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The influence of voluntary and mandatory environmental performance on financial performance: An empirical study of Indonesian firms

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Abstract

This paper, using data derived from a questionnaire survey of Indonesian firms, analyzes not only whether a firm's environmental performance improves its financial performance, but also whether this relationship depends on the firm's stance on conducting environmental management voluntarily or mandatorily. The estimation results suggest that a reduction of greenhouse gas (GHG) emissions increases a firm's profit, because firms that conduct environmental management voluntarily are more likely to reduce GHG emissions. However, this is not the case for the reduction of pollution emissions, because firms that conduct environmental management mandatorily are more likely to reduce pollution emissions. These results imply that only firms conducting environmental management voluntarily can improve financial performance through better environmental performance in Indonesia.

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1. Introduction

Since the latter half of the 1990s, many firms have not only mandatorily, but also voluntarily, conducted environmental management to improve the environment, in response to increasing social environmental preferences and pressures (Nishitani, 2009). This implies that firms cannot survive if they ignore the environment when operating their business. This is applicable to firms in developing countries as well as those in developed countries where their businesses are globally connected. Thus, firms in developing countries also have an incentive to conduct environmental management voluntarily to meet the global standard. For example, in Indonesia, the number of ISO 14001 certifications, the most widely recognized international standard for environmental management systems, increased from three in 1996[1] to 1,028 in 2010[2], which supports the view that the number of firms voluntarily conducting environmental management to meet the global standard has increased considerably in developing countries.

Because firms are reputedly primary polluters through their production activities, it is preferable for sustainable development if there is a positive relationship between a firm's environmental and financial performance (Dessus and Bussolo, 1998). However, the debate about whether a firm's environmental performance actually enhances its financial performance is ongoing even in the context of developed countries. One issue is that because a firm's environmental management incurs additional costs, its improved environmental performance leads to higher prices and reduced competitiveness (Porter and van der Linde, 1995a). Another issue is that because a firm's improved environmental performance increases customer demand and improves productivity, it leads to increased sales and cost reductions (Hui et al., 2001; Nishitani, 2011). This implies that different firms take different stances on environmental management subject to environmental policies, and therefore not all firms improve their financial performance through better environmental performance (Jaffe and Palmer, 1997). Previous studies including Baas (1995), Sharma and Vredenburg (1998), and Aragon-Correa and Sharma (2003) suggest that firms that voluntarily (or proactively) conduct environmental management beyond compliance with environmental regulations are more likely to achieve better financial performance. Conversely, if firms just mandatorily

[1] http://www.iso.org/iso/survey10thcycle.pdf
[2] http://www.iso.org/iso/database_iso_14001_iso_survey_2011.xls

(or reactively) conduct environmental management for compliance with regulations, the benefits would not exceed the costs. This view is obvious in, for example, the discussion of the relationship in manufacturing processes between the end-of-pipe approach, mainly employed by environmentally reactive firms, and cleaner production approach, mainly employed by environmentally proactive firms (discussed in Section 2).

Environmental innovation is key to the win–win relationship between environmental and financial performance, which is often discussed in terms of the Porter hypothesis and resource-based view (Iwata and Kokubu, 2010; Lanoie et al., 2011). For example, the Porter hypothesis suggests that properly designed environmental regulation can trigger innovation that can offset the cost of regulation compliance through improved efficiency (Porter and van der Linde, 1995b). The resource-based view argues that a firm's competitive strategies and performance depend significantly on firm-specific organizational resources and capabilities such as environmental technologies that have the potential to improve productivity and minimize environmental burdens simultaneously (Sharma and Vredenburg, 1998; Shrivastava, 2007). Any case suggests that such environmentally proactive firms can enhance financial performance through environmental innovation.

Therefore, it is expected that if firms mandatorily conduct environmental management only to meet environmental (direct) regulations, it would be difficult for them to enhance financial performance through better environmental performance. In contrast, if firms voluntarily conduct environmental management, it would be easier for them to do so. However, although many previous studies that analyzed the effect of a firm's environmental performance on its financial performance generally found a positive relationship, they focused only on voluntary environmental performance, or did not consider the firm's stance on whether environmental management should be conducted voluntarily or mandatorily. Furthermore, while environmental issues are global in scope, there are only a few studies focusing on developing countries. It is necessary to analyze whether voluntarily or mandatorily engaging in environmental management, and its associated improvement in performance, has different effects on financial performance in developing countries.

