

Firm Performance in Environmentally-friendly Firms in Indonesia: The Effects of Green Innovation

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This study aims to analyse the effect of Environmental Management Accounting (EMA) on firm performance with green innovation as an intervening variable. This study looked at 107 year-observation from manufacturing firms listed on the Indonesian Stock Exchange (IDX) for the years 2012-2016. The data were analysed using multiple linear regression method and Sobel test. This study finds that green products and green process innovation mediates the relation between EMA and firm performance. This research suggests management that creates environmental friendly innovation will produce more innovative output within the firms and hence increase the firm performance.

Key words: *Environmental Management Accounting, Firm Performance, Green Product Innovation, Green Process innovation.*

Introduction

Global warming and climate change are a worldwide issues nowadays (Dispensa and Brulle, 2003). The presence of industrial activities that are not environmentally conscious is one of the main causes and this makes manufacturing companies some of the main contributors of environmental pollution. The use of raw materials gives companies in the manufacturing sector a higher probability of producing waste that can interfere with environmental sustainability. Sukoco *et al.* (2018) show that firm's Environmental programs are related to the level of organisational performance. Companies are therefore encouraged to pay more attention to their environmental management including their disclosure (Burrit et al., 2002).

In terms of disclosure, the structure of financial statements are very important and need to accommodate environmental aspects (Gray, 1993). Legitimacy theory has become the basis of

environmental disclosure to stakeholders. This theory also influences the implementation of Environmental Management Accounting (EMA) in the company (Mousa and Hassan, 2015). EMA is defined as managing environmental and economic performance. This is done through the development and application of systems and accounting practices related to the environment, including reporting and auditing, in several companies (IFAC, 2005).

Research on the application of EMA still provides inconclusive results (Saeidi and Sofian, 2014; Link and Naveh, 2006; Ramli and Ismail, 2013). Saeidi and Sofian (2014) shows that a good application of Environmental Management Accounting will increase firm performance. In line with this, Ramli and Ismail (2013) also show that EMA has a positive relationship with firm performance. EMA is considered capable of significantly reducing operational costs. This will result in substantial cost savings to improve performance. On the other hand, Link and Naveh (2006) who used a sample of companies in Israel stated that the application of EMA does not improve firm performance because some companies do not yet have an *ISO 14001* certificate which shows a company's attention to environmental issues.

The inconsistencies of previous studies raise green innovation to attention. Green innovation is a new aspect that is expected to bridge the relationship between EMA and firm performance. Innovation is needed within the company to increase their competitiveness (Alam *et al.*, 2019). The company's efforts to create green innovation are expected to increase the stakeholder interest and give positive feedback (Guoyou *et al.*, 2011). Green innovation has two dimensions, green product innovation and green process innovation (OECD, 2005). Organisations are required to develop new products and improve existing processes to reduce resource use and environmental damage (Ferreira *et al.*, 2010).

The effective implementation of EMA will result in effective implementation of green product innovation and green process innovation as well (Saeidi *et al.*, 2013). We argue that the effective implementation of green innovation will change stakeholder's perspective on firm environmental awareness. This strategy will give impact on firm product value and attract customer interest that benefits the company and improves their performance (De beer and Friend, 2006).

In Indonesia, there have been several studies analysing environmental aspects on company performance (Soewarno *et al.*, 2019; Agustia *et al.*, 2019; Tuwanku *et al.*, 2018; Bukit *et al.*, 2018; Muda & Wahyuni, 2019). However, less studies discuss the green innovation. The research gap has motivated the researchers to conduct an Indonesia setting. The objective of this research is to determine the mediating effect of green innovation on the relationship between EMA and firm performance. Based on 107 years-observation of manufacturing firms listed on the Indonesian Stock Exchange (IDX) for the years 2012-2016, we find that green product innovation and green process innovation is able to mediate the relationship between

EMA and firm performance. This research highlights the importance for management to create environmentally friendly innovation as they can produce more innovative output within the firms and hence increase firm performance.

The remainder of this paper is structured as follows: Section 2 develops the research hypotheses; Section 3 describes the sample and variables; Section 4 specifies the empirical result and; Section 5 summarises the paper and presents concluding remarks.

