.g. Bieker, Dyllick et al., 2001; Epstein and Wisner, 2001; Hockerts, 2001; Figge, Hahn et al., 2002; Gminder and Bieker, 2002; Sidiropoulos, Mouzakitis et al., 2004; Van der Woerd and van den Brink, 2004; Moller and Schaltegger, 2005; Dias-Sardinha, Reijnders et al., 2007; Hansen, Sextl et al., 2009). However, some of these

frameworks are contradictory. For example, some frameworks have suggested introducing an additional perspective within the balanced scorecard while others have argued that the SBSC should only encompass the four traditional perspectives proposed in the Kaplan and Norton's balanced scorecard (i.e. financial, customers, internal business processes, learning and growth perspectives). Also, most of these frameworks remain unclear or incomplete. For example, most of these frameworks have neglected the notion of social performance and how stakeholder management, one of the fundamental elements of sustainability performance, should be integrated into the SBSC; as a result, this area remains overlooked. More importantly, the cause-and-effect relationships among perspective and performance indicators have received limited attention in the SBSC literature. Hence, our knowledge about how environmental and social aspects interact with the other key performance indicators encompassed within the balanced scorecard to support the corporate sustainability strategy remains limited. The fundamental objective of the balance scorecard is to formulate a hierarchical set of performance indicators that are linked together through cause-and-effect relationships in order to communicate, monitor, control, and measure the successful implementation and achievement of the corporate strategy. This lack of knowledge may represent an important obstacle to the design and implementation of a reliable and effective SBSC.

The aim of this study is to address these issues and limitations by developing a more complete and comprehensive SBSC conceptual framework that supports a corporate sustainability strategy. More specifically, this study proposes a SBSC design for profit-seeking manufacturing firms that include the three pillars of sustainability, namely economic, environmental and social performance, and also integrate stakeholder management. Furthermore, in order to provide a better understanding of this SBSC design, this study presents a theoretical overview of the cause-and-effect relationships between the different perspectives and performance indicators included within the SBSC using conceptual arguments and empirical findings provided by more than 200 articles from, among others, management, operation, marketing, and strategic literatures.

The remainder of this paper is organized as follows. First, a short review of the SBSC literature is presented. The next sections present the SBSC conceptual framework. Then, the theoretical contributions, practical implications and limitations of this study are presented.

3.2 SBSC LITERATURE REVIEW

The SBSC literature has provided some insights into the strengths, reasons and benefits of integrating environmental and social aspects within SBSC (e.g. Lämsiluoto and Järvenpää, 2008), the ability of the SBSC framework to support governmental sustainability policies (e.g. Blazejczak, 2004; Beiman, 2008; Sharma and Dragomirescu, 2009), its capacity to evaluate corporate sustainability performance (e.g. Dias-Sardinha and Reijnders, 2005; Hubbard, 2009), and its interrelation with sustainability accounting and sustainability reporting (e.g. Schaltegger and Wagner, 2006; Laurinkevičiūtė, Kinderytė et al., 2008). This stream of research has also focused its attention on examining the more basic and fundamental question about how the environmental and social aspects may be integrated within the Kaplan and Norton's balanced scorecard to form a SBSC (e.g. Bieker, 2002; Figge, Hahn et al., 2002; Van der Woerd and van den Brink, 2004; Moller and Schaltegger, 2005). Three main possibilities of SBSC design have been proposed in this literature: (i) the creation of a derived environmental and social scorecard, (ii) the integration of environmental and social aspects within the four conventional balanced scorecard perspectives, and (iii) the introduction of an additional perspective into the balanced scorecard.

First, several studies have proposed the integration of environmental and social aspects within a derived scorecard (e.g. Figge, Hahn et al., 2002; Dias-Sardinha, Reijnders et al., 2007). Although this type of SBSC framework may have some benefits, such as clarifying the role of the sustainability department and helping managers from this unit focus their initiatives and measure their performance (Bieker, Dyllick et al., 2001; Figge, Hahn et al., 2002), the main problem with this parallel scorecard is that it is not linked to the main activities of the organization. Hence, by including only environmental and

social indicators, the strategic contribution of business, environmental, and social activities to create financial value is not considered within this SBSC. In their study of the design and implementation of SBSC by environmental service units of three large Portuguese companies, Dias-Sardinha, Reijnders et al. (2007) have recognized the importance of this issue: “In the opinion of the participants involved in [our] study, environmental and social activities are mainly important to extend that they benefit company business development and profit. (...) Participants indicated a strong need to identify the contributions their environmental activities were making to financial value creation within the company. (...) Financial value creation was viewed as being far more important than environmental and social value creation” (p. 28-31). Hence, by not linking environmental and social aspects to financial value creation, the dedicated scorecard failed to address the strategic needs of organizations.

Furthermore, Figge, Hahn et al. (2002) pointed out that the creation of a derived environmental and social scorecard cannot be developed without the conventional balanced scorecard because it contrasts the basic vision that sustainability integrates social, environmental and economic issues. They do not consider this option advisable because a specific scorecard can never replace the core scorecard and can only be formulated after having implemented a main scorecard that integrates environmental and social aspects into economic aspects. Hence, this type of scorecard seems to have little value added for organizations that seek to implement a sustainability strategy.

The second option proposed in the literature involves integrating environmental and social aspects within the four traditional balanced scorecard perspectives: financial, customers, internal business processes, and learning and growth. In that case, environmental and social aspects become integrated within the scorecard and are managed like all other potential strategically relevant aspects (Figge, Hahn et al., 2002). Different variants of the integration of environmental and social aspects within the conventional scorecard have been proposed in the literature (Bieker, Dyllick et al., 2001; Hockerts, 2001; Bieker and Waxenberger, 2002; Gminder and Bieker, 2002). The partial approach, or selected bridges approach, may involve the integration of only one or two

environmental or social objectives within the scorecard or the set up of one sustainability index that summarizes several environmental and societal aspects into one indicator that is included in the balanced scorecard. This type of approach has only limited effects, but can be a valuable first step towards sustainability management (Gminder and Bieker, 2002). On the other hand, the transversal or complete approach, involves the integration of environmental and social aspects within all four perspectives of the balanced scorecard. This approach would strongly increase the integration of sustainability management (Bieker, Dyllick et al., 2001).

However, for Figge et al. (2002), the four perspectives embedded within the conventional scorecard remain almost exclusively in the economic sphere and, consequently, exchanges outside the market mechanism are almost never considered. Hence, this type of SBSC seems more relevant for organizations that adopt a defensive posture towards environmental aspects as well as in the case where their strategies are strongly related to cost control and when social and environmental aspects have a limited influence on business strategies (Figge, Hahn et al., 2002; Van der Woerd and van den Brink, 2004). Considering this, Van der Woerd and Van den Brink (2004) have some doubt about the format of a traditional balanced scorecard to fit the strategy of a company that strives for higher levels of sustainability.

The third option of SBSC design examined in the literature involves the expansion of the conventional balanced scorecard by adding a fifth dimension. The SBSC literature has proposed different labeling and purposes for this fifth perspective. For example, Figge et al. (2002) suggest introducing a “non-market” perspective within the traditional balanced scorecard to include the “non-market” strategically relevant environmental and social aspects that may emerge from other mechanisms than the exchange market process (e.g. social pressure of community). Bieker (2002; 2003) proposed the addition of a societal perspective within the conventional balanced scorecard that includes political co-responsibility, public self-binding, and contributions of companies to public welfare. Hansen, Sextl et al. (2009) suggest adding a community perspective to the four conventional balanced scorecard perspectives which includes corporate community

involvement activities, such as sponsoring and donations, cause-related marketing, the establishment of a foundation, corporate volunteering and social or educational infrastructure investments. Finally, Sidiropoulos, Mouzakitis et al. (2004) added an eco-perspective dimension to the conventional balanced scorecard that is mainly related to environmental issues. Hence, while this third option can have the advantage of focusing managerial and employees' attention on corporate sustainability objectives and highlighting the importance of the social and environmental priorities of organizations (Epstein and Wisner, 2001; Dias-Sardinha and Reijnders, 2005), the lack of consensus about this fifth dimension makes its role and contribution ambiguous. Furthermore, the objectives and performance indicators that should be included within this perspective remain ambiguous while few indications have been provided by the authors. More importantly, while this type of SBSC allow to link environmental and social initiatives with financial value creation, this option fails to fully integrate environmental and social aspects within the activities of the organization since those aspects are addressed in parallel of other processes and key elements of the firms. However, a corporate sustainability strategy may require that the environmental, social, and economic aspects be addressed simultaneously, and this choice of SBSC option to support the corporate sustainability strategy efficiently and successfully may be questionable.

More globally, three important issues emerge from this SBSC literature. The first one concerns social performance. Globally, research investigating corporate sustainability has extensively described and examined the way to monitor and measure environmental activities and performance within the organization through environmental performance indicators (e.g. Azzone, Noci et al., 1996; Tyteca, 1996; Olsthoorn, Tyteca et al., 2001). However, this research has paid limited attention to examining the social dimension of sustainability (Hockerts, 2001; Michael, 2003). This same issue is presented in the SBSC literature while the notion of social performance is often neglected or remains vague within the proposed SBSC framework. Many of these frameworks include no or very few social indicators. Hence, our knowledge about what the corporate social performance

would be within a SBSC framework and which categories of performance indicators this dimension could include is still limited.

Second, although the majority of the SBSC proponents have stressed the importance of extending the integration of stakeholders within the SBSC, the way that this should be done remains unclear. This represents a very important issue and for the most part, the environmental management and the corporate social responsibility literatures recognize that stakeholder management is a central element of sustainability performance (e.g. Hillman and Keim, 2001; Neely, Adams et al. 2002; Buysse and Verbeke, 2003; Unerman and Bennett, 2004; Steurer, Langer et al., 2005; Unerman, 2007; Delmas and Toffel, 2004, 2008). Building on stakeholder theory that rests on the principles that building and maintaining durable relationships with all members of the stakeholder network is vital so that a company can last over time (e.g. Freeman, 1984; Donaldson and Preston, 1995; Clarkson, 1995; Atkinson, Waterhouse et al., 1997; Mitchell, Agle et al., 1997; Post, Preston et al., 2002), this literature argues that companies must assume a broader role than simply delivering value to their shareholders if they want to succeed over time. Companies that do not focus enough on multiple stakeholders, including investors, customers, employees, suppliers, regulators, local communities, and pressure groups, will jeopardize their reputation and market capitalization, and ultimately shareholder value, and are likely to suffer in one way or another. The consequence of this stakeholder view is that companies must meet their stakeholders' requirements. In order to ensure that the stakeholder expectations are fulfilled, the SBSC should include specific indicators measuring stakeholder's management performance to focus attention, monitor, and provide feedback concerning the level of its achievement (Sundin, Granlund et al., 2010).

Another important reason that motivates the integration of specific stakeholders' objectives and performance indicators into the SBSC framework is the difficulty to determine what level of economic, environmental and social performance an organization should attain to be considered as performing. While the definition of sustainability is difficult to operationalize (Roth, 2008), it is more difficult to know what is the level of

performance that an organization should reach to be considered sustainable. In this context, the acceptable level of performance could be set from the expectations of the stakeholders.

The SBSC research presented above is incomplete because it fails to specifically address the stakeholders' expectations and satisfactions from the organization and their contribution to the companies' objectives. A notable exception is the work of Van der Woerd and Van den Brink (2004) that have proposed a responsive business scorecard that emphasizes stakeholder relations. Building on the European Corporate Sustainability Framework (see Hardjono and de Klein, 2004 and Van Marrewijk, 2004), this framework combines options two and three presented above by reshuffling the four basic perspectives of the Kaplan and Norton' balanced scorecard and by adding one perspective called society and planet. While this framework provides very interesting insights into how stakeholder's relationships may be included within a SBSC, it fails to explicitly highlight the contribution of stakeholders in sustainability performance (Atkinson, Waterhouse et al., 1997). Hence, the question about how to adequately design a SBSC to allow the integration of stakeholder's expectations and satisfaction as well as to maintain their contributive role in the corporate sustainability strategy remains open.

The last and probably the most important issue resides in the fact that few studies have investigated the way that environmental and social aspects interact with financial aspects and other perspectives within the SBSC. Indeed, the cause-and-effect relationship, one of the fundamental components of Kaplan and Norton's balanced scorecard, has received limited attention in the SBSC literature. Some authors have argued this cause-and-effect relationship must be determined and monitored within the organization (e.g. Epstein and Wisner, 2001; Van der Woerd and van den Brink, 2004), while others have provided only a few examples of cause-and-effect relationships within a SBSC (e.g. Figge, Hahn et al., 2002; Bieker, 2003; Moller and Schaltegger, 2005; Dias-Sardinha, Reijnders et al., 2007); Furthermore, the cause-and-effect relationships between the perspectives, objectives, and indicators of the SBSC remains globally overlooked. This major issue turns out to be an obstacle in identifying the drivers of sustainability performance, to understand their

interconnectedness, to provide links between sustainability strategy and their underlying objectives and goals, and to develop strategic sustainability learning (Blazejczak, 2004).

