Strategic cost management and performance: The case of environmental costs

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Abstract

Despite recent developments in the stream of research devoted to strategic cost management (SCM), there are limitations found with this research, notably the overemphasis on one component of SCM (executional cost management), the underemphasis on the other component (structural cost management), the insufficiency of links between those two components, and the absence of evidence supporting their link with performance. The aim of this study is to examine the relationship between both components of SCM, and financial performance. Two main research questions are investigated: (i) To what extent do executional and structural cost management influence financial performance? (ii) To what extent does structural cost management mediate the link between executional cost management and financial performance? In order to examine the link between SCM and performance, one specific context is investigated, namely environmental costs. The environmental costs reflect an ‘executional’ aspect aimed at managing, controlling and optimizing costs for a given environmental strategy, but also a ‘structural’ aspect based on their influence on the firm's cost structure notably in terms of product design, raw materials used and operational process design. Survey data have been collected on a sample of 319 Canadian manufacturing firms to examine the link between SCM and financial performance.

Keywords: Environmental costing; Strategic cost management; Tracking of environmental costs

1. Introduction

In the current business environment characterized by intense competitive pressures, organizations need to implement strategies to manage costs and reduce these costs not only on a short-term basis, but also over the long term (Nimocks, Rosiello, & Wright, 2005). Strategic cost management (SCM) is the deliberate alignment of firms' resources and associated cost structure with long-term strategy and short-term tactics (Anderson & Dekker, 2009a). It represents one aspect of a larger stream of research devoted to strategic management accounting (i.e., Bromwich, 1990; Cadez & Guilding, 2008; Lord, 1996; Roslender & Hart, 2003). Drawing on the work of Shank and Govindarajan (1992, 1994) and Tomkins and Carr (1996), Anderson...
(2007) describes two forms of SCM: (i) structural cost management, and (ii) executional cost management. Both have always been central to profitable firms (Anderson & Dekker, 2009b).

Structural cost management refers to the cost management activities aimed at changing the cost structure of the firm. It includes organizational tools, products and processes designed to build a cost structure that is coherent with strategy. It basically refers to the strategic decisions that typically define the gross parameters of the firm's cost structure. Executional cost management refers to the cost management activities aimed at improving performance for a given strategy. It is based on common management accounting tools used to measure cost performance in relation with competitive benchmarking used to identify improvement opportunities. It basically refers to the analysis of performance following strategic decisions. In other words, the purpose of SCM is to align a firm's resources and associated cost structure with: (i) short-term tactics through cost reductions (executional cost management), and (ii) long-term strategy through the reengineering of the value chain and production of a different cost structure (structural cost management).

Despite the recent development in the stream of research devoted to SCM (Cugini, Caru, & Zerbini, 2007; Hsu & Qu, 2012; Nicolaou, 2003), there are three significant limitations associated with this research. First, this stream is narrowly focused on executional cost management whereas the structural cost management knowledge is developed mainly outside the scope of accounting research (Anderson, 2007). Most accounting studies address issues related to executional cost management, such as cost allocation (e.g., allocation of overhead and joint cost, cost driver analysis, activity-based costing, etc.) and cost accounting (cost variance, use of cost information for decision-making, etc.) (Hesford, Lee, Van der Stede, & Young, 2007). On the other hand, few studies address issues related to structural cost management, notable exceptions include recent studies examining target costing (e.g., Dekker & Smidt, 2003; Kee & Matherly, 2006; Yasukata, Yoshida, Yamada, & Oura, 2013) and interorganizational cost management (e.g., Agndal & Nilsson, 2009; Fayard, Lee, Leitch, & Kettinger, 2012).

Secondly, the stream of research devoted to SCM does not establish a sufficient number of links between the executional and structural cost management dimensions, and thus fails to create a unified body of knowledge (Anderson, 2007). Hence, although there is a need to examine structural cost management more intensively, this examination should not neglect executional cost management in order to prevent the results from being incomplete or spurious effects. Hence, there is a need to examine simultaneously both components of SCM to shed light on their mutual dependencies.

Thirdly, although various claims have been made promoting the benefits of SCM (Aluko, Mayhall, Wauquiez, & Vercio, 2010; Cooper & Slagmulder, 2003; Freeman, 1998; Wong, 1996), and despite the empirical investigation of the impact of executional cost management activities on the effectiveness of cost management systems (Cohen & Kaimenaki, 2011; Hughes & Paulson Gjerde, 2003; Nicolaou, 2003; Schoute, 2009), limited empirical evidence has been provided to support the impact of SCM on financial performance. More specifically, in the executional cost management literature, the empirical evidence supporting the link between cost-system design and financial performance is limited and conflicting (Lee, 2003; Pizzini, 2006). For instance, past research related to activity-based costing have provided mixed empirical results (Gosselin, 2007; Maiga, Nilsson, & Jacobs, 2014). One possible explanation is the
absence of structural cost management within the model developed and tested in past studies. Not only does structural cost management have the potential to influence financial performance (Anderson & Dekker, 2009b; Cooper & Slagmulder, 2004), it could also potentially intervene in the relationship between executional cost management and financial performance. In fact, the basic management accounting tools used to measure cost performance (executional cost management) might provide the necessary cost knowledge in order to proceed to the reengineering of the value-chain and the production of different cost structures (structural cost management) leading to financial performance.

