

GREEN INNOVATION ON FIRM VALUE WITH FINANCIAL PERFORMANCE AS MEDIATING VARIABLE: EVIDENCE OF THE MINING INDUSTRY

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ABSTRACT

The topic of environmental performance is gaining much attention from academics and politics when it is associated with each country's policies regarding environmental problems. Unfortunately, the comprehensive studies to observe this case become rare, therefore this study is aimed to investigate the direct and indirect effect of green innovation on firm value based on financial performance as the mediating variable. Mining companies which participate in Corporate Performance Rating Assessment (PROPER) listed in the Indonesia Stock Exchange during the year of 2012–2018 were used as the samples. The financial performance was measured by return on assets (ROA) and the firm value were measured by Tobin's Q. The results showed that green innovation had a positive effect on firm value. Financial performance has a positive effect on firm value and financial performance mediates the effect of green innovation on firm value. The green innovation could increase the mining company value. This increase is mediated by financial performance. This present study has been conducted to reveal the direct and indirect effect of green innovation and firm value, financial performance, and firm value comprehensively in which never been done before.

Keywords: green innovation, firm value, financial performance, corporate performance rating assessment

INTRODUCTION

Nowadays, environmental innovation aiming to reduce the impact of product and process on natural environment has become an issue discussed in every sector including accounting. This topic has been increased rapidly when it is related to each country's policies regarding environmental issues (Ozusaglam, 2012). These issues are caused by many human activities including irresponsible mining activities. In Indonesia, environmental problems due to mining activities have been reported to damage the area of forest land in East Java Province (in 2016 was 608.913 hectares) and in Aceh Province (in 2016 was 460.099 hectares), moreover, in Bengkulu Province, there was damage to watersheds, resulting in reduced the clean water supply (Ardiansyah, 2014).

The increase in environmental damage cases caused by mining activities has made people more aware of social and environmental issues. This event made a special concern for the business world, thus demanding companies to carry out social and environmental responsibilities and encourage the creation of green innovation to reduce environmental damage (Boons & Lüdeke-Freund, 2013; Arfi et al., 2018).

Green innovation, one of the environmental innovation studies, is an indicator of firm performance in developing better environmental conditions through effective and efficient management mechanisms (Giannarakis et al., 2017). Green innovation is used in the company's operational activities in the form of environmentally friendly processes and products to enhance the company's competitiveness including innovation in technology, such as energy savings, pollution prevention, recycling management, and waste management (Tang et al., 2017).

In Indonesia, the performance of environmental implementation – responsibility for business to control the pollution, environmental damage, and management of hazardous and toxic waste – is assessed by Corporate Performance Rating Assessment (PROPER). Since 2015, PROPER has been conducted by Indonesia Ministry of Environment and Forestry to increase environmental performance according to legislation and trigger environmental-friendly and sustainable industrial technology innovations. The results of the PROPER evaluation will be represented by five colours symbolised rating (from poor to excellence performance) – black, red, blue, green, and gold (Wahyudianto & Boedisantoso, 2016; Nurputri & Nuzula, 2019).

The main issue obtained in this research is whether the company's involvement in the green innovation activities will give an impact on the firm's value or not. The discussion on this subject is inseparable from the two theories used, namely

stakeholder theory and contingency theory. Stakeholder theory states that corporate responsibility is not limited to capital owners (Freeman, 1984). The company has responsibilities to other stakeholders for the impacts caused by its operational activities (Freeman, 2011). Meanwhile, contingency theory explains that the design of an organisation will be effective and can be applied universally only in certain conditions (Otley, 1980).

Some previous researchers have tested the effect of green innovation on firm value, however, the empirical evidence provides varied and inconsistent results. Research conducted by Osazuwa and Che-Ahmad (2016), Rubera and Kirca (2017), and Sulastri et al. (2018) found that green innovation and corporate value have a positive influence on firm value. On the other hand, different results were found in research conducted by Meng et al. (2014) which concluded that green innovation has no significant effect on firm value, there is a negative effect of green innovation on firm value. Therefore, the current study indicates there is still no clear conclusion yet about green innovation impact on firm value. Govindarajan (1986) states that the inconsistency of the research results is due to the other factors that are contingent. Therefore, from a number of empirical studies related to contingency theory, this present study uses financial performance as a mediating variable that has not been researched yet.