Therefore, the purpose of this paper is to analyze whether a firm's improved environmental performance resulting from voluntary environmental management enhances its financial performance in Indonesia. For this purpose, using data derived from a questionnaire survey of Indonesian firms, we analyze not only whether a firm's environmental performance, such as reductions of GHG emissions and pollution

emissions, improves its financial performance, but also whether this relationship depends on the firm's stance on conducting environmental management voluntarily or mandatorily.

The main findings are as follows. A reduction of GHG emissions contributes to higher firm profit, because firms that conduct environmental management voluntarily are more likely to reduce GHG emissions. However, this is not the case for the reduction of pollution emissions because firms that conduct environmental management mandatorily are more likely to reduce pollution emissions. These results imply that only firms conducting environmental management voluntarily can improve financial performance through better environmental performance in Indonesia.

This paper is divided into the following sections. Section 2 discusses the hypotheses concerning the relationship between environmental and economic performance. Section 3 details the data and variables, and Section 4 provides the estimation results. Section 5 presents some concluding remarks.

2. Hypotheses

Environmental management by firms to improve the environment both generates revenues and incurs costs. To examine whether the additional revenues from environmental management exceed costs, many studies have empirically analyzed the relationship between a firm's environmental and financial performance. Hart and Ahuja (1996) find a positive relationship between total chemical substance emission reduction and return on sales (ROS), return on assets (ROA), and return on equities over 1–2 years. Russo and Fouts (1997) find a positive relationship between environmental rating scores by the Franklin Research and Development Corporation and ROA. Sarkis and Cordeiro (2001) find that both pollution prevention and end-of-pipe approaches are negatively related to ROS. King and Lenox (2002) find that pollution prevention influences ROA positively. Darnal et al. (2007) find a positive relationship between reductions in wastewater effluent and air pollution, and financial benefit. Zeng et al. (2010) find that cleaner production activities positively influence financial performance. Heras-Saizarbitoria et al. (2011) do not find that firms with ISO 14001 certification have better financial performance. Iwata and Okada (2011) find that GHG reduction leads to improved financial performance measured by ROA, return on investment, and return on invested capital, but waste emissions do not. Nishitani (2011) finds that the

implementation of an environmental management system increased a firm's value added by increasing demand and improving productivity. Nishitani et al. (2011) find that a reduction of pollution emissions through the prevention approach increases a firm's value added, but the end-of-pipe approach does not. Hatakeda et al. (2012) find that although there is a positive relationship between a firm's GHG emissions and ROA, this relationship is mitigated if the firm has a positive stance on environmental management to reduce GHG emissions. Thus, many studies have found a positive relationship between environmental and financial performance.

As Nishitani (2011) suggests, the positive effect of environmental performance on financial performance could occur through two paths. The first is an increase in demand through strengthened customer loyalty and enhanced firm image (Hui et al., 2001). Better environmental performance provides positive information about environmentally friendly firms and their products to customers, which enables firms to increase their market share and/or charge higher prices for their products (Khanna et al., 1998; Khanna, 2001). The second is an improvement in productivity through process innovation and improvements in staff morale (Hui et al., 2001). Because poor environmental performance is regarded as reflecting poor management practices and a lack of innovativeness, potential cost savings are available by reducing environmental burdens (Porter and van der Linde, 1995a). Changes in process technology, raw material substitution, specific water consumption and waste profiles, specific energy consumption, process efficiency, and aesthetics are critical factors for improving the environment as well as productivity (Azbar, 2004). However, several previous studies that have obtained a controversial result suggest that not every firm can enjoy a positive relationship between environmental and financial performance. If anything, some cases indicate that the environmental costs associated with improving the environment outweigh the benefits. This is because different firms take different stances on environmental management subject to the environmental policy of the government (Jaffe and Palmer, 1997). As a result, differences in environmental performance derived from differences in firms' stances on environmental management can result in variation in financial performance, as Hatakeda et al. (2012) find. Baas (1995) suggests that a firm's environmental stance will shift from "reactive" to "proactive". An example is the shift from the end-of-pipe to cleaner production approaches to reduce environmental burdens in manufacturing processes. The end-of-pipe approach improves environmental performance through end-of-pipe technologies that aim to remediate problems with pollutants after they have been discharged instead of before, which causes unexpected

