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Linking environmental strategy to environmental performance: Mediation role of environmental management accounting

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Abstract

Purpose – This paper aims to test a conceptual framework that describes the relationship between environmental strategy, environmental management accounting and environmental performance. In this paper, the authors argue that environmental strategy can directly influence environmental performance through environmental management accounting.

Design/methodology/approach – This paper examines the survey responses of general managers, operations managers, financial managers and environmental managers in an ISO 14001 certified company listed on the Indonesia Stock Exchange. The hypotheses were tested using a consistent partial least squares approach and bias-corrected and accelerated bootstrap confidence intervals to test the significance between variables.

Findings – In general, the proposed framework obtains adequate goodness-of-fit statistics. Furthermore, the results support the argument that there is a positive and significant effect of environmental strategies on the environmental performance of companies and that the role of environmental management accounting can mediate their relationship.

Research limitations/implications – The limitations of this study relate to the small sample size, as environmental results are still regarded as confidential by many companies. A causal relationship cannot be confirmed for the results. The instrument used is fully adopted from previous research, without unidimensional re-testing. This study contributes to the natural resource-based view literature by responding to recent calls to test the combined effect of resources on environmental performance.

Practical implications – This result could serve as a specific reference for policymaking at firms to continuously improve their environmental performance. This study also has important implications for management practices by illustrating the potential of environmental strategies and environmental management accounting to improve environmental performance.

Social implications – This result indicates that the improving green accounting in Indonesia would appear to require more mandated pressure from, particularly, governmental powers.

Originality/value – This study contributes to the corporate environmental accounting literature by providing empirical evidence linking environmental strategy with environmental performance through the implementation of environmental management accounting.

Keywords ISO 14001, Environmental performance, Environmental management accounting, Environmental strategy

Paper type Research paper

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1. Introduction

Corporate social and environmental responsibility have been the focus of global and media attention in recent years, in part because of concerns about environmental hazards, such as climate change, greenhouse gas emissions and biodiversity degradation, and in part because companies' performance today is measured in terms of not only financial but also environmental performance (Schaltegger and Burritt, 2006; Parker, 2005; Schaltegger and Lüdeke-Freund, 2013). One consequence of this trend has been a strong desire among stakeholders to encourage managers to focus more on environmental issues and environmental performance evaluation (Bennett *et al.*, 2003; Burritt and Schaltegger, 2010; Rodrigue *et al.*, 2013). To achieve this goal, many companies have recently considered implementing a sustainable environmental strategy and using environmental management accounting (EMA) to improve their environmental performance (Burritt, 2005; Gunarathne and Lee, 2015; Lisi, 2015; Wagner and Schaltegger, 2004). However, to date, it is unclear whether a combination of these two practices can improve the environmental performance of a company as a whole. Given that the reporting of environmental performance in some countries remains voluntary, with a low level of disclosure particularly in developing countries (Clarkson *et al.*, 2008; He and Loftus, 2014), this issue urgently requires further exploration.

To fill this gap, this study aims to open this black box by testing the ability of a company that has been certified ISO 14001 in Indonesia to maintain and continuously improve its environmental performance. Specifically, this study aims to investigate the influence of environmental strategy on a company's environmental performance through the role of EMA. This study is driven by the fact that implementation of ISO 14001, the standard used by organizations to implement, maintain and improve their environmental management systems and disclose to other parties their compliance with the environmental management system standard, is still voluntary for Indonesian companies. Additionally, Indonesia is the largest country in Southeast Asia and has a complex geographical environment; the problem of deforestation there is serious according to a 2013 report from Indonesia's Ministry of Environment and Forestry. However, research in Southeast Asia and Indonesia is rare and reflects an empirical gap (Derchi *et al.*, 2015). This indicates that environmental issues in Indonesia are very important to study.

As stated by Pérez *et al.* (2007), the process of continuous and sustainable environmental improvement requires the involvement of corporate resources (intangible assets) including the following:

- employee awareness;
- employee knowledge;
- employee expertise and skills;
- manager commitment;
- coordination and communication among all related functions in the company;
- a planning process that integrates corporate strategy with environmental issues; and
- the use of management accounting practices.

The use of accounting practices requires the continuous involvement of management accountants in improving company performance through good corporate environmental strategy. A good corporate environmental strategy considers environmental information costs that are recognized as an environmental accounting development in conjunction with

the emergence of the idea of environmental friendliness (being green) (Ullmann, 1976; Burritt *et al.*, 2002). In general, managers of a company are working not just to reduce costs but also to minimize the environmental impact of the company's operations (Schaltegger *et al.*, 2003) [1]. These efforts aim to align the company's philosophy and mission to always be environmentally friendly (Rodrigue *et al.*, 2013). Additionally, the demand on the firm to maintain good environmental performance comes from other stakeholders, including the government, mass media, consumers, investors, employees, financiers and non-governmental organizations. Malmi and Brown (2008) assert that the cultural environment (such as social values and beliefs) is one of the key influences in regulating behavior, and this influence leads managers to focus on indicators of environmental performance.

Minimizing hazardous environmental impacts requires the availability of information related to the environmental costs associated with the company's operation. In developing countries, some companies accumulate, use and distribute information related to the natural environment, which is a fundamental change from several decades ago (Gray *et al.*, 2014; Schaltegger and Burritt, 2000; Burritt *et al.*, 2002). Organizations are beginning to implement environmental management systems with the purpose of continuously improving their environmental performance. Unfortunately, these systems were not accompanied by sufficient information to aid managers in their decision-making process, as it can be quite difficult to provide information related to different types of production and allocation of resources. Therefore, the information related to EMA should be modified; this can be done by modifying the conventional management accounting systems. Accounting for environmental management helps companies improve environmental benefits and achieve greater environmental responsibility (Jasch, 2009; Schaltegger and Burritt, 2000).

Larrinaga-Gonzalez and Bebbington (2001) indicate that when a company undertakes environmental management initiatives, it requires accounting functions to be more integrated with environmental strategies. Relatedly, EMA is used as part of an environmental management control system (EMCS) as a means to maintain or improve a company's competitive advantage (Ferreira *et al.*, 2010; Pondeville *et al.*, 2013), and implementing this strategy in a competitive environment is expected to improve the company's environmental performance. Referring to the theoretical framework of the natural resource-based view (NRBV) proposed by Hart (1995), Russo and Fouts (1997) and Clemens and Bakstran (2010), corporate strategy (especially environmental strategy) is a major predictor of companies' improving environmental performance by better allocating their resources. Thus, efforts to improve environmental performance should be conducted continuously and sustainably by mobilizing and using all of a company's resources (human, technical and financial). Although the current literature has described company resources from the NRBV perspective, several important issues have been overlooked. First, while the literature implicitly suggests that the combination of certain resources can contribute to environmental performance, little empirical evidence has been provided to support this argument. More importantly, little attention has been devoted to assessing companies' ability to improve their sustainability (Hart and Dowell, 2011).