Moreover, the lack of knowledge about the cause-and-effect relationships encompassed within the SBSC impedes discussion about the relevance of the choice of indicators included within the SBSC (Zingales and Hockerts, 2003), and it may also hamper the design choices of the SBSC itself. Indeed, to establish the right SBSC design, an understanding of the linkages and causal relationships that exist between the various drivers of sustainability performance is required and an understanding of the levers that are available to managers to influence performance (Epstein and Roy, 2001). The cause-and-effect relationships represent a powerful tool used to determine what performance drivers and outcome indicators have to be included in the SBSC and help demonstrate how and to what extent they contribute to the sustainability strategy (Zingales and Hockerts, 2003). Consequently, the SBSC designs proposed in the literature may be incomplete or inadequate because they are not supported by the comprehension and knowledge provided by the cause-and-effect relationships.

In sum, important issues remain within the SBSC literature concerning the consideration of social performance, the integration and contribution to value creation of stakeholder relations and the overlook of the cause-and-effect relationships among perspectives, objectives and performance indicators. In addition, the way that the conventional balanced scorecard can be adapted to support a corporate sustainability strategy remains a very important question worthy of investigation.

The objective of this study is to address these issues and limitations by developing a more complete and comprehensive SBSC conceptual framework that supports a corporate sustainability strategy and to provide a global overview of the cause-and-effect relationship between the different perspectives and performance indicators included within the SBSC. More specifically, this study proposed a SBSC conceptual framework that partly relies on the second option proposed in the literature by integrating environmental and social aspects within all the perspectives of the SBSC. However, in

order to incorporate the three pillars of sustainability, namely economic, environmental and social performance, as well as to integrate stakeholder management, several of the traditional perspectives of the Kaplan and Norton' balanced scorecard are modified to form a new SBSC framework encompassing four dimensions: sustainability performance, external stakeholders, internal business processes, and skills and capabilities. This SBSC conceptual framework is presented next.

3.3 SBSC CONCEPTUAL FRAMEWORK

As with any management control system, the balanced scorecard should be “tailored explicitly to support the strategy of the business to enhance competitive advantage and encourage superior performance” (Langfield-Smith, 2007:753). Hence, when organizations decide, for different reasons, to integrate environmental and social aspects within their strategy and consequently adopt a sustainability corporate strategy, their balanced scorecard must be adapted in order to provide a reliable and effective framework to support this new strategic orientation. Environmental and social aspects are integrated within the balanced scorecard or from a SBSC.

Not only must the balanced scorecard be adapted to different types of corporate strategy, but it also must be adapted to the type of organization. Indeed, the strategic objectives of non-profit and for-profit organizations may diverge substantially. Thus, the design of a balanced scorecard will probably be different for these two types of organizations. Also, the internal processes of a firm in the service sector may be different from the one of a manufacturing firm because no product is produced in the first organization. As a result, the balanced scorecard design will probably be different for those two firms. Hence, while the balanced scorecard has to be adapted to these different realities, this study presents one generic SBSC by specifically focusing on for-profit manufacturing organizations. This choice is justified by the fact that the manufacturing sector is one of the greatest polluters in North-America (International Energy Agency, 2007; EPA, 2011). Considering the increasing concerns about climate change, greenhouse gas emissions, and biodiversity impoverishment and the increasing pressure from regulators and

shareholders (Berry and Rondinelli, 1998), this industry is expected to play a major role in the near future in controlling ecological problems (Shrivastava, 1995c). Thus, it is highly probable that manufacturing firms will have to integrate environmental and social aspects within their strategy and consequently, they will have to adapt their management control systems, including their balanced scorecard, to support this new strategic orientation.

Hence, this paper proposes a SBSC conceptual framework for profit-seeking manufacturing firms. In the next sections, a SBSC design is first presented. Then, a theoretical overview of the cause-and-effect relationships between the different perspectives and performance indicators encompassed within this SBSC is provided. However, before proceeding through this SBSC conceptual framework development, it is necessary to define corporate sustainability strategy as it is used in this study.

3.3.1 Corporate sustainability strategy definition

Sustainable development is defined in the Brundland Report as the “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). At the corporate level, corporate sustainability is defined as meeting the needs of a firm’s direct and indirect stakeholders (such as shareholders, employees, customers, pressure groups, communities, etc.) without compromising its ability to meet the needs of future stakeholders as well (Dyllick and Hockerts, 2002).

Expanding on the environmental strategy definition provided by Stead and Stead (1995), which is appropriate for profit-seeking firms, the sustainability corporate strategy refers to the recognition by the organization of the legitimacy and importance of the integration of ecological and social aspects in the formulation of organizational strategy in order to help create a competitive advantage. This definition relies on the “managerialism” view of sustainability (Gray & Bebbington, 2000) while the economic performance represent the finality for profit-seeking firms. Managerialism refers to a business-centred view of sustainability performance whereby the economic consequences of environmental and

social actions are emphasized in the assessment of sustainability performance. However, this business-centred view typically maintains the implicit assumption that what is good for business is good for the environment. This study, in contrast, rests on the principle that what is good for the planet and the society may also be good for the business. In other words, this study argues that the consideration of ecological and social aspects within the organization may contribute to the environmental and social performance of firms, which in turn, may influence economic performance.

In order to clarify each of the dimensions of performance included within the sustainability corporate strategy, the definition for economic, environmental and social performance is examined. Following the definition of Adams and Ghally (2006) and of Dyllick and Hockerts (2002), environmental sustainability refers to the non-depletion of natural resources (i.e. the consumption of natural resources at the rate below the natural reproduction, or at the rate below the development of a substitute), to atmospheric stability (avoid emissions beyond the capacity of the natural system to absorb and assimilate them), and to the protection of biodiversity and ecosystems. Hence, according to this definition, corporate environmental performance includes the levels of consumption of material, energy, and water, waste, noise, smells and odour emissions, air emissions, soil contamination, landscape damage, and biodiversity destruction. Social sustainability refers to adding value to the communities in which a firm or its different subsidiaries and plants operate by increasing human capital of individual partners as well as furthering the social capital of this community. It includes good working conditions, health and safety improvements for employees and the community, the protection of human rights, work force diversity, equity and fairness, and local economic development. Finally, economic sustainability refers to the generation of sufficient cashflow to ensure liquidity while producing a persistent above average return to firm shareholders. Economic sustainability can be reached through continuous profitability improvements that may occur through revenue improvements or cost reductions.

3.3.2 SBSC design

The objective of this section is to propose a conceptual SBSC design for profit-seeking manufacturing firms. This SBSC integrates environmental and social aspects into all the perspectives of the SBSC, incorporates the three pillars of sustainability, namely economic, environmental and social performance, and includes stakeholder management. The Kaplan and Norton balanced scorecard is modified to form a new SBSC framework encompassing four dimensions: sustainability performance, external stakeholders, internal business processes, and skills and capabilities. The SBSC design is presented in the Figure 4.

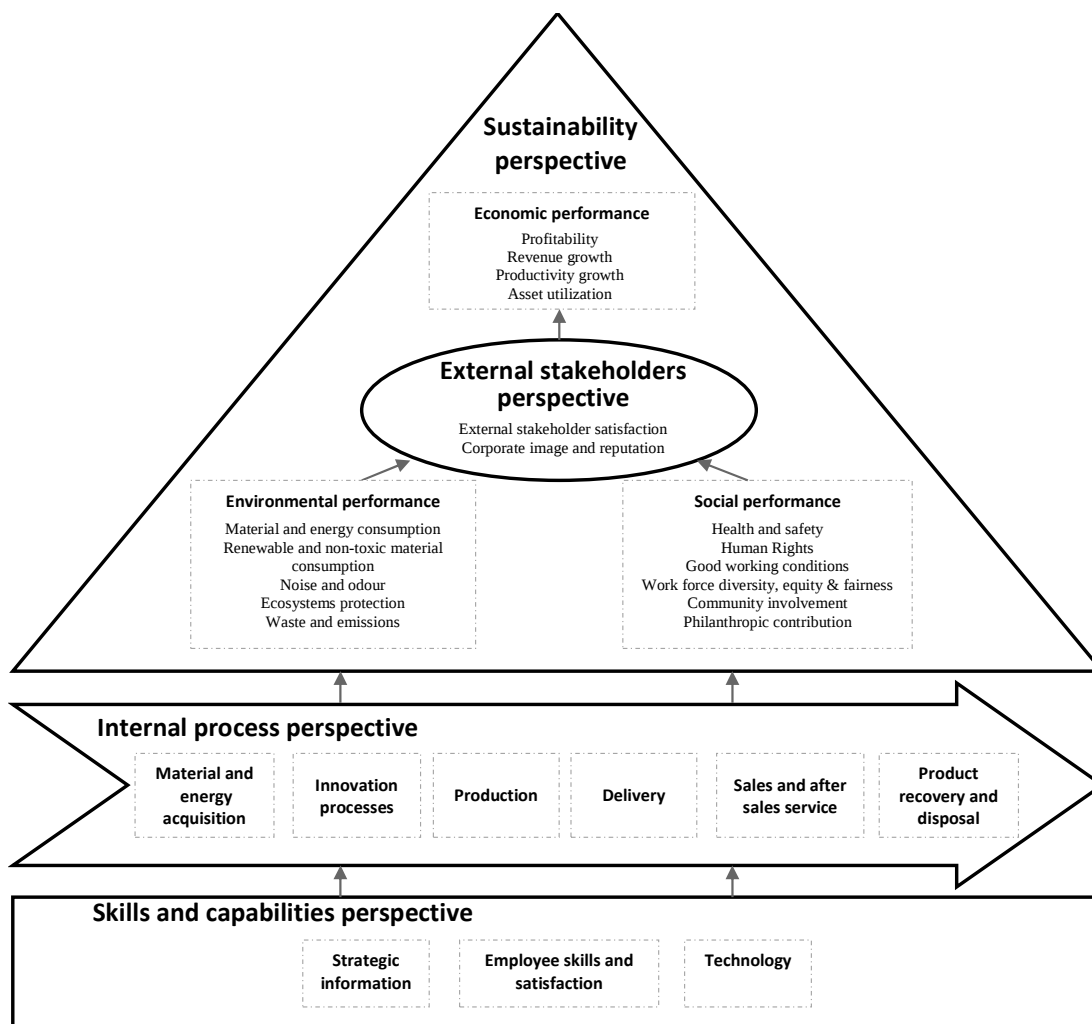


Figure 4: The SBSC design

First, the sustainability perspective extends the conventional financial perspective proposed in the Kaplan and Norton balanced scorecard by integrating environmental and social performance. Hence, the objective of this perspective is to measure the sustainability performance of organizations. As highlighted above, the environmental and social performances are leading performance indicators of financial performance. Hence, following the view of Kaplan and Norton, the financial performance provides the ultimate definition of an organization's success and demonstrates whether the organization's strategy is succeeding or failing.

Several reasons have motivated the integration of specific environmental and social dimensions into the SBSC scorecard. First, as for the financial dimension that suggest lag measures that aggregate all the financial impacts related to the internal business processes and customer behaviors, this SBSC includes a lag aggregate measure of all the environmental and social impacts of the initiatives and practices included in the organizational processes. These comprehensive outcomes may help managers to measure their level of environmental and social performance that otherwise would be difficult to ascertain. Also, the measures included within these dimensions may be used to report the environmental and social performance to external stakeholders. Moreover, these measures can help to benchmark their environmental and social performance with other organizations.

Also, three main reasons have motivated the choice of expanding the financial perspective instead of creating a fifth perspective to include environmental and social performance as suggested by several authors (e.g. Epstein and Wisner, 2001; Figge, Hahn et al., 2002; Blazejczak, 2004; Moller and Schaltegger, 2005; Schaltegger and Wagner, 2006). First, the sustainability perspective incorporated the three dimensions of the definition of sustainability and it appears to be more natural, intuitive and comprehensive for the users of a balanced scorecard to incorporate these dimensions into one perspective. More importantly, because the organization may adopt a sustainability strategy, the main objectives described by this strategy include not only financial goals, but also environmental and social goals. Because these objectives represent the desired

outcomes and have to be addressed simultaneously and complementarily in order to successfully implement the sustainability strategy, it seems more efficient to include these three dimensions into one perspective. Finally, past research (e.g. Libby, Salterio et al., 2004; Kaplan and Wisner, 2009; Alewine and Stone, 2010) has demonstrated that adding a fifth dimension within the SBSC for environmental and social performance indicators does not contribute to increased performance-related judgments and decision-making regarding these issues.

Recognizing that efficient stakeholder management is necessary for the long term profitability and survival of the organization in the marketplace (Freeman, 1984; Donaldson and Preston, 1995; Mitchell, Agle et al., 1997; Barton, 2011), the second perspective includes the firm's external stakeholders¹⁶. This perspective extends the conventional customer perspective proposed in the Kaplan and Norton balanced scorecard by incorporating the stakeholder management and adding other important external stakeholders, such as regulators, ESNGOs, investors, financial institutions and communities that have a strategic influence on organizations. The objective of this perspective is to focus on the external stakeholder's needs and satisfaction, but the inclusion of an external stakeholder within this perspective will depend on its level of influence and interaction with the organization. For example, for a very large and publicly owned firm, it may be expected that almost all the external stakeholders listed above will have to be included within the perspective because they all have influence and interaction with the organization. In contrast, a very small privately-owned firm may experience the influence of only several of them (e.g. regulators, community).

