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Effects of environmental strategy, environmental uncertainty and top management's commitment on corporate environmental performance: The role of environmental management accounting

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ABSTRACT

This study aims to examine the effect of the combination of corporate environmental strategy, top management commitment, and environmental uncertainty, with a focus on the role of environmental management accounting (EMA), on corporate environmental performance. Using an online survey, we collect the sample data of 107 responses in ISO 14001 certified companies listed on the Indonesia Stock Exchange. The empirical evidence shows that there is a positive and significant influence between those organizational resources (corporate environmental strategy, top management commitment, and environmental uncertainty) on the use of EMA, which in turn can improve the environmental performance of companies. These findings indicate that EMA is a useful and important tool for providing information to achieve superior corporate environmental performance in Indonesian firms and the findings also suit for companies operating in other countries in terms of developing capabilities with regards to perceived environmental uncertainty to be able to manage EMA tools and, as a consequence, to improve organizational environmental performance.

1. Introduction

Environmental accounting is increasingly gaining momentum in the search for sustainable organizations (Christ and Burritt, 2015; Schaltegger and Csutora, 2012; Schaltegger and Lüdeke-Freund, 2013). This is because stakeholders have pressured managers to focus more on environmental issues and environmental performance evaluation (Bennet et al., 2003; Burritt and Schaltegger, 2010; Rodrigue et al., 2013). In order to achieve better corporate environmental management, the implementation of environmental strategies and the use of environmental management accounting (EMA) have been considered key competitive advantages for many companies (Burritt, 2005; Gunarathne and Lee, 2015; Lisi, 2015; Wagner and Schaltegger, 2004). In this work, environmental accounting is understood as the management of monetary, physical and qualitative information on the environmental impacts and the financial consequences of environmentally relevant business activities—information that supports internal and external decision-making, reporting and accountability (Schaltegger et al., 2003).

An environmentally friendly organization tends to be dependent on the commitment of top management, which ultimately can result in the achievement of an improved competitive advantage (Spencer et al., 2013; Porter and van der Linde, 1995). The process towards a world-class environmental performance requires the involvement of company resources that includes the commitment of top management, a planning process capable of integrating corporate strategy with environmental issues, and the use of environmental management accounting (EMA). However, to date, the empirical testing of these relationships has not been extensive and has not taken into account the reality of emerging economies, such as Indonesia. Nevertheless, the literature suggests that more research is necessary to understand the Indonesian situation in

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terms of sustainability-related concepts and practices (Chapple and Moon, 2005).

This research is motivated by the lack of empirical evidence currently available on cleaner production about whether or not the use of EMA can improve the environmental performance of companies (Jasch, 2006; Schaltegger et al., 2012). Most of the existing research linking accounting to sustainability has focused on corporate social disclosure (Mäkelä, 2017; Maas et al., 2016; Lodhia and Hess, 2014)and has been more focused on the effects of eco-efficiency on firms' performance (Burritt and Saka, 2006; Journeault, 2016; Lee, 2012). However, several critical review studies (Derchi et al., 2015; Owen, 2008; Parker, 2011) show that there are a number of persistent gaps in the literature that have not been examined, including the role of the combined resources of the company – such as EMA, top management support, etc. – in boosting corporate greening (Hart and Dowell, 2011).

In this context, the main objective of this work is to empirically test a framework on the effects of environmental strategy, environmental uncertainties and top management commitment on improving the environmental performance of companies by considering the role played by EMA. Secondary objectives are:

1. To understand the direct and indirect (through EMA) effects of an environmental strategy on corporate environmental performance;
2. To understand the direct and indirect (through EMA) effects of top management's commitment on corporate environmental performance;
3. To understand the direct effect of perceived environmental uncertainty on environmental management accounting.

Indonesia was chosen as the context background of this work for many reasons. The adoption of ISO 14001 certification and corporate social disclosure in Indonesia are still voluntary (Djajadikerta and Trireksani, 2012), and deserve to be better understood. Besides, Indonesia is the largest country in Southeast Asia that has faced the challenges of combining economic growth and environmental protection. Colonized by the Dutch, Indonesian territory is spread across a chain of thousands of islands between Asia and Australia. Nowadays, the country is ethnically diverse, with more than 300 local languages, with a mix of rural life and modern urban elite. Indonesia has become one of the world's major emerging economies (BBC, 2007), and it is believed that it will become among the top economies globally by 2050 (PricewaterhouseCoopers, 2015). Academically, empirical evidence from Indonesia has been scarce (Parker, 2011; Zhong et al., 2016).