costs including expensive nonproductive pollution control equipment (Hilson, 2000). In contrast, the cleaner production approach prevents the generation of environmental pollutants in the manufacturing process through process innovation, which not only saves the cost of installing and operating end-of-pipe technologies, but also improves productivity (Cebon, 1992; Hart, 1995; Hilson, 2000; King and Lenox, 2002; Nishitani et al. 2011)[3].

Environmental (not only technology, but also process) innovation is key to whether firms take the mandatory or voluntary approach, which in turn can influence the win–win relationship between environmental and financial performance (Iwata and Kokubu, 2010; Lanoie et al., 2011). Some triggers for environmental innovation are government environmental policy and firm's resources. Porter and van der Linde (1995b) originally suggested that properly designed environmental regulations could trigger innovation, which may partially or more than fully offset the cost of complying with them. This is the so-called "Porter hypothesis". However, the methods available for firms to reduce environmental burdens include not only direct regulation, but also indirect regulation and promotion of voluntary actions by firms (Hatakeda et al., 2012). Given that, and using Jaffe and Palmer's (1997) classification, Lanoie et al. (2011) interpret the hypothesis as follows. The "weak" version of the hypothesis is that environmental regulation will stimulate certain kinds of environmental innovations, although there is no claim that the direction or rate of this increased innovation is socially beneficial. The "narrow" version of the hypothesis asserts that flexible environmental policy instruments, such as pollution charges or tradable permits, give firms greater incentive to innovate than prescriptive regulations such as technology-based standards. Finally, the "strong" version posits that properly designed regulation may induce innovation that more than compensates for the cost of compliance and improves the financial situation of the firm. This indicates how the government's environmental policy leads to environmental innovation by firms. In contrast, the resource-based view of the firm argues that firms consist of strategic and operating resources and capabilities, and therefore a competitive advantage may be established by firms with new and unique resources such as environmental technologies that affect the value chain at multiple points (Sharma and Vredenburg, 1998; Shrivastava, 2007). The competitive advantages derived from environmental technologies include the potential to improve productivity

[3] Some firms that have already adopted the cleaner production approach supplement this with the end-of-pipe approach to reduce environmental burdens further.

and minimize environmental burdens simultaneously and to improve firm image. These technologies and capabilities are more likely to be realized through innovation (Wernerfelt, 1984; Sharma and Vredenburg, 1998).

Thus, it is expected that firms that conduct environmental management voluntarily are more likely to increase their financial performance through better environmental performance. In contrast, this is not the case for firms that conduct environmental management mandatorily. However, it is widely believed that because the (local) governments of developing countries have an incentive to make environmental regulations less strict in order to promote foreign investment, less environmentally friendly firms can be induced to relocate to minimize costs (Wheeler, 2001). Furthermore, because only a small number of studies analyze firms' environmental management in developing countries (for example, we found only Zeng et al. (2010)'s analysis of Chinese firms), it seems that voluntary environmental management in developing countries has not yet become the norm. Thus, a firm's stance on environmental management in developing countries including Indonesia might be relatively more reactive than that in developed countries. In other words, we cannot yet discuss environmental management in developing countries in the same way as in developed countries. Hence, it is expected that firms with poorer environmental performance are more likely to improve their financial performance, regardless of their stance on environmental management.

Accordingly, this paper develops the following three possible hypotheses regarding the relationship between environmental and financial performance in Indonesian firms.

Hypothesis 1: Firms that voluntarily conduct environmental management are more likely to reduce their environmental burden, and consequently they can achieve improved financial performance through better environmental performance.

Hypothesis 2: Although firms that mandatorily conduct environmental management are more likely to reduce their environmental burden, they cannot achieve improved financial performance through better environmental performance.

Hypothesis 3: Firms can achieve improved financial performance through poorer environmental performance, regardless of a firm's stance on environmental management.