Literature Review and Hypothesis Development

Environmental Management Accounting and Firm performance

Environmental Management Accounting can improve company performance and competitive advantage by providing detailed environmental information to their stakeholders (Saeidi et al., 2011). The application of EMA gives signal to the community that the company consider environmental aspects and norms in their operational activities (Saeidi, 2013). Quantitative environmental reporting and voluntary environmental disclosure were found to work as a complement to enhance the performance of economic, social, and environment spheres and thus to achieve sustainable development (Kumar, 2017). According to Deegan et al (2002) environmental and social disclosure is related to the effect of legitimacy theory and will benefit the company. When stakeholders react positively to the company's production results, there will be an increase in the company's profits. The profit increase is expected and can improve a company's performance both financially and environmentally (Aniela, 2012). In other words, if the application of EMA increases, it is expected that the company's performance will also increase (Ramli & Ismail, 2013; Saeidi & Sofian, 2014).

H1: Environmental Management Accounting is positively related on firm performance

Environmental Management Accounting and Green Product Innovation

According to stakeholder theory, companies need to prove their efforts on environmental performance to stakeholders through published reports (Fronzel et al., 2008). The company applies EMA as evidence to the public that the company give attention to environmental issues and norms in its operational activities (Lang and Lundlom, 1993). The application of Environmental Management Accounting is a form of competitive advantage and a cost focus strategy that is especially environmentally cost-efficient (Azizah et al., 2013). The use of EMA (Environmental Management Accounting) tends to be associated with green product innovation because competitive advantage and company performance cannot be achieved without innovation. Green product innovation is improving when there is an increase in the application of product changes or the creation of new products (Ferreira et al., 2010; Saeidi et

al, 2013). Saeidi et al. (2013) and Renning et al. (2011) empirically prove that there is a positive relationship between the EMA implementation on green product innovation. Based on the description above, the researcher proposes the following hypothesis:

H2: Environmental Management Accounting is positively related to green product innovation

Environmental Management Accounting and Green Process Innovation

EMA assists managers to achieve economic efficiency. Through the implementation of EMA, companies are expected to achieve a sustainable development. Companies with greater use for Environmental Management Accounting (EMA) will increase green process innovation practices to reduce environmental costs, waste, and other negative impacts on society (Ferreira et al., 2010). Increased green process innovation within the company is closely related to significant changes in the internal production process. According to Jayanti and Mutmainah (2016) and Ferreira et al. (2010), there is a positive relationship between the effect of the use of EMA on green process innovation. Based on the description above, the researcher proposes the following hypothesis:

H3: Environmental Management Accounting is positively related to green process innovation

The Effect of Green Product Innovation and Firm Performance

Green product innovation is the creation of new products that have taken environmental aspects into their life cycle, starting from raw materials, their production processes, transportation, use up to those products so that they have minimal impact on the environment (Pemayun and Suprapti, 2016). Green product is shown to have a higher demand and hence could increase a firm's income (Dewi *et al.*, 2019). Green product innovation created by companies is expected to minimise the use of resources and create efficiency in the allocation of operating expenses. The decrease in operating expenses will be reduced, so the company can earn higher profits and improve company performance (D'souza et al., 2006). Research by Ar (2012) and Lin et al. (2013) provides empirical evidence that the application of green product innovation has a positive effect on firm performance. Based on the description above, the researcher proposes the following hypothesis:

H4: Green product innovation is positively related to firm performance

The Effect of Green Process Innovation and Firm Performance

Green process innovation includes company activities considering energy savings and resources used (Chen et al., 2012). These savings are expected to minimise operating expenses

and increase company profits. This increase in profits can automatically improve company performance. Lin and Chen (2014) and Hassan et al. (2013) proved that the application of green process innovation had a significant effect on firm performance. Based on the description above, the researcher proposes the following hypothesis:

H5: Green process innovation is positively related to firm performance

Environmental Management Accounting on Firm Performance with Green Product Innovation as a Mediation Variable

The application of EMA (Environmental Management Accounting) helps companies to identify, control and minimise company costs and their impact on the environment. EMA is also useful in disclosing the costs of production savings, product innovation and processes, and other competitive advantages (IFAC, 2005). The company's reputation depends on how well the companies perform to develop new innovations through superior information collected by EMA and utilise resources to improve the company's performance (Guthrie and Ward, 2006). Masanet-Llodra (2006) found a positive relationship between EMA and company product innovation. EMA is considered an information system that can improve the performance and quality of a company's management business. Saeidi et al. (2011) provide empirical evidence that the use of EMA has a positive effect on company performance which focuses on innovation. Environmental innovation - in this case green product innovation - is very likely to lead to enhanced environmental performance and company performance. Based on the description above, the researcher proposes the following hypothesis:

H6: Environmental Management Accounting affect firm performance with green product innovation as a mediating variable

Environmental Management Accounting on Firm Performance with Green Process Innovation as a Mediation Variable

Companies that produce social and environmental information through periodic reporting are able to develop better internal control systems, thus resulting in better decision-making processes. Social and environmental information can be achieved through the implementation of EMA. Green process innovation can encourage the development of technological processes to be more advanced, and increase cost efficiency (Chen et al., 2014). The company's efforts to improve performance are not only through the disclosure of social and environmental information for shareholders, investors and markets but also to the public. Research conducted by Saeidi et al. (2011) provides empirical evidence that the use of EMA that focuses on innovation is positively related to firm performance. Green process innovation is a relevant factor in developing ideas, behaviour, and contributing to the reduction of the environmental

burden. Then it can be strongly suspected that EMA affects firm performance with green process innovation as a mediating variable. Based on the description above, the researchers propose the following hypothesis:

H7: Environmental Management Accounting affect firm performance with green process innovation as a mediating variable

Method

Sample Dan Data

The sample used in this study is manufacturing companies listed on the Indonesian Stock Exchange in the period 2012-2016. Data is obtained through audited financial statements and annual reports accessed through the IDX website. The final sample in this study amounted to 107 observations. The reason manufacturing companies were chosen in this study is because the manufacturing sector is the sector with the most complex operational activities. In addition, manufacturing companies also make a major contribution to environmental issues that are importantly disclosed to the public. Table 1 summarises our sample selection.

Table 1: Sample Selection

No.	Criteria	Number of observation				
		2012	2013	2014	2015	2016
1.	Manufacturing companies listed on the Indonesia Stock Exchange	27	34	36	37	33
2.	Companies that have been delisted from the Indonesia Stock Exchange	(1)	(2)	(0)	(6)	(0)
3.	Companies that do not publish complete financial statements and do not provide the required data	(4)	(7)	(6)	(6)	(7)
4.	Companies that do not have a financial reporting date at the end of December 31	(3)	(4)	(3)	(5)	(6)
Total Sample		19	21	27	20	20

Variable Measurement

Environmental Management Accounting

EMA is an environmental-related cost information service that focuses on the input and output of a company's physical material (Sirisom and Sonthiprasat, 2011). The cost information handled by EMA is related to a company's production costs. The aim is to produce a product

at a level of company achievement that increases resource efficiency. The measurement of Environmental Management Accounting in this study adopted the measurements made by Peters (2005) as follows:

$$EMA = \frac{\text{prior year production process} - \text{current year production process}}{\text{prior year production process}}$$

Firm Performance

Firm performance is measured using the rate of return or profit generated from the management of assets and investments. Firm performance is measured using ROA (Return On Assets) (Chen et al., 2006). ROA ratio is calculated using the formula:

$$ROA = \frac{\text{Net income}}{\text{Total asset}}$$

Green Product Innovation

The operational definition of Green product innovation is innovation that can streamline the use of finance for company productivity by using the R&D equation compared to the company's total sales. The measurement of green product innovation adopts the measurement technique used by Peters (2005) as follows:

$$\text{Green Product Innovation} = \frac{R\&D}{\text{Total Sales}}$$

Green Process Innovation

Green process innovation is an increase in the burden of technology as an effort to minimise manufacturing costs compared to total sales as a measure of the profits obtained by the company. The measurement of green process innovation in this study adopted measurements made by Peters (2005) as follows:

$$\text{Green Process Innovation} = \frac{\text{Technology expense}}{\text{Total Sales}}$$

Methodology

This study uses a path analysis technique, and linear regression approach. We tested the hypothesis using path analysis with SPSS version 20 statistical tools. To test the direct effect

of the independent variable (environmental management accounting) on the dependent variable (firm performance) in this study, several regression models were used as stated below:

- Model 1
 $Product = \beta_1 .EMA + e \dots\dots\dots (1)$

- Model 2
 $Process = \beta_2 .EMA + e \dots\dots\dots (2)$

- Model 3
 $FP = \beta_3 .EMA + \beta_4 .Product + \beta_5 .Process + e \dots\dots\dots (3)$

Notes:

Product is Green product innovation; Process is Green process innovation; FP is Firm performance; EMA is Environmental management accounting; $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ is Regression coefficient; and e is Error term.