Multiple contributions are expected from this work. Firstly, this is the first study to integrate the concepts of the effect of environmental strategies, environmental uncertainties and top management commitment to the environmental performance of companies considering the role of the EMA. Following recent research in social and environmental accounting literature (Christ and Burritt, 2013; Pondeville et al., 2013; Spencer et al., 2013), this study answers the call to provide empirical evidence of these factors on firms' 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 the EMA, the framework tested here is more comprehensive. Second, this study adds research findings from Indonesia to a field of research that has discovered mixed results. For example, Christ and Burritt (2013) found that the environmental strategy is a strong predictor of EMA, while Ferreira et al. (2010) found no association. Instead, Pondeville et al. (2013) showed that environmental uncertainty does not affect the adoption of environmental information systems, while Agbejule and Burrowes (2007) found a positive relationship.

The remainder of this paper is organized as follows. The next section presents the theoretical background and development of the hypotheses, followed by the research methodology design. Subsequently, we present our empirical results. Finally, we discuss the results and provide implications that may be useful for both academicians and practitioners.

2. Theoretical background and hypotheses development

2.1. The natural resource-based view (NRBV)

This study uses the lens of the natural resources-based view as proposed by Hart (1995) in support of the framework models tested. The NRBV argues that the competitive advantage can be maintained only if there is the ability to create profits that are supported by resources that are not easily duplicated by competitors. It consists of three interrelated strategies, namely: (1) pollution prevention; (2) product stewardship; and (3) sustainable development.[1] Each of these have different environmental driving forces, which build upon different key resources, and they have a different source of competitive advantage. For example, removing pollutants from the production process can increase efficiency by (a) reducing the input required, (b) simplifying the process, and (c) reducing compliance costs and liabilities (Hart and Dowell, 2011). Products stewardship extends the scope to include the prevention of pollution throughout the value chain or the "life cycle" of the company's product system. Through the commitment of top management, it can be effectively integrated into the product development process, where it will create the potential competitive advantage of the strategy adopted. Finally, a sustainable development strategy not only seeks to reduce environmental damage, but to really produce continuous environmental performance in the future in a way that can be sustained.

Moreover, if improved environmental performance is directed at the company's reputation, this will indirectly increase the company's ability to manage its resources. Merging the resources and capabilities in all the different parts of the company will provide even more added value. Sharma and Vredenburg (1998) stated that the company's specific capabilities can reduce costs, improve operations, improve product quality, differentiate products, improve employee morale and enhance the company's reputation. The NRBV with three interrelated strategies provide insights related to environmental uncertainties faced by the company.

Several studies have shown evidence through the lens of NRBV (Darnall and Edwards, 2006; Hoffman et al., 2012; Journeault, 2016) and concluded that three of these strategies can generate a sustainable competitive advantage. However, Hart and Dowell (2011) re-evaluate NRBV theory based on existing empirical research, and conclude that most of the propositions built by Hart (1995) is already supported. However, how the combination of companies' resources influences environmental performance has not been explored further. An example of a recent study that failed to use a combination of organizational resources in its analyzes is Wijethilake (2017)'s work, which recently tested the mediating effect of EMA on the relationship between proactive sustainability strategy and corporate sustainability performance.

Considering that EMA is useful for monitoring environmental costs and recording environmental performance (Burritt and Saka, 2006), organizational resources and capabilities, such as top management commitment, environmental strategy, and awareness of environmental uncertainty will be relevant antecedents for EMA.

[1] See also Hart and Dowell (2011) for the evaluation of NRBV fifteen years after.

Therefore, this study uses the lens of NRBV as a theoretical basis to explain the combination of those resources in continuously improving the environmental performance of companies (Aragón-Correa et al., 2008; Christ and Burritt, 2013; Journeault, 2016).

2.2. Environmental strategy, EMA and the corporate environmental performance

Environmental strategies can be defined as a set of initiatives that can reduce the impact of operations on the natural environment through products, processes and corporate policies such as reducing energy consumption and waste, using green sustainable resources and environmental management system implementation (Bansal and Roth, 2000). Management's attention to environmental issues triggers the company's ability to establish a proactive environmental strategy (Hart and Dowell, 2011). Companies which have proactive orientation strategies are led to improved environmental performance (Rodrigue et al., 2013) which will appear on the use of environmental performance indicators. Every company today, is required to continue to have a proactive environmental strategy development, environmental information systems and environmental management control system (EMCS).

The use of EMA and EMCS in companies is affected by the company's environmental strategy as part of a business strategy. EMA can help companies to meet environmental responsibility and lead to the identification of the economic benefits of improved environmental and economic performance (Burritt et al., 2002; Ferreira et al., 2010; Schaltegger and Burrit, 2000) and it is an approach to disclose information which assists firms to reach better environmental and financial performance (Zhou et al., 2017). Instead, EMCS ensures that managers use available resources effectively and efficiently to promote environmental performance (Pondeville et al., 2013). Thus, both are designed to meet company objectives in order to achieve sustainable environmental performance (Guenther et al., 2016; Journeault, 2016). Rodrigue et al. (2013) and Lisi (2015) indicate that environmental performance indicators will interact with the company's environmental strategy through the process of evaluation of environmental performance. On the other hand, the results of empirical research of Henri and Journeault (2010), Christ and Burritt (2013), and Journeault (2016) found that the planning of environmental strategies as part of the eco-control package can improve environmental and economic performance of companies through the use of EMA. From the above discussion the following hypotheses (H) can be derived:

H1a. *Environmental strategies have a positive effect on corporate environmental performance*.