3. Data and variables

In 2002, the Indonesian Ministry of the Environment launched an encouragement award called the Company's Environmental Performance Rating (PROPER) as a compliance instrument, which involves an annual evaluation and ranking of Indonesian firms into five categories according to their environmental management activities. The data used in the analysis are cross-sectional on 100 Indonesian firms in the mining, manufacturing, agriculture, and electricity, gas and water supply industries. The data were obtained from a questionnaire survey conducted through the Corporate Social Responsibility (CSR) Association of Indonesia during the period February 1–28, 2011. The sample firms were selected randomly from each category of the PROPER in 2009. Thus, we regard them as a representative sample of all Indonesian firms. In the survey, firms are asked about their environmental management activities, current business operations, firm characteristics, and so on. A list of the variables is provided in Table 1, and descriptive statistics in Table 2.

3-1 Financial performance

- Profit growth

The proxy for financial performance is profit growth, which is measured over a five-year period for each firm on a five-point Likert scale (5 = significantly improved; 4 = improved; 3 = constant; 2 = deteriorated; 1 = significantly deteriorated).

The mean of this profit measure is 3.860, which suggests that sample firms have generally improved their profit growth. There are no firms that rated 1 on this financial performance scale.

3-2 Environmental performance

- Reduction of GHG emissions
- Reduction of pollution emissions

The proxies of environmental performance are reduction of GHG emissions and reduction of pollution emissions, which are measured over a five-year period for each firm on a five-point Likert scale (5 = significantly reduced; 4 = reduced; 3 = constant; 2 = increased; 1 = significantly increased).

However, it is generally believed that it is easier to obtain a positive relationship between environmental performance and economic performance when subjective data are used for the analysis. This is because firms with better environmental performance

and those with better economic performance are more likely to answer the questionnaire. Therefore, to avoid this bias as much as possible, if the value of a reduction of GHG emissions and reduction of pollution emissions is scored 5 or 4 (namely the sample firm chose "considerably reduced" or "reduced"), we weight these values by the degree of the firm's effort to reduce their environmental burden, where we assume that a firm's environmental performance depends largely on its environmental effort. The weights for these environmental efforts are as follows. First, the degree of effort to reduce GHG or pollution emissions is measured on a four-point Likert scale (4 = made considerable effort on reduction; 3 = made effort on reduction; 2 = did not make effort on reduction; 1 = did not make any effort on reduction), respectively. Second, because the degree of effort for these reductions is measured on a four-point (not a five-point) Likert scale, environmental performance is temporarily scored 4 if the sample firm chose "considerably reduced" or they are temporarily scored 3 if it chose "reduced" for the sake of calculation convenience. Finally, the weights are calculated by dividing the degree of effort into that of environmental performance. Accordingly, if the scores (i.e., degrees) of effort for the environment and environmental performance are equivalent or the score of effort is larger than that of environmental performance, the weight is set at 1, and if the score of effort is smaller than that of environmental performance, the weight is set at less than 1.

The means of the reductions of GHG and pollution emissions are 3.378 and 3.470, respectively, which suggests that the sample firms reduced their GHG and pollution emissions.

3-3 Environmental management (instrumental variables)[4]

- Environmental management score
- Environmental management score × Business strategy
- Environmental management score × Regulatory compliance

The proxies for environmental management are the environmental management score, the interaction term of the environmental management score and business strategy, and the interaction term of the environmental management score and regulatory compliance. The environmental management score is measured on a four-point Likert scale (4 =

[4] Nishitani et al. (2012) suggest that a firm's environmental management indirectly influences its profitability through environmental performance. Therefore, we chose the environmental management score, the interaction term of the environmental management score and business strategy, and the interaction term of the environmental management score and regulatory compliance as the instrumental variables.

strongly agree; 3 = agree; 2 = disagree; 1 = strongly disagree) using statements of the extent of environmental consideration firms take in their business operations. Business strategy and regulatory compliance are dummy variables that take a value of 1 if firms select "strongly agree" or "agree" when asked whether environmental management is part of their business strategy or a value of 0 if they select "neither", "disagree", or "strongly disagree", where the latter is associated with a view of compliance. We assume that if firms regard environmental management as a key component of their business strategy, they are voluntary-oriented, and that if firms regard environmental management as regulatory compliance, they are mandatory-oriented. Accordingly, the interaction term of environmental management score and business strategy captures the difference in the effect of the voluntary environmental management score and the involuntary environmental management score, and the interaction term of the environmental management score and regulatory compliance capture the difference in the effect of the mandatory environmental management scores and the nonmandatory environmental management scores.