Result and Discussion

Descriptive Analysis

Descriptive analysis provides a description of the maximum, minimum, mean, and standard deviation of each of these variables. Descriptive statistical analysis of this research can be seen in the table below:

Table 2: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
EMA	107	-1.305349	.260952	-.06531636	.164509602
FP	107	-.155970	.497740	.07947178	.085685945
PRODUCT	107	.000010	.049380	.00272785	.007751962
PROCESS	107	.000200	.201800	.01405514	.028596319
Valid N (listwise)	107				

Environmental Management Accounting and Firm Performance

Hypothesis 1 states that Environmental Management Accounting (EMA) has a significant positive effect on firm performance. The results of this study indicate that environmental management accounting has a positive but not significant effect on firm performance. This is shown in Table 3 through the P value of 0.197 which is greater than α 0.05 (5%), so H1 is rejected. This is due to the large number of sample companies experiencing increased production costs which have a negative impact because they have to be faced with choices such

as reducing the quantity of product sales, increasing product prices, and using low-quality raw materials that have a negative impact on the environment. The risks faced by these producers will have an impact on the decline in production levels and product sales results because they are left by stakeholders, especially the public, as green customers. This risk has an impact on the quality of company information disclosure. This decline in value also has an impact on the company's performance, which has also declined due to the lack of support from stakeholders. The results of this study are in line with research conducted by Iqbal et al. (2013).

Table 3: Environmental Management Accounting (EMA) and Firm Performance

Variable	Beta	Sig	Conclusion
EMA	.133	.197	Positive and Not-significant

Environmental Management Accounting and Green Product Innovation

Hypothesis 2 states that Environmental Management Accounting (EMA) has a significant positive effect on green product innovation. The results of this study indicate that environmental management accounting has a significant positive effect on green product innovation. Table 4 shows the P value of 0.020 which is smaller than α 0.05 (5%). The results showed that the EMA measured from the difference in production costs last year and the current year is the company's effort to minimise the value of production costs can be done by using raw materials that can be recycled in production. This raises the desire for managers to develop existing products by using environmentally friendly materials. The large use of environmentally friendly raw materials will encourage managers to be more innovative in developing environmentally-friendly products (green product innovation). The results of this study are in line with research conducted by Renning et al. (2011) and Saeidi et al. (2013).

Table 4: Environmental Management Accounting and Green Product Innovation

Variable	Beta	Sig	Conclusion
EMA	.225	.020	Positive and Significant

Environmental Management Accounting and Green Process Innovation

Hypothesis 3 states that Environmental Management Accounting (EMA) has a significant positive effect on green process innovation. The result of this study is in accordance with the hypothesis. Table 5 shows the value of P 0,000 is smaller than α 0.1 (10%). The results of this study indicate that the use of EMA is their effort to minimise production costs to achieve economic efficiency. These efforts can be achieved through new innovations in the production process, and green process innovation. This innovation will encourage the improvement of process technology that is "aware" of the environment and is more advanced as well as

improving the cost structure to be more efficient. The results of this study agree with the previous research by Jayanti and Mutmainah (2016) and Ferreira et al. (2010).

Table 5: Environmental Management Accounting and Green Process Innovation

Variable	Beta	Sig	Conclusion
EMA	.362	.000	Positive and Significant

Green Product Innovation and Firm Performance

The results of this study are in accordance with hypothesis 4. Green product innovation is shown to have a significant positive effect on firm performance. Table 6 shows a P value of 0.008 smaller than α 0.05 (5%). The greater the size of green product innovation, the larger the impact on the increasing performance of the company. If the green product innovation created by the company is successful in minimising the use of resources, the company can create efficiency in the allocation of operational expenses. The decrease in operating expenses will cause the company to produce increased profits and company performance (D'souza et al., 2006). The results of this study are in line with research conducted by Ar (2012) and Lin et al. (2013).