H1b. *Environmental strategies has a positive indirect effect on corporate environmental performance through EMA*.

2.3. The commitment of top management, EMA and the corporate environmental performance

Pérez et al. (2007) state that there are three key intangible assets in the context of continuous environmental improvement, namely: (1) the top management commitment towards environmental issues; (2) planning of environmental strategies and (3) the use of EMA. Spencer et al. (2013) found that the top management which committed to the environment will tend to adopt a system that is able to provide information related to the environment (such as material flow cost accounting, Christ and Burritt, 2015). Information generated from EMA usually assists managers in developing indicators for measurement of their environmental performance (Lisi, 2015). When top management understands the potential benefits that may result from certain environmental initiatives (such as increased performance), they will be motivated to commit to environmental sustainability. Previous research has found a significant relationship between top management commitment to the improved environmental performance of companies (Pérez et al., 2007; Spencer et al., 2013), and between top management support and the use of EMA (Phan et al., 2017). Another study by Wee and Quazi (2005) showed that the top management's commitment to the environment is an important factor in assessing and improving environmental management practices and the adoption of EMA (Chang and Deegan, 2010). Dixon-Fowler et al. (2017) found that the existence of an environmental committee in organizations reflectsupon top management's commitment to environmental issues and as a result, corporate environmental management performance improves. From the above discussion the following hypotheses can be derived:

H2a. *The commitment of top management has a positive effect on corporate environmental performance*.

H2b. *The commitment of top management has a positive indirect effect on corporate environmental performance through EMA*.

2.4. The perceived environmental uncertainty and the use of EMA

Environmental uncertainty is a situation that cannot be predicted (such as climate change or natural disasters) or the rate of change in the market (such as customer desires, challenges competitors and technological change) that lead the company to respond either currently or in the future (Pondeville et al., 2013). This change led to new uncertainties associated with the natural environment, or the perceived ecological environmental uncertainty (Lewis and Harvey, 2001). Environmental uncertainty is a challenge for every company today, and is related to the lack of information on green accounting and the speed of environmental information as a factor that limits an action. In conditions of high uncertainty, sophisticated information can help managers improve decision quality and reduce environmental impact, because this information provides some alternatives and solutions. For instance, accountability and transparency lead decisions on environmental management actions (Cadman et al., 2016). Some studies support that environmental uncertainty in the natural environment is enough to influence the environmental strategy and accounting practices in an organization (Lewis and Harvey, 2001). Furthermore, Chang and Deegan (2010) found that one of the factors that encourage the adoption of environmental management accounting (EMA) is environmental uncertainty. From the above discussion the following hypothesis can be derived:

H3. *The perceived environmental uncertainty has a positive effect on the use of EMA.*

The relationship between variables and structural models tested as shown in Fig. 1.

3. Research method

Respondents in this study were upper level managers consisting of the general manager, operations manager, financial manager and environmental manager who work for ISO 14001 certified companies listed on the Indonesia Stock Exchange (BEI). We chose ISO 14001 certified companies on the grounds that they are more concerned about environmental issues and have a strong commitment to environmental responsibility. The data collection was carried out by using an online survey which put the questionnaire used to measure each of the variables of this study on an application platform. A web link to the questionnaire was sent

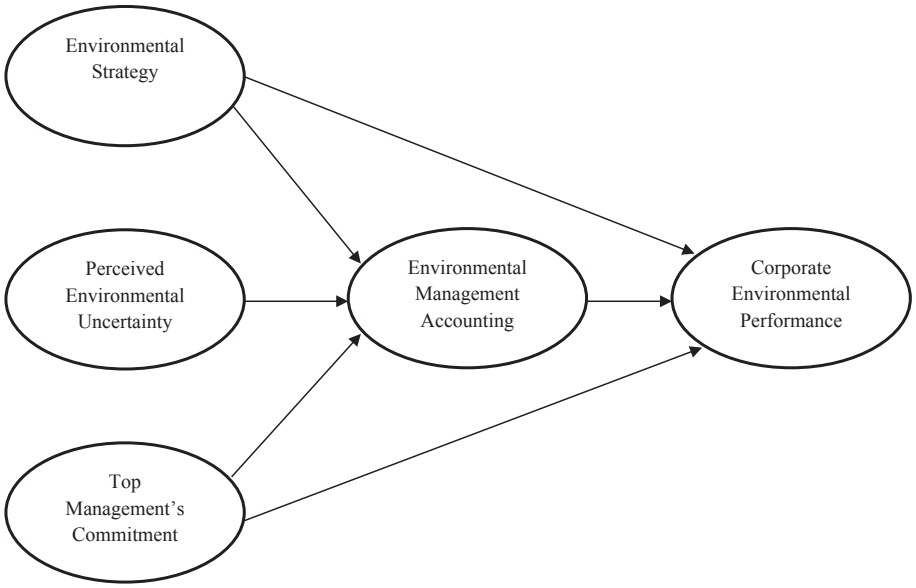

Fig. 1. Conceptual model and relationships between variables.