The means of the environmental management scores, the interaction term of the environmental management score and business strategy, and the interaction term of the environmental management score and regulatory compliance are 3.440, 2.520, and 2.510, respectively, which suggests that the environmental management scores are almost the same for firms conducting environmental management voluntarily and those conducting it mandatorily.

3-4 Control variables[5]

- Sales growth
- Firm size
- Firm age
- Domestic market orientation
- Type of firm
- Supply chain area
- Type of industry

[5] If we use five-year data of profit growth and environmental improvement, data on firm size and firm age from prior to that period should be used to explain the dependent variables. Thus, this paper analyzes the recognition of environmental and financial performance by firms.

The control variables that can influence firms' environmental and economic performance are: sales growth, which is measured over a five-year period for each firm on a five-point Likert scale (5 = significantly increased; 4 = increased; 3 = constant; 2 = deteriorated; 1 = significantly deteriorated); firm size measured by number of employees; firm age measured by 2011 minus the establishment year; domestic market orientation measured by a dummy variable equal to 1 if a firm's primary market is Indonesia; type of firm measured by a dummy variable equal to 1 if a firm is owned by a national private firm, national state-owned firm, or multinational firm; supply chain area measured by a dummy variable equal to 1 if the firm is located on the upper, middle, or lower streams of the supply chain; type of industry measured by a dummy variable equal to 1 if the firm operates in manufacturing or another industry.

The mean of sales growth is 3.820, which suggests that sample firms on average, if anything, improved their sales growth. The mean of firm size is 2878.940, which suggests that on average sample firms have approximately 2,879 employees. The mean firm age is 30.970, which suggests that sample firms on average are approximately 31 years old. The mean domestic market orientation is 0.760, which suggests that on average 76% of sample firms target the domestic market with their business. The means of firm type are 0.630 for national private firms, 0.200 for national state-owned firms, and 0.170 for multinational firms, which suggests that the sample includes relatively more national private firms. The means of the supply chain areas are 0.210 for upper stream, 0.200 for middle stream, and 0.590 for lower stream, which suggests that the sample includes relatively more firms located on the lower stream of the supply chain. The mean industry type is 0.170 for manufacturing, which suggests that the sample includes approximately 17% of firms belonging to the manufacturing industry.

(Table 1)

(Table 2)

4. Estimation results

Table 3 presents the estimation results. The effects are estimated simultaneously by an instrumental-variables ordered-probit model (IV-oprobit)[6]. Note that reduction of pollution emissions and reduction of GHG emissions are regarded as a continuous

[6] We use Stata module cmp for the estimations (Roodman, 2011).

variable, not an ordinal variable, because they are weighted variables. The IV-oprobit estimates the effects of the environmental management scores on reduction of GHG emissions and reduction of pollution emissions in the first stage, and then determines the effects of reduction of the GHG emissions and reduction of pollution emissions using the estimated values from the first stage on profit growth in the second stage. The upper section (Eq. (1)) shows the effect of a firm's environmental management score on reduction of GHG emissions, the middle section (Eq. (2)) the effect of a firm's environmental management score on reduction of pollution emissions, and the lower section (Eq. (3)) the effects of reductions of GHG and pollution emissions on profit growth.

In Eq. (1), the environmental management score is significantly positive at the 1% level, and the interaction term of environmental management scores and business strategy is significantly positive at the 10% level. Thus, there is a significant difference in the effect of environmental management scores between firms conducting environmental management voluntarily and those conducting it involuntarily. However, the interaction term of environmental management score and regulatory compliance whose sign is negative is not significant. This suggests that firms conducting environmental management, especially conducting it voluntarily, are more likely to reduce GHG emissions. In addition, national private firms are significantly negative at the 10% level, and national state-owned firms are significantly negative at the 10% level. Hence, multinational firms are more likely to reduce GHG emissions than national private firms and national state-owned firms.