Our goal is to contribute to the growing SCM stream of research and we specifically intend to address these three limitations. More specifically, the aim of this study is to examine the relationship between SCM, in terms of both executional and structural cost management, and financial performance. Two main research questions are investigated: (i) To what extent do executional and structural cost management influence financial performance? (ii) To what extent does structural cost management mediate the link between executional cost management and financial performance? In order to provide answers to those questions, a conceptual model has been developed and survey data have been collected on a sample of 319 Canadian manufacturing firms. Structural equation modeling (SEM) is used to provide empirical support and test the conceptual model.

To examine the link between SCM and financial performance, one specific context is investigated, namely the environmental costs. Typically, environmental costs represent an important portion of the operating and manufacturing costs, notably for manufacturing firms (Parker, 1999). For instance, Canadian firms invest approximately nine billion dollars each year on the protection of the environment (Statistics Canada, 2010). For the European Union, the total environmental costs represent more than forty-five billion Euros (Roewer, 2008). Considering the importance of environmental costs for organizations, it is not surprising to observe that CEOs worldwide consider the reduction of these costs to be an important sustainability driver (Aschaiek, 2012).

The environmental costs have been chosen to examine the strategic cost management approach for three main purposes. First, it is now commonly recognized that environmental issues are an important part of a firm's strategy (Hart, 1995; Porter & Van der Linde, 1995b; Russo & Fouts, 1997). Therefore, there is a need to examine environmental costs at the strategic level and not only at the operational level. Second, environmental costs reflect an ‘executional’ aspect aimed at managing, controlling and optimizing costs for a given business and environmental strategy, but also a ‘structural’ aspect based on their influence on the firm's cost structure notably in terms of product design, raw materials used and operational process design. Third, past research devoted to environmental cost accounting is predominately comprised of descriptive or prescriptive studies (e.g., Cortez & Penacerrada, 2010; Epstein & Birchard, 2000; Letmathe & Doost, 2000; Rannou & Henri, 2010) and suffers from a lack of empirical evidence (Bouma & Van der Veen, 2002; Burritt, 2004).

In sum, this study contributes specifically to three accounting streams of research, namely (i) strategic cost management, (ii) environmental management accounting, and (iii) cost accounting. First, as previously mentioned, the strategic cost management literature focuses mainly on
executional cost management and overlooks the links between the executional and structural cost management dimensions (Anderson, 2007). Furthermore, past research has provided little empirical evidence examining the deployment and influence of environmental management accounting systems. Lastly, the cost accounting literature suffers from limited and conflicting empirical evidence supporting the link between costing practices and performance (Lee, 2003; Pizzini, 2006).

The remainder of this paper is organized as follows. The next section describes strategic cost management and environmental costs, and presents hypotheses regarding the link between executional cost management, structural cost management, and financial performance. The following section presents the methodology followed by description of the results of our analyses. Lastly, we discuss the results and the conclusion of this study.

2. Conceptual framework

2.1. Strategic cost management and environmental costs

Strategic cost management (SCM) is defined as “deliberate decision making aimed at aligning the firm's cost structure with its strategy and optimizing the performance of the strategy” (Anderson, 2007). In the context of environmental costs, this study examines the influence of one executional cost management tool, namely the tracking of environmental costs, on one important structural cost management activity, namely the implementation of environmental initiatives.

The tracking of environmental costs is defined as the identification and accumulation of specific internal costs related to the protection of the environment (Henri, Boiral, & Roy, 2014). “The identification refers to the observation, description, and classification of various types of environmental costs, whereas the accumulation refers to the separate collection and recording of those costs within the cost accounting systems” (Henri et al., 2014, 648). It represents an executional cost management activity because it motivates managers and employees to manage, control and reduce environmental costs in line with the current strategy (Burritt, 2000), and it prevents suboptimal decisions being made (Joshi, Krishnan, & Lave, 2001). The implementation of environmental initiatives refers to the actions needed for organizations to master operational control over activities that might have a significant impact on the environment as well as on the cost structure. For instance, several generic initiatives have been identified in the industrial ecology literature such as product and process redesign, substitution and reduction of raw materials used, and recycling (Allenby, 1999; Graedel & Allenby, 1995). In other words, these initiatives refer to typical environmental actions which have an influence on the business as a whole. The implementation of environmental initiatives represent structural cost management activities because they help define the gross parameters of the firm's cost structure in terms of product design (e.g., attributes, design features, characteristics), nature and level of raw materials used (e.g., polluting vs. non-polluting material, recycled vs. non-recycled material), and operational process design (e.g., pollution prevention vs. end-of-pipe approach).

2.2. Overview of the conceptual model
Fig. 1 presents the conceptual model that reflects the extent to which the tracking of environmental costs, as one executional cost management activity (hypothesis 1), and the implementation of environmental initiatives, as one structural cost management activity (hypothesis 2b), specifically support financial performance. These two hypotheses are associated with the first research question. Furthermore, the model also reflects the mediator role of structural cost management (hypothesis 2). More specifically, it is argued that the tracking of environmental costs has a positive influence on the implementation of environmental initiatives (hypothesis 2a), which in turn positively influence financial performance. These hypotheses relate to the second research question and will be discussed in greater detail in the next sections.