through email to each company. The email addresses were obtained from companies' websites or by a directory and information available from the Ministry of the Environment (KNLH). There are 250 companies surveyed in this study, which includes all the Indonesian ISO 14001-certified companies. Based on this information, 1.000 managers companies were contacted. After sending the invitation to complete the survey, the research team sent three additional reminders by email. Finally, to improve the response rate, the research team implemented a more personal approach by calling the targeted respondents. In addition, the respondents were assured of confidentiality and the anonymity of their responses and did not disclose their personal information. Furthermore, for the purpose of testing non-response bias, as suggested by Dillman et al. (2014), the duration of time given to respondents to complete this survey was 3 months.

At the end of the data collection process, which took place between January–April 2016, we obtained a response of 113 questionnaires and plus 15 questionnaires were late, so the total questionnaires was 128. However, 21 out of 128 questionnaires were not fulfilled completely, so the valid questionnaires were 107 or 10.7% response rate. From the completed questionnaires, 40.32% came from manufacturing companies, 36.09% came from mining companies and 23.59% was derived from various types of companies such as the construction, agriculture, forest industry plants, chemistry, petrochemical, cement, automotive, textile, pulp & paper. Results of *t*-test showed that there was no difference in response that was statistically significant ($p < 0.05$) between the type of industry and also the problem of social desirability response bias (Randall and Fernandes, 2013).[2] This indicates that the type of industry did not affect the results of the analysis and there were no problems of social desirability response bias of the respondent's own reporting regarding environmental performance. In addition, the statistical test results also showed that there was no significant difference between respondents who responded early, compared with respondents who were late, which means that there was no problem of non-response bias that occurred systematically (Dillman et al., 2014).[3] We also examined issues of common method bias (Podsakoff et al., 2012) using a measured latent marker variable (MLMV) approach as recommended by Chin et al. (2012).[4] The analysis showed that there was no common method bias problem that did not affect the result.

3.1. Measures and scales

The instrument used to measure each of the variables in this study consisted of three parts. The first section described the purpose and objectives of this research, by asking the respondent's willingness to participate in the survey. The second part asked the respondents about their demographic information such as gender, age, education level, and occupation. The third section presented questions related to the variables to be studied. The instrument used was adopted from previous studies on the grounds that it did not need to be formed again. Each construct in this study was measured using reflective indicators.

To measure environmental performance variables, we used instruments with a total of 7 questions adopted from Lisi (2015) and Spencer et al. (2013). Given that there is no general agreement on how to measure the environmental performance variables, there are different variations in previous studies. For example, some previous research measures environmental performance through environmental impacts, such as environmental compliance (Lisi, 2015; Pérez et al., 2007) or pollution and waste (Journault, 2016; Pattern, 2002). However, according to Henri and Journeault (2010), such measurements have limited the scope of environmental performance to one aspect and ignore other aspects, thus failing to capture the essence of this variable. Therefore, we combined some aspects of environmental performance measurements to obtain more precise measurements. Respondents were asked about their environmental performance related to compliance with the

[2] 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.

[3] We compared 15 samples beginning with 15 samples at the end to obtain more precise results. Most studies generally compare the overall sample before and after the cut-off. Differences in the distance are too close and may lead to biased analysis (Latan et al., 2016).

[4] MLMV approach has several advantages compared to other techniques. To use this approach, the indicators should be included in the initial data collection.

existing regulations, the environmental impact, and benefits of environmental management. Environmental management accounting variables, were measured by 12 questions which were adapted from Ferreira et al. (2010) and an additional 1 question from Christ and Burritt (2013). Respondents were asked whether the use of EMA can provide useful information on the environment. Tables 1 and 2 below shows the indicators and outcome measurement model for environmental performance variables and EMA.

Furthermore, environmental strategy variables were measured by 4 questions from Walls et al. (2008). Respondents were asked to provide feedback related to the environmental strategies implemented in the company, including investment, managerial vision, the ability of top management, and certification. Environmental uncertainty was measured by 7 questions from Pondeville et al. (2013). Respondents were asked to provide feedback related to environmental uncertainty facing by companies related to regulatory and market demand. Finally, top management commitment was measured using 9 questions from Spencer et al. (2013). Respondents were asked to provide feedback related to their commitment to the environment. In this case, we did not assume that all top management always shared the same view, but rather that their views would be in harmony with the vision of the company (see Table 3). The value of the loading factor, average variance extracted (AVE) and reliability derived from the analysis of the measurement model for all variables were loading factor > 0.60, composite reliability/rho_A > 0.70 and AVE > 0.50; this meets the recommended rule of thumb (Henseler et al., 2017; Latan and Ghozali, 2015). Although there were some questions that had a loading factor < 0.60, they were still acceptable as long as the value was AVE > 0.50.