In Eq. (2), the environmental management score is significantly positive at the 5% level, and the interaction term of the environmental management score and regulatory compliance is significantly positive at the 10% level. Thus, there is a significant difference in the effect of environmental management score between firms conducting environmental management mandatorily and those conducting it nonmandatorily. However, the interaction term of the environmental management score and business strategy, which has a significantly positive effect on the reduction of GHG emissions, is negative and insignificant. This suggests that firms conducting environmental management, especially mandatorily, are more likely to reduce pollution emissions. In the control variables, national private firms are significantly negative at the 10% level, and the upper stream of the supply chain is significantly positive at the 1% level. Multinational firms are more likely to reduce pollution emissions than national private firms, and firms located on the upper stream of the supply chain are more likely to reduce pollution emissions than those located on the lower stream.

In Eq. (3), reduction of GHG emissions is significantly positive at the 5% level. This suggests that firms achieving greater reductions in GHG emissions are more likely to achieve higher profit. Therefore, because Eq. (1) shows that firms conducting environmental management voluntarily are more likely to reduce GHG emissions, our hypothesis 1 is supported. In contrast, firms achieving larger reductions in pollution emissions do not appear to be more likely to achieve higher or lower profits. Because the results indicate that firms conducting environmental management mandatorily are more likely to reduce pollution emissions in Eq. (2), hypothesis 2 is also supported. However, hypothesis 3 is not supported. Furthermore, sales growth is significantly positive at the 1% level. Although sales growth does not influence environmental burdens, it enhances profit. That is, firms that are increasing sales are more likely to increase their profit. However, other control variables do not have significant effects. Although these control variables do not directly influence firms' profit growth, some of them indirectly influence growth through the reductions of GHG emissions and pollution emissions.

In summary, these estimation results suggest that the reduction of GHG emissions contributes to higher firm profit because firms that conduct environmental management voluntarily are more likely to reduce GHG emissions. In contrast, however, this is not the case for the reduction of pollution emissions, because firms that conduct environmental management mandatorily are more likely to reduce pollution emissions.

(Table 3)

5. Concluding remarks

This study, using data derived from a questionnaire survey of Indonesian firms, analyzed whether a firm's environmental performance improves its financial performance and whether this relationship depends on the firm's stance on environmental management. The main findings are as follows. Firms conducting environmental management voluntarily are more likely to reduce GHG emissions, and consequently they achieve higher profit growth through the reduction of GHG emissions. In contrast, firms conducting environmental management mandatorily are more likely to reduce pollution emissions, and consequently they do not achieve higher profit growth through the reduction of pollution emissions. Thus, a firm's stance on environmental

management influences its environmental performance, and consequently its environmental performance influences its profit growth, which supports our hypotheses 1 and 2. However, it is not found that firms achieve higher profit growth through greater GHG and pollution emissions regardless of a firm's stance on environmental management, which did not support our hypothesis 3.

In terms of environmental policy, in Indonesia at least, there is some evidence that hypothesis 1 is supported in the case of the reduction of GHG emissions and hypothesis 2 is supported in the case of the reduction of pollution emissions. First, although there are some direct regulations to control "national level" GHG emissions such as Presidential Decree 61/2011 about a national action plan on GHG emissions, there is no direct regulation that controls "individual firm level" GHG emissions in Indonesia. Conversely, the Indonesian government tries to reduce a firm's GHG emissions by establishing a green economy plan to: 1) reduce poverty, 2) provide proper jobs, 3) improve economic sustainability, and 4) incorporate environmental issues into all activities. Thus, if anything, it seems that the Indonesian government implements environmental policies to promote the reduction GHG emissions voluntarily by firms, which implies that environmental policies to stimulate firms' economic incentives are appropriate for the purpose. For example, PROPER works effectively as such an environmental policy, because the firms receiving PROPER awards raised their reputation as environmentally friendly firms by reducing their joint GHG emissions by the equivalent of 11.8 million tons of CO_2 in 2010. Thus, environmental innovation by Indonesian firms could be encouraged by these environmental policies.