In addition, green innovation can increase the firm value if managed properly. Firm value can be seen from the movement of stock prices. The higher the stock price, the higher the firm's value and attractiveness to potential investors in investing their funds (Kurniasari & Warastuti, 2015; Sabrin et al., 2016). Umrie and Yuliani (2014) revealed that investors will invest in companies that care about the environment. Investment in the environment increases the company's burden in the short run but increases future profits to improve investor confidence (Horváthová, 2012; Burnett et al., 2011).

On the other hand, companies do green innovation due to the pressure of external parties and the availability of corporate financial resources in allocating environmental care costs (Rosli & Sidek, 2013; Weng et al., 2015). Soltmann et al. (2013) stated that the Organisation for Economic Cooperation and Development (OECD) countries such as Austria, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, United Kingdom, and United States carried out green innovation due to political issues. Suki (2017) revealed an increase in purchasing power in Malaysia is due to the company has been producing environmentally friendly products.

In accordance to the research result of Meng et al. (2014), the green innovation has negatively impact the firm value. It can be due to financial performance as main indicator of management system control is experiencing a change from financial performance model into social and environmental performance model as a strategy to fulfill the expectations of various stakeholders, such as shareholders, customers, and employees (Freeman, 1984; Ezzi & Jarboui, 2016). Therefore, this present study is aimed to determine the mediating effect of financial performance on companies that apply green innovation to firm value.

LITERATURE REVIEW

Green Innovation and Firm Value

To prevent greater environmental damage from production activities, the companies can create an environment-based innovation, better known as green innovation. Green innovation may bring advantages for companies to carry out a differentiation strategy in enhancing company reputation and competitiveness (Chen et al., 2012). Companies must implement green innovation in their production processes and results to face challenges in the global market. Green innovation in this study was measured using the PROPER method. PROPER is a measuring tool used to determine the impact of green innovation on company value. The existence of good environmental management will be able to improve the quality of production, improve the company image, and company performance (Sarumpaet, 2005). The Ministry of Environment and Forestry of the Republic of Indonesia created the program to encourage corporate governance in environmental management through information instruments. Through PROPER, the community can assess companies that have a good reputation in environmental management for their operational impacts. Sabrin et al. (2016) states that the performance of the company has a positive effect on firm value. Rubera and Kirca (2017) revealed that innovation can increase firm value because companies are able to utilise resources effectively and efficiently. Schueth (2003) revealed that the company must produce improvements to the environment because at present it is not possible to work without caring about the community and the environment. Therefore, this following hypothesis is developed:

H1: Green innovation has positive impact on the firm value.

Green Innovation and Financial Performance

Green innovation and company value is a compulsive topic for further research. This issue originated from the birth of environmental accounting that began to develop in the 1970s. Environmental accounting started to arise as the community began to have a high level of environmental awareness. The community has begun to demand companies to provide information transparency of the company financial, social and environmental impacts as a result of company activities, and the solutions by the company to overcome them.

Stakeholder theory reveals that the company will inform all forms of responsibility for company's activities related to the environment. Financial performance is an important indicator for investors in measuring the success of a company. Investors expect returns on their investments. Return is obtained if the company is able to produce good performance. Rosli and Sidek (2013) revealed that green innovation has a positive effect on financial performance (Rajapathirana & Hui, 2018; Xie et al., 2019). The company's environmental performance aims to avoid protest or environmental penalties, increase productivity, improve the company's reputation, foster a green awareness image, develop new markets, and achieve competitive advantage (Chen et al., 2006). Referring to the theory and empirical evidence of previous research, another hypothesis is be considered as follows:

H2: Green innovation has positive impact on the financial performance.