![Conceptual model illustrating the link between structural cost management and performance.](image)

Fig. 1. Conceptual model illustrating the link between structural cost management and performance.

Consistent with both the management accounting and environmental management literatures, numerous studies suggest that other factors could influence the variables under study (Al-Tuwaijri, Christensen, & Hughes, 2004; Chenhall, 2007; Henri & Journeault, 2010). Thus, we control for the potential influence of three variables (i.e., organizational size, environmental exposure, and public visibility) on the main variables under study. These control variables are also discussed more specifically later.

2.3. Direct relationship between the tracking of environmental costs and financial performance

Given that the environmental costs constitute an important element of the cost structure, their tracking has the potential to improve organizational members' awareness of the importance and scope of impact of environmental management activities within the firm (Parker, 1999). As a result, they are able to establish links between environmental and organizational goals, and thus help reduce costs for the current strategy and analyze performance following strategic decisions (Anderson, 2007). In other words, more cost consciousness contributes to increased financial performance.

Furthermore, by supporting effective resource management, proper accounting information has the potential to contribute to financial performance (Baines & Langfield-Smith, 2003). In fact, as potential areas for operational and productive efficiencies are revealed, the specific tracking of
environmental costs may help eliminate waste and reduce production costs. More specifically, it is typically argued that more relevant and useful data are produced by more sophisticated cost systems. This greater transparency and accuracy of information in turn improves managerial decision making, and thus leads to improved financial performance (Lee, 2003; Maiga et al., 2014; Pizzini, 2006). The specific monitoring of environmental costs allows organizations to avoid underestimating or overestimating the cost of its products and services, and to include the cost of environmental processes and impacts in the pricing of particular products and services (Parker, 1999; Rannou & Henri, 2010). By failing to sufficiently recognize environmental costs, a number of consequences could occur, notably in terms of decisions-making. For instance, suboptimal decisions could be taken by managers, such as inappropriate product mix, product mispricing, plant closure and inadequate investment decisions Joshi et al. (2001). Those kinds of decisions could have a negative impact on financial performance.

Lastly, the tracking of environmental costs can also contribute to financial performance when used as a legitimization tool providing data for external reporting. The disclosure of environmental information, including environmental costs, is away to communicate with various stakeholders. In so doing, firms influence the public's perception of the organization (Dixon, Mousa, & Woodhead, 2005). The specific identification of environmental costs may be used as information to pursue or preserve social legitimacy in order to reduce the likelihood of costly public policy actions taken against the organization (Patten, 2005).

In sum, it is argued that environmental costs represent an important component of a firm's cost structure. The tracking of a broad range of environmental costs increases the cost consciousness of managers who are able to better manage these costs on a short term basis in line with the current strategy. More refined information on environmental costs enhances managers' decisions and external reporting, which lead to improvements in financial performance. Even if the tracking of environmental costs requires human, technological and financial resources to develop and manage (Pizzini, 2006), the net effect is expected to be positive. Hence, formally stated:

**Hypothesis 1.** As an executional cost management activity, the tracking of environmental costs positively influences financial performance.

2.4. Indirect relationship between the tracking of environmental costs and financial performance

2.4.1. Relationship between the tracking of environmental costs and the implementation of environmental initiatives

The tracking of environmental costs represents an executional cost management activity that provides information concerning the appropriateness of the level and volatility of environmental costs as compared to organizational goals and competitive benchmarks (Anderson, 2007). This information raises awareness about environmental costs throughout the firm and supports organizational members in their understanding of business processes and organizational activities (Shields & Young, 1994). More specifically, the tracking of environmental costs facilitates the understanding of the links between costs and output, and provides insights into possible cost reductions through specific actions on cost drivers. This understanding acts as the trigger for the development of initiatives to act on those cost drivers, such as product and process redesign,
substitution, recycling, etc. Therefore, the tracking of environmental costs may help implement the environmental initiatives needed to build the cost structure that has been revealed by the improved understanding of cost behavior.

The tracking of environmental costs also provides information concerning the level of improvement of environmental costs (Anderson, 2007), which may reveal potential organizational gaps. In the absence of the specific identification of environmental costs reflecting areas of improvements, organizational slack may accumulate, i.e. the difference between the potential performance of an organization and the actual performance achieved (Levinthal & March, 1981). The detection of a performance gap impedes the development of slack by stimulating innovation and creativity (Ettlie, 1983; Hage, 1980; Shrivastava, 1983). It is argued that by improving cost knowledge and detecting a performance gap, the tracking of environmental costs may facilitate the development of environmental initiatives such as the reduction in the material and energy intensity of goods or services, the reduction in the dispersion of toxic materials, improvement of the recyclability, maximum use of renewable resources, and greater durability of products (WBCSD, 2000). These initiatives will help address the performance gap revealed by tracking environmental costs.