The external stakeholders perspective builds on a large body of literature that has argued that organizations that report good environmental and social performance may increase their economic performance by meeting the requirements and expectations of their external stakeholders and increase their corporate image and reputation (e.g. Atkinson, Waterhouse et al., 1997; Mitchell, Agle et al., 1997; Hillman and Keim, 2001). Following

¹⁶ This perspective includes only external stakeholders since internal stakeholders are already included in other perspectives (employees in skills and capabilities perspective, suppliers internal process perspective, shareholders in financial dimension of the sustainability perspective).

this view, the social and environmental performance of the firms represents an important requirement of the external stakeholders. These stakeholders will judge if the environmental and social level of performance is adequate and will economically reward or punish the firm according to the level of performance achievement. These reactions may influence the profitability of the firms both directly, through direct impacts on cost and revenues (e.g. penalty and fines, cost of capital, boycott, etc.) and indirectly. Indeed, these reactions, as well as the environmental and social performance reported by firms, may damage or improve corporate image and reputation. According to this, the external stakeholder perspective is embedded within the sustainability perspective. In other words, environmental and social performance contributes to satisfying external stakeholders and increased corporate image and reputation which in turn drives economic performance.

The third perspective includes the internal business processes. The objective of this perspective is to measure the performance of the key internal processes that drive the sustainability strategy. This perspective extends the conventional processes perspective in the Kaplan and Norton balanced scorecard by integrating the environmental and social thinking within the supply chain management that include cradle-to-grave corporate responsibilities (Srivastava, 2007). Therefore, all the organizational processes from resource extraction to the product disposal at the end of its life should be considered within the green supply chain management. Hence, this perspective includes resource acquisition, innovation, production and service building, delivery, after-sales service, and end-of-life products recovery and disposal categories of performance indicators. These performance indicators are drivers of customer satisfaction included within the stakeholder perspective as well of economic, environmental and social performance included within the sustainability perspective.

Finally, the fourth perspective includes organizational skills and capabilities. This perspective focuses attention on measuring the fundamental building blocks of the organization's ability to compete, improve processes and ultimately create value. The organizational skills and capabilities support all organizational activities included within the internal business processes perspective. The combination of employee skills and

satisfaction, technologies and information, enable the execution of the organization's business processes. In the context of the corporate sustainability strategy, this perspective includes the environmental and social aspects and thus organizations will have to develop the environmental and social skills of employees, develop and/or acquire green technologies, and obtain environmental and social strategic information to drive their green and socially-responsible internal business processes.

In sum, the SBSC design for profit-seeking manufacturing firms proposed in this study incorporate four generic perspectives: sustainability, external stakeholders, internal business process, and skills and capabilities. They are interrelated in order to support the sustainability strategy of the firm. In order to have a better understanding of these interrelations, to provide insight into the drivers of sustainability, to facilitate the identification of the spectrum of actions that should be undertaken by managers to improve sustainability, and to offer a visualization of the consequences of these actions on economic, social, and environmental performance, the next section presents a theoretical overview of the cause-and-effect relationships among the different perspectives and performance indicators included within the SBSC.

3.3.3 Cause-and-effect relationships within the SBSC

The objective of the balanced scorecard is to translate business strategy into a hierarchical cause-and effect performance indicators network (Kaplan and Norton, 2000, 2001b, 2004b). To establish the right SBSC design, this requires an understanding of the linkages and causal relationships that exist between the various drivers of sustainability performance. This knowledge helps managers to identify how environmental, social and economic performance may be influenced and improved in order to support the sustainability strategy (Epstein and Roy, 2001; Zingales and Hockerts, 2003). Therefore, to provide global understanding of the interrelations among the different objectives and performance indicators derived from a sustainability strategy, this study used theoretical arguments and empirical findings provided by more than 200 articles from, among others, management, operation, marketing, and strategic literatures.

Several premises have guided the presentation of the cause-and-effect relationships. First, in order to facilitate and simplify the reading, the text presents most of the time the positive impacts resulting from the relationships between different perspectives and performance indicators. However, the same relationship also exists in a negative way. For example, while it is argued that good environmental and social performance may improve the corporate image, the inverse is also true. A bad environmental and social performance may impair corporate image. Second, in order to simplify the discussion, each of the relationships is described one by one. However, the reality is often more complex and several of these relationships may occur simultaneously. More importantly, one action may help create paradoxical or conflicting cause-and-effect relationships. For example, the purchase of greener material input may improve environmental performance but decrease economic performance if the cost of this material is more expensive. Also, while the expectations and requirement of different stakeholders may diverge, a specific firm's decision or action may produce paradoxical or divergent reactions among them. Hence, it is important to keep in mind that conflicting cause-and-effect relationships often exist within the SBSC. By describing the potential cause-and-effect relationships that may occur among the various components of the SBSC, this study provides useful insights into understanding these possible trade-off effects and facilitating more accurate decision making. Third, this study does not claim to take into account of all the possible performance indicators that may be integrated within a SBSC nor to describe all the possible cause-and-effect relationships that may exist. The aim of this section is to provide a better understanding of the SBSC design suggested above by presenting a global overview of the interaction of environmental and social aspects with the other activities, processes and outcomes of the organization. However, this study places more emphasis on describing the cause-and-effect relationships related to environmental and social aspects. Hence, even if the conventional cause-and-effect relationships included in the traditional Kaplan and Norton balanced scorecard remain overlooked in this study, the SBSC framework may also encompass these more conventional relationships. Finally, all the cause-and-effect relationships described in this study will not necessarily be relevant for every organization. Because the context of each firm is different, the combination of relationships that make up the SBSC framework will also be different. Factors such as the

type of sustainability strategy and the organizational structure may influence this composition. These particularities will be discussed in more detail later in this paper.

This section begins by presenting the impact of environmental and social performance on financial performance through external stakeholder perspective. Then, the influence and contribution of internal business process on customer's satisfaction and sustainability performance are presented. The identification of the corporate skills and capabilities required to support the internal business processes are next discussed. Finally, the feedback effect of environmental and social performance on employees' skills and satisfaction is presented.

3.3.3.1 The impact of environmental and social performance on financial performance through external stakeholders perspective

As mentioned above, the external stakeholders perspective is embedded within the sustainability perspective since it has been argued that the environmental and social performance contributes to the external stakeholders satisfaction and corporate image and reputation which in turn drive the economic performance. The causes-and-effect relationships between these are summarized in the Figure 5 and are examined in more detail next.

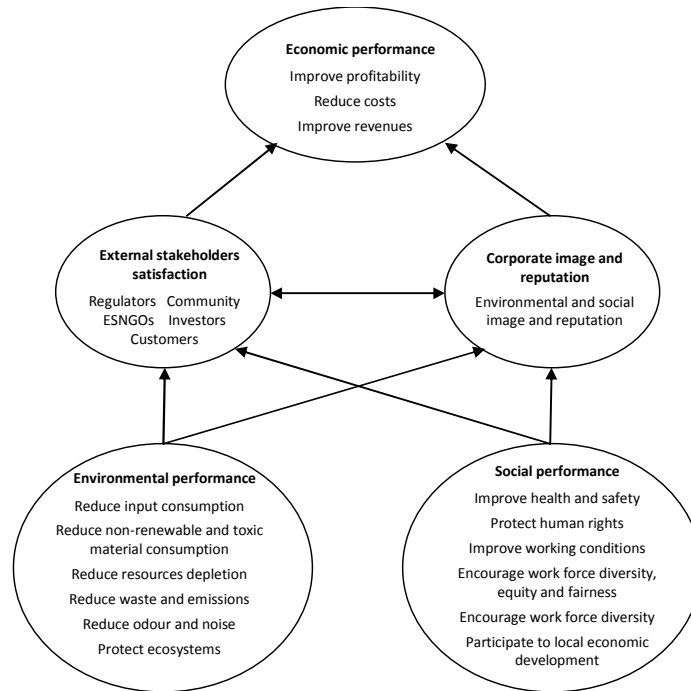


Figure 5: The impact of environmental and social performance on economic performance through external stakeholder satisfaction and corporate image and reputation

The impact of environmental and social performance on economic performance through external stakeholder's satisfaction.

Depending on the context, numerous different external stakeholders, which may include, among others, customers, regulators, ESNGOs, investors, financial institutions, and community, may have an influential role to play in translating environmental and social performance into economic performance. First, regulator stakeholders include regional, national and international regulators as well as trade associations which have the power to dictate laws and rules that must be respected by organizations. The requirements and expectations of regulators involve environmental and social conformity. Environmental and social regulations are becoming progressively more stringent (Gonzalez-Benito and Gonzalez-Benito, 2005; Vogel, 2003), and compliance to these policies has become a major concern for organizations (Quazi, Khoo et al., 2001; Morrow and Rondinelli, 2002; Gonzalez-Benito and Gonzalez-Benito, 2005). Hence, having good environmental and

social performance allow companies to get ahead of the regulatory curve giving them a firmer legal footing (Shrivastava, 1995c; Klassen and McLaughlin, 1996) and prevents negative economic impacts by avoiding payments of fines or reducing the risk of litigation and pursuit for environmental and social nonconformity (Waddock and Graves, 1997; King and Shaver, 2001; Ambec and Lanoie, 2008).

Also, good environmental and social performance may help influence public policies in ways that facilitate a competitive advantage (Russo and Fouts, 1997). For example, organizations may turn this good environmental and social compliance into a political edge in order to neutralize or promote social and environmental regulations (Logsdon, 1985; Neu, Warsame et al., 1998). Moreover, good environmental and social performance may improve relations with regulators which in turn may provide positive economic returns (Adams and Neely, 2000; Bartolomeo, Bennett et al., 2000; Epstein and Roy, 2001). For example, a good relationship between the firms and regulators may ease the delivery of permits to companies which have consistently reported a strong sustainability performance record, thus reducing the time and investment required to bring new products and services to the market (Epstein and Roy, 2001: p.598).

Second, communities expect to live in a healthy, safe and peaceful environment. Hence, communities expect to avoid environmental pollution coming from their neighbors, such as discharge in rivers and lakes, soil contamination, and air emission of pollutant, as well as to minimize noise, odour, vibration and other nuisances (Gupta, 1995). In addition, communities may expect and require local involvement of businesses, through economic development, worker employment, or donations. Therefore, organizations that demonstrate a good environmental and social performance could meet these expectations and requirements and help to maintain good community relations (Jayathirtha, 2001). Otherwise, businesses that do not meet the expectations and requirements of the communities may be exposed to pressures, boycott, and even lawsuits from them, which could have important negative impacts on their economic performance.

Third, the ESNGOs may have a great influence on the economic performance and the perenity of the organization depending on its the level of environmental and social performance. The essence of ESNGOs is to be the guardian of the ecosystems and the communities and they continuously watch organizations in order to verify that they protect the environment and respect humans. Since this surveillance from ESNGOs is growing (Gonzalez-Benito and Gonzalez-Benito, 2005), organizations have to consider and meet their expectations and requirements in order to reduce this pressure and to avoid negative impacts, such as bad publicity, calls for boycott, and litigation (Reinhardt, 1999; King and Shaver, 2001; Perrini and Tencati, 2006; First and Khetriwal, 2010).

Fourth, investors and financial institutions are more and more reluctant to assume environmental and social risks (Waddock, Bodwell, et al., 2002). These stakeholders consider less socially responsible firms to be riskier investments (McGuire, Sundgren et al., 1988; Kiernan, 2001; Sharfman and Fernando, 2008). Thus, organizations that have better environmental and social performance may reduce the perceived risk by investors and bankers and consequently reduce their cost of capital and improve their economic performance (Feldman, Soyka et al., 1997; Jayathirtha, 2001; Sharfman and Fernando, 2008). More specifically, decreasing a firm's environmental and social risk exposure can reduce the cost of capital in three different ways: by reducing the cost of debt, by increasing the firm's debt capacity and thereby increasing the amount of income the firm can protect form corporate taxation, and by reducing the firm's cost of capital (Sharfman and Fernando, 2008). Moreover, good environmental and social performance may facilitate access to capital as investors and financial institutions pay greater amounts to environmental and social performance and give preference to companies with favorable records (Epstein and Roy, 2001).

Lastly, customers are becoming increasingly concerned about environmental and social issues and are requesting more and more that firms respond to these concerns (Henriques and Sadorsky, 1999; Christmann and Taylor, 2001; Buysse and Verbeke, 2003; Delmas and Toffel, 2004; MIT Sloan Management Review and The Boston Consulting Group, 2011). Hence, their satisfaction with an organization may increase if the firm makes an

effort to minimize the negative environmental and social impacts of their products and processes (Daub and Ergenzinger, 2005). Indeed, customers may likely perceive an increased value and, consequently, higher satisfaction from a product that is made by a socially responsible company (Bhattacharya, Rao et al., 1995; Bhattacharya and Sen, 2003; Luo and Bhattacharya, 2006). Improved customer satisfaction with green and socially-responsible firms may in turn influence economic performance. Indeed, the accounting and marketing literature has recognized customer satisfaction as being a key driver of firm profitability (e.g. Anderson, Fornell, et al., 1994; Ittner and Larcker, 1998; Banker, Potter, et al., 2000; Gruca and Rego, 2005; Luo and Bhattacharya, 2006). Based on this research, higher customer satisfaction may improve financial performance by increasing the loyalty of existing customers (Andreassen and Lindestad, 1998; Robertson, 1993; Yoon et al., 1993) and repeat patronage (Dick and Basu, 1994). Also, improved customer satisfaction may reduce price elasticity as satisfied customers are more willing to pay for the benefits they receive and are more likely to be tolerant of increases in prices. This may help lower marketing costs through positive word-of-mouth advertising and reduce transaction costs because the firm does not need to spend as much to acquire new customers (Reichheld and Sasser Jr, 1990; Fornell, 1992; Anderson, Fornell, et al., 1994).