Our study contributes to the current literature in several ways. First, this is the first study to examine the effect of environmental strategies on environmental performance considering the role of EMA in a single comprehensive model. Thus, this study answers the call by Christ and Burritt (2013) and Pondeville *et al.* (2013) for research that extends the testing role of EMA in the relationship between strategy and environmental performance. Although the studies of Christ and Burritt (2013) and Pondeville *et al.* (2013) have examined the role of contingency factors, context and strategies in influencing EMA, the models they tested were incomplete[2]. Second, this study reconciles the mixed evidence on the

relationship between environmental strategy and EMA for the Indonesian context, whereas previous studies provided inconsistent evidence. For example, Christ and Burritt (2013) found that environmental strategy is a strong predictor influencing EMA, whereas Ferreira *et al.* (2010) found no such relationship.

Third, this study extends the state-of-the-art research on environmental accounting by providing evidence from Indonesia. Based on our best knowledge, no study conducted in Indonesia has examined the role of EMA in the relationship between strategy and environmental performance at certified ISO 14001 companies. Because no empirical results are available from Indonesia on this relationship in the context of accounting, this study provides initial evidence of the importance of the strategy and of the use of EMA companies' environmental performance. Finally, it is important to conduct this study with experienced professionals, such as managers, who have greater responsibility for decision-making and environmental initiatives than others in the company.

The remainder of this paper proceeds as follows. The next section presents the literature review and hypothesis development, followed by the research design. Next, we present our empirical results. Finally, we discuss the results and the important implications of our study as well as its limitations.

2. Literature review and hypotheses development

An environmental management system allows a company to continuously manage, measure and improve its operating aspects to avoid a decline in its environmental performance. In addition to using EMA to implement an environmental management system, this study considers strategic variables; both types of factors are specific resources owned by the company to improve its environmental performance with the goal of gaining competitive advantages.

This approach is consistent with the empirical research conducted by Wagner and Schaltegger (2004), Wagner (2005), Ferreira *et al.* (2010), Christ and Burritt (2013) and Pondeville *et al.* (2013). A corporate orientation toward an environmental strategy (environmental shareholder value [ESV]) has significant positive correlations with environmental and economic performance (Henri and Journeault, 2010; Wagner and Schaltegger, 2004; Wagner, 2005; Journeault, 2016). One of the key determinants of this positive relationship is the corporate commitment to paying constant attention to the orientation of its environmental strategy. An environmental strategy will lead company policy toward applying an environmental management system, including the implementation of EMA (Ferreira *et al.*, 2010) with the aim of achieving sustainable environmental performance. Prior research further notes that any company with environmental concerns that views the environment as something more than a public charity will find EMA essential to continuously improving and approaching sustainable environmental performance (Ferreira *et al.*, 2010).

The pressures on companies as related to the importance of EMA is seen to be a gap in the accounting research, particularly in relation to the role of corporate environmental strategy (Clemens and Bakstran, 2010), which is used as a basis for environmental performance assessment using EMA. This observation is corroborated by Jones (2010) in a theoretical model of environmental accounting and environmental reporting where the relationship between industry and the environment is understood through a company policy that represents a long-term radical reorientation of the company's sustainability development. It is expected that environmental targets will be achieved with the application of a holistic accounting system, as existing systems are not sufficient.

2.1 Resource-based view of nature (natural resource-based view)

The theoretical framework of this study originated from Hart (1995), Klassen and McLaughlin (1996), Russo and Fouts (1997), Jones (2010) and Clemens and Bakstran (2010). Klassen and McLaughlin (1996) stated that the environmental management strategy influences environmental and financial performance. Research by Klassen and McLaughlin (1996) more specifically emphasized financial performance in the form of profits and market response being related to companies' efforts to implement sustainable environmental management through corporate environment-related activities. However, this relationship has not been described well in terms of how environmental activities act as mediators in the environmental management system. In addition, the present study refers to the theoretical framework of the resource-based view (RBV) and the NRBV; these theories make the following assertion (Hart 1995, p. 991):

> A company's strategy (we refer to environmental strategy) and competitive advantage (company's environmental performance) need to be rooted as based on capabilities that facilitate environmentally sustainable economic activity – a natural-resource-based view of the firm.

The association between a firm's capabilities and its competitive advantage has been thoroughly discussed in the literature. However, a study by Hart (1995) took this association a step further by introducing the concept of the NRBV, which posits that competitive advantage can be sustained only if the capabilities creating the advantages are supported by resources that are not easily duplicated by competitors. The NRBV consists of three interrelated strategies:

(1) pollution prevention;

(2) revamping the product; and

(3) sustainable development.

The NRBV and its three interrelated strategies provide an easy way to understand the environmental challenges faced by companies, especially as related to companies' environmental strategies. Several researchers have produced evidence through the lens of the theoretical RBV (Christmann, 2000; Darnall, 2006; Darnall and Edwards, 2006; Dowell *et al.*, 2000; Hart, 1995). These studies state that an effective environmental strategy could be valuable, rare and difficult to imitate if resources or capabilities that are not replaceable can generate a sustainable competitive advantage (Hart, 1995; Hart and Dowell, 2011; Klassen and Whybark, 1999). Hart and Dowell (2011) re-evaluated NRBV theory based on existing empirical research and concluded that most of Hart's propositions (1995) were supported. Nevertheless, there has been no further exploration of how the combination of a company's resources influences environmental performance. Therefore, this study uses the NRBV lens as a theoretical basis for explaining the effect of strategy on a company's environmental performance considering the role of EMA (Aragon-Correa *et al.*, 2008; Christ and Burritt, 2013; Journeault, 2016).

Furthermore, if the improvement in environmental performance is directed toward a company's reputation, this will indirectly increase the company's ability to manage its resources. An improved reputation means that the combination of resources and capabilities across all different parts of the company will be more profitable (Ensign, 2004). Sharma and Vredenburg (1998) stated that firm-specific capabilities could be cost reduction, improved operations, better product quality, product differentiation, improved employee morale and improved company reputation. Based on the above explanation of the theories, and associating these explanations with the relationship between the variables in this study, the NRBV would direct corporate environmental strategy toward the use of EMA and

thereby affect environmental performance. As described by Verbeke *et al.* (2006), based on the typology proposed by Hart (1995), environmental strategies will affect a company's capability as represented by the use of EMA.

Adherence to strategic environmental rules for preventing pollution and other environmental impacts will direct the company to ceaselessly seek a systematic approach that emphasizes the reduction of resources (Hart, 1995; Hart and Dowell, 2011). This NRBV tends to differentiate the resources used by the company from those of other companies; this resource use will affect the company's environmental performance and ultimately improve its financial performance (Russo and Fouts, 1997).