Moreover, the tracking of environmental costs is used not only to communicate the importance of environmental costs, but also to integrate environmental issues into the organizational routines via other management control systems (MCS). More specifically, the tracking of environmental costs represents one crucial step in the integration of environmental issues into other MCS, such as budgeting, incentives, risk management and strategic planning. Those MCS are part of the organizational routines and are used in order to maintain or alter organizational patterns (Simons, 1987). The MCS, or more specifically the eco-control systems (Arjalies & Mundy, 2013; Gond, Grubnic, Herzig, & Moon, 2012; Henri & Journeault, 2010; Pondeville, Swaen, & Ronge, 2013) are used notably to translate intentions into actions. Hence, the tracking of environmental costs and their integration into other eco-controls can contribute to the development of routines which support the implementation of environmental initiatives.

In sum, the tracking of environmental costs represents an executional cost management activity used to measure cost performance. By improving cost knowledge and the detection of a performance gap, this tracking contributes to the implementation of environmental initiatives. This impact also occurs because of the integration of environmental costs within the other eco-controls. These environmental initiatives, which represent structural cost management activities, will help define the gross parameters of the firms' cost structure. Formally stated:

**Hypothesis 2a.** As an executional cost management activity, the tracking of environmental costs has a positive influence on one structural cost management activity, namely the implementation of environmental initiatives.

2.4.2. **Relationship between the implementation of environmental initiatives and financial performance**

The industrial ecology and operation management literatures provide considerable empirical evidence suggesting that the implementation of environmental initiatives contributes to the
reduction of ecological impacts (e.g., Boiral & Henri, 2012; Henri & Journeault, 2010; King & Lenox, 2001; Lopez-Gamero, Molina-Azorín, & Claver-Cortes, 2009; Zhu & Sarkis, 2004). Following an eco-efficiency view, the implementation of environmental initiatives may not only help reduce ecological impacts, but also to reduce environmental costs. This view refers to the simultaneous reduction of ecological impacts and the creation of economic value (WBCSD, 1992). The reduction in ecological impacts translates notably into better cost control, which in turn improves financial performance (Adams & Ghaly, 2006; Dyllick & Hockerts, 2002; Young & Tilley, 2006). Past accounting and environmental management studies have supported the eco-efficiency view through both empirical studies (e.g., Al-Tuwaijri et al., 2004; Burnett & Hansen, 2008; Henri et al., 2014; Orlitzky, Schmidt, & Rynes, 2003; Wisner, Epstein, & Bagozzi, 2006) as well as case studies (e.g., Ditz, Ranganathan, & Banks, 1995; Epstein, 1996).

For instance, by redesigning the product or process, firms may (i) reduce energy consumption and consequently, the cost of energy, (ii) reduce the quantity of waste and consequently the costs of unproductive raw materials and the cost of waste disposal, and (iii) replace materials with more ecological and less expensive ones, and/or make more use of recycled components, and/or consume waste internally, which consequently reduce the cost of direct and indirect materials. In so doing, firms may reduce the generation of solid waste, air emission levels, water pollution and greenhouse gas emissions. This helps to reduce the (i) regulatory compliance costs, (ii) effort (and costs associated with it) related to the management of stakeholder relations and corporate image, and (iii) costs ensued from environmental risks and future events (fines, penalties, pursuits, environmental crisis, new regulation, etc.).

In sum, the implementation of environmental initiatives represents a structural cost management activity used to redesign the organization, its products and its processes so that environmental impacts and costs are minimized (Anderson, 2007). Those initiatives will contribute to firms building a cost structure that supports the achievement of financial performance. The following hypothesis is thus proposed:

**Hypothesis 2b.** As a structural cost management activity, the implementation of environmental initiatives positively influences financial performance.

In sum, it has been argued that the tracking of environmental costs supports the implementation of environmental initiatives (H2a). The implementation of these initiatives is in turn expected to have a positive influence on financial performance (H2b). Thus, it is argued that the tracking of environmental costs indirectly influences financial performance through the implementation of environmental initiatives. Formally stated:

**Hypothesis 2.** The tracking of environmental costs (executional cost management) influences positively the implementation of environmental initiatives (structural cost management), which in turn positively influences financial performance.

2.5. Control variables

Given the possible effect of contextual factors on the variables under study, three control variables are examined, namely (i) organizational size, (ii) environmental exposure, and (iii)
public visibility (e.g. Al-Tuwaijri et al., 2004; Buysse & Verbeke, 2003; Henri & Journeault, 2010; Henriques & Sadorsky, 1999; Judge & Douglas, 1998; Sharma & Vredenburg, 1998; Wagner & Schaltegger, 2004). We control for the influence of these control variables on the three main constructs, namely the tracking of environmental costs, the implementation of environmental initiatives, and financial performance. Environmental exposure is defined as the degree of exposure to future environmental costs faced by the firm because of environmental pollution inherent to its production processes. Public visibility refers to exposure of the firm to public scrutiny (Al-Tuwaijri et al., 2004).

3. Research methodology

3.1. Survey design

As part of a larger project (Henri et al., 2014), the data were collected from a survey administered to a random sample of 1514 Canadian manufacturing firms obtained from Scott's database. The use of survey becomes necessary as no database contains the appropriate information regarding strategic cost management. Considering their production processes and environmental impacts, manufacturing firms constitute a logical choice to examine the executional and structural cost management in a context of environmental costs.