The impact of environmental/social performance on economic performance through corporate image and reputation

In addition to its influence on economic performance through the satisfaction of external stakeholder, environmental and social performance may also contribute to the corporate image and reputation which in turn may influence economic performance. Several studies have stressed the importance of the environmental and social performance within firm's reputation and image (Greeno and Robinson, 1992; Miles and Covin, 2000; Lankoski, 2008; Nair and Menon, 2008). Indeed, organizations who have shown efforts to minimize the environmental impacts of their production or service delivery as well as have considered social issues within their activities may improve their corporate image and reputation (Shrivastava, 1995b; Rowley and Berman, 2000; Jayathirtha, 2001; Hess,

Rogovsky et al., 2002; Porter and Kramer, 2002; Brammer and Pavelin, 2006), gain social legitimacy (Dixon, Mousa et al., 2005; Patten, 2005), and obtain a license-to-operate (Porter and Kramer, 2006). A recent survey conducted by the MIT Sloan Management Review and the Boston Consulting Group (2011) of more than 3 000 business executives and managers from organizations located around the world has shown that more than fifty percent of the respondents have mentioned that addressing sustainability has improved corporate image and reputation.

Not only can social and environmental performance improve corporate image and reputation, but meeting stakeholder expectations may also play a role in building the environmental and social image of organizations. Corporate reputation refers to the perceptions, impressions and feelings of multiple stakeholders (Fombrun, 1996) and those opinions depend on a firm's success in meeting the expectations of stakeholders (Donaldson and Preston, 1995; Surroca, Tribó et al., 2010). Regulators, ESNGOs, communities and investor act as opinion leaders and provide negative or positive publicity that influence the reputation and image of the organization. For example, ESNGOs may provide negative and long term damage to the reputation of a company because it employed children in manufacturing or reported poor working conditions and pollution in their facilities. Also, multiple fines and penalties from regulators for poor environmental performance may impair the corporate image and reputation.

The media plays an important role in forming a company's public image and reputation (Gary and Balmer, 1998; Aerts and Cormier, 2009). By conveying good and bad environmental and social actions, impacts and performance of an organization, the media has a high degree of influence on stakeholders and public opinion of the firms (Fanelli and Misangyi, 2006). The environmental and social corporate image and reputation may also be influenced by marketing strategy and sustainability reporting and communications. These activities may educate consumers about responsible consumption (Shrivastava, 1995a; Hart, 1997; First and Khatriwal, 2010) and ensure the communication of the environmental and social performance of the company to customers and other stakeholders (Manuilova, Hallberg et al., 2005). Hence,

sustainability reporting, eco-labeling and safety data sheets are all tools that may contribute to increase transparency about environmental and social performance of the firms and advise and educate customers, and the public in general, about the environmental and social benefits of products and services produced by the firm (Shrivastava, 1995c). Therefore, the use of these tools may contribute to improve company image and reputation (Manuilova, Hallberg et al., 2005).

Good environmental and social image and the reputation of organizations may in turn contribute to economic performance. The corporate image and reputation shape the future behavior of customers by creating higher corporate credibility, by improving confidence and reducing perceived risks of the firms, and by improving customer attitudes (Brown and Dacin, 1997; Sen and Bhattacharya, 2001; Gürhan-Canli and Batra, 2004; Gonzalez-Benito and Gonzalez-Benito, 2005; Davies, Chun et al., 2010). By building and defining the corporate identity, a good environmental and social corporate reputation may encourage customers to identify with the company (Bhattacharya and Sen, 2003; Bhattacharya and Sen, 2004) and generate affective feelings from socially and ecologically committed consumers (De Ron, 1998). This social and environmental corporate identity may promote the customer's sense of being part of a family, of a community (Handelman and Arnold, 1999) and to support the companies' social contribution to society (Hansen, Sextl et al., 2009). Hence, a positive reputation may contribute to customer acquisition and loyalty (Jayathirtha, 2001; Sirdeshmukh, Singh et al., 2002; Bhattacharya and Sen, 2003; Ambec and Lanoie, 2008; Hansen, Sextl et al., 2009) and can increase the willingness to pay a price premium (Fombrun, 1996; Bhattacharya and Sen, 2004). Consequently, this positive reputation may lead to an increase in sales and then to improve economic performance (Harrison, 1993; Piasecki, 1995; Russo and Fouts, 1997). In contrast, a sudden damage to reputation, caused for example by an environmental disaster or bad working conditions, can adversely affect sales and financial performance (Mitroff II, 1988).

Finally, a good environmental and social corporate image and reputation may increase stakeholders' satisfaction, which in turn, as discussed above, may contribute to economic

performance. According to Gray and Balmer (1998), a reputation of an entire industry can be a critical factor in determining the degree of friendliness of the industry legislation passed. Also, local regulatory agencies, which are required by law to monitor and regulate firms, have considerable discretion in how they interpret and apply the law. Hence, where they have a positive perception of a company, they are likely to be much less censorious. Moreover, firms that have a bad environmental and social reputation may receive greater criticism and harassment from ESNGOs and the community, may be perceived as riskier by investors and financial institutions, and may reduce the satisfaction of customers which could eventually decide to boycott the company.

3.3.3.2 The impact of internal business processes on sustainability performance

Every organization includes numerous formal and informal processes (Dosi, Nelson et al., 2000) that are developed over time (Amit and Schoemaker, 1993). Firms combine resources to generate new functions and desired outputs (Kozut and Zander, 1992; Dutta, Rajiv et al., 2005). Kaplan and Norton (1992, 1996c, 2000) have argued that organizational processes represent the heart of the organization because it is by using these processes that organizations may deliver services and products that will meet the needs of their customers and then contribute to financial performance. This traditional approach has mainly evaluated the business process performance in terms of cost, quality, time and service (Jimenez and Lorente, 2001). However, as organizations expand the scope of their strategy by adopting a sustainability vision, these firms may be motivated to integrate environmental and social aspects within their internal business processes with the objective to improve their environmental and social performance. Indeed, this integration has been recognized as the basic building blocks and the precondition necessary for implementing a sustainability strategy (Schmidheiny, 1992; Porter and Van der Linde, 1995a; Christmann, 2000).

The operations management literature has recognized the important role and influence of the business operations and processes on sustainability performance (e.g. Gupta, 1995; Shrivastava, 1995c; Sarkis, 1998; Angell and Klassen, 1999; Jimenez and Lorente, 2001;

Sroufe, 2003; Henri and Journeault, 2009). The economic contribution of operational processes, such as lean manufacturing (e.g. Oliver, Delbridge et al., 1996; Womack and Jones, 1996; Lewis, 2000; Shah and Ward, 2003), just-in time philosophy (e.g. Huson and Nanda, 1995; Balakrishnan, Linsmeier et al., 1996; Fullerton and McWatters, 2002), and total quality management (e.g. Reed, Lemak et al., 1996; Hendricks and Singhal, 1997; Samson and Terziovski, 1999; Douglas and Judge Jr, 2001), is well-known and has been largely described in this literature. However, this study emphasizes the analysis of the cause-and-effect relationships between the inclusion of environmental and social issues within business processes and the economic, social, and environmental performance of firms. Numerous streams of research within the operation management literature have examined the contribution of operational practices to reduce environmental and social impacts of organizational activities. For example, the industrial ecology research has examined the possible reduction of the collective environmental load of a group of production units through inter-organizational cooperation and network (Shrivastava, 1995b; Allenby, 1999; Allenby, 2000a). Studies have demonstrated that it is possible for the organization to create interdependent industrial networks modeled on biological ecosystems in order to minimize the environmental degradation by using each other's waste and by-products and by sharing and minimizing the use of resources (Ayres and Simonis, 1992; Ayres and Ayres, 1996). Also, the green engineering research has summarized this idea of these industrial ecosystems by arguing that products, processes and systems must be integrated and interconnected with available energy and material flows in order to reduce costs and environmental impact (Anastas and Zimmerman, 2003). Moreover, the total quality environmental management (TQEM) research has proposed to use the quality vehicle to address environmental and social issues. These literatures have established an analogy between the challenge of environmental management at the moment and the challenge that quality management presented some decades ago (e.g. Hanna and Newman, 1995; Klassen and McLaughlin, 1993, 1996; Chandrashekar, Dougless et al., 1999; Chinander, 2001). Just as total quality management demands improvement in each stage of the design and production process to attain the "zero-defects" goals, a TQEM perspective seeks to optimize the environmental and social performance of the entire corporate system to reach "zero-discharge", "zero-impact" and

“zero-risk” goals (Shrivastava, 1995c). Thus, researchers in this domain have posited that the adoption of a TQEM approach helps to minimize the life-cycle costs and improve the quality of products and services as well as reduce environmental and social impacts through the reduction of production inefficiencies and waste (Shrivastava, 1995c; Jayathirtha, 2001; King and Lenox, 2001a).

Each of these stream of research has demonstrated the contribution of internal business processes to support the sustainability strategy of the firms by helping to reduce the input of material and energy consumption, to eliminate waste and effluents pollution, and to increase production efficiency, and improve the health and safety of workers and the communities (Shrivastava, 1995b). More importantly, this research has pointed out that the environmental and social issues have to be considered within the various phases of the product or service life-cycle, from cradle-to-grave. Following a supply-chain management approach (Zsidisin and Siferd, 2001; Rao and Holt, 2005; Srivastava, 2007), these phases include the extraction and acquisition of raw materials and resources from suppliers, manufacturing or service building, including innovation, development and fabrication, delivery, the post-sale services, the end-of-life products recovery, and the final waste disposal. Processes included in each of these phases may contribute to the economic, environmental and social performance of the organization. These causes-and-effect relationships are summarized in Figure 6 and are examined in more detail next.

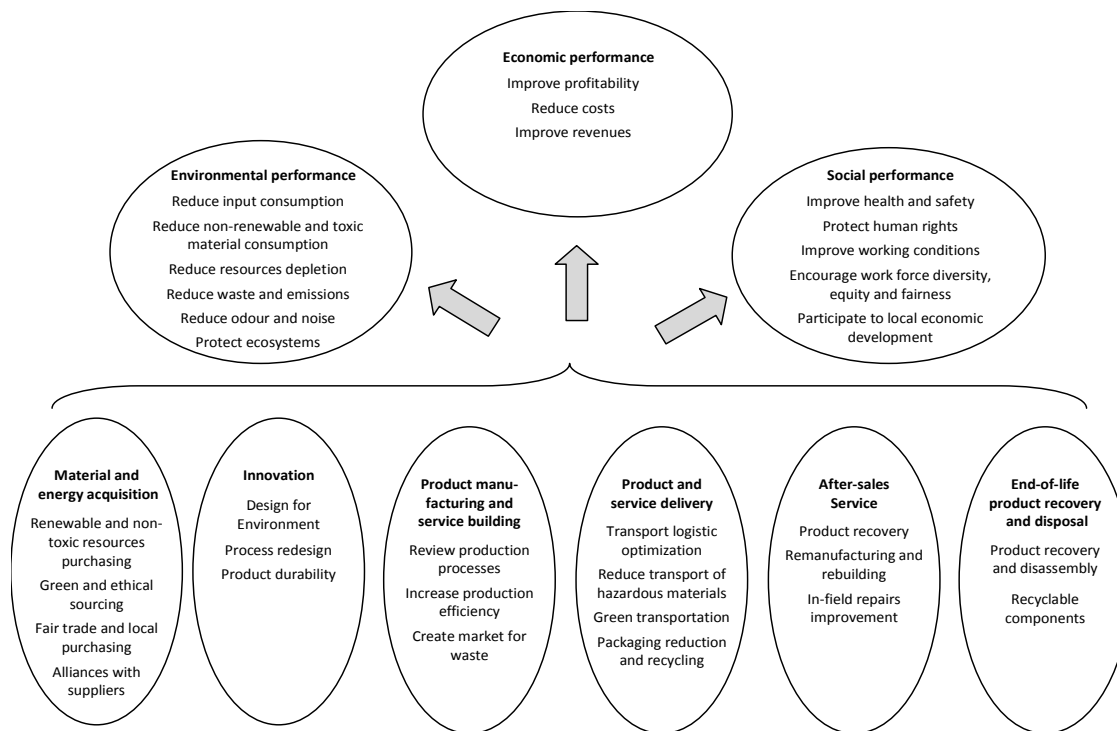


Figure 6: The impact of internal business processes on sustainability performance

Material and energy acquisition. Organizations may increase their sustainability performance by adopting several ecological and ethical purchasing politics and practices concerning the goods, services, and transport provided by internal and external suppliers (Shrivastava, 1995c; Manuilova, Hallberg et al., 2005). More specifically, organizations may improve their environmental performance through the maximization of the renewable material and energy resources acquisition and through the reduction of their depletion by pacing the resource exploitation in such a way that they can regenerate themselves through natural processes (Shrivastava, 1995a; Shrivastava, 1995c). Also, the organization may attempt to reduce or eliminated hazardous material and energy inputs when possible (Anastas and Zimmerman, 2003). This practice can contribute simultaneously to the environmental and social performance of the organization by reducing the environment impact associated with toxic air emission and waste and also on improving both employees and the public's health and safety (Jayathirtha, 2001). Moreover, the organization may form alliances and partnerships with subcontractors and

suppliers to encourage them to use more environmental friendly material within their products as well as to reduce packaging and waste (Borri and Boccaletti, 1995; Handfield, Walton et al., 1997; Crane, 1998). As a result, these alliances may contribute to improving environmental and economic performance of both firms. Moreover, organizations may impose purchase policies on their subcontractors and their suppliers in order to ensure good working conditions, eradicate child labour, and eliminate gender discrimination and sexual harassment in order to ensure a good level of social performance along its value chain (Lund-Thomsen and Nadvi, 2010). Social performance can also be improved through fair trade products sourcing and local purchasing that contribute to local economic development (Bacon, 2005; Nicholls and Opal, 2005). A “buy locally” approach may also improve, in many cases, environmental performance of the supply-chain by reducing pollution related to the transport of material and energy inputs.