2.2 Environmental strategy and environmental performance

A company with an environmental strategy that is oriented toward ESV achieves better environmental performance than a company that lacks such orientation (Wagner and Schaltegger, 2004). A company's desire to disclose its environmental performance demonstrates commitment to its environmental strategy. Companies want to make a voluntary pact to comply with environmental standards. The attention given by management to environmental issues will affect the company's ability to establish a proactive environmental strategy (Hart and Dowell, 2011). An orientation toward proactive strategies that lead to improvement in a company's environmental performance must move beyond mere compliance with existing regulations (Rodrigue *et al.*, 2013). Good environmental performance results from a good corporate environmental strategy. A company should continue to document and develop environmental performance indicators to address existing environmental issues (Rodrigue *et al.*, 2013).

Most companies focus on environmental strategies such as eco-efficiency, pollution prevention, product development and corporate social responsibility, which are challenging issues. Firms' strategic initiatives for a sustainable environment are sometimes not sufficient to allow them to develop a strategy that can actually solve social and environmental problems (Hart and Dowell, 2011). How a company implements its environmental strategy will be apparent in its environmental performance (use of environmental performance indicators), and the environmental performance assessment process shows the importance of a proactive corporate environmental strategy (Clemens and Bakstran, 2010; Hart, 1995; Rodrigue *et al.*, 2013).

Improvement in companies' environmental strategies supports the use of indicators to ensure environmental performance in the long term. The results of the previous studies indicate that environmental performance indicators will interact with a company's environmental strategy through the process of evaluating environmental performance (Rodrigue *et al.*, 2013). Companies can improve their environmental performance based on stakeholder decisions, and thus, stakeholders are able to indirectly manage the company's environmental performance. The stakeholders and the company can work together to improve the environment, and thereby to achieve the common goal of meeting the company's objectives through its environmental strategy. Stakeholders should be encouraged to assess environmental strategy and environmental performance by selecting environmental performance indicators (Lisi, 2015; Rodrigue *et al.*, 2013). Research by Henri and Journeault (2010) and Journeault (2016) explains that an organization's strategic planning environment, as part of the eco-control package within its environmental capabilities, can improve environmental performance, which will ultimately also improve economic performance. Considering the above discussion, the following hypothesis can be derived:

H1. There is a positive association between environmental strategies and environmental performance.

2.3 Environmental strategy and the use of environmental management accounting

Demand that companies be aware of sustainability issues and the importance of environmental information continues to increase (Hopwood, 2009; Bouten and Hoozée, 2013). Every company today finds it essential to have a proactive and continuously developing an environmental strategy, an environmental information system and an EMCS. The use of EMA in a company is affected by the company's environmental strategy, which would be part of its business strategy. The EMCS ensures that managers use the available resources effectively and efficiently to promote environmental performance (Pondeville *et al.*, 2013). Thus, an EMCS is designed to meet the need of companies to achieve sustainable environmental performance (Derchi *et al.*, 2015; Journeault, 2016; Simons, 1995).

Companies expect that they will be allowed to change their reporting and accounting practices under certain conditions (Bouten and Hoozée, 2013). Environmental accounting is considered to be a form of innovation (de Beer and Friend, 2006) that emphasizes a variety of standard procedures and practices to maximize the effectiveness of environmental management. Pérez *et al.* (2007) indicated that there are two types of intangible assets considered in the process of continuous improvement:

(1) the integration of environmental issues into strategic planning processes; and

(2) the use of management accounting practices.

The greater the synergy between the two is, the more likely that the environmental management system will generate intangible assets that will improve the company's environmental performance. Gosselin (1997) concluded that the types of strategy chosen by the company determine the need for innovation related to management activities and observed that those who are pursuing strategies tend to adopt accounting innovations.

The argument above aligns with the environmental accounting and reporting perspective proposed by Jones (2010), and the relationship between industry and the environment is reflected in the long-term radical company strategy known as sustainable development, as current conventional accounting alone is not sufficient and a new, holistic view of accounting is needed. The adoption of EMA is expected to meet this need. Some studies find that environmental uncertainty in the natural environment is sufficient to affect the environmental strategy and accounting practices within an organization (Lewis and Harvey, 2001). Chang and Deegan (2010) found that there were changes in environmental strategies that could encourage the management accounting system to provide information and reduce environmental uncertainty. This has driven the relationship between environmental strategy (how the company fulfills its commitment to the environment) and the adoption of EMA, as well as the role of EMCS in support of this strategy. Christ and Burritt (2013) showed that the environmental strategy is a contingency variable that significantly affects the adoption of EMA. From the above discussion, the following hypothesis can be derived:

H2. There is a positive association between environmental strategies and the use of environmental management accounting.

2.4 Environmental management accounting and environmental performance

Pérez *et al.* (2007) stated that there are two key intangible assets in the context of continuous environmental improvement analysis:

(1) the integration of environmental issues in the strategic planning process; and

(2) the use of management accounting practices.

These key assets contribute to the improvement of companies' environmental performance in line with the RBV proposed by Russo and Fouts (1997) and the typology of strategies introduced by Hart (1995). Perego and Hartmann (2005) argued that the relationship between environmental strategy and the use of an environmental performance measurement system is not direct but rather is mediated by the multiple attributes of EMCSs and the scarcity of measurement systems (Lisi, 2015).

A concept developed by de Beer and Friend (2006) emphasized the importance of the environmental accounting system in evaluating two different aspects:

(1) current environmental project alternatives; and

(2) a company's future environmental and economic performance.

Accounting for environmental management helps companies work toward achieving potential environmental benefits and understanding their responsibilities (Derchi *et al.*, 2015; Schaltegger and Burritt, 2000) so that they can derive a method for applying financial controls and environmental management strategies, such as special applications in EMCS. Controls help organizations measure, control and disclose environmental performance. Previous studies by Aragon-Correa *et al.* (2008), Henri and Journeault (2010) and Journeault (2016) showed that eco-efficient practices are positively related to firm performance. The more sophisticated the use of management accounting practices (in this case, the EMA) is, the better the control and decision-making process is and the more solid the impact of EMCS on the company's environmental performance will be. Based on the arguments above, the following hypothesis is proposed:

H3. There is a positive association between the use of EMA and environmental performance.

Figure 1 depicts the relationship to be tested between environmental strategies, the use of EMA and environmental performance.