The questionnaire was first validated using a pretest administered to four academics and twenty managers. The goals of the pretest were twofold: (i) to validate the understanding of the content of the initial questionnaire, and (ii) to validate the time necessary to complete the questionnaire. Minor adjustments were made in terms of wording and presentation to produce the final questionnaire. Data were then collected through this questionnaire sent to the CEO or the highest member of the ‘corporate’ top management team (autonomous entity) or ‘local’ top management team (subunit) for which the identity was revealed in the database. A total of 319 usable questionnaires were received, for a response rate of 21.1%. On average, firm size was 342 employees and the respondents had on average 14.1 years of experience working for their organization. Appendix 1 presents a description of the sample in terms of position and experience of the respondents, as well as the number of employees in the organization. To check

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1 This database includes both a subunit of a larger firm (e.g. division) and a fully autonomous entity (e.g. small and medium enterprise). In all cases, they appeared as separate entities in the database. We selected organizations with 100 employees or more, and for which contact names of the top management team were available. The initial sample comprised 1556 organizations. 52 organizations were lost because of wrong addresses, organizations that moved, and departures or transfer of managers. Consequently, the final sample was reduced to 1514.

2 We sent the questionnaire to the respondents along with a letter explaining the purpose of the study and a self-addressed stamped envelope was included with each questionnaire. Four weeks after the initial mailing, the non-respondents received a replacement questionnaire.

3 It is commonly suggested that a sample size varying between 100 and 200 is adequate for small-to-medium structural-equation models, or between 5 and 10 observations per estimated parameter (Anderson & Gerbing, 1988; Bentler & Chou, 1987). In the current study, the sample size is adequate to test the proposed model (n = 319) as well as the ratio of observations per parameter (9.67).
for potential non-response bias, a two-step analysis was conducted and the results suggest that non-response bias is not a major concern in this sample\(^4\).

### 3.2. Measurement of constructs

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. Based on the International guidance document of Environmental Management Accounting (IFAC, 2005), the environmental cost classification provided by the US EPA (1995), and the work of Parker (1999), we identified different types of environmental costs and developed an instrument to measure the tracking of these costs. We included the environmental operating expenditures (not the capital expenditures) which refer to the potentially hidden costs. This instrument asks respondents to indicate the extent to which five types of environmental costs are explicitly tracked by their organization, each on a five-point Likert-type scale (1 = Not at all to 5 = To a great extent). A higher mean score indicates more visibility of environmental costs in the accounting systems.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Descriptive statistics and correlation matrix of the variables.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tracking of environmental costs</td>
</tr>
<tr>
<td>No. of items used</td>
<td>5</td>
</tr>
<tr>
<td>Theoretical range</td>
<td>1–5</td>
</tr>
<tr>
<td>Minimum</td>
<td>1</td>
</tr>
<tr>
<td>Maximum</td>
<td>5</td>
</tr>
<tr>
<td>Mean</td>
<td>3.19</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.83</td>
</tr>
<tr>
<td>Median</td>
<td>3.20</td>
</tr>
</tbody>
</table>

**Pearson correlation matrix**

<table>
<thead>
<tr>
<th></th>
<th>Tracking of environmental costs</th>
<th>Implementation of env. initiatives</th>
<th>Financial performance</th>
<th>Organizational size</th>
<th>Environmental exposure</th>
<th>Public visibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracking of env. costs</td>
<td>1.0</td>
<td>0.252**</td>
<td>-0.051</td>
<td>1.0</td>
<td>-0.003</td>
<td>-0.034</td>
</tr>
<tr>
<td>Implementation of env. initiatives</td>
<td>0.252**</td>
<td>1.0</td>
<td>-0.051</td>
<td>1.0</td>
<td>-0.003</td>
<td>-0.034</td>
</tr>
<tr>
<td>Financial performance</td>
<td>0.043</td>
<td>-0.051</td>
<td>1.0</td>
<td>-0.003</td>
<td>0.006</td>
<td>0.024</td>
</tr>
<tr>
<td>Organizational size</td>
<td>-0.003</td>
<td>0.035</td>
<td>0.031</td>
<td>1.0</td>
<td>0.010</td>
<td>0.024</td>
</tr>
<tr>
<td>Environmental exposure</td>
<td>-0.003</td>
<td>0.035</td>
<td>0.031</td>
<td>1.0</td>
<td>0.010</td>
<td>0.024</td>
</tr>
<tr>
<td>Public visibility</td>
<td>0.275**</td>
<td>0.066</td>
<td>0.034</td>
<td>-0.008</td>
<td>0.006</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*Note: *significant at the 0.05 level; **significant at the 0.01 level.*

Six items from the instrument developed by Melnyk, Sroufe, and Calantone (2003) were used to measure the implementation of environmental initiatives. The respondents were asked to assess the extent of implementation of various initiatives on a five-point Likert-type scale (1 = not at all, 5 = to a great extent). A higher score indicates more environmental initiatives implemented by the organization. Financial performance is measured using a perceptual instrument. As several authors argue, in terms of consistently providing valid and reliable performance assessment, neither objective nor subjective measures are superior (e.g., Boulianne, 2007; Dess & Robinson, 1984).