Innovation process. The innovation process involves procedures and practices that the organization adopts to develop, transform and create new ideas, processes, product and services that meet customer requirements and initiate strategic environmental, social and economic improvement (Hurley and Hult, 1998; Aragon-Correa, Hurtado-Torres et al., 2008). High-quality innovation processes may contribute to the sustainability performance of the firms by adopting operational practices, such as production processes redesign, products designed for the environment and products designed for disassembly, that reduce energy and material consumption, minimize waste and emissions, and improve both employees and the community’s health and safety (Allenby, 1992, 1993, 1994; Hart, 1995; Porter and Van der Linde, 1995a; Shrivastava, 1995b; UNEP, 2007). More specifically, design for the environment represents a systematic way of incorporating environmental considerations into the design of a product, service or a process (Manuilova, Hallberg et al., 2005). The impact on the ecosystems as well on the community and employees’ health and safety is analyzed through life-cycle assessment (Sarkis, 1998). Designers may attempt to reduce the material and energy inputs and outputs as well as the use of hazardous, toxic, and virgin materials (Shrivastava, 1995c; Anastas and Zimmerman, 2003). They may also design products for disassembly by

creating environmentally-friendly products that facilitated dismantlement, recovery, recycling and disposal of the products (Shrivastava, 1995b). Finally, designers can improve the products' durability by facilitating their repair and parts recycling which would reduce the demand on the natural resource base and avoid unnecessary waste and disposal costs (Anastas and Zimmerman, 2003).

Product manufacturing and service building. Multiple initiatives and practices may be undertaken by the organization during the product manufacturing and service building phase to improve their sustainability performance. First, firms may review their production practices and processes in order to minimize emissions, effluents, and waste as well as to reduce the risk of worker accidents and improve the health and safety of the communities (Davenport and Short, 1990; Shrivastava, 1995a; Shrivastava, 1995c). Hence, the organization may reduce their production inefficiencies by adopting total quality and lean manufacturing practices. In the first case, the organization may attempt to minimize defective parts and products and then reduce waste as well as material and energy consumption (Angell and Klassen, 1999). The good housekeeping practices associated with lean manufacturing contribute to pollution prevention and to the reduction of emissions, spills and wastes (King and Lenox, 2001a). Also, firms may attempt to reduce the amount of material and energy necessary to manufacture their products as well as to reduce waste disposal and material and energy consumption by consuming waste internally (Melnik, Sroufe et al., 2003). Moreover, organizations can develop a market for their waste or be included within an industrial network whereby their emissions and waste are treated as input by another production site (Allenby, 1999; 2000a; Melnik, Sroufe et al., 2003).

Product and service delivery. The product and service delivery is often a dimension of supply-chain management that is overlooked by organizations. However, changing practices in this area can provide substantial improvements in all sustainability areas of performance. For example, firms may attempt to optimise their transportation logistics by cutting the average distance travelled to deliver products and services, by reducing the number of hazardous products deliveries that require specialized and costly carriers, by

making greener transportation choices, by switching from truck transportation to train transportation for example, and by purchasing alternative fuel vehicles for their fleet (Wu and Dunn, 1995; Handfield, Walton et al., 1997; Byrne and Polonsky, 2001; Rodrigue, Slack et al., 2001). Also, organizations may increase their sustainability performance by focussing on packaging reduction and recycling as well as by rearranging loading patterns to reduce the amount of space used in warehouses and trailers (Sarkis, 1998). Each of these solutions may potentially play a role in improving environmental performance by reducing material and energy consumption, air pollution and greenhouse gas emissions, improves social performance by reducing the impact of air pollution on the community's health, and improves economic performance by reducing costs associated with energy consumption and to the use of specialized carriers.

After-sales service. Sustainability performance of the firms may also be improved during the after-sales service by implementing product recovery, remanufacturing and rebuilding practices. Hence, instead of sending defective parts or products to landfills, the organization may take these products back, repair them or recycle good parts and reuse them to manufacture new ones. This practice has the advantage of reducing costs and environmental impacts by reducing disposal and material consumption. Also, the organization may facilitate the in-field repairs of their products in order to avoid replacements that are costly and have important environmental impacts while new material and energy should be consumed to manufacture a new product and to ship it to the client.

End-of-life product recovery and disposal. Adopting a cradle-to-grave approach involves the responsibility of firms to recuperate, recycle and dispose of products at the end of their useful life. Consequently, organizations may implement a reverse logistic in which the end-of life materials are collected, separated, disassembled and reintegrated into the manufacturing system (Sarkis, 1998). The organization may also use recyclable parts within their products that could be reintroduced within industrial recycling networks, such as plastic or glass, and become an input for another product (Melnik, Sroufe et al., 2003). By doing this, organizations may reduce their disposal and material purchasing

costs and improve their environmental performance by diverting materials from landfills and by reducing material consumption when the old parts are recuperated and integrated into new products.

3.3.3.3 The impact of internal business processes on customer satisfaction

The literature has documented the contribution of each phase of the traditional internal business process to meet customer satisfaction, by delivering products and services that meet their expectations about quality, time, cost, and service (Jimenez and Lorente, 2001). With the increase in the environmental and social conscientiousness of customers, organizations may create new products and market that fulfilled the requirements and needs of these clients who are asking for ecologically and socially friendly products and services and that are willing to pay for them (Vandermerwe and Oliff, 1990; Shrivastava, 1995b; Shrivastava, 1995c; Reinhardt, 1999; Eurobarometer, 2008; Barton, 2011). Following the work of Ottman, Stafford and Hartman (2006), these customers commonly recognize five desirable benefits associated with green and socially-responsible products: efficiency and cost-effectiveness (e.g. reduce costs associated with energy consumption), health and safety (e.g. reduce exposure to toxic chemicals, hormones or drugs), performance (e.g. products that perform better than conventional ones, longevity), symbolism and status (e.g. support a cause, being part of a trend, a family), and convenience (e.g. time-saving, ease-to-use).

Hence, firms may choose to adapt their internal business process to develop, build and deliver goods or services with attributes and characteristics that meet these expectations and requirements of green and socially-friendly consumers. For example, firms may decide to include recycled input within their product (e.g. recycled fiber within paper and cardboard), offer toxic free products (e.g. biodegradable washing powder), develop low greenhouse gas emission products (e.g. hybrid cars), design recyclable products (e.g. green TV, recyclable packaging), and propose fair trade products (e.g. chocolate and coffee). These characteristics may allow the organization to create a first-mover and differentiation advantage by satisfying customers in the environmentally and socially

sensitive market segments (Shrivastava, 1995c). This influence of internal business processes on customer satisfaction is summarized in Figure 7.

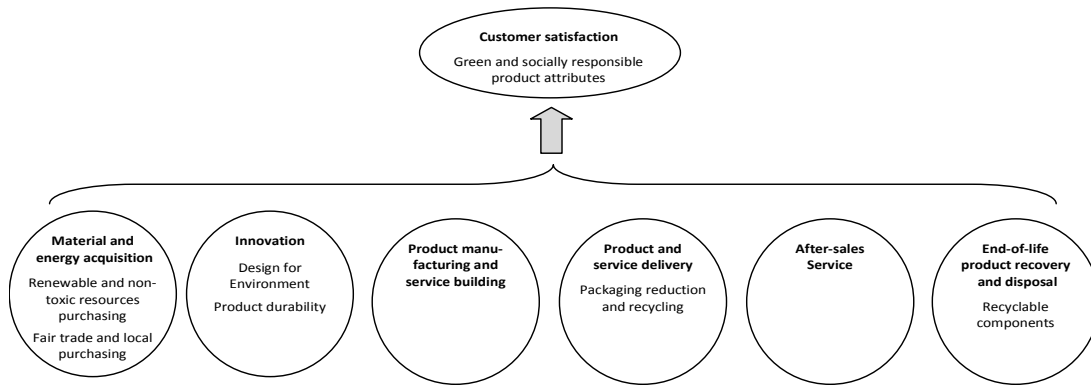


Figure 7: The impact of internal business processes on customer satisfaction

3.3.3.4 The impact of organizational skills and capabilities on internal business processes

Kaplan and Norton (1996b, 1996c, 2001b, 2004a, 2004b) as well as Neely, Adams et al. (2001, 2002) have argued that the development of organizational skills and capabilities represent a fundamental prerequisite for successfully and efficiently executing a corporate strategy. According to these authors, organizational skills and capabilities contribute to the organization's ability to deploy internal business processes and ultimately to create value. These skills and capabilities are not linked specifically to one action or practice, but rather they support all organizational activities encompassed within the internal business process perspective. Following that view, the organizations that adopt a corporate sustainability strategy need to develop sustainability skills and capabilities in order to manage and support green and social activities within the organization. In the context of a sustainability strategy, the literature has identified three main skills and capabilities that may be necessary to support internal business processes: employees, technology, and information.

First, for Kaplan and Norton (2004a, 2004b), the employees represent the cornerstone and the foundation of any organization. According to this view, the employees' skills and abilities as well as their motivation and satisfaction are prerequisites needed for the successful implementation of a corporate sustainability strategy, which is also the case for any type of organizational strategy. This is because the employees are the driving force of the organization's activities. Indeed, since the sustainability approach requires that employees develop new skills needed to adapt to the sustainability strategy (Shrivastava, 1995c; Daily and Huang, 2001), these organizations need to ensure that their workers have the necessary skills and abilities to manage and support green and social activities and initiatives within the organization. Hence, organizations should provide environmental and social training for all their employees (Theyel, 2000; Daily and Huang, 2001; Govindarajulu and Daily, 2004) and attempt to attract and retain high-quality employees. Interestingly, while highly-qualified employees are required to achieve a sustainability strategy, studies have shown that the attraction and retention of employees is facilitated when organizations integrate environmental and social elements within their values, culture and vision (Albinger and Freeman, 2000). In the context where highly qualified workers are more and more difficult to recruit and retain, embracing environmental and social values may help the organization to win the war for talent (Bhattacharya, Sen et al., 2008). Also, organizations may use philanthropy to enhance labor skills and availability within a market through charitable contributions to college and university educational programs (Porter and Kramer, 2002).

Second, the literature has argued that a sustainability strategic orientation requires high involvement, team and collaborative efforts among all employees (Shrivastava, 1995a; Russo and Fouts, 1997; Hanna, Newman et al., 2000; Theyel, 2000; Daily and Huang, 2001). Also, this literature has argued that the employee motivation and satisfaction are key factors in ensuring the success of a corporate sustainability strategy. The integration of environmental and social aspects within the firms' values, culture and vision may foster the motivation and satisfaction of green and socially-conscientious employees by matching employees' goal and values with those of the organization. This is important to consider in order to improve employee satisfaction (Rampersad, 2008). Nevertheless,

these organizations may also increase the motivation and satisfaction of their employees by adapting the employees' remuneration structure to incorporate incentives when the environmental and social objectives of the firms are achieved. Moreover, organizations adopting a corporate sustainability strategy may increase the motivation and satisfaction of employees by improving their working conditions (Neely, Adams et al., 2001; Waddock and Graves, 1997; Tuffrey, 2003; Godfrey, 2005). For example, these organizations may attempt to reduce air pollution, toxic substance and noise in production as well as increase the health and safety of workers.

Technological skills and capabilities include the ability of the organization to develop and adopt technologies that limit or reduce the negative impact of products or services on the environment and society. Furthermore, they contribute to manufacturing or service performance benefits (Shrivastava, 1995b; Russo and Fouts, 1997; Klassen and Whybark, 1999). Since the existing technology in many facilities is not environmentally and socially sustainable (Hart, 1997), the development of cleaner technologies is one of the most important prerequisites for these organizations to achieve sustainability (Atkinson, 2000b; Weaver, Jansen et al., 2000). Because a sustainability strategy requires in most cases more than incremental changes in technology (Weaver, Jansen et al., 2000) and that technology is in constant evolution (Porter and Van der Linde, 1995a), the capability to develop and acquire technology represents one of the cornerstones of a successful implementation of a corporate sustainability strategy.

Third, information skills and capabilities refer to the ability of the organization to acquire, analyze, and share information. This information may be provided by databases, information systems, networks, and information technology infrastructure (Kaplan and Norton, 2004a). The adoption of a sustainability strategy requires the development of environmental and social information that is not commonly acquired within an organization in order to support decision-making. Also, it requires the free flow of environmental, economic and social information within organizations as well as between the organization and the relevant stakeholders. Hence, developing information skills and capabilities that include environmental and social information is a key factor to drive the

green supply chain management performance (Preuss, 2005; Srivastava, 2007; Solér, Bergström et al., 2010). The relationships between organizational skills and capabilities and internal business processes are summarized in Figure 8.