In addition, we tested the discriminant validity or divergent validity for all latent variables in the model using the Fornell-Lacker criterion and heterotrait-monotrait ratio (HTMT). In Table 4, it can be seen that the square root of the AVE on diagonal lines is greater than the correlation between the constructs in the model, which means that it can be concluded that all variables in this research model meet the discriminant validity. We also tested the discriminant validity using HTMT, and the results of the analysis in the table above show that the value of HTMT was smaller than 0.90, which means that it meets the recommended rule of thumb (Henseler et al., 2017; Latan and Ghozali, 2015).

3.2. Data analysis

We chose to use the PLS-PM method to analyze the data in this study with the following considerations: 1) PLS-PM is a suitable method for testing mediation effects where a feature is available to complete an indirect effect with various options; 2) PLS-PM has progressed rapidly, so as to be able to test the theory with the availability of goodness of fit indices; 3) PLS-PM enables researchers to simultaneously test the relationships among variables. In this case, the research objectives 1 to 3 will be tested together. This study uses consistent estimators or so-called consistent PLS (PLSc), to mimic the covariance-based SEM approach in testing or confirming the theory (Dijkstra and Henseler, 2015). Due to the use of PLSc, the required sample size should be large and no fewer than 100 cases (Latan and Ghozali, 2015; Latan et al., 2017). Previous research in this area has used PLS-PM as a tool of analysis (Ferreira et al., 2010; Lisi, 2015; Pondeville et al., 2013). Unlike other multivariate techniques, PLS-PM does not depend on the assumption of normality (distribution-free) because it is non-parametric. However, assumptions such as multicollinearity and goodness of fit indices for local model assessment need to be considered. Overall, the data analysis for hypothesis testing in this study will pass four stages. First, we assess the measurement model to ensure that each construct's indicators are reliable and valid. Second, we assess the structural model for representing the suitability of the model with observational data. Third, we tested the direct effects to determine the relationship between each predictor variable and the outcome (all objectives). Finally, we tested the indirect effects on the relationship between predictor variables and outcome, mediated by EMA.

4. Research findings

After we confirm that all the indicators of the variables are reliable and valid in the first step (see Fig. 2 below), the next step is to assess the results of the structural model and to test the hypotheses. Since the PLS-PM algorithms use the iteration method following multiple regression series, the path coefficient interpretation in PLS-PM is equal to the standardization of regression coefficients. Similarly, interpretation of adjusted r-square, variance inflation factor (VIF), effect size (f^2) and predictive relevance (Q^2) (Hair et al., 2017; Latan and Noonan, 2017). We use PLSc in algorithm selection and bootstrapping using the SmartPLS 3 program (Ringle et al., 2015).

Before we describe the analysis results from this second step in more detail, we first test the collinearity of the structural model. To assess collinearity, we use the same measure in multiple regression. The recommended VIF values < 3.3 or <5 are still acceptable for all variable predictors in the model (Hair et al., 2017; Latan and Ghozali, 2015) The results of the analysis in Table 5 show that there is no collinearity problem interfering with our results. Furthermore, we evaluated the structural model by looking at the coefficient of determination (R^2 or adjusted R^2), f^2 and Q^2. The coefficient of determination measures the predictive power of the model and this coefficient represents the amount of variance in the endogenous variable that can be explained by all exogenous variables. The coefficient of determination above 0.20 can be considered high in some disciplines, but values between 0.25 and 0.50 are considered good.

Table 1
Construct indicators and measurement model of EP

Indicators/Items	Code	FL	AVE	rho_A
Environmental Performance			0.564	0.910
Complying with environmental regulations	EP1	0.851		
Preventing and mitigating environmental crises	EP2	0.706		
Uncovering cost cutting opportunities	EP3	0.869		
Limiting environmental impact beyond	EP4	0.708		
Improved reputation	EP5	0.823		
Generating societal benefits	EP6	0.724		
Increased competitive advantage	EP7	0.522		

[a]FL is factor loading.

Table 2
Construct indicators and measurement model of EMA.