Green Innovation, Financial Performance, and Firm Value

Financial performance is a key indicator of the management control system which has shifted from a financial performance model to a social and environmental performance model as a combination of the expectations of various stakeholders (Freeman, 2011; Ezzi & Jarboui, 2016). Other studies also explain that financial performance as a mediating variable affects the technological innovation on the company value (Kim et al., 2012). The results show that financial performance partially mediates technology innovation and company value. The same research conducted in Malaysia shows that financial performance strengthens the effect of eco-innovation on company value (Osazuwa & Che-Ahmad, 2016). Company performance is an important indicator for investors in the company to mediating the influence of green innovation on firm value (Rajapathirana & Hui, 2018; Chan et al., 2015). Environmental innovations that have been carried out by companies can increase competitive advantage and company performance (Tang et al., 2017). Therefore, another hypothesis has been made as follows:

H3: Green innovation has a significant positive impact on firm value mediated by financial performance.

METHODOLOGY

Population and Sample

The population in this study is the mining industries registered in the Indonesia Stock Exchange in 2012–2018. The research sample was companies that had been published the annual report of their activity. The sample collection was done by saturated sampling technique; it is a sampling technique when all members of the population are used. The company's annual report in this present study was accessed from the website www.idx.go.id and PROPER's ranking report in this study was obtained from the site www.mnlh.go.id. The list of samples used in this present study can be seen in Table 1.

Table 1
List of samples and its criteria

No	Criteria	2012	2013	2014	2015	2016	2017	2018
1	Mining companies are listed in the Indonesia Stock Exchange in the period of 2012–2018 and also PROPER participants who published annual reports	30	32	31	30	29	30	31
2	Mining companies are listed in the Indonesia Stock Exchange and are PROPER participants whose annual reports has not been completed	17	16	16	16	17	18	14
3	Final sample	13	16	15	14	12	12	17

Variables Measurement

Independent variable

Green innovation refers to improvements strategy in manufacturing processes and systems of company's activities to reduce negative impacts on the environment, such as energy savings, pollution prevention, waste recycling, and others (Dangelico & Pujari, 2010). Assessment of companies that have implemented green innovation can be measured based on PROPER assessment. PROPER is a company evaluation system that applies environmental, natural resource, and

energy conservation management based on social, cultural, and political conditions in Indonesia. This assessment system was formed by the Indonesian Ministry of the Environment. PROPER ranking consists of five levels as follows: (1) Gold: Excellent, (2) Green: Very Good, (3) Blue: Good, (4) Red: Poor, and (5) Black: Very Poor.

Dependent variable

Firm value is indicating the success level of a company in managing its resources based on investor judgment. Firm value is measured based on market performance using Tobin's Q formula as it covers the fundamental aspects and the assessment of external parties in assessing the company based on investment decisions, funding, and asset management. A high Tobin's Q value indicates that the company has a strong brand image, while the low value portrays the company is generally in a very competitive industry (Chung & Pruitt, 2007; Kirk et al., 2013).

$$\text{Tobin's Q} = \frac{MVCS + STL - STA + BVLTD}{BVTA} \quad (1)$$

Where:

Tobin's Q	=	Firm value
MVCS	=	Market value of commons stock
STL	=	Short-term liabilities
STA	=	Short-term asset
BVLTD	=	Book value of long-term debt
BVTA	=	Book value of total asset

Mediation variable

Financial performance is the result of the achievements achieved by each company in running each of their businesses within a certain period of time. Al-Matari et al. (2014) revealed that the company's performance can be assumed as the efficiency and effectiveness of the company's operational activities for one year. Financial performance can be measured based on financial performance, return on asset (ROA).

$$ROA = \frac{\text{Net profit}}{\text{Total asset}} \quad (2)$$

Control variable

The control variable was used to manage outside factors to not affect the relationship between the independent variable and the dependent variable. Control variables are entered into the mediation model to reduce bias and obtain a model that can confirm the data. There are two control variables used in this study, namely firm size and firm age. Firm size in this present study used company's total assets which has been measured based on the natural logarithm of total assets. Firm age is calculated as the number of years starting from the year the company was founded up to the year of the annual report used in this present study.