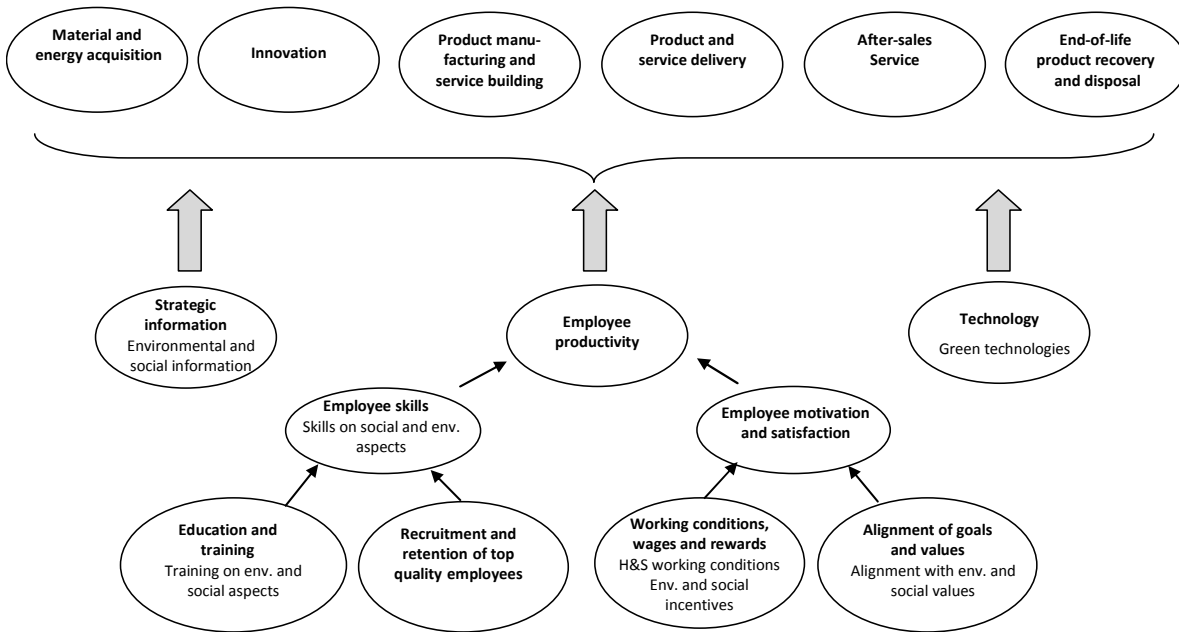


Figure 8: The impact of organizational skills and capabilities on internal business processes

3.3.4. Additional SBSC design considerations

So far, this paper has proposed a SBSC conceptual framework that may effectively support the corporate sustainability strategy. A design for profit-seeking manufacturing firms has been described and a theoretical overview of the cause-and-effect relationships between the different perspectives and performance indicators included within this SBSC has been presented, providing a better understanding of the drivers of sustainability performance and of the interaction between these drivers. However, four additional considerations must be addressed when we consider designing and implementing a SBSC: (i) the type of sustainability strategy, (ii) the structure of the organization, (iii) the choice of performance indicators, and (iv) the number of performance indicators to include.

First, since the type of sustainability strategy may differ from one manufacturing organization to another (Van der Woerd and van den Brink, 2004; Dias-Sardinha and Reijnders, 2005), the design of the SBSC should be adapted to the type of strategy adopted (Bieker, Dyllick et al., 2001). Several elements of the framework could be withdrawn if they are not important aspects of corporate strategy or if they have little influence on the organization. For example, an organization adopting a compliance-driven sustainability strategy may not consider the end-of-life products recovery category of performance indicators within the internal business process perspective if no regulations force the taking-back of products. Also, for organizations that face little pressure from community and/or ESNGOs may decide not to consider these stakeholders within their SBSC. Moreover, as mentioned previously, it is important to note that this SBSC design is mainly useful to for-profit manufacturing organizations and could also be adapted in part to other types of organizations. Thus, for firms in the service sector, the internal service processes perspective should be adapted when no products are manufactured. However, globally, the essence of the SBSC design proposed in this study will stand for any kind of for-profit organization and type of corporate sustainability strategy. Hence, all for-profit organizations that adopt a sustainability strategy will have to include environmental, social, and financial objectives. All these organizations will have to conform to environmental and social regulations. Moreover, customer satisfaction is an unavoidable objective for any for-profit organization if they want to operate in the long term. The image and the reputation would be an important and strategic element for most of these organizations, although for eco-efficient strategically-oriented or smaller ones, and image and reputation contributes to improving a firm's legitimacy and providing a license-to-operate (Boiral and Jolly, 1992; Deegan and Rankin, 1996; Porter and Kramer, 2006). Finally, all organizations will need skills and capabilities to support their business process which in turn will contribute to stakeholder satisfaction and sustainability performance.

Second, not only should SBSC be adapted to the sustainability strategy of the firm but also to its structure. For large organizations that have multiple divisions or different

geographical business units, the objectives and performance indicators should be cascaded downwards within the company from the corporate level to business units, and ultimately to the functions and operations (Dias-Sardinha and Reijnders, 2001; Epstein and Wisner, 2001; Dias-Sardinha, Reijnders et al., 2002). In that case, the corporate-level scorecard may be used to clarify the corporate values and beliefs and to identify the main objectives of the organization while the scorecard for each division or business unit may be customized to reflect their specific market and operational challenges (Epstein and Wisner, 2001).

Third, another important SBSC design element to consider is which indicators should be integrated within the SBSC framework. As discussed previously, organizations have to manage their relationships with stakeholders in order to meet their expectations and ultimately create a competitive advantage (Perrini and Tencati, 2006). This may require external reporting initiatives to communicate a company's sustainability performance to stakeholders. Also, for this reason, the stakeholder may benchmark the level of sustainability performance of the firm with competitors (Globerson, 1985; Neely, Mills et al., 2000; Dias-Sardinha, Reijnders et al., 2007). The organization has to divulge comprehensive, comparable, transparent and complete sustainability performance indicators (Schaltegger and Wagner, 2006). Consequently, organizations will need to adopt a standard set of universally reported indicators. Also, in a synergetic view and to ensure adequacy between internal performance and the external communication of performance, sustainability performance management and sustainability communications and reporting should therefore be linked and include the same set of performance indicators (Schaltegger and Wagner, 2006).

Among the hundreds of standards developed to evaluate the sustainability performance of companies (ISO Advisory Group on Corporate Social Responsibility, 2003), the Global Reporting Initiative (GRI) has become one of the most predominant sustainability report standards around the world. The GRI offers one of the most complete approaches to sustainability evaluation aimed at an external audience (Dias-Sardinha, Reijnders et al., 2002: p.58). It provides a generic performance measurement and reporting that

concentrates on key information which is relevant to all major target audiences (Azzone, Brophy et al., 1997; Schaltegger and Wagner, 2006). Consequently, the inclusion of performance indicators proposed by the GRI within the SBSC may provide substantial benefits for organizations by facilitating benchmarks among national and international companies and increasing transparency for stakeholders.

Fourth, the number of indicators that would be included in a SBSC is an important element to consider. Basically, Kaplan & Norton (1996b; p.68) have recommended to include no more than twenty five performance indicators in the balanced scorecard in order to ensure that top managers will have the capacity to absorb the information provided. In practice, this recommendation frequently implies a reduction and an aggregation of defined objectives and goals and it is usually disapproved. Nevertheless, such a reduction is extremely helpful to focus on the most important strategic goals (Bieker, 2003). The inclusion of environmental and social aspects within a balanced scorecard dramatically increases the number of performance indicators included in the framework (Hubbard, 2009). Hence, the question arises as to how these performance indicators should be included and managed within the SBSC without providing too much information to managers.

The answer may reside in the application of the concept of diagnostic versus interactive use of performance systems described by Simons (1990; 1995; 2000) to manage the performance indicators within the SBSC. The diagnostic use of performance indicators implies a management-by-exception approach, while these indicators monitor organizational outcomes and signal any deviations from preset standards to managers who may undertake actions to correct them. In that case, these performance indicators require little attention from top managers. In contrast, the interactive use of performance indicators implies a personal, regular and intensive involvement from managers in order to ensure that organizations do what is necessary to reach the performance indicator target. Although all the performance indicators included within the SBSC may be relevant and important to accomplish the sustainability strategy, only several of them may necessitate a constant and intensive involvement from top managers. Less important

performance indicators may be left to the attention of subordinates. Hence, although a SBSC may contains hundreds of performance indicators, it is possible for an organization to successfully monitor them and drive the sustainability strategy throughout the firm by adequately identifying performance indicators that necessitate an interactive approach versus those that necessitate a diagnostic one.

Another possible way to reduce the number of performance indicators is to incorporate two-dimensional indicators instead of focussing only on indicators that measure one-dimension at a time (Dyllick and Hockerts, 2002, Young and Tilley, 2006; Adams and Ghaly, 2006). These two-dimensional performance indicators may include, among others, an eco-efficiency ratio, that measures economic and environmental performance simultaneously, and the socio-efficiency ratio that provides an aggregated measure of the economic and social performance. Using these types of performance indicators may help reduce the number of performance indicators included within the SBSC.

3.4. CONCLUSION

The aim of this study was to propose a conceptual SBSC framework that can support the sustainability strategy of for-profit manufacturing organizations. More specifically, this study proposed a SBSC design that incorporates four perspectives: sustainability, external stakeholders, internal business processes, and skills and capabilities perspectives. Then, building on theoretical arguments and empirical findings from the management, operation, marketing, and strategic literatures, this study depicts the cause-and-effect relationships between the different perspectives and performance indicators encompassed within the SBSC.

Not only has this study contributed to the SBSC literature by proposing a more complete and comprehensive SBSC conceptual framework, but it also expands our knowledge on the interaction and the interconnectedness between the different perspectives included within the proposed SBSC. More specifically, it provides useful insights into how the environmental and social aspects may provide a competitive advantage and contribute to

the economic performance of firms. Hence, this study expands the large body of literature that has examined the associations among environmental, social and economic performance (e.g. Russo and Fouts, 1997; Waddock and Graves, 1997; King and Lenox, 2001b; Al-Tuwaijri, Christensen et al., 2004; Henri and Journeault, 2010; Surroca, Tribó et al., 2010) by offering theoretical arguments that explain how these relationships are operationalized within the organization. Indeed, the cause-and-effect relationships described in this study illustrated how the integration of environmental and social aspects within the internal business process can contribute to environmental and social performance as well as to economic performance by reducing costs through production efficiency improvements and increasing revenues through meeting the needs of green consumers. Also, this study illustrated the important role and contribution of stakeholders to mediate the relationship between environmental and social performance and economic performance. Hence, this study sheds light on the importance for organizations to meet stakeholders' requirements and expectations to gain a competitive advantage and improve their economic performance.

This study has also important practical implications for managers. By proposing and developing a SBSC conceptual framework, this study provides a very helpful strategic tool that can help managers to successfully support the implementation and realization of their sustainability strategy. This SBSC conceptual framework provides some guidance in deciding which perspectives should be taken into account when organizations pursue a sustainability strategy, such as meeting stakeholder expectations and requirements, considering the economic, environmental and social aspects on the entire life-cycle of the products and services, and building core skills and capabilities that can support their operational initiatives and actions undertaken to accomplish their sustainability objectives. It also provides good insights for managers on the drivers of sustainability, identifies the spectrum of actions that should be undertaken by managers to improve sustainability, and offers a visualization of the consequences of these actions on economic, social, and environmental performance through the cause-and effect relationships.

This study suffers from several limitations. First, while this research has attempted to provide a comprehensive overview of the cause-and-effect relationships of organizational skills and capabilities, processes and initiatives, external stakeholders satisfaction and sustainability performance, it is highly probable that other relationships exist among these dimensions. Second, this paper remains mainly theoretical although several cause-and-effect relationships described in this study have already been tested and validated empirically by other studies. Future research can investigate empirically the cause-and-effect relationships proposed in this paper in order to confirm them. Furthermore, this study has proposed a SBSC framework for profit-seeking manufacturing organizations, but further research is needed to examine how this conceptual SBSC could be adapted to other types of organizations. Finally, case studies will be necessary to see how this SBSC framework can be applied to practice, with different organizational structures and sustainability strategies.

Conclusion

The aim of this thesis is to examine the role and contribution of eco-control in supporting a corporate sustainability strategy. Using three different articles, this thesis sheds light on the role of eco-control support the various phases of sustainability strategy formulation, implementation and realization. More specifically, this thesis examines, through these three articles, the potential of eco-control to facilitate the formulation of corporate environmental capabilities, to facilitate the deployment of this strategy within the organization, to assist in the conversion of strategic intentions into actions, and to contribute to the improvement of the environmental, social, and economic performance of the firm. The interrelation between the eco-control systems and the different phases of corporate sustainability strategy investigated for each article of the thesis are presented in Figure 9 and described in more detail next.