However, firms' environmental innovation to reduce GHG emissions can be accelerated through not only such environmental policies, but also pressure from various stakeholders in the future. One of these stakeholders, especially for manufacturing firms, is customers in the green supply chain. Green supply chain management concerns not only traditional management performance including timeliness, transaction costs, product quality, and effective communication, but also environmental management performance (Faruk et al., 2002). Because a product's end-of-life GHG emissions in the upper stream of the supply chain influence that in the lower stream, customers assess suppliers' GHG emissions management and require them to undertake measures that ensure lower GHG emissions from their products and processes (Arimura et al., 2011). This is obvious where the GHG protocol produced by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) is widely accepted (Gentil et al., 2009). It focuses on not only direct emissions (Scope 1) and

emissions from direct purchases of energy (Scope 2), but also indirect emissions upstream and downstream in the supply chain (Scope 3) (Huang et al., 2009). Thus, the focus has shifted from reporting direct impacts from on-site processes toward reporting indirect impacts embodied in the supply chain of a firm (Wiedmann et al., 2009). When such lifecycle-based environmental management is becoming the norm for trade, firms, especially manufacturing firms, not only those in developed countries, but also those in developing countries, have an incentive to innovate, and consequently they will be able to improve their financial performance through not only an improvement of energy efficiency, but also an increase in sales.

Second, the Indonesian government has enacted direct regulations such as Presidential Decrees 5/2006 and 32/2009 to control firms' pollution emissions. In addition, the Indonesian government has also enacted Presidential Decree 40/2007 to stipulate CSR by direct regulation, and it might indirectly influence a firm's environmental management to reduce pollution emissions. These direct regulations in Indonesia force firms to conduct environmental management to reduce pollution emissions mandatorily rather than voluntarily. Because Hatakeda et al. (2012) suggests that direct regulations negatively impact economic activities, our estimation results are consistent.

Therefore, our results proved that if firms voluntarily conduct environmental management, they are more likely to achieve higher profit growth through better environmental performance, at least through the reduction of GHG emissions. One possible interpretation is that firms have greater incentive to innovate, which leads to higher profit growth under the flexible environmental policy instruments than prescriptive regulations (Jaffe and Palmer, 1997). In these circumstances, a new policy mix to provide firms economic incentives to innovate for the sake of the environment would be preferable for sustainable development in Indonesia.

Because this paper has some limitations, in conclusion, we provide some options for future research. It is generally believed that it is easier to obtain a positive relationship between environmental performance and financial performance when subjective data are used for the analysis. This is because firms with better environmental performance according to the questionnaire tend to achieve better financial performance, and vice versa. However, it is very difficult to obtain objective firm data for developing countries. Although our analyses can be improved in this respect, the bias derived from this issue might not be strong because our estimation results did not find a consistent positive relationship between environmental performance and financial performance. If objective

data become available, the analysis would be improved. Thus, although this paper has some limitations, it provides a new analysis of the current environmental management of firms in Indonesia. Accordingly, this study will hopefully encourage further research on corporate environmental management in developing countries.

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Table 1 List of variables

Profit growth is measured over a five-year period for each firm on a five-point Likert scale (5 = significantly improved; 4 = improved; 3 = constant; 2 = deteriorated; 1 = significantly deteriorated).
Reduction of GHG emissions is measured over a five-year period for each firm on a five-point Likert scale (5 = significantly reduced; 4 = reduced; 3 = constant; 2 = increased; 1 = significantly increased). Note that it is weighted by the degree of emission reduction effort.
Reduction of pollution emissions is measured over a five-year period for each firm on a five-point Likert scale (5 = significantly reduced; 4 = reduced; 3 = constant; 2 = increased; 1 = significantly increased). Note that it is weighted by the degree of emission reduction effort.
Environmental management scores are measured on a four-point Likert scale (4 = strongly agree; 3 = agree; 2 = disagree; 1 = strongly disagree) using statements about to what extent firms consider the environment in their business decisions.
Business strategy is a dummy variable that takes a value of 1 if a firm selects "strongly agree" or "agree" regarding whether they regard environmental management as a business strategy, and 0 otherwise.
Regulatory compliance is a dummy variable that takes a value of 1 if a firm selects "strongly agree" or "agree" regarding whether they regard environmental management as a matter of compliance, and 0 otherwise.
Sales growth is measured over a five-year period for each firm on a five-point Likert scale (5 = significantly increased; 4 = increased; 3 = constant; 2 = deteriorated; 1 = significantly deteriorated).
Firm size is measured by the number of employees.
Firm age is measured by 2011 minus the establishment year.
Domestic market orientation is measured by a dummy variable equal to 1 if a firm's primary market is Indonesia.
Type of firm is measured by a dummy variable equal to 1 if a firm is owned by a national private firm, national state-owned firm, or multinational firm.
Supply chain area is measured by a dummy variable equal to 1 if the firm is located on the upper, middle, or lower stream of the supply chain.
Type of industry the firm operates in is measured by a dummy variable equal to 1 if a firm belongs to the manufacturing industry.