Data Analysis

The data obtained in this present study was processed and analysed using PLS-SEM with statistical software tools WarpPLS 6.0 (Sholihin & Ratmono, 2013). Partial least square method in this study aimed to see the effect between variables. The independent variable is green innovation which was proxied by PROPER, and the intervening variable is financial performance which was proxied by ROA. The dependent variable, which is the firm value was proxied by Tobin's Q. The statistical model of this research can be seen as follows:

$$FV_{it} = \alpha_0 + \beta_1 GPI_{it} + \beta_2 FS_{it} + \beta_3 FA_{it} + \varepsilon_{it} \quad (3)$$

$$FP_{it} = \alpha_0 + \beta_1 GPI_{it} + \varepsilon_{it} \quad (4)$$

Where:

α = Constant value

$\beta_1 - \beta_3$ = Coefficient value

FV = Firm Value of company i in year t

Glit = Green Innovation of company i in year t

FSit = Firm Size of company i in year t

FAit = Firm Age of company i in year t

FPit = Firm Performance of company i in year t

ε_{it} = Standard error of company i in year t

Robustness Test

The robustness test was done by replacing the green innovation proxy using ISO 1400 certification for a firm to reduce the environmental damage caused by the firm activities.

RESULTS

Descriptive Statistics of Variables Tested

The average of the financial performance, the firm value, the firm size, and the firm age were 0.06, 1.20, 7.48, and 38.26, respectively (Table 2).

Table 2
Descriptive statistic of variable tested

Variable	Mean	Min	Max	Std. Dev
Financial performance	0.06	-0.64	0.46	0.13
Firm value	1.20	0.05	7.69	1.02
Firm size	7.48	4.50	9.44	1.19
Firm age	38.26	1	50	13.53

Based on PROPER assessment (Table 3), 71% of companies can be categorised as Blue category, 14% of companies as Green category and 15% of companies as Gold category, including: PT Aneka Tambang Tbk, PT Medco Energi International Tbk, and PT Bukit Asam Tbk. It can be concluded that mining companies in Indonesia have good performance in implementing environmental management.

Table 3
Green innovation (PROPER assessment)

Category	Ranking	Percentage
Blue	70	71
Green	14	14
Gold	15	15
Total	99	100

Inner Model Assessment

The measurement of the inner model is intended to predict the role of financial performance on the impact of green innovation on firm value. The measurement of the inner model was based on the adjusted R-square value while considering the Q-square value as stated in Table 4. It was indicated that financial performance or ROA has an adjusted R-square value of 0.086 or 8.6%, which means that the green innovation variable is able to explain the company's financial performance of 8.6%, while the rest is other variables that are not used in this present study. Moreover, firm value has an adjusted R-square value of 0.108 or 10.8% which

means that green innovation is able to explain the firm value of 10.8%. Based on the results of predictive validity (Q^2) calculation, the value of Q^2 financial performance is 0.483 and firm value is 0.586 that is greater than zero so that they meet the criteria of a good predictive validity.

Table 4
Output of inner model

Dependent variables	Adjusted R-Square	Q-Square
Financial performance (ROA)	0.086	0.483
Firm value (Tobin'S Q)	0.108	0.586

This study uses four sizes of fit models including: average path coefficient (APC), average R-square (ARS), average adjusted R-square (AARS), and average block variance inflation factor (AVIF). AARS model is used to measure the average value of the path coefficient, R-square, and adjusted R-square produced in the model. The four sizes of the fit model are measured based on the required ρ -value $\rho \leq 0.05$ (Sholihin & Ratmono, 2013; Hair et al., 2016). Moreover, AVIF model is used to test the collinearity problem in the PLS model in which it must be ≤ 5 but the recommended value is $AVIF \leq 3.3$ (Hair et al., 2016). The APC, ARS, and AARS (Table 5) have ρ -values ≤ 0.05 and AVIF values ≤ 3.3 which indicate that there is no multicollinearity problem between proxies and variables used.