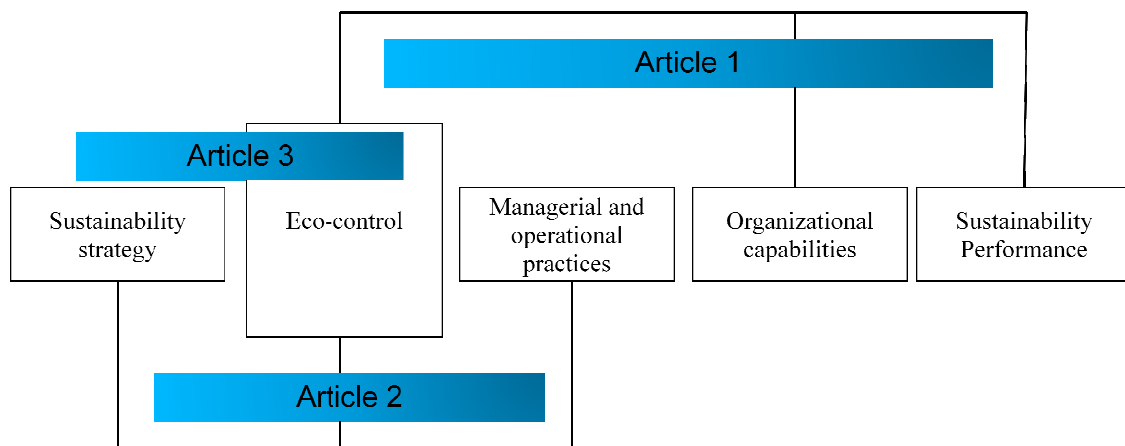


Figure 9: The interrelation between the eco-control systems and the different phases of corporate sustainability strategy investigated in the three articles of the thesis

The first article, entitled “The influence of eco-control on environmental and economic performance: A natural resource-based approach” examines the potential of eco-control

to foster environmental capabilities and to analyze their impact on performance. Using data collected from 249 Canadian manufacturing firms, this study provides insight into how eco-control systems may support strategy materialization in order to contribute to sustainability performance. Indeed, contrary to what has been demonstrated in the literature thus far, which is that eco-control systems directly influence environmental and economic performance, this research has empirically demonstrated that the use of eco-control systems contributes indirectly to both performances by fostering four environmental capabilities, namely eco-learning, continuous environmental innovation, stakeholder integration, and environmental shared vision capabilities, which in turn influence environmental and economic performance. More globally, this study provides insight into the role of management control systems to foster organizational capabilities by providing information, focusing attention and supporting decision-making. It has also demonstrated that the adoption of specific capabilities, such as environmental capabilities, may contribute not only to economic performance, but also simultaneously to another specific level of performance, such as environmental performance. Hence, this article has provided one illustration of how the influence of eco-control on environmental performance may be operationalized within the organization and has provided an alternative to improving environmental performance without compromising corporate profitability.

The second article examines the ability of eco-controls to translate environmental strategy into actions. Entitled, *“Levers of eco-control and environmental strategy”*, this article has shown that the uniqueness of the sustainability strategy context may provide different results from what has been found for other types of strategies. Specifically, it has demonstrated that the adoption of different types of sustainability strategies may influence not only the type of eco-control systems adopted by an organization, but also their level of deployment. Hence, firms which adopt an internally-oriented environmental strategy rely more intensively on the four levers of eco-control systems than for organizations which adopt an externally-oriented environmental strategy. Also, it has provided empirical support for the more essential and important role played by the eco-control systems when strategic intentions are addressed more globally and widely at the

managerial level than when those issues are addressed more locally at the operational level. Moreover, it has illustrated the synergetic and complementary role played by different types of eco-control systems to translate these intentions into tangible actions.

Finally, the third article, entitled “*Sustainability balanced scorecard: a conceptual framework*” sheds light on how the traditional management control systems could be adapted to support a corporate sustainability strategy. More specifically, it has expanded on Kaplan and Norton’s traditional balanced scorecard by proposing a complete and comprehensive sustainability balanced scorecard (SBSC) conceptual framework for profit-seeking manufacturing firms that include four dimensions: sustainability performance, external stakeholders, internal business processes, and skills and capabilities. This paper has provided useful insight into how the environmental and social aspects may provide a competitive advantage and contribute to the economic performance of the firms as well as the important role and contribution of external stakeholders to mediate these relationships. It has shown that the fulfillment of external stakeholders’ expectations and needs has an important influence on economic performance. Moreover, by presenting a theoretical overview of the cause-and-effect relationships between the different perspectives and performance indicators included within the SBSC, this study proposes a framework that can support managers’ decision-making process by helping them to identify the drivers of sustainability, to determine the spectrum of actions that should be taken to improve sustainability, and to visualize the consequences of these actions on economic, social, and environmental performance.

Globally, this thesis provides insight into several of the numerous challenges faced by organizations and managers when attempting to adopt and implement a sustainability strategy. More specifically, this study shows that eco-control systems, such as surveillance and liaison mechanisms, may support the formulation of a corporate sustainability strategy, facilitate the deployment of this strategy within the organization, assist in the conversion of strategic intentions into actions and contribute to the improvement of the environmental, social, and economic performance of the firm. Moreover, this study illustrates that the eco-control systems, such as sustainability

balanced scorecard, should be implemented by adapting existing systems instead of being developed in parallel. Furthermore, this thesis illustrates two different aspects related to stakeholders influencing the sustainability performance of the firm. First, the thesis demonstrates that the stakeholder integration capability, that consists of establishing trust-based collaborative relationships with a wide variety of internal and external stakeholders contribute to environmental performance which in turn influences economic performance. Second, this thesis shows that stakeholders play may contribute to the economic performance of the firm by evaluating the environmental and social performance of the firm and by taking position and action on that level of performance. Hence, a good level of environmental and social performance may contribute to meet governmental regulations, to respond to the needs of green customers, to answer to the requirement of the community and to meet the expectations of green and social investors which in turn may influence economic performance by avoiding costs and increasing sales.

Also, this thesis expands on the research that examines the link between strategy and management control systems. Most of this research has restricted management control systems to a passive role. However, this study demonstrates the more dynamic and active role that management control systems can play in the development of strategy as well as their continuous implication during the strategic-management process. Also, this research contributes to the environmental and social reporting stream of literature, which is the most prevalent field of research in environmental and social accounting, in many ways. First, this thesis illustrates how organizations can increase their triple bottom line performance reported in their sustainability report. It also shows that the reporting of environmental social performance to external stakeholders can influence the image and reputation of the firm, which in turn, may contribute to its economic performance. In addition, this thesis highlights the value of using eco-control systems not only for internal monitoring, controlling, and decision-making, but also for providing the information that will be reported to external stakeholders.

Moreover, this study has important practical implications for management practices. Considering the increasing importance of environmental management within organizations, managers should be aware of the importance of integrating environmental aspects into their control systems in order to support the transformation of environmental strategic motivations into environmental actions. More specifically, this study provides empirical evidence that the integration of environmental aspects within traditional management control systems, such as mission, vision, code of conduct, and policies helps communicate environmental intentions and values throughout the organization, to focus attention on environmental organizational priorities, and to motivate employees and sustain their enthusiasm to monitor environmental actions. Also, the diagnostic and interactive use of eco-control allows managers to translate their environmental intentions into environmental realized strategy by measuring, monitoring and controlling the deliberate environmental actions as well as by provoking and supporting the emergence of new environmental ideas and initiatives. Moreover, this thesis provides concrete solutions for managers to support the implementation and the operationalization of the sustainability strategy within the firm by proposing a new sustainability balanced scorecard framework that integrates the environmental and social aspects with economic activities. More fundamentally, this thesis shows that it is possible to improve the environmental and social performance of firms without compromising their economic performance. Hence, this thesis provides clear indications to managers that the use of eco-control systems is a key tool needed to face the numerous challenges related to a corporate sustainability strategy.

However, although research into the role of eco-control in the context of corporate sustainability is still in its infancy stage, a considerable amount of work remains to be done in the area of corporate sustainable development. Since this thesis has placed emphasis on performance indicators and balanced scorecard, the role and contribution of other eco-control systems, such as environmental strategic planning, environmental budget, and environmental incentives, to support a corporate sustainability strategy remain to be investigated. Also, although initial insight has been provided into how management control systems may be adapted to support a corporate sustainability

strategy, little is known about how this adaptation and change may be managed within organizations. It may represent an important field for future research. Moreover, another important avenue of research is to examine how organizations manage paradoxical or conflicting effects of firms' initiatives or decisions on the different dimensions of sustainability performance. Similarly, even though expectations and requirements of different stakeholders may diverge, it could still be interesting to examine how organizations deal with these conflicting demands and how the eco-control systems may help managers to manage them. Finally, future research could investigate the role of the corporate and national culture on the adoption of eco-control, corporate sustainability strategy and sustainability performance. Considering that the national culture diverges substantially from one continent to another, it may influence, to a certain extent, the way in which the business is conducted within different firms. Also, combined with the different types of corporate cultures that we may encounter from one firm to another, these differences may potentially influence the way that the organization will implement and use the eco-control systems, the type of corporate sustainability strategy adopted and the level of sustainability performance.

In conclusion, Oscar Wilde said that "we contemplate nature too much and we live too little with her". I hope that this thesis contributes, to a certain extent, to change this idea by showing that it is possible for firms to simultaneously improve environmental, social and economic performance through the adoption of a sustainability strategy and the support of eco-control systems and to foster them to become active participants in the building of a better world for generations to come.

Appendix 1: Description of the sample

INDUSTRY	
SCIAN code	#
113 Forestry and Logging	1
211 Oil and Gas Extraction	3
212 Mining and Carrying	3
311 Food Manufacturing	45
312 Beverage and Tobacco Product Manufacturing	3
313 Textile Mills	2
315 Clothes Manufacturing	2
321 Wood Product Manufacturing	20
322 Paper Manufacturing	17
323 Printing and Related Support Activities	5
324 Petroleum and Coal Products Manufacturing	5
325 Chemical Manufacturing	24
326 Plastic and Rubber Products manufacturing	13
327 Non-Metallic Mineral Product Manufacturing	2
331 Primary Metal Manufacturing	14
332 Fabricated Metal Products Manufacturing	14
333 Machinery Manufacturing	19
334 Computer and Electronic Product Manufacturing	8
335 Electrical Equip., Appliance and Component Manuf.	12
336 Transportation Equipment Manufacturing	24
337 Furniture and Related Product Manufacturing	6
339 Miscellaneous Manufacturing	7
TOTAL	249

SIZE	
Number of employees	#
< 100	16
between 100 and 499	143
between 500 and 999	42
between 1 000 and 4 999	41
> 5 000	7
TOTAL	249
AVERAGE	779

Note: The sixteen firms included in the 100 employees or less have been classified in accordance with the answer of the survey's respondents. These firms have been previously identified and selected in the Scott's database as firm of more than 100 employees.

POSITION OF RESPONDANTS	%	Experience within the firm (average in years)
CEO / General manager	33%	17.2
COO	7%	15.7
Senior Vice-presidents	32%	12.1
Environmental representatives ^a	17%	9.2
Other	11%	14.4
Average		13.8

^a This group includes various environmental representatives such as advisor, coordinator, specialist, manager, and supervisor.

Appendix 2:

Questionnaire items and statistics of measurement analysis of the article “The influence of eco-control on environmental and economic performance: A natural resource-based approach”

Environmental performance measurement systems (EPMS)

Confirmatory factor analysis (CFA)	Initial model		Respecified model	
	Standardized loadings	R ²	Standardized loadings	R ²
Items				
Provide data for internal decision-making	0.943**	0.888	-	-
Motivate continuous improvement	0.891**	0.793	-	-
Monitor internal compliance with environmental policies and regulations	0.818**	0.669	-	-
Provide data for external reporting	0.753**	0.567	-	-
Goodness-of-fit of the model:	$\chi^2(1) = 0.568$ p=0.451 NNFI= 1.000; CFI=1.000; RMSEA = 0.000			
Cronbach Alpha	0.885			
Composite reliability:	0.915			
Variance extracted:	0.730			

* Significant at the .05 level ** Significant at the .01 level.

Eco-learning

Confirmatory factor analysis (CFA)	Initial model		Respecified model ^a	
	Standardized loadings	R ²	Standardized loadings	R ²
Items				
Environmental learning is the key to improvement	0.876**	0.767	-	-
Basic organizational values include environmental learning as a key to improvement	0.879**	0.773	0.812**	0.659
Once we quit env. learning we endanger our future	0.781**	0.609	0.794**	0.631
Env. learning is viewed as an investment, not an expense	0.776**	0.601	0.849**	0.721
Goodness-of-fit of the model:	$\chi^2(2) = 21.33$ p> .001 NNFI= 0.917; CFI=0.972; RMSEA = 0.188		$\chi^2(0) = 0$ p> .001 NNFI= 1.0; CFI=1.0; RMSEA = 0.00	
Cronbach Alpha	0.886		0.840	
Composite reliability:	0.898		0.859	
Variance extracted:	0.688		0.670	

^a The first item was deleted because of presence of multicollinearity between the first two items

* Significant at the .05 level ** Significant at the .01 level.

Environmental innovation

Confirmatory factor analysis (CFA)	Initial model		Respecified model	
	Standardized loadings	R ²	Standardized loadings	R ²
Items				
Technical environmental innovation (research results) is readily accepted	0.861**	0.740	-	-
Environmental innovation is readily accepted in program/project management	0.832**	0.692	-	-
Management actively seeks env. innovation and ideas	0.683**	0.466	-	-
Goodness-of-fit of the model:	$\chi^2(0) = 0$ p> .001 NNFI= 1.0; CFI=1.0; RMSEA = 0.00			
Cronbach Alpha	0.799			
Composite reliability:	0.837			
Variance extracted:	0.633			

* Significant at the .05 level ** Significant at the .01 level.