Indicators/Items	Code	FL[a]	AVE	rho_A
Environmental Management Accounting			0.518	0.937
Identification of environmental costs	EMA1	0.634		
Estimated contingent liabilities relating to the environment	EMA2	0.657		
Classification of environmental costs	EMA3	0.675		
Allocation of environmental costs associated with the production process	EMA4	0.655		
Allocation of environmental costs associated with the product	EMA5	0.714		
Introduction or improvement to environment-related cost management	EMA6	0.707		
Creation and use of environment-related cost accounts	EMA7	0.773		
Development and use of environment-related key performance indicators	EMA8	0.809		
Product life cycle cost assessment	EMA9	0.815		
Product inventory analyses	EMA10	0.812		
Product impact analyses	EMA11	0.827		
Product improvement analysis	EMA12	0.667		
Assessment of potential environmental impacts associated with capital investment decisions	EMA 13	0.556		

[a] FL is factor loading.

Table 3
Construct indicators and measurement model of CES, PEU & TMC.

Indicators/Items	Code	FL[a]	AVE	rho_A
A. Environmental Strategy			0.537	0.842
Performance indicators (KPIs), identified four main categories of air, waste, water, and energy	CES1	0.753		
Investment in research and development environments	CES2	0.818		
ISO Certification	CES3	0.822		
Long-term commitment to the environment	CES4	0.485		
B. Perceived Environmental Uncertainty			0.510	0.882
National/international environmental laws	PEU1	0.582		
Environmental tax policies	PEU2	0.788		
Environmental regulations affecting the sector	PEU3	0.731		
Availability of substitute environmental products	PEU4	0.718		
Environmental product demand	PEU5	0.740		
Changes in the production process on the market	PEU6	0.696		
Changes in the competitor's environmental strategies	PEU7	0.727		
C. Top Management's Commitment			0.540	0.923
My own work has made a contribution to the environmental performance	TMC1	0.728		
Accurate environmental cost information	TMC2	0.635		
Continues to put an emphasis on environmental performance	TMC3	0.819		
Improve my company's environmental management system	TMC4	0.752		
Continue to treat environmental performance	TMC5	0.676		
Extra effort to meet environmental performance	TMC6	0.754		
Environmental performance is one of the most important targets to achieve	TMC7	0.696		
Providing accurate information on company's environmental performance	TMC8	0.513		
Responsibility for the environmental performance	TMC9	0.937		

[a] FL is factor loading.

Table 4
Correlations and discriminant validity results.

Construct	Mean	S.D	1	2	3	4	5
EP	4.32	1.06	*0.751*	0.780	0.770	0.839	0.847
EMA	5.15	1.24	0.675*	*0.720*	0.640	0.633	0.649
CES	5.52	1.13	0.668*	0.534*	*0.733*	0.525	0.663
PEU	5.56	1.21	0.648*	0.542*	0.605*	*0.714*	0.603
TMC	5.39	1.16	0.570*	0.557*	0.653*	0.606*	*0.735*

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

In Table 5 it can be seen that the environmental performance and EMA can be explained by the predictor variables with the value of adjusted R^2 respectively by 0.510 and 0.499. The values indicate that the strength approaching is enough to explain the relationships (Latan and Ghozali, 2015). The resulting effect size value of each predictor variable in the model ranges from 0.09 to 0.19 which are included in the category of small to medium. The Q^2 predictive

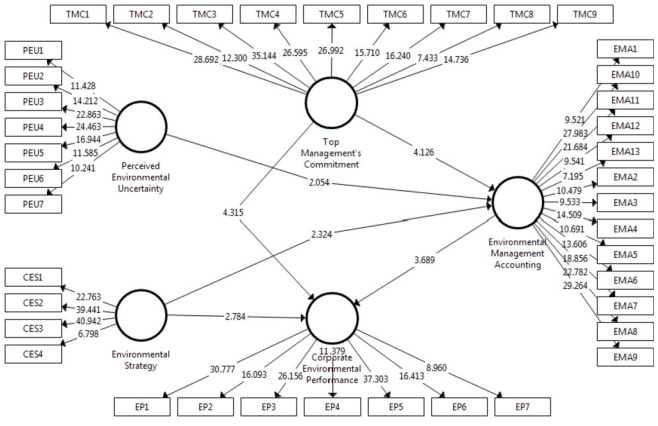

Fig. 2. Evaluation of the structural measurement model.

relevance value generated 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

Table 5
Structural model results.

Constructs	Adj. R^2	f^2	Q^2	VIF	SRMR	NFI
Environmental Strategy (CES)	–	0.077–0.157	–	2.016	–	–
Environmental Uncertainty (PEU)	–	0.099	–	2.911	–	–
Top Management's Commitment (TMC)	–	0.104–0.168	–	2.143	–	–
Environmental Management Accounting (EMA)	0.449	0.191	0.446	–	0.076	0.869
Environmental Performance (EP)	0.510	–	0.503	–	0.076	0.869

Table 6
Relationships between variables (direct effect).