Table 5
Output of fit model testing

Model fit testing	Value
APC	0.219; $\rho \leq 0.001$
ARS	0.299; $\rho \leq 0.003$
AARS	0.285; $\rho \leq 0.007$
AVIF	1.049

Hypothesis Examination

Table 6 shows the result of hypotheses testing using PLS analysis. This present study has two hypotheses to test the direct and indirect impact of using mediation variable. The results showed that green innovation directly has a significant positive impact on firm value (Table 6, panel A.). This supports H1 which stated that green innovation has a positive impact on firm value. In addition, financial performance mediates the influence of the green innovation on firm value, therefore, H3 is accepted.

As a comparison (Table 6, panel B), the indirect effect showed that green innovation has a positive and significant effect on financial performance (path coefficient = 0.15 and $p > 0.05$), which means H2 is accepted (green innovation has a positive impact on financial performance). Moreover, financial performance has a positive and significant effect on firm value (path coefficient = 0.19 and p -value < 0.05), which means that H4 is accepted. Thus, financial performance increases firm value.

Table 6
Output part least square (path coefficient and p -value)

Interaction between variables	Path coefficient	p -value
Panel A. Direct Effect		
GI → FV	0.08	0.03
Panel B. Indirect Effect		
GI → FV	0.01	0.44
GI → FP	0.15	< 0.01
FP → FV	0.19	< 0.01

Note: GI = green innovation, FP = financial performance, FV = firm value

Moreover, the study results were consistent when additional analyses were performed (Table 7). When the proxy for green innovation is replaced by using ISO 14001, it showed the ISO 14001 has a significant positive effect on the firm value. The results also showed that financial performance mediated the impact of green innovation (ISO 14001) on firm value when the financial performance was used as a mediating variable. The environmental certification obtained by mining companies in Indonesia can gradually become an attempt by the company to reduce environmental damage.

Table 7
Addition analysis-output part least square (path coefficient and p -value)

Interaction between variables	Path coefficient	p -value
Panel A. Direct Effect		
ISO 14001 → FV	0.57	< 0.01
Panel B. Indirect Effect		
ISO 14001 → FV	0.29	< 0.01
ISO 14001 → FP	0.34	< 0.01
FP → FV	0.13	0.034

The Impact of Green Innovation on Firm Value

The results of this study are in line with research conducted by Rubera and Kirca (2017) and Sucuahi and Cambarihan (2016) revealed if there are innovations that were carried out by the company on an ongoing basis, the firm value would be better. Thus, investor confidence in the company will increase.

This present study also explains that many mining companies in Indonesia have implemented green innovation. These companies are considered to have the ability to use energy resources efficiently. Thus, the public and stakeholders are interested in buying their products. When the firm value increases (seen from stock movements), the company's sales will also have the same trend.

DISCUSSION

The Impact of Green Innovation on Financial Performance

Green innovation has a significant positive effect on financial performance. Another study stated that environmental innovation and performance can create economic value for manufacturing to increase the environmental proactive and contribute to transform environmental performance benefits into financial performance (Ong et al., 2019). This shows that the good implementation of green innovation has positive impact on financial performance. This finding is in line with the results of the study by Soewarno et al. (2018) and Nishitani et al. (2017) which explained that green innovation can improve a mining company's financial performance. This positive influence is due to the high number of mining companies in Indonesia that have carried out green innovation. When mining companies are considered to have environmental responsibility, opportunities to increase sales are improved. Investment in environmental care and improvement will add burden to the company and community sustainability in the short term while increasing financial performance. This statement supports the stakeholder theory which states that companies that create environmental sustainability by making various innovations in order to reduce negative impacts on the environment can increase the company's profits (Arfi et al., 2018; Xie et al., 2019; Burnett et al., 2011).