Table 6: Green Product Innovation and Firm Performance

Variable	Beta	Sig	Conclusion
Product	.258	.008	Positive and Significant

Green Process Innovation and Firm Performance

The results of this study agree with hypothesis 5, that green process innovation is shown to have a significant positive effect on firm performance. This is shown in Table 7 of the P value of 0.019 which is smaller than α 0.1 (10%). The greater the green process innovation results are met with increasing firm performance. In the implementation of green process innovation, the company saves energy and resources which are expected to increase efficiency and increase the volume of goods produced to obtain maximum sales. If the level of sales increases, the profits derived by the company will increase. Increased profits can improve firm performance. The results of this study are in line with previous research by Lin and Chen (2014), and Hassan et al. (2013).

Table 7: Green Process Innovation and Firm Performance

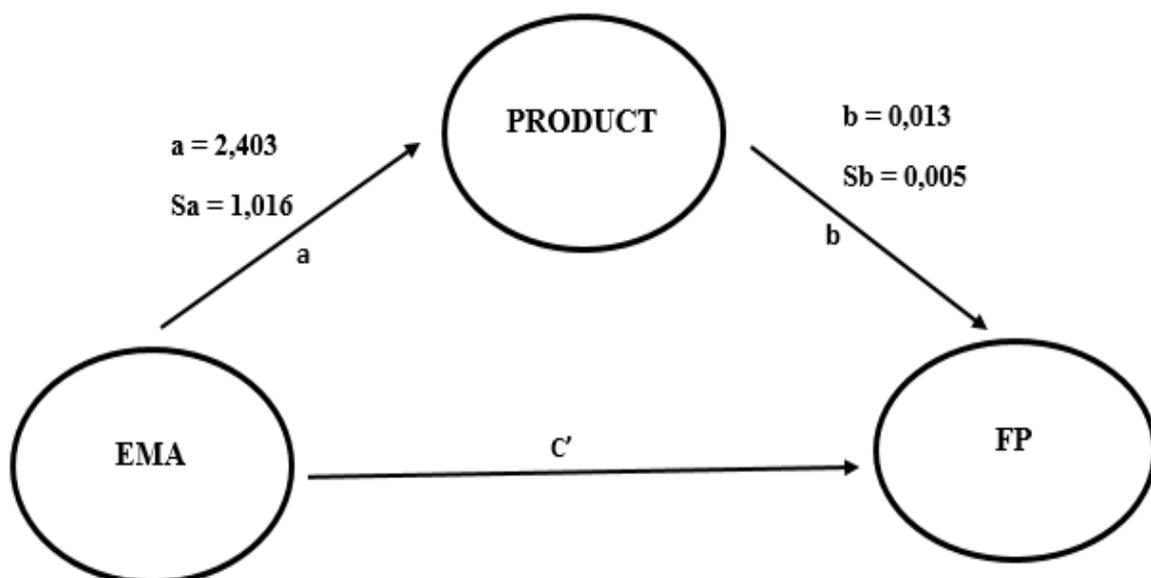
Variable	Beta	Sig	Conclusion
Process	.239	.019	Positive and Significant

The Effect of Environmental Management Accounting on Firm Performance with Green Product Innovation as Mediating Variable

Hypothesis 6 states that green product innovation can mediate the relationship between Environmental Management Accounting (EMA) and firm performance. Through the Sobel test results in Figure 1 it can be seen that the indirect effect of EMA on firm performance has a t-count value of 2.479653. T-count is greater than the t-table value of 1.982597 (sig. 5 %). There is a significant indirect effect of EMA on firm performance through the green product innovation as mediation variable. This green product innovation contributes to reducing the environmental burden or the company's survival target in producing environmentally-friendly products that are determined from the community legitimacy.

Based on stakeholder theory, the role of EMA in improving company performance, is by providing detailed environmental information to the market, the community, and stakeholders. The results of this study are in line with research by Saeidi et al. (2011) who found that green product innovation mediates the relationship between the influence of environmental management accounting on firm performance. These results show that the company's operations depend on the adequacy of external information relating to the EMA. This information is used to improve product innovation in order to obtain the maximum profit that can improve company performance. The development of the company will depend on the company's innovation related to EMA and resource efficiency in order to improve company performance (Guthrie and Ward, 2006).