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\(^4\) To check for potential non-response bias, a two-step analysis was conducted. First, respondents were compared with non-respondents in terms of sample characteristics (size, industry and geographical region). Then, early respondents (i.e., those providing answers before follow-up) and late respondents (i.e., those providing answers after follow-up and used as proxies for non-respondents) were compared in terms of main construct measures. Using chi-square statistics, no significant differences (p > 0.05) were found between the size, geographical region and industry of respondent firms and non-respondent firms. A comparison of the means of the main constructs found no difference between early and late respondents. Hence, it appears that non-response bias is not a major concern in this sample.
Financial performance was measured using four items in which the respondents were asked to rate the overall performance of their facility over the past three years relative to others in their industry, based on a five-point Likert-type scale (1 = much worse, 5 = much better). A higher mean score thus indicates better financial performance.

The control variables are measured as follows. Size is measured using the natural log of the number of employees. Environmental exposure was measured with a dichotomous variable using the data from NPRI to identify low and high polluting industries. Ownership was used as a proxy to measure public visibility based on a dichotomous variable. Private firms are associated with low public visibility while public ones are associated with high visibility.

3.3. Reliability of constructs

To establish the reliability of each construct, we examined the Cronbach Alpha and composite reliability. The constructs must exceed the recommended cut-off point of 0.70 to reflect an acceptable level (Fornell & Larcker, 1981; Nunnally, 1967). Moreover, to verify convergent validity (i.e. similarity between measures of theoretically related constructs), the variance extracted has been analyzed and we have performed first-order confirmatory factor analyses (CFA). The variance extracted must exceed the recommended cut-off point of 0.50 to reflect acceptable validity (Hair, Anderson, Tatham, & Black, 1998). Three main elements were examined for the CFA, namely the significance of the standardized factor loading and the R2 for each item, and the overall acceptability of the measurement model using chi-square statistics and three fit indices. Those indices, namely NNFI (non-normed fit index), CFI (comparative-fit index), and RMSEA (root mean square error of approximation) include two complementary types of indices (absolute fit and incremental fit measures) and they are among the most frequently reported to assess the quality of the structural model.6 Lastly, discriminant validity (i.e., the absence of a correlation between measures of unrelated constructs) was assessed by comparing the variance extracted from each individual construct with the squared correlation between latent constructs (Fornell & Larcker, 1981). To support discriminant validity, the variance extracted for each construct must exceed the squared correlations. Lastly, we tested for the presence of common-rater bias by conducting Harman's (1967) single-factor test.

Appendix 2 presents the statistics of the measurement analysis for the initial and respecified models. Respecifications (i.e. adjustments to the initial model of measurement in order to reach acceptable level of reliability and validity) were necessary for only one construct, namely the implementation of environmental initiatives (three items were deleted because of inadequate R2 and insufficient variance extracted see Appendix 2 for details). After those respecifications, all constructs exceed the recommended cut-off point for the Cronbach Alpha, composite reliability and variance extracted, exhibit acceptable model fit (except for one RMSEA which is slightly

5 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).

6 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).
above the threshold), reflect adequate R2, and all factor loadings are statistically significant (p < 0.01). All comparisons between the variances extracted and the squared correlations support the discriminant validity of the constructs. Lastly, given that the Harman's single-factor test did not reveal the presence of a single factor, we can conclude that our data were not subject to common-rater bias.

3.4. Data analysis

Structural equation modeling (SEM) is used to test the conceptual model. The purpose of this choice is threefold: (i) SEM allows for the representation of unobserved concepts (latent variables) with a set of factors (measurement variables), (ii) the relationships between measurement and latent variables are free of measurement error because error has been estimated and removed, leaving only common variance, and (iii) it allows for the estimate of direct and indirect structural effects between latent variables. We analyzed the data collected from the survey with LISREL 8.72 and used a covariance matrix as an input matrix7. 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 & Chou, 1987).

4. Results and discussion

Table 2 presents the results of the structural model in terms of path coefficients, Z statistics, number of iterations, proportion of variance (R2), and goodness-of-fit indices. Panel A presents the specific results for each path coefficient while Panel B breaks up the total effects in their direct and indirect component. The model respects the recommended threshold mentioned previously for the three fit indices: NNFI =0.979; CFI =0.986, RMSEA =0.057 (see note 7). 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. Evidence related to the two research questions are presented next as well as a discussion on the hypotheses ensuing from those questions.

7 The input matrices are available from the author upon request.
4.1. To what extent do executional and structural cost management specifically influence financial performance?

The results of Panel A suggest a significant effect of the tracking of environmental costs on financial performance (0.365; p < 0.01). This positive and significant direct link supports hypothesis 1. This suggests that more refined information on environmental costs increases managers' awareness of costs and enhances their short-term decisions (Joshi et al., 2001; Parker, 1999), which in turn improves financial performance. This supports the typical argument that more refined cost systems produce more relevant and useful data (Lee, 2003; Pizzini, 2006).