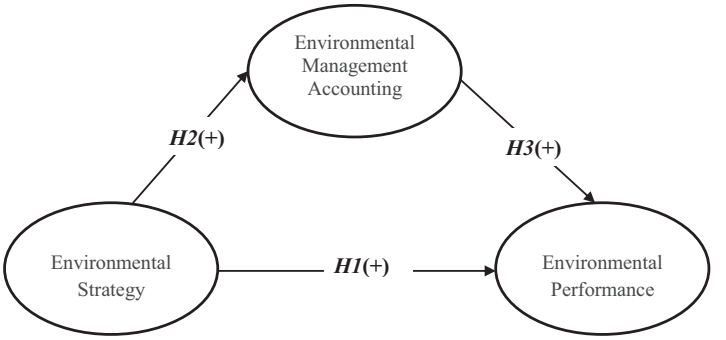

Figure 1.
Conceptual model of research

3. Research method

This study was conducted using a quantitative approach (a questionnaire survey), as this allows the researchers to obtain comprehensive information on a population and determine the effect of one variable on another. The study aims to test the hypothesis that the associative form generates accurate data based on empirical phenomena that can be measured and to test for the presence of doubt as related to the validity of knowledge and theory through theoretical testing, building or constructing facts and data, statistical description, clarity and predictive relationships.

3.1 Sample selection and data collection

The sample in this research comprises ISO 14001-certified companies holding the minimum certification by the end of 2013. We chose ISO 14001-certified companies with the reasoning that they are more concerned than other companies about environmental issues and are likely to have a strong commitment to environmental responsibility. The respondents in this study are the general manager, operations manager, financial manager and environmental manager at the sample firms. As outlined in previous studies examining strategy and the environment (Christmann, 2000; Sharma, 2000), we selected respondents at the managerial level because the information made available on a company's environmental performance measurement system is expected to be comprehensively useful at that level, as managers need it to carry out their responsibilities and duties in their area of responsibility (Aragon-Correa *et al.*, 2008).

Before the field survey was conducted, pre-test questionnaires were distributed to teaching staff on the economics faculties of public and private universities located in Semarang, Indonesia, who were willing to participate. Teachers were chosen as they could be assumed to be able to understand and provide input related to the developed instruments, and as a result, they could help us develop questionnaires that would be easily understood by the respondents. Based on the results of this review, the authors made several revisions to the wording of the questions. There are 265 companies surveyed in this study, which includes all the Indonesian ISO 14001-certified companies. The process of data collection was conducted over a period of four months (between April 2013 and July 2013). Data were collected by hard and soft copy (company e-mail) so that the researchers could obtain answers to the questions through multiple channels. When the specified deadline arrived, 50 responses had been collected by mail and e-mail. Because this number was still far from the expected number of responses, the authors extended the data collection period until October 2013. The final results of the data collection included only 18 additional copies for 68 responses representing 68 companies – a 25.6 per cent response rate.

The respondents for this study came from different industries; the sample was dominated by construction (25 per cent of the respondents), followed by manufacturing (21 per cent), mining (19 per cent) and electronics (12 per cent). The remaining respondents came from other industries, such as agriculture, forestry, chemicals, petrochemical, cement, automotive, textiles, pulp and paper and business. There are thirteen different industries represented by the respondents, indicating that different types of industries have implemented environmental management systems and EMA. The results of a *t*-test showed that there were no statistically significant differences in the responses ($p < 0.05$) by type of industry and no social desirability response bias concern (Randall and Fernandes, 2013)[3]. These findings indicate that the type of industry will not affect the results of the analysis and that there are no issues of social desirability response bias in the respondents' reporting on environmental performance; we also used the Wilcoxon test for comparison. Additionally, the statistical test results showed that there was no significant difference

between the responses of the initial 18 respondents and the 18 late respondents[4], which means that non-response bias does not affect the systematic results (Dillman *et al.*, 2014). We also conducted testing for common method bias (Podsakoff *et al.*, 2003) using a full collinearity approach (Kock, 2015). The analysis obtained the value AFVIF < 3.3, indicating that no common bias problems existed.

3.2 Instruments

The instrument used to measure each of the variables in this study consisted of three parts. [5] The first section described the purpose and objectives of this research and asked whether the respondents were willing to participate in the survey. The second section captured the respondents' demographic information. The third section presented questions related to each of the variables to be studied. The instrument used was adopted from previous studies with proven reasoning and did not need to be retested. Each construct in this study was measured using reflective indicators.

3.2.1 Environmental performance. Environmental performance is defined as "an overview of the use of operational performance indicators that evaluate the use of resources, waste disposal, emissions or water consumption" (Nawrocka and Parker, 2009). These aspects are easily measured in the short-term; however, others are more difficult to quantify, such as internal social benefits and impact on stakeholders. Based on several environmental performance measurements adopted by Henri and Journeault (2008), the respondents were asked questions regarding the use of environmental performance indicators using an instrument developed as part of the ISO 14031 standard. The instrument consists of 13 items in three different categories using a seven-point Likert scale. Table I (Panel A) shows the indicators and outcome measurement model for this variable.

In addition to relying on the self-declared environmental performance measure, we also consider the external measures of environmental performance, such as the PROPER ranking [6]. The Corporate Performance Rating Program (PROPER) is a program used by the Indonesian Ministry of the Environment together with the Environment Agency and the judge of the province to monitor and assess a given company's environmental performance. By the end of December 2013, PROPER membership reached 1.812 (including 20 under a special monitoring program), and over the past two years (as outlined in Table II), the number of participating companies increased by 36.07 per cent (475 companies compared to the previous period in 2012). Likewise, when the past five years is viewed in Table II, the increase PROPER membership is very significant, at approximately 200 per cent. This indicates that efforts to improve sustainability and raise environmental awareness in business have increased.

PROPER's members are rated on a scale of 5 (five) colors ranging from the highest, gold, down to green, blue, red and black. Gold and green ratings are given to companies that go beyond mere compliance and include three criteria:

(1) implementing environmental management systems (ISO 14001);

(2) using resources; and

(3) implementing community development (community development).

Criteria measuring companies' compliance with environmental regulations are used for the blue, red and black rankings.

The Ministry of Environment's 2012 report states that the number of companies receiving a gold rating increased sharply that year, increasing by 140 per cent compared to 2011 (albeit from 5 to 12 companies), while the green rating increased by 7 per cent (106 to

Indicators/Items	Code	FL[a]	AVE	rho_A
Panel A. Environmental Performance				
Compliance with the requirements or expectations of standard	KLP1	0.781		
Energy input	KLP2	0.865		
Relationship with the community	KLP3	0.854		
The solid waste output	KLP4	0.759		
Output of air emissions	KLP5	0.732		
Financial impact	KLP6	0.822		
Maintenance for the installation, operation, facilities and facilities for physical equipment	KLP7	0.761	0.631	0.961
Liquid waste output	KLP8	0.782		
Raw materials input	KLP9	0.669		
Water input	KLP10	00.739		
Implementation of environmental policies and programs	KLP11	00.825		
Input auxiliary materials	KLP12	00.869		
The indicators provide information about the environmental conditions locally, regionally and nationally	KLP13	00.841		
Panel B. Environmental Strategy				
Orientation of history, in the form of questions about the history of the implementation of environmental programs	SLP1	0.734		
ISO Certification	SLP2	0.709		
Investment in research and development environments	SLP3	0.637		
Long-term commitment to the environment	SLP4	0.792	0.590	0.906
Level reporting structure	SLP5	0.776		
Performance indicators, identified four main categories of air, waste, water and energy	SLP6	0.828		
Relative performance	SLP7	00.848		
Environmental awards	SLP8	00.797		