Structural path	Coef (β)	S.D	P-Values	95% BCa CI	Conclusion
CES → EP	0.245	0.089	0.000**	(0.400, 0.003)**	H1a supported
CES → EMA	0.241	0.103	0.010*	(0.414, 0.003)**	H1b supported
TMC → EP	0.311	0.073	0.000**	(0.431, 0.000)**	H2a supported
TMC → EMA	0.433	0.101	0.000**	(0.592, 0.020)*	H2b supported
PEU → EMA	0.223	0.108	0.020*	(0.412, 0.008)**	H3 supported
EMA → EP	0.378	0.103	0.000**	(0.536, 0.003)**	H1b, H2b supported

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

mean squared residual (SRMR) is equal to 0.076 < 0.080 and the normed fix index (NFI) 0.837 > 0.80, which means that our model fits the empirical data.

4.1. Hypotheses testing

We tested the hypothesis with a view of the coefficient parameter and the significant value generated from the 95% bias corrected confidence intervals of each independent variable.[5] As shown in Table 6, all path coefficients provide significant value (at the $p = 0.05$ level).[6] Based on the analysis in Table 6, environmental strategies have a significant positive effect on the environmental performance of companies. From the analysis results obtained the value of the coefficient (β) to the relationship CES → EP is 0.245 with a p-value < 0.01. This means that the hypothesis 1a (H1a) is supported. These results support previous studies (Journeault, 2016; Lisi, 2015; Rodrigue et al., 2013; Wagner and Schaltegger, 2004). Furthermore, it can be seen that the value of the coefficient (β) for the relationship of CES → EMA is 0.241and EMA → EP is 0.378 with a p-value < 0.05. This means that hypothesis 1b (H1b) is fully supported. These results support previous studies (Aragón-Correa et al., 2008; Christ and Burritt, 2013; Journeault, 2016; Pondeville et al., 2013). We also tested the indirect effect by using the method proposed by Cepeda et al. (2017) and obtained the same results.[7]This shows that the EMA may act as complementary mediation of the relationship between strategy and environmental performance.

Furthermore, from Table 6, it can be seen that the top management commitment has a positive effect on the environmental performance of companies with a value of path coefficients (β) = 0.311, and this relationship TMC → EP was significant at 0.000. This means that hypothesis 2a (H2a) is supported. These results support previous studies (Pérez et al., 2007; Spencer et al., 2013; Wee and Quazi, 2005). It can be seen that the coefficient (β) for relationship TMC → EMA is 0.433 and EMA → EP is 0.378 with a p-value < 0.01. This means that hypothesis 2b (H2b) is fully supported. This finding was also confirmed by the influence of indirect effects which were tested and obtained the same results. This shows that the EMA may act as complementary partial mediation of the relationship between top management commitment and environmental performance. Finally, for the relationship PEU → EMA obtained the value of path coefficient (β) is 0.223 and significant at the 0.020 < 0.05. This shows that the uncertain environment encourages companies to adopt EMA. These results support prior research in environmental accounting literature (Chang and Deegan, 2010).

4.2. Additional analyses

To validate and ensure the robustness of the main model results, we run an additional analysis. We compare the PROPER ratings obtained by each company from the environment ministry with their respective environmental performance based on respondents' answers. The results show that there is no significant difference ($p > 0.05$) between PROPER ratings and managers' perceptions of their environmental performance, which means that the main model results have good robustness. This suggests that there is no systematic bias that interferes with these results for two measures of corporate environmental performance (Cho et al., 2012).[8]

5. Discussions

Regarding the research objective 1, it was stated that environmental strategies can directly affect environmental performance indirectly through the use of EMA. The results of the analysis provide evidence to fully support H1, and thus, objective 1 was fully achieved. These results support the proposition of NRBV (Hart, 1995; Hart and Dowell, 2011), in which the environmental strategy improves the environmental performance of companies on an ongoing basis. This finding also supports the results of previous

[5] We use 5000 resamples with options bias-corrected and accelerated (BCa) bootstrap.

[6] We tested the hypothesis by using the one-tailed test rather than the two-tailed test. Testing the hypothesis by using one-tailed test is more appropriate when the hypothesis direction is clear so as to minimize the type II error.

[7] Cepeda et al. (2017) proposes using a spreadsheet to calculate the indirect effects.

[8] PROPER's members are ranked into 5 (five) different criteria ranging from the highest which is gold then green, blue, red, and black. Gold and green ratings are given to companies that more than merely comply with the three criteria, namely: (1) the implementation of environmental management systems (ISO 14001); (2) resource utilization; and (3) implementation of community development (community development). The criteria for companies' compliance with environmental regulations are the criteria used for blue, red, and black ranking.

studies such as the study conducted by Aragón-Correa et al. (2008) who found that proactive environmental strategies have a significant positive effect on improvement of financial performance, by Maraseni and Cockfield (2015) who discussed the link between environmental management actions and establishment costs, and Rodrigue et al. (2013) that found a proactive environmental strategy led the company to improved environmental performance. Thus, companies should continue to document the development of indicators of their environmental performance to address environmental issues which exist. Similar results were found by Christ and Burritt (2013), Journeault (2016), Lisi (2015) and Wagner and Schaltegger (2004) where environmental strategies have a significant positive effect on the environmental and economic performance through EMA.