Furthermore, a significant and positive association is observed between the implementation of environmental initiatives and financial performance (0.145; p <0.05), and thus supports hypothesis 2b. This suggests that those initiatives contribute to firms building a cost structure that supports their strategic positioning and helps reduce their costs over the long term (Anderson, 2007). More globally, this result supports the eco-efficiency view (Adams & Ghaly, 2006; Dyllick & Hockerts, 2002; Huppes & Ishikawa, 2005; Young & Tilley, 2006) and the general conclusions from this emerging stream of research in accounting (e.g., Al-Tuwaijri et al., 2004; Burnett & Hansen, 2008; Wisner et al., 2006).

In sum, as suggested by Anderson and Dekker (2009b), both executional cost management (the tracking of environmental costs) and structural cost management (the implementation of environmental initiatives) contribute specifically to financial performance. This supports empirically the claim that strategic cost management is beneficial for firms (Aluko et al., 2010; Cooper & Slagmulder, 2003; Freeman, 1998; Wong, 1996).
4.2. To what extent does structural cost management mediate the link between executional cost management and financial performance?

First, a significant and positive association is observed between the tracking of environmental costs and the implementation of environmental initiatives (0.629; p < 0.01), and thus supports hypothesis 2a. This suggests that the specific identification of environmental costs assists in the development of environmental initiatives by improving cost knowledge and the detection of a performance gap (Levinthal & March, 1981; Shields & Young, 1994). It represents a signal that focuses organizational attention on the search for innovative ways to reduce environmental costs and impacts (Simons, 1990). This supports the conclusions drawn from previous eco-control studies (Arjalies & Mundy, 2013; Henri & Journeault, 2010; Pondeville et al., 2013). Given that there is a positive and significant link between the tracking of environmental costs and the implementation of environmental initiatives, as well as the positive significant link discussed earlier between the implementation of environmental initiatives and financial performance, the presence of a mediation relationship is suggested.

More specifically, the results of Panel B suggest a significant total effect of the tracking of environmental costs on financial performance (0.456; p < 0.01). Of this total effect, 80% refer to the direct effect discussed earlier (0.365; p < 0.01) while 20% refer to an indirect effect (0.091; p < 0.05). This indirect effect represents the influence of the tracking of environmental costs on the implementation of environmental initiatives, which in turn has an impact on financial performance. This supports hypothesis 2.

In sum, executional cost management (the tracking of environmental costs) and structural cost management (the implementation of environmental initiatives) are related to each other and they act together to contribute to financial performance. This globally suggests that the influence of the tracking of environmental costs on financial performance occurs via two channels: (i) it acts as a catalyst for efficiency improvements within the same cost structure, and (ii) it acts as a catalyst for new initiatives which help to create a different cost structure (Anderson & Dekker, 2009a). Thus, structural and executional activities constitute two connected components that collectively give rise to strategic cost management.

4.3. Control variables and sensitivity analyses

Two links among control and main variables are statistically significant. Organizational size is positively and significantly associated with the implementation of environmental initiatives at the operational level (0.130; p < 0.01). As previously documented in past studies, this result suggests that larger firms have more financial, human and technological resources to develop innovative actions (Damanpour, 1991; Frambach & Schillewaert, 2002). Also, public visibility is positively and significantly associated with the tracking of environmental costs (0.225; p < 0.01). This suggests that firms that are exposed extensively to public scrutiny are urged to track environmental costs in order to disclose cost information to various stakeholders as well as to reduce environmental impacts.

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

5. Conclusion

Building on a strategic cost management approach, the aim of this paper was to examine the relationships between executional and structural cost management, and performance. In the context of environmental costs, this study has specifically investigated the links among the tracking of environmental costs (executional cost management), the implementation of environmental initiatives (structural cost management), as well as financial performance. More specifically, two research questions have been investigated: (i) To what extent do executional and structural cost management influence specifically financial performance? (ii) To what extent does structural cost management mediate the link between executional cost management and financial performance? Based on a sample of 319 manufacturing firms, the results suggest three main conclusions:

i. The tracking of environmental costs is one important executional cost management tool that helps align a firm's resources and associated cost structure with short-term tactics through cost reductions. Empirically, our results suggest a positive and significant association between the tracking of environmental costs and financial performance.

ii. The development of environmental initiatives is one aspect of structural cost management that helps to align a firm's resources and associated cost structure with long-term strategy through the reengineering of the value chain and production of a different cost structure. Empirically, our results suggest a positive and significant association between the implementation of environmental initiatives and financial performance.

iii. The tracking of environmental costs indirectly influences financial performance through the implementation of environmental initiatives. Therefore, executional and structural cost management work together to influence financial performance.

This study contributes specifically to three streams of research, namely (i) strategic cost management, (ii) environmental management accounting, and (iii) cost accounting. First, as suggested by Anderson (2007), the strategic cost management literature focuses mainly on executional cost management and overlooks the links between the executional and structural cost management dimensions. This research provides evidence suggesting that executional cost management allows for the analysis of performance which influences structural cost management and the definition of cost structure. It assists in creating a unified body of knowledge in the area of strategic cost management. Furthermore, past research has provided little empirical evidence examining the deployment and influence of environmental management accounting systems. More specifically, much of the literature investigating environmental costing is descriptive or prescriptive (Burritt, 2004) and does not examine the link with performance. This paper provides empirical results from 319 manufacturing firms supporting the impact of the tracking of
environmental costs on financial performance in the context of strategic cost management. Lastly, there is limited and conflicting empirical evidence in the cost accounting literature supporting the link between costing practices and performance (Lee, 2003; Pizzini, 2006). Our results contribute to this stream of research by suggesting that although a direct link may occur between the design of cost systems and financial performance, one portion of the effect may be indirect through organizational actions. Thus, past conflicting results might be explained in part by the lack of attention devoted to structural cost management.