Note: [a]FL is factor loading

Table I. Construct indicators and measurement model of CEP and CES

Period	No. of participants	Growth	(%)
2002-2003	85		
2003-2004	251	166	195.29
2004-2005	466	215	85.66
2006-2007	519	53	11.37
2008-2009	627	108	20.81
2009-2010	690	63	10.05
2010-2011	1,002	312	45.22
2011-2012	1,317	315	31.44
2012-2013	1,812	475	36.07

Source: Ministry of Environment (2013), processed by the authors

Table II. PROPER's membership between December 2002 and 2013

113 companies). Although the growth of the gold rating was significant, the number of participants with gold and green ratings remains relatively low (Figure 2) and shows a decreasing trend (from 11.08 per cent in 2011 to 9.95 per cent in 2012 to 6.90 per cent in 2013). Additionally, a majority of PROPER's membership (88.92 per cent in 2011; 90.05 per cent in 2012; and 93.10 per cent in 2013) have blue, red and black ratings as an environmental

management parameter (as outlined in Figure 2); these ratings reflect that companies that have implemented ISO 14001 have not maintained their commitment to continuously improve their environmental performance[7]. Without this commitment, it is possible for certified companies to pollute the environment within the period of certification, a concern that clearly exists given the number of ISO 14001-certified companies with below green – namely, blue, red and black (Ministry of Environment 2011).

3.2.2 Environmental strategy. Environmental strategy is a:

> Set of initiatives that can reduce the impact of activities on the natural environment through a company's products, processes and policies, such as reducing energy consumption and waste, using sustainable ecological resources, and implementing environmental management systems (Bansal and Roth, 2000).

Considering the dimensions of the potential environmental measurements that show the concept of strategy to construct a multi-dimensional environment, as developed by Walls and Berrone (2008), the six potential corporate environments were historical orientation, issue formation, corporate philanthropy, managerial vision, top management ability and human resources. The instrument consisted of eight items representing six potential environmental considerations using a seven-point Likert scale. Table I (Panel B) shows the indicators and outcome measurement model for this variable.

3.2.3 Use of environmental management accounting. EMA is a "technique to improve, analyze and use both financial and non-financial information, with the aim of improving a company's environmental and economic performance and contributing to sustainable business" (Bennett *et al.*, 2003; Deegan, 2003). Our construct related to the use of EMA consisted of 12 items adapted from the measurement constructs proposed by Ferreira *et al.* (2010) to reflect EMA activities. Some items focused more on the monetary aspects. Other research on EMA places more emphasis on the physical aspects, as proposed by Burritt *et al.* (2002). Questions posed to the respondents included the following: "Please indicate the extent to which your company has done each of the following in the last three years", on a seven-point Likert scale with the three options "do not do it at all", "has been done to a certain extent" and "has been done most of the time". From the analysis of the measurement model for all the variables, the value of the loading factor > 0.60, while composite reliability/rho_$A > 0.70$ and average variance extracted (AVE) > 0.50; therefore, the model fulfills the recommended requirements (Hair *et al.*, 2017; Latan and Ghozali, 2015; Latan and Noonan, 2017). Table III shows the indicators and outcome measurement model for this variable.

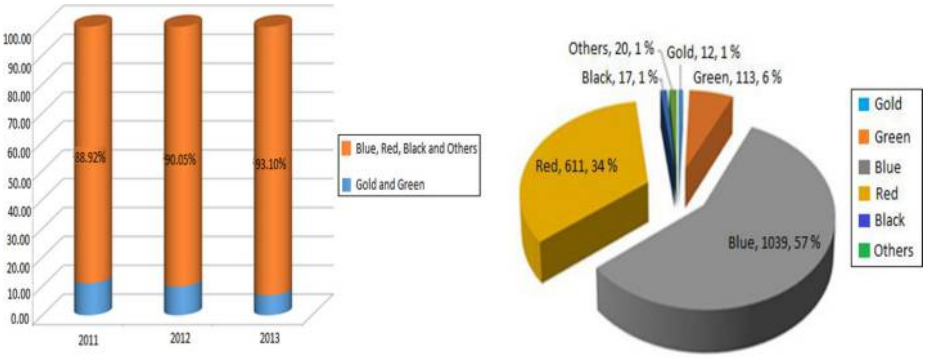

Figure 2.
The development and composition of PROPER ranking (December 2011-2013)

Indicators/Items	Code	FL[a]	AVE	rho_A
C. Environmental Management Accounting				
Identification of environmental costs	AML1	0.813		
Estimated contingent liabilities relating to the environment	AML2	0.867		
Classification of environmental costs	AML3	0.765		
Allocation of environmental costs associated with the production process	AML4	0.673		
Allocation of environmental costs associated with the product	AML5	0.814		
The introduction or improvement of the environment associated with the management costs	AML6	0.825	0.588	0.939
The manufacture and use of environmental cost accounts	AML7	0.825		
Development and use of key performance indicators relating to the environment	AML8	0.769		
Product life cycle cost assessment	AML9	00.800		
Analysis of product inventory	AML10	00.685		
Analysis of the impact of the product	AML11	00.665		
Analysis of product improvement	AML12	00.665		

Note: [a] FL is factor loading

Table III. Construct indicators and measurement model of EMA

Additionally, we tested the discriminant validity for all of the variables in the model. Table IV shows the results of the discriminant validity (divergent) testing using the Fornell–Larcker criterion and the heterotrait–monotrait ratio (HTMT). From the analysis above, it can be seen that the square root of the AVE on the diagonal lines is greater than the correlation between the constructs in the model, which means that all of the variables in this research model possess discriminant validity. We also tested the discriminant validity using HTMT, and the results in the table show that the value of HTMT is less than 0.90, which means that it fulfills the recommended requirements (Hair *et al.*, 2017; Latan and Noonan, 2017).

3.3 Data analysis

In this study, data analysis and hypothesis testing were conducted using variance-based structural equation modeling (SEM). One of the techniques available today is partial least squares (PLS)-SEM, which, as the most fully developed technique, has become a vital tool allowing researchers to examine various issues in social science. PLS-SEM was developed with the main purpose of prediction and then extended to test theory with consistent results

Construct	Mean	SD	1	2	3
Environmental Performance	55.18	00.920	*00.794*	00.708	00.636
Environmental Strategy	55.66	00.811	00.688*	*00.768*	00.650
Environmental Management Accounting	44.97	10.070	00.612*	00.608*	*00.767*

Notes: * Correlation is significant at the 0.05 level (2-tailed); Diagonal and italicized elements are the square roots of the AVE; Below the diagonal elements are the correlations between the construct values;. Above the diagonal elements are the HTMT values.