The second research objective explored whether the commitment of top management can directly affect environmental performance indirectly through the use of EMA. By pursuing objective 2, the results of the analysis provide evidence to fully support H2. This result is in line with Pérez et al. (2007) who found that one of the factors that can improve the environmental performance of the company is the commitment of top management to environmental issues. The management knows the potential benefits of certain environmental initiatives, so they will be committed to environmental sustainability. Spencer et al. (2013) found that if top management is committed to the environment, it will tend to adopt a system that is able to provide information related to the environment (such as EMA). The EMA is seen as a tool that is able to provide information relating to the environment in support of environmental performance indicators. The results support the findings of previous research that found a significant relationship between top management's commitment to the environment with improved environmental performance of companies (Pérez et al., 2007; Spencer et al., 2013).

Finally, the third research objective relates to whether or not environmental uncertainty can directly affect the use of EMA. This objective relates to the testing of H3, which was fully supported. Chang and Deegan (2010) found that the uncertainty of the environment is one of the factors that encourages the adoption of EMA. Companies are currently facing uncertainty in regards to the environment; both ecological environment and market uncertainty. Thus, the demand for environmental information is increasing. The use of EMA is considered as solutions that assist managers in making the right decisions, when facing uncertain environments. EMA offers information that leads to achievement indicators for environmental performance. The results support the findings of Lewis and Harvey (2001) who find environmental uncertainties affecting change in an organization's accounting practices.

6. Conclusions

This study aimed to examine the effect of the combination of organizational resources such as intangible assets in order to continuously improve environmental performance. We answered the research calls of Christ and Burritt (2013), Pérez et al. (2007) and Pondeville et al. (2013) to extend their testing taking into account the consequences of the adoption of the EMA (Derchi et al., 2015). In this paper, we argued that in order to achieve improvement of environmental performance, commitment from the top management is required, as the implementation of appropriate environmental strategies, and the use of EMA. The findings confirm our predictions.

We support the hypothesis that the combination of the resources inherent in companies such as, top management commitment, environmental strategy and awareness of environmental uncertainty can continuously improve environmental performance. The empirical evidence shows that there is a positive and significant influence between those resources on the use of EMA, which in turn can improve the environmental performance of companies. PLS analysis results provide a strong argument in which the role of the intangible assets can improve the environmental performance. This research extends, for instance, Wijethilake (2017)'s work, because this article analysed the combined effect of organizational resources and capabilities on EMA, and in turn on environmental performance, whereas, other articles tested the mediating effect of EMA on the relationship between proactive sustainability strategy and corporate sustainability performance.

In the practical implications, these findings provide a deep understanding of how companies certified by ISO 14001 in Indonesia should improve their environmental performance by implementing suitable environmental strategies, developing top management commitment to the environment and using EMA tools. This result could provide a reference to organizational decision makers in order to continuously improve environmental performance. Other practical implications of the research for management accountants, environmental managers and top management in general is to develop capabilities with regards to perceived environmental uncertainty, for instance, environmental tax policies, environmental product demand and environmental regulation; to be able to manage EMA tools and, as a consequence, to improve organizational environmental performance.

There are several limitations to this study. First, this study used a relatively small sample size, from Indonesian firms. Thus, the results of this work should be understood by considering the particularities of Indonesia. This is because information about environmental performance is still regarded as a secret. Second, this study only considers the use of EMA as a driving force to improve the environmental performance of companies, without examining the role of EMCS or environmental information system. Different results may be obtained when considering both. Third, this study limits to the sample of companies that have been certified ISO 14001. So that needs caution in generalizing the findings. This study only tested the improved environmental performance without examining the impact on the economic or financial performance (Henri and Journeault, 2010; Journeault, 2016; Wagner and Schaltegger, 2004). Previous research reached inconclusive results regarding whether improved environmental performance will be followed by improvements in economic performance, or vice versa. Finally, the results are related to a sample of Indonesian companies, and according to Cadman et al. (2016) different national contexts may influence governmental and organizational priorities.

Future research may consider testing the role of EMCS (Guenther et al., 2016) in support of the company's environmental performance. The contextual and contingency factors also need to be considered for further study. This is a call for research to provide empirical evidence of the relationship. Furthermore, future research may use a larger sample size by using longitudinal studies that allow for the investigation of the changes in the practice of EMA over time. It is also a consideration to test the causality relationship. Replication studies on the other subjects and organizations will also allow access to generalize the findings of this study. Overall, we feel that it is necessary to replicate this study in different countries as this will be fruitful for future research and will reinforce our findings.

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