The following limitations should be considered. First, we focus specifically on one component of executional cost management, namely the tracking of environmental costs. Other components could be examined in future research, such as the design and use of financial and non-financial environmental performance indicators (EPIs). Similarly, only one aspect of structural cost management is examined, namely the implementation of environmental initiatives, which focuses on the value proposition. Other aspects focusing on the organizational design in the context of environmental management could be investigated in future studies, such as the scale of operation, sourcing & firm boundaries, partner selection and design of buyer-supplier relationships. Second, other structural models based on the same data may reflect similar levels of fit, but propose different links among constructs (MacCallum, Wagner, Uchino, & Farbiger, 1993). Third, the cross-sectional survey data obtained prevent any conclusions regarding causality. The results should only be considered consistent with conceptual arguments and hypotheses. Finally, considering cultural, political and legislative differences among countries, the results may not be generalized outside the scope of the current sample (i.e. Canadian firms).

Appendix 1. Description of the respondents and firms in the sample

<table>
<thead>
<tr>
<th>Position of the respondent</th>
<th>%</th>
<th>Experience within the firm (average in years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEO/general manager</td>
<td>21%</td>
<td>19.3</td>
</tr>
<tr>
<td>Senior executive/other manager</td>
<td>43.3%</td>
<td>11.9</td>
</tr>
<tr>
<td>Production manager</td>
<td>6.6%</td>
<td>12.4</td>
</tr>
<tr>
<td>Director of environmental affairs</td>
<td>14.7%</td>
<td>13.1</td>
</tr>
<tr>
<td>Other manager of environmental affairs</td>
<td>11.3%</td>
<td>15.1</td>
</tr>
<tr>
<td>Information not available</td>
<td>3.1%</td>
<td>14.0</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>14.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Company size</th>
<th>Number of employees</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100</td>
<td></td>
<td>10.7</td>
</tr>
<tr>
<td>Between 100 and 149</td>
<td></td>
<td>23.8</td>
</tr>
<tr>
<td>Between 150 and 299</td>
<td></td>
<td>29.8</td>
</tr>
<tr>
<td>Between 300 and 499</td>
<td></td>
<td>25.0</td>
</tr>
<tr>
<td>&gt;500</td>
<td></td>
<td>10.7</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>342</td>
</tr>
</tbody>
</table>
Appendix 2. Questionnaire items and statistics of measurement analysis

*Tracking of environmental costs*

Please indicate the extent to which the following environmental costs are explicitly tracked by your facility: Scale: 1 = Not at all to 5 = To a great extent.

<table>
<thead>
<tr>
<th>Items</th>
<th>Initial model</th>
<th>Respecified model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory costs (permits, fines, consultant fees, legal costs)</td>
<td>0.774**</td>
<td>0.590</td>
</tr>
<tr>
<td>Recycling and waste disposal costs</td>
<td>0.722**</td>
<td>0.521</td>
</tr>
<tr>
<td>Remediation costs</td>
<td>0.837**</td>
<td>0.700</td>
</tr>
<tr>
<td>Efficiency control costs</td>
<td>0.765**</td>
<td>0.585</td>
</tr>
<tr>
<td>Environmental management and control system costs</td>
<td>0.773**</td>
<td>0.598</td>
</tr>
</tbody>
</table>

Goodness-of-fit of the model:

- $\chi^2(5) = 14.064, p = 0.01$;
- NNFI = 0.98; CFI = 0.99;
- RMSEA = 0.07

Composite reliability: 0.88
Variances extracted: 0.60

*Implementation of environmental initiatives*

To what extent have the following initiatives been implemented within your facility: Scale: 1 = Not at all to 5 = To a great extent.

<table>
<thead>
<tr>
<th>Items</th>
<th>Initial model</th>
<th>Respecified model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product and process redesign</td>
<td>0.658**</td>
<td>0.669</td>
</tr>
<tr>
<td>Substitution</td>
<td>0.783**</td>
<td>0.783</td>
</tr>
<tr>
<td>Reduction</td>
<td>0.775**</td>
<td>0.791</td>
</tr>
<tr>
<td>Recycling</td>
<td>0.508**</td>
<td>0.258</td>
</tr>
<tr>
<td>Internal consumption</td>
<td>0.371**</td>
<td>0.137</td>
</tr>
<tr>
<td>Prolonged use</td>
<td>0.442**</td>
<td>0.196</td>
</tr>
</tbody>
</table>

Goodness-of-fit of the model:

- $\chi^2(9) = 35.73, p < 0.001$;
- NNFI = 0.94; CFI = 0.96;
- RMSEA = 0.10

Cronbach alpha: 0.76
Composite reliability: 0.77
Variances extracted: 0.38

Financial performance

Please rate the overall performance of your facility over the past three years relative to others in your industry on each of the following items.
Scale: 1 = Much worse, to 5 = Much better.