Stakeholders integration

Confirmatory factor analysis (CFA)	Initial model		Respecified model ^a	
	Standardized loadings	R ²	Standardized loadings	R ²
Items				
Environmental nongovernmental organizations (ENGOS)	0.790**	0.626	0.829**	0.688
Community	0.690**	0.476	0.634**	0.402
Suppliers	0.666**	0.443	0.702**	0.492
Employees	0.613**	0.376	-	-
National, provincial or municipal governments	0.579**	0.335	-	-
Customers	0.548**	0.306	-	-
Goodness-of-fit of the model:	$\chi^2(7) = 22.76$ p> .001 NNFI= 0.955; CFI=0.979; RMSEA = 0.097		$\chi^2(0) = 0$ p> .001 NNFI= 1.0; CFI=1.0; RMSEA = 0.00	
Cronbach Alpha	0.819		0.752	
Composite reliability:	0.814		0.768	
Variance extracted:	0.426		0.527	

^a The three last items were removed from the interactive dimension because of inadequate loading factors and R²

* Significant at the .05 level ** Significant at the .01 level.

Shared environmental vision

Confirmatory factor analysis (CFA)	Initial model		Respecified model	
	Standardized loadings	R ²	Standardized loadings	R ²
Items				
Everybody working in the organization influences the way to work and the environmental objectives of the firm	0.921**	0.849	-	-
The environmental objectives of the organization are very well-known to everybody working here	0.770**	0.593	-	-
Everybody in the organization freely contributes his/her points of view about how to run environmental activities smoothly	0.664**	0.441	-	-
Goodness-of-fit of the model:	$\chi^2(0) = 0$ p> .001 NNFI= 1.0; CFI=1.0; RMSEA = 0.00			
Cronbach Alpha	0.814			
Composite reliability:	0.832			
Variance extracted:	0.627			

* Significant at the .05 level ** Significant at the .01 level.

Environmental performance

Second-order Confirmatory factor analysis (CFA)				
Items	Initial model		Respecified model ^a	
	Standardized loadings	R ²	Standardized loadings	R ²
Operational environmental performance	0.987**	0.973	0.987**	0.973
<i>Improved process innovations</i>	0.899**	0.808	0.900**	0.810
<i>Increased knowledge about effective ways of managing operations</i>	0.824**	0.680	0.821**	0.674
<i>Increased productivity</i>	0.819**	0.670	0.826**	0.682
<i>Increased process/production efficiency</i>	0.808**	0.653	0.808**	0.652
<i>Reduction in process/production costs</i>	0.767**	0.588	0.769**	0.591
<i>Improved product quality</i>	0.740**	0.548	0.746**	0.557
<i>Improved products innovations</i>	0.682**	0.465	0.680**	0.463
<i>Reduction in material costs</i>	0.643**	0.414	0.642**	0.413
<i>Reduction in costs of regulatory compliance</i>	0.575**	0.330	-	-
Relational environmental performance	0.770**	0.593	0.759**	0.576
<i>Overall improved company reputation and goodwill</i>	0.911**	0.836	0.915**	0.836
<i>Improved employee morale</i>	0.871**	0.759	0.872**	0.760
<i>Better relationships with stakeholders such as communities, regulators, and environmental groups</i>	0.812**	0.959	0.811**	0.657
<i>Organizational-wide learning among employees</i>	0.799**	0.639	0.799**	0.639
Goodness-of-fit of the model:	$\chi^2(61) = 278.30$ p < .001 NNFI= .954; CFI=.964; RMSEA = 0.122		$\chi^2(50) = 236.24$ p < .001 NNFI= .955; CFI=.966; RMSEA = 0.124	
Cronbach Alpha	0.933		0.933	
Composite reliability:	0.954		0.956	
Variance extracted:	0.619		0.645	

^a The *reduction in costs of regulatory compliance* item was removed because of inadequate loading factors and R²

* Significant at the .05 level ** Significant at the .01 level.

Economic performance

Confirmatory factor analysis (CFA)				
Items	Initial model		Respecified model	
	Standardized loadings	R ²	Standardized loadings	R ²
Operating profits	0.988**	0.976	-	-
Return on investment (ROI)	0.908**	0.825	-	-
Cash flow from operations	0.903**	0.815	-	-
Goodness-of-fit of the model:	$\chi^2(0) = 0$ p > .001 NNFI= 1.0; CFI=1.0; RMSEA = 0.00		-	
Cronbach Alpha	0.936			
Composite reliability:	0.953			
Variance extracted:	0.872			

* Significant at the .05 level ** Significant at the .01 level.

Appendix 3:

Questionnaire Items and Statistics of Measurement Analysis of the article “Levers of eco-control and environmental strategy”

Internally-oriented competitive environmental strategy

Confirmatory factor analysis (CFA) Items	Initial model		Respecified model ^a	
	Standardized loadings	R ²	Standardized loadings	R ²
1. Increasing production efficiency	0.651**	0.424	0.603**	0.363
2. Reducing costs related to energy consumption	0.858**	0.735	0.890**	0.793
3. Reducing costs related to material consumption	0.880**	0.795	0.868**	0.754
4. Reducing costs related to waste management	0.761**	0.580	0.749**	0.560
5. Reducing costs associated with fines and litigation	0.386**	0.149	-	-
6. Reducing the risk of environmental liabilities and disasters	0.520**	0.271	-	-
Goodness-of-fit of the model:	$\chi^2(7) = 38.20$ p < .001 NNFI= .921; CFI=.963; RMSEA = 0.139		$\chi^2(0) = 0$ p> .001 NNFI= 1.0; CFI=1.0; RMSEA = 0.00	
Cronbach Alpha	0.781		0.810	
Composite reliability:	0.843		0.863	
Variance extracted:	0.489		0.618	

^a Items 5 and 6 were removed from the cost reduction dimension because of inadequate loading factors and R².

** Significant at the .01 level.

Externally-oriented competitive environmental strategy

Confirmatory factor analysis (CFA) Items	Initial model		Respecified model	
	Standardized loadings	R ²	Standardized loadings	R ²
1. Gaining access to new markets	0.749**	0.561	-	-
2. Increasing sales	0.860**	0.739	-	-
3. Increasing market shares	0.901**	0.811	-	-
4. Responding to the need of consumers	0.713**	0.509	-	-
Goodness-of-fit of the model:	$\chi^2(0) = 0$ p> .001 NNFI= 1.0; CFI=1.0; RMSEA = 0.00		-	
Cronbach Alpha	0.885			
Composite reliability:	0.883			
Variance extracted:	0.655			

** Significant at the .01 level.

Belief systems

Confirmatory factor analysis (CFA)	Initial model		Respecified model	
	Standardized loadings	R ²	Standardized loadings	R ²
Items				
1. Our mission statement clearly communicates the firm's environmental values to our workforce	0.702**	0.492	-	-
2. Top managers communicate environmental values to our workforce	0.819**	0.670	-	-
3. Our workforce is aware to the firm's environmental values	0.906**	0.821	-	-
4. Our mission statement inspires our workforce about environmental values	0.814**	0.662	-	-
Goodness-of-fit of the model:	$\chi^2(0) = 0$ p> .001 NNFI= 1.0; CFI=1.0; RMSEA = 0.00			
Cronbach Alpha	0.884		-	
Composite reliability:	0.886			
Variance extracted:	0.662			

** Significant at the .01 level.

Boundary systems

Confirmatory factor analysis (CFA)	Initial model		Respecified model	
	Standardized loadings	R ²	Standardized loadings	R ²
Items				
1. Our firm relies on a code of conduct to define appropriate environmental behaviors for our workforce	0.844**	0.713	-	-
2. Our code of conduct informs our workforce about environmental behaviors that are off-limits	0.883**	0.780	-	-
3. Our firm has a system that communicates to our workforce environmental risks that should be avoided	0.862**	0.743	-	-
4. Our workforce is aware of the firm's environmental code of conduct	0.904**	0.817	-	-
Goodness-of-fit of the model:	$\chi^2(2) = 4.284$ p= 0.117 NNFI= 0.992; CFI=0.997; RMSEA = 0.066			
Cronbach Alpha	0.914		-	
Composite reliability:	0.928			
Variance extracted:	0.763			

** Significant at the .01 level.

Diagnostic systems

Confirmatory factor analysis (CFA) Items	Initial model		Respecified model ^a	
	Standardized loadings	R ²	Standardized loadings	R ²
1. Track progress towards environmental goals	0.864**	0.746	0.983**	0.966
2. Compare env. outcomes to expectations	0.846**	0.716		
3. Enable the organization to focus on common issues	0.930**	0.865		
4. Enable discussion in meetings of superiors, subordinates and peers	0.894**	0.799		
5. Enable continual challenge and debate of underlying data, assumptions, and action plans	0.899**	0.809	0.919**	0.844
6. Provide a common view of the organization	0.886**	0.785		
7. Develop a common vocabulary in the organization	0.878**	0.772		
8. Enable the organization to focus on critical success factors	0.930**	0.864		
9. Monitor environmental results	0.866**	0.750	0.972**	0.945
10. Review key environmental measures	0.895**	0.801		
11. Tie the organization together	0.912**	0.831		
Goodness-of-fit of the model:	$\chi^2(44) = 914.94$ p < .001 NNFI= .874; CFI=.899; RMSEA = 0.349		$\chi^2(0) = 0$ p> .001 NNFI= 1.0; CFI=1.0; RMSEA = 0.00	
Cronbach Alpha	0.972		0.971	
Composite reliability:	0.977		0.971	
Variance extracted:	0.794		0.919	

^a To eliminate multicollinearity effect, composite indices were used to regroup the items of the diagnostic dimension. The single-factor method was used to compose the composite indices. Items 1,2,3 and 4 are grouped together. Items 4, 5,6, 7 and 8 form the second group while items 9,10 and 11 form the third group.

** Significant at the .01 level.

Interactive systems

Confirmatory factor analysis (CFA)	Initial model		Respecified model ^b	
	Standardized loadings	R ²	Standardized loadings	R ²
Items				
1. Top management pays little day-to-day attention to the environmental performance indicators (reverse coding)	0.472**	0.228	-	-
2. Top management relies heavily on staff specialists in preparing and interpreting information from environmental performance indicators (reverse coding)	-0.281**	0.079	-	-
3. Operating managers are involved infrequently and on an exception basis with the env. performance indicators (reverse coding)	0.391**	0.153	-	-
4. Top management pays day-to-day attention to the environmental performance indicators	0.848**	0.720	0.851**	0.724
5. Top management interprets information from environmental performance indicators	0.821**	0.675	0.844**	0.712
6. Operating managers are frequently involved with environmental performance indicators	0.859**	0.739	0.840**	0.706
Goodness-of-fit of the model:	$\chi^2(9) = 164.80$ $p < .001$ NNFI= .627; CFI=.776; RMSEA = 0.247		$\chi^2(0) = 0$ $p > .001$ NNFI= 1.0; CFI=1.0; RMSEA = 0.00	
Cronbach Alpha	0.668		0.860	
Composite reliability:	0.798		0.882	
Variance extracted:	0.431		0.714	

^b Items 1, 2 and 3 were removed from the interactive dimension because of inadequate loading factors and R².

** Significant at the .01 level.

Managerial environmental practices

Confirmatory factor analysis (CFA)	Initial model		Respecified model ^a	
	Standardized loadings	R ²	Standardized loadings	R ²
Items				
1. Periodic environmental audits	0.860**	0.739	0.863**	0.744
2. Environmental training for firm's employees	0.784**	0.614	0.785**	0.616
3. Total quality program with environmental aspects	0.763**	0.581	0.750**	0.563
4. Environmental analysis of product life cycle	0.486**	0.236	-	-
5. Environmental emergency response procedures	0.754**	0.569	0.760**	0.578
6. Publication of environmental reports or voluntary disclosure of env. performance information	0.752**	0.566	0.751**	0.564
7. Consultation with local environmental groups and plant neighbors on environmental issues	0.640**	0.410	0.639**	0.408
Goodness-of-fit of the model:	$\chi^2(13) = 43.01$ p < .001 NNFI= .967; CFI=.979; RMSEA = 0.099		$\chi^2(8) = 30.06$ p < .001 NNFI= .967; CFI=.982; RMSEA = 0.108	
Cronbach Alpha	0.862		0.868	
Composite reliability:	0.885		0.891	
Variance extracted:	0.531		0.579	

^aItem 4 was removed because of inadequate loading factors and R²

** Significant at the .01 level.

Operational environmental practices

Confirmatory factor analysis (CFA)	Initial model		Respecified model	
	Standardized loadings	R ²	Standardized loadings	R ²
Items				
1. Product redesign	0.625**	0.391	-	-
2. Process redesign	0.581**	0.338	-	-
3. Disassembly	0.625**	0.391	-	-
4. Substitution	0.793**	0.629	-	-
5. Reduce	0.767**	0.588	-	-
6. Recycling	0.728**	0.531	-	-
Goodness-of-fit of the model:	$\chi^2(8) = 19.79$ p < .001 NNFI= .952; CFI=.961; RMSEA = 0.074			
Cronbach Alpha	0.829		-	
Composite reliability:	0.844			
Variance extracted:	0.478			

** Significant at the .01 level.

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