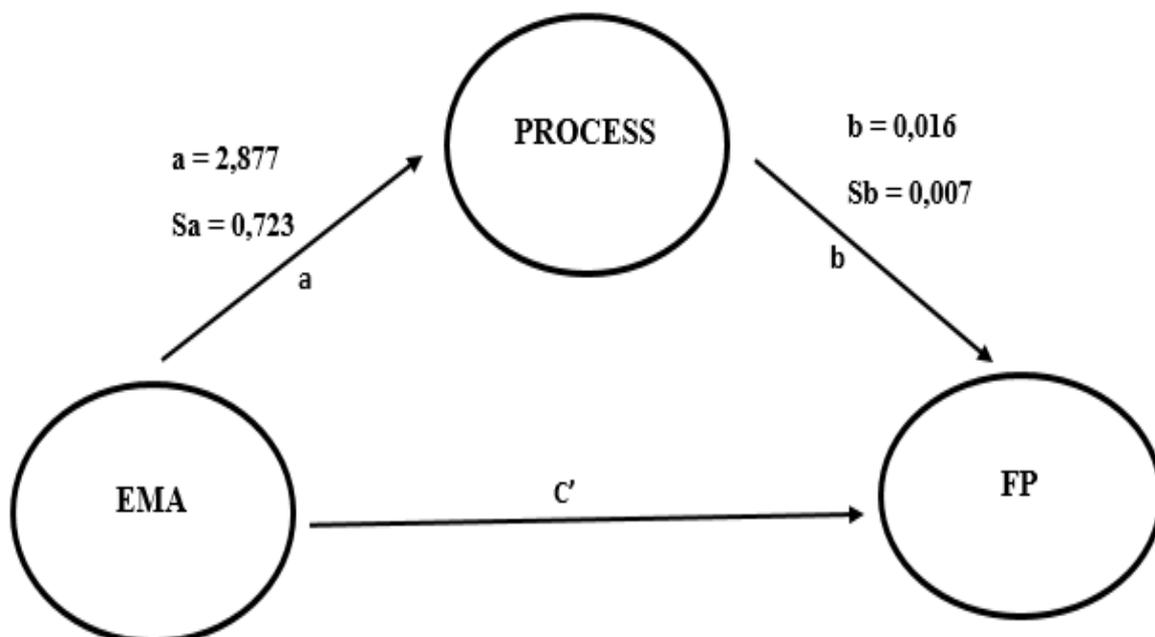
Figure 1. Path Analysis Result 1



The Effect of Environmental Management Accounting on Firm Performance with Green Process Innovation as Mediating Variable

Hypothesis 7 states that green process innovation can mediate the relationship between Environmental Management Accounting (EMA) and firm performance. Through the Sobel test results in Figure 2 it can be seen that the indirect effect of EMA on firm performance has a t-count value of 1.862223, where the t-count is greater than the t-table value of 1.659356 (sig. 10%). The results of this study indicate that the application of EMA in companies is an effort to maintain or improve competitive advantage and firm performance. One way to achieve this is through green process innovation. The application of green process innovation is expected to encourage the development of more advanced process technologies, new products, and increased cost structures. These efforts are expected to provide more accurate information management and cost information so as to improve the company's processes and performance. The results of this study are in line with research by Saeidi et al. (2011) who found empirical evidence that green process innovation mediates the relationship between the influence of environmental management accounting on firm performance. The results of the study show that through EMA the company can disclose costs in the context of cost efficiency, improve product and process innovation, and gain competitive advantage in the market, and improve company performance.

Figure 2. Path Analysis Result 2



Conclusion

The focus in this study is to analyse the mediating effects of green product innovation and green process innovation on EMA-Firm performance relationships in the Indonesian firm. Empirical findings show the following results. First, Environmental Management Accounting (EMA) has no significant effect on firm performance. Environmental Management Accounting (EMA) has a positive and significant influence on green product innovation. Environmental Management Accounting (EMA) has a positive and significant influence on green process innovation. Green product innovation has a positive and significant effect on firm performance. Green process innovation has a positive and significant influence on firm performance. Green product innovation can mediate the effect of Environmental Management Accounting (EMA) on firm performance. And lastly, green process innovation can mediate the influence of Environmental Management Accounting (EMA) on firm performance.

Limitations in this study are the data used are limited to the financial statements and annual reports of manufacturing companies listed on the Indonesian Stock Exchange in 2012-2016. The sample sizes are quite small due to the small number of companies that include R&D expenses in the company's financial statements. In this study, the green innovation proxy only uses R&D and the total additional technology burden compared to total sales and the firm performance proxy only uses ROA. Future studies are expected to be able to use a sample with a more diverse company sector and use other proxies in measuring green innovation and firm performance.

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