Table IV. Correlations and discriminant validity results

for factor models. We chose to use the consistent partial least squares (PLSc) approach (on selection algorithms and bootstrapping) because it will provide similar results to covariance-based SEM[8]. Until now, few studies have used PLSc. However, PLSc is a new algorithm in PLS-SEM that makes the PLS-SEM results more accurate. As stated by Aguirre-Urreta and Rönkkö (2018), PLSc is the best option for use in the PLS-SEM for common factor models.

Before we analyzed the overall model, we ensured the adequacy of the sample size for the estimation of the model[9]. Because the data analysis in this study used the PLSc approach, the sample had to be sufficiently large (Latan and Ghozali, 2015; Latan *et al.*, 2017). The main purpose of PLSc is to mimic the covariance-based SEM approach to test or confirm theory (Dijkstra and Henseler, 2015). Previous research in this area has already used PLS-SEM as an analytical tool (Ferreira *et al.*, 2010; Lisi, 2015; Pondeville *et al.*, 2013). In contrast to other SEM techniques, PLS does not rely on the assumption of normality (distribution-free) because it is non-parametric. However, some assumptions, such as multicollinearity and goodness of fit, must be considered for the local model assessment. We used the SmartPLS 3 program (Ringle *et al.*, 2015) to analyze these models through PLSc.

4. Results

We used a two-step approach to test the models: the measurement model and the structural model. The assessment of the measurement model is intended to test the validity (convergent and discriminant) and reliability of each indicator forming latent constructs (see Figure 3). After ensuring that all of the indicator constructs were valid and reliable, we continued to the second stage of assessing the quality of the structural model and testing the hypotheses. The results of the quality assessment for the structural model are presented in Table V.

In Table V, it can be seen that environmental performance can be explained by the predictor variables (strategy and EMA) of 0.518. This value indicates that the predictors are approaching a sufficiently substantial explanation (Latan and Ghozali, 2015). The resulting

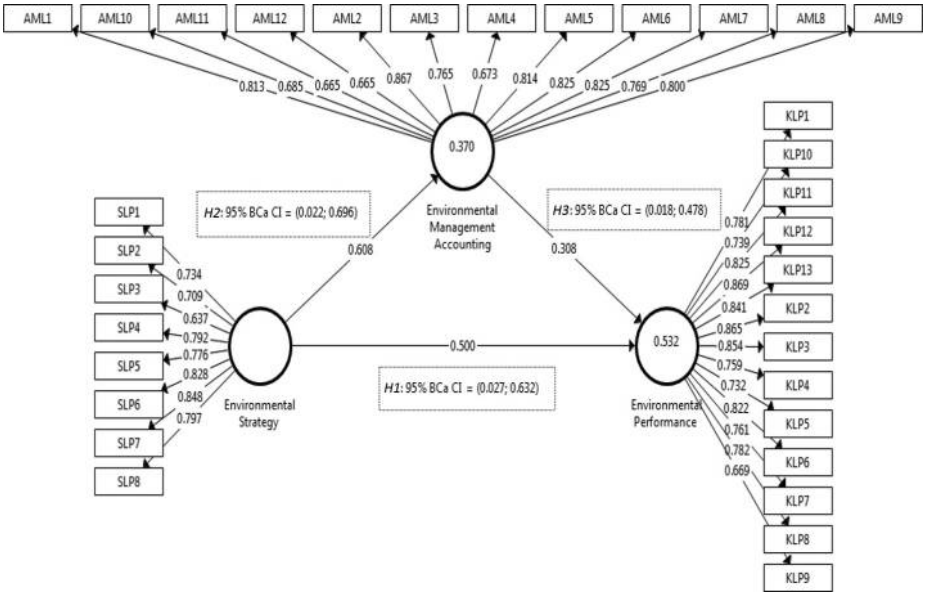

Figure 3.
Evaluation of the measurement and structural model

effect size value of each predictor variable in the models ranges from 0.128 to 0.588, which is in the category of medium to large effects. The value of the variance inflation factor (VIF) generated for all of the independent variables in the model is <3.3, which means that there is no collinearity issue between the predictor variables. The Q^2 predictive relevance value generates excellent endogenous variables, i.e., >0, which means that the model has predictive relevance. The value of goodness of fit that is generated through the standardized root mean squared residual (SRMR) is equal to 0.074<0.080, and the normed fix index (NFI) 0.832 > 0.80, which means that our model fits the empirical data. However, this NFI value is sufficient for PLS-SEM testing. Hair *et al.* (2017, p. 193) states that when using PLS-SEM, it is important to recognize that the term "fit" has a different meaning in the context of covariance-based SEM (CB-SEM) and PLS-SEM.[AQ3] Thus, the threshold is likely too low for PLS-SEM. This is because the discrepancy between the observed correlations and the model-implied correlations plays different roles in CB-SEM and PLS-SEM.

4.1 Hypotheses testing

We tested the hypotheses with a view toward the coefficient parameter and the significant value generated from the 95 per cent bias-corrected confidence intervals of each independent variable[10]. As shown in Table VI, all of the path coefficients provide significant value (at the $p = 0.05$ level). [11]Based on the analysis, Table VI shows that environmental strategies have a significant positive effect on companies' environmental performance. From the analysis results, we found that the value of the coefficient (β) for the relationship CES → CEP is 0.500 with a p-value < 0.01. This means that *H1* (*H1*) is supported. These results support those of previous studies (Henri and Journeault, 2010; Journeault, 2016; Lisi, 2015; Rodrigue *et al.*, 2013; Wagner and Schaltegger, 2004).

Furthermore, it can be seen that the value of the coefficient (β) to the relationship CES → EMA is 0.608 and EMA → CEP is 0.308 with a p-value < 0.01. This means that *H2* and *H3* are fully supported. We also tested the indirect effect to determine the mediating role of EMA (Gerdin and Greve, 2004; Hayes, 2013) using the method proposed by Cepeda *et al.* (2018) and obtained the same results.[12] The analysis showed that an indirect effect of < 0.05 is obtained, which means that the EMA acts as a mediator on the relationship between environmental strategy and environmental performance. These results support those of

Constructs	Adjusted R^2	f^2	Q^2	VIF	SRMR	NFI	AFVIF
Environmental strategy	–	0.337 – 0.588	–	1.588	–	–	–
Environmental management accounting	0.361	0.128	0.357	1.588	–	–	–
Environmental performance	0.518	–	0.511	–	0.074	0.832	1.392

Table V. Structural model results

Structural path	Coefficient (β)	SD	p-Values	95% Bias-corrected and accelerated, confidence interval	Conclusion
CES → CEP	0.500	0.097	0.000**	(0.027, 0.632)*	*H1* supported
CES → EMA	0.608	0.072	0.000**	(0.022, 0.696)*	*H2* supported
EMA → CEP	0.308	0.095	0.001**	(0.018, 0.478)*	*H3* supported

Note: *,** statistically significant at the 5% and 1 % levels, respectively

Table VI. Relationships between variables (direct effect)

previous studies (Aragon-Correa *et al.*, 2008; Christ and Burritt, 2013; Journeault, 2016; Pondeville *et al.*, 2013). This shows that EMA may offer complementary partial mediation of the relationship between strategy and environmental performance (Cepeda *et al.*, 2018).