The company's commitment to preserving the environment can guarantee the sustainability of the company's business (Soewarno et al., 2018). Based on the results of the assessment carried by the Indonesian Ministry of Environment, PROPER participants listed in the Indonesia stock exchange have carried out their activities based on the concept of environmentally friendly and sustainable

growth. This will have a positive impact on investors for companies that comply with environmental regulations.

The Impact of Green Innovation, Financial Performance, and Firm Value

Financial performance is able to mediate the impact of green innovation on firm value. Thus, the company's financial performance has an impact on increasing the firm value. Green innovation applies eco-efficiency that product development with environmental management and focus on market, so the financial performance increase because of market differentiation or cost advantage generated through environmental innovation (Ong et al., 2019). Green innovation applied on firm value lead the investors interest to the company because they are sure that the company focus on environmental sustainability in the future. High environmental performance of the company will enhance the investors' interest, company's value and stakeholders to use the products, therefore it improves the company profit (de Beer & Friend, 2005; Aguilera-Caracuel & Ortiz-de-Mandojana, 2013; Agustia et al., 2019).

The results of this study support the stakeholder theory that companies must fulfill the rights of stakeholders related to information on company's activities such as pollution, social movements, and company business for safety in order to obtain support and face the level of competition between industries (Rubera & Kirca, 2017; Sulastri et al., 2018). Green innovation that has been carried out by the company is positively correlated with the company's internal and external interests.

Thus, mining companies become responsive to environmental conditions of their surroundings. One form of the application is the company's participation in environmental programs at the national and international level. The survival and financial performance is determined by the innovation strategy undertaken by the company and supports government programs to make the industrial area become environmentally friendly (Eiadat et al., 2008).

Green innovation is a form of environmental strategy in financial and non-financial investment (Baker & Sinkula, 2005). Green innovation is considered as a burden for companies, especially in developing countries. However, on the other hand, it is also considered as a strategy to increase profits in the future (Burnett et al., 2011; Horváthová, 2012; Rajapathirana & Hui, 2018). Financial performance is the main assessment standard of investors towards companies in the internal and external environment (Usman et al., 2017). Previous study mentioned that green innovation plays a role in increasing firm value (Guenster et al., 2011). This is because the

company uses technology that is safe so that it does not carry negative impacts on the environment (Osazuwa & Che-Ahmad, 2016).

The Impact of Financial Performance on Firm Value

Financial performance has a significant positive effect on firm value. This finding indicates that financial performance can increase the firm value which is seen to be higher in stock prices. High profits from stock prices will attract investors to invest which will have a positive effect on firm value (Sulastri et al., 2018; Tariq et al., 2019). Sabrin et al. (2016) provide empirical evidence that profitability has a significant positive effect on firm value (Kurniasari & Warastuti, 2015). Profitability shows the effectiveness of the company in generating profit levels from managing its assets. Investor's assessment of financial performance will affect the company's sustainability in the future. Sabrin et al. (2016) revealed that the higher the profitability will lead the company to obtain good prospects so that investors will pay more for the company.

CONCLUSIONS AND LIMITATIONS

This study provides four main findings. First, green innovation has a significant positive effect on firm value. In other words, green innovation is a factor that enhances the company's ability to be involved in reducing environmental damage due to company's activities. The second finding shows that green innovation has a positive effect on financial performance. The third finding is that financial performance fully mediates the effect of green innovation on firm value. These results indicate that green innovation cannot directly affect the value of the company but must go through the financial performance. The fourth finding is that financial performance has a significant positive effect on firm value. Furthermore, the result of this present study can be used as consideration for developing the environmental accounting standards by the Indonesian government to improve the quality of existing regulatory standards.

This study has limitations that can be taken into consideration for further research. First, the sample used is limited to mining companies, so it does not describe the overall condition of companies in Indonesia. Second, the financial performance in this study only uses ROA. Third, the green innovation proxy is limited to companies that participated in PROPER assessment. This can be a consideration for other studies interested in green innovation.

As suggestions, future research will be interesting by adding more samples other than mining companies only. Further studies may also want to consider using more standard of financial performance measurement and add more green innovation measurement variables.

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