Table 2 Descriptive statistics

	Obs	Mean	SD	Min	Max
Profit growth	100	3.860	0.739	2	5
GHG reductions	100	3.378	0.588	2.5	5
Pollution reductions	100	3.470	0.656	1	5
Environmental management score	100	3.440	0.656	1	4
Business strategy	100	0.700	0.461	0	1
Regulatory compliance	100	0.690	0.465	0	1
Environmental management score × Business strategy	100	2.520	1.720	0	4
Environmental management score × Regulatory complia	100	2.510	1.744	0	4
Sales growth	100	3.820	0.809	2	5
Firm size	100	2878.940	8514.463	8	75000
Firm age	100	30.970	32.312	1	178
Domestic market orientation	100	0.760	0.429	0	1
Type of firm					
National private firms	100	0.630	0.485	0	1
National state-owned firm	100	0.200	0.402	0	1
Multinational firm	100	0.170	0.378	0	1
Supply chain area					
Upper stream	100	0.210	0.409	0	1
Middle stream	100	0.200	0.402	0	1
Lower stream	100	0.590	0.494	0	1
Manufacturing industry	100	0.170	0.378	0	1

Table 3 Estimation results

	(1)	
GHG REDUCTIONS	Coefficient	SE
Environmental management score	0.234	0.091 ***
×Business strategy	0.069	0.037 *
×Regulatory compliance	−0.001	0.036
Sales growth	0.030	0.076
Firm size	0.000	0.000
Firm age	−0.002	0.002
Domestic market orientation	−0.038	0.150
Type of firm		
National private firms	−0.369	0.174 **
National state-owned firm	−0.415	0.218 *
Supply chain area		
Upper stream	0.166	0.160
Middle stream	0.040	0.141
Manufacturing industry	0.016	0.137
Constant	2.635	0.349 ***

	(2)	
POLLUTION REDUCTIONS	Coefficient	SE
Environmental management score	0.253	0.104 **
×Business strategy	−0.009	0.045
×Regulatory compliance	0.073	0.044 *
Sales growth	0.065	0.084
Firm size	0.000	0.000
Firm age	−0.001	0.002
Domestic market orientation	0.089	0.139
Type of firm		
National private firms	−0.278	0.151 *
National state-owned firm	0.011	0.198
Supply chain area		
Upper stream	0.466	0.169 ***
Middle stream	0.090	0.137
Manufacturing industry	0.115	0.142
Constant	2.195	0.403 ***

	(3)	
PROFIT GROWTH	Coefficient	SE
GHG reductions	1.341	0.636 **
Pollution reductions	−0.733	0.790
Sales growth	1.594	0.474 ***
Firm size	−0.00001	0.00001
Firm age	−0.001	0.005
Domestic market orientation	−0.361	0.408
Type of firm		
National private firms	0.264	0.406
National state-owned firm	0.736	0.508
Supply chain area		
Upper stream	−0.046	0.396
Middle stream	−0.239	0.397
Manufacturing industry	−0.246	0.459
Observations	100	
Log pseudolikelihood	−185.525	
Wald test of excluded instruments (pollution)	0.000	
Wald test of excluded instruments (GHG)	0.000	

Note 1: Standard errors are White-corrected standard errors.
Note 2: *, **, and *** indicate that the coefficient is significantly different from zero at the 10%, 5%, and 1% level, respectively.