4.2 Additional analyses

To validate and ensure the robustness of the results of the main model, two additional analyses were performed. First, we compared each company's PROPER rating with the respondents' perception of their environmental performance using independent-sample *t*-test and correlation matrix. The results showed that there was no significant difference (p 0.142 > 0.05) between the PROPER ratings and the respondents' perception of environmental performance, which means that the results of the main model have good robustness (see Table VII). This finding confirmed that there are no systematic biases that interfere with this result for two measures of environmental performance (Cho *et al.*, 2012). Second, to test the influence of extraneous variables, such as company size (measured by four categories of employees, i.e., 10-29, 30-49, 50-99 and > 100), industry type (measured by a dummy variable of 1 for companies that are more sensitive to the environment such as mining and resources, chemicals, oil, gas and consumable fuels, and 0 otherwise) and organizational structure (measured by a dummy variable that is 1 for organizational structure with environmental vision, and 0 otherwise), we ran a multi-group analysis (PLS-MGA). The purpose of the PLS-MGA was to compare two groups of samples to determine statistically significant differences. Before running the PLS-MGA, we considered using it to test the measurement invariance of composite models (MICOM) using a permutation procedure.[13] Testing measurement invariance ensures that the specific-group differences of the estimation model do not affect the results for latent variables in the entire group (Henseler *et al.*, 2016). From the analysis, it can be concluded that there is no difference in the variance and average values between the groups. The results further show that there are no significant differences (p > 0.05) in company size, industry type and organizational structure (see Table VIII). This finding means that extraneous variables did not affect the results of the analysis of the main models for the ISO 14001-certified companies.

4.3 Importance–performance map analysis

We next conducted an importance–performance map analysis (IPMA) to determine the important predictor variables in the model. Ringle and Sarstedt (2016) stated that the IPMA gives researchers the opportunity to enrich their PLS-SEM analysis and, thereby, to gain additional results and findings. Nevertheless, PLS-SEM provides advantages in IPMA analysis, such as by testing the relationships between multiple variables, and can be used for latent variables (Streukens *et al.*, 2018). The IPMA analysis results are shown in Table IX below.

t-Test for equality of means	Variables	1	2	3	4	5	6
PROPER ↔ CEP $^{n.s}$	PROPER	1					
Levene's test = 0.109	CES	00.584*	1				
Significant difference = 0.142	EMA	00.712*	00.679*	1			
	SIZE	00.138	00.252	00.738*	1		
	TYPE	00.468*	00.492*	0.102	00.124	1	
	STRUCTURE	00.537*	00.581*	00.445*	00.178	00.203	1

Table VII.
Robustness test

Notes: n.s., not significant, * Correlation is significant at the 0.05 level (2-tailed)

From the above analysis (Table IX), it can be seen that environmental strategy has a relatively low performance equal to 56.97. If matched to other constructs, environmental strategy is slightly below average. On the other hand, with a total effect of 0.80, this construct's importance is high. Therefore, a one-unit increase in environmental strategy from 56.97 to 57.97 would increase environmental performance by 0.80 points. Therefore, when the company aims to improve the environmental performance, their first priority must be to improve the performance of their environmental strategy. Furthermore, aspects related to EMA follow as the second priority. Therefore, this study concludes that EMA plays an important role in improving current environmental performance compared with the environmental strategy.

4.4 Discussion

H1 stated that a company's environmental strategy has a positive influence on its environmental performance; given the empirical evidence, it can be concluded that *H1* is supported. These results provide support for the NRBV theory proposed by Hart (1995) and Hart and Dowell (2011), who determined that a company's strategy will improve its environmental performance. This study is in line with research by Aragon-Correa *et al.* (2008) that proves that a proactive environmental strategy has a positive and significant relationship with a company's financial performance and the performance of competing companies. Henri and Journeault (2010), Journeault (2016), Lisi (2015) and Wagner and Schaltegger (2004) also produced empirical evidence of the influence of environmental strategy, finding that it has a positive and significant impact on corporate performance, both environmental and economic. The study also finds value when a company's environmental strategy helps to identify the effect of environmental activities and strategies on environmental performance through the creation of shareholder value. As stated by Rodrigue *et al.* (2013), an orientation toward a proactive strategy that leads to improvement in environmental performance requires more than mere compliance with existing regulations. Thus, companies must continue to document and develop environmental performance indicators to address existing environmental issues. Environmental performance indicators should be taken from the company's environmental strategy, so an appropriate environmental strategy will determine the success of a company's

Structural path	PLS-MGA	95% Bias-corrected and accelerated, confidence interval Permutation	MICOM	Equal variances	Conclusion
CES → CEP	$0.083^{n.s}$	$0.119^{n.s}$	$(-0.042; -0.106)^{n.s}$	Yes	No different
CES → EMA	$0.138^{n.s}$	$0.124^{n.s}$	$(-0.053; -0.185)^{n.s}$	Yes	No different
EMA → CEP	$0.267^{n.s}$	$0.259^{n.s}$	$(-0.178; -0.109)^{n.s}$	Yes	No different

Note: n.s.; not significant

Table VIII. PLS-MGA results

Constructs	Importance	Performance
Environmental Management Accounting	0.27	59.40
Environmental Strategy	0.80	56.97

Table IX. The IPMA for construct environmental performance

environmental performance. In the Indonesian context, this finding can serve as a guideline to help ISO 14001-certified companies to improve their environmental strategy and achieve sustainable environmental performance.

H2 states that a company's environmental strategy has a positive influence on the use of EMA. The findings provide significant support for this hypothesis: the use of EMA is influenced by the environmental strategy applied in the company. The more that corporate strategy focuses on the environment, the more influence this will have on the use of EMA. Indonesian ISO 14001-certified companies that have implemented an environmental management system choose to use EMA as a tool to achieve their strategic objectives (Ferreira *et al.*, 2010). In this context, ISO 14001-certified companies in Indonesia are beginning to realize the importance of using EMA to support the provision of information to managers. Given the adoption of an environmental strategy to address uncertainty, the use of EMA can be very useful in helping achieve the company's environmental objectives. A company business strategy that supports environmental performance will apply management initiatives, one of which would be the use of EMA in the context of decision-making to create efficient and effective environmental management. The results of this study are consistent with the theory of environmental accounting and reporting proposed by Jones (2010), Lewis and Harvey (2001) and Chang and Deegan (2010); this theory explains that the uncertainty of the environment is sufficient to influence environmental strategy and accounting practices within an organization, so that changes in environmental strategy will cause modifications to support management accounting systems and allow them to continue to provide information and reduce environmental uncertainty.

H3 states that the use of EMA has a positive effect on companies' environmental performance, and it is also empirically supported. The results of this analysis indicate that a company's environmental performance is affected by the frequency of EMA use. The more frequently EMA is used in the company, the better that company's corporate environmental performance will be. This finding is in line with previous research by Aragon-Correa *et al.* (2008) and Journeault (2016). It is found that eco-efficient practices are positively related to firm performance. The more sophisticated the use of management accounting practices (in this case, EMA) is, the better the company's control and decision-making process and the more concrete an impact will the environmental management system have on the company's environmental performance (Hart and Dowell, 2011; Pondeville *et al.*, 2013). This finding has important implications for ISO 14001-certified companies in Indonesia: the use of EMAs is a key factor for improving their company's environmental performance and bridging current environmental strategies. EMA will allow any decision made by managers related to the environment to be more accurate and efficient, so there is no waste of resources or inefficient prevention of environmental pollution. This finding is in line with the NRBV theory and its three strategies for improving a company's ongoing capabilities and performance.

This study contributes to the NRBV literature by responding to recent calls to test the combined effect of resources on environmental performance and to identify what triggers the development of this capability (Hart and Dowell, 2011). This study provides empirical evidence that environmental strategy is a mechanism that can be used by companies to support the development of EMA, which, in turn, can affect their environmental performance. This study also has important implications for management practices because it illustrates the potential of environmental strategies and EMA to improve environmental performance. Strategically, it is important for managers to promote environmentally friendly ideas such as sustainable environmental innovation, green products and waste management, which in turn contribute to environmental performance. Thus, it is urgent for

managers to adopt such practices, as they can represent solutions to the economic and environmental challenges of a company.

5. Conclusion

The use of EMA as an intangible asset has benefited companies by providing information on their operational activities, especially as related to the environment and the results of good environmental performance. Several studies have examined the benefits of good EMA. In this paper, we argue that environmental strategies can influence a company's environmental performance through the role of EMA. The findings confirm our predictions.

We find support for the hypothesis that environmental strategies can affect environmental performance both directly and indirectly through the use of EMA. The empirical evidence shows that there is a positive and significant influence between environmental strategy and the use of EMA, which, in turn, can improve companies' environmental performance. The PLS analysis results provide a strong argument that intangible assets, such as a company's environmental strategy and use of accounting practices, particularly EMA, improve its environmental performance. In terms of practical implications, these findings provide a deep understanding of how certified ISO 14001 companies in Indonesia improve their environmental performance by implementing a good environmental strategy and using EMA. This result could be used as a specific reference for company policy making to continuously improve environmental performance. These findings suggest that public and business policies should specifically emphasize the implementation of environmental strategies to encourage the integration of environmental issues into decision-making and process control. This research also has practical implications for accounting and environmental managers and for top management in general, suggesting that managers should adopt environmental initiatives if they want to focus on environmental issues in their companies.

There are several limitations to this study that should be considered. First, this study used a relatively small sample: many companies are reluctant to provide information related to environmental performance, as most companies treat this information as "confidential". Information related to strategy, the use of EMA and environmental performance is thus not publicly known. The low response rate supports this notion, although the companies contacted in this study were all ISO 14001-certified companies that had achieved environmental management system standards. Second, this study only considers the strategic factors affecting companies' environmental performance, without examining the other factors, such as the context (Pondeville *et al.*, 2013) or contingencies (Christ and Burritt, 2013). Different results could be obtained when considering both. Third, there is no evidence to support a causal relationship between the variables, and thus, this relationship cannot be justified by the survey data and the cross-sectional analysis. Instead, the findings should be considered to be consistent with the theoretical arguments and proposed hypotheses. Finally, this study used instruments adopted from previous studies, without re-examining unidimensional constructing indicators.

Further research can extend this study by considering the role of organizational capabilities (Journeault, 2016) or EMCSs (Guenther *et al.*, 2016; Malmi and Brown, 2008) in mediating the relationship between environmental strategy and environmental performance. This is a call for research to provide empirical evidence of this relationship. The contextual and contingency factors must also be considered for further study. Furthermore, future research could use a larger sample and longitudinal data that allow investigating the changes in EMA practices over time. Testing

causality should also be considered. Further research should also consider using more renewable instruments. As noted by Spencer *et al.* (2013), there is little agreement among researchers on how to measure the variables used here. Replicating this study on other subjects and organizations will also allow generalization of the findings of this study. Overall, the researchers feel that it is necessary to replicate this study using qualitative approaches, such as case studies or fuzzy-set qualitative comparative analysis (Ragin, 2008), as this could open a new avenue for future research. Until now, few studies have used a qualitative approach for exploring environmental accounting (Baker and Schaltegger, 2015; Derchi *et al.*, 2015).

Notes

1. Schaltegger *et al.* (2003) provide an excellent overview of a company's environmental management.
2. Christ and Burritt (2013) and Pondeville *et al.* (2013) examined the antecedent factors that influence EMA and EMCS but ignore the consequences of the impact on environmental performance. In line with this, Hart and Dowell (2011) also suggested future research testing the influence of a company's combined resources on environmental performance.
3. Social desirability response bias is broadly understood as the tendency of individuals to deny socially undesirable traits and behaviors and to admit to socially desirable ones.
4. We compared the 18 initial samples with the 18 later samples to obtain more precise results. Most studies generally compare the overall sample before and after the cut-off. However, differences in the distance are too close and may lead to biased analysis (Latan *et al.*, 2016).
5. The original copy of the questionnaire is available from the author.
6. Empirical research on the relationship between environmental disclosure (which is also a self-declaration about environmental performance) and real environmental performance tends to show that the best disclosing firms are not the best environmental performers (Cho *et al.*, 2012).
7. We will use this ranking for robustness checks.
8. Dijkstra and Henseler (2015) give a detailed explanation related to PLSc.
9. Although this study used a component-based approach (PLS-SEM), the adequacy of the sample size remains a concern for researchers.
10. We used a 5,000 resample with bias-corrected and accelerated bootstrap options.
11. We tested the hypothesis by using the one-tailed rather than the two-tailed test. Testing a hypothesis using the one-tailed test is more appropriate when the hypothesis direction is clear so as to minimize type II error.
12. Cepeda *et al.* (2018) propose using a spreadsheet to calculate the indirect effects.
13. Conceptually, measurement invariance expresses the idea that the measurement properties of X in relation to the target latent trait *W*t are the same across populations.

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