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Does ISO 14001 Moderate the Effect of Green Innovation on Financial Performance

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Abstract

The purpose of this research is to gather empirical evidence on the influence of green processes and green product innovation on financial performance moderated by ISO 14001. The research population is the manufacturing sector listed on the Indonesia Stock Exchange during 2012-2019. The sample was chosen based on specific criteria and so the research sample obtained 184 observations. The conclusion is that green process innovation and green product innovation influence an increase in financial performance proxied by return on assets (ROA) however, ISO 14001 certification does not moderate the influence of green process innovation and green product innovation on financial performance. Regardless of whether the organization achieves ISO 14001 certification, it will continue to implement green innovation. The purpose of ISO 14001 certification is to create a green image for the organization; therefore, a company with ISO 14001 certification does not always apply green innovation or even increase its performance.

Keywords
green process innovation; green product innovation; return on assets; ISO 14001

I. Introduction

Activities carried out by humans such as the transfer of land functions and the continued use of fossil fuels until nowadays cause an increment in greenhouse gas emissions on earth (Radon, 2019). On Monday, July 06, 2020, via pers release in the presidenri.go.id, President Joko Widodo said that the industrial sector in Indonesia still has responsibility for reducing 0.11 percent carbon emissions. There are three main sources of carbon emissions in the industrial sector, the biggest one around 40 percent comes from energy use, and the rest comes from the industrial waste process and management technology. Economic growth in a country that is not followed by energy resource efficiency and safeguarding environmental sustainability will lead to the inhibition of sustainable economic development (Ar, 2012). The company's disregard for the environment will harm its image and lower its market value (Maesaroh and Etty, 2021). Furthermore, Indonesia passes Law Number 03 of 2014 about Industry. This law stated that industry throughout Indonesia needs to be greener. The company fully supports the government's efforts in addressing global warming and realizing sustainable development. One of the most significant components in establishing its success is innovation (Simamora and Sulistianingsih, 2021). The company tries to be more environmentally friendly by implementing green innovation in its business process (Calza et al., 2017).

Green Innovation is a type of corporate growth that involves integrating environmental methods while adhering to government rules (Agustia et al., 2019). Green innovation implemented by the company according to Calza et al. (2017) will make the company improve its products, processes, and management to be greener. Green innovation improves existing products and processes in the company to be more efficient in terms of energy use, raw material conservation, and pollution prevention (Asni and Agustia, 2021). Green innovation has already been classified as green process innovation and green product innovation by researchers such as Tang et al. (2018); Tariq et al. (2019); Xie et al. (2019). Green process innovation is defined as the implementation of novel concepts. Green process innovation is described as the incorporation of novel ideas into the manufacturing process and business systems to develop environmentally friendly products. Companies implement green process innovation by adopting new technologies that are more efficient in the use of resources and energy (Küçükoğlu and Pınar, 2015; Xie et al., 2019). Green product innovation is a type of product innovation that occurs in a firm with the goal of achieving environmental concerns (Lin et al., 2013). Companies that embrace green product innovation are expected to have fewer environmental issues than competitors since the product cycle may be managed as efficiently as feasible (Wong et al., 2012). Durif et al. (2012); Tang et al. (2018); Asni and Agustia (2021) found that green product innovation helps companies to make items from recycled materials that are still durable, non-toxic, and require minimum packaging. Green product innovation in businesses can differentiate products by making them more ecologically friendly (Chen et al., 2006); (Calza et al., 2017); (Asni and Agustia, 2021).

Many researchers have undertaken research related to green innovation and firm performances however the results are mixed, implying that past research is inconsistent. According to Ar (2012), green product innovation has a considerable positive impact on the company's performance and competitiveness. Green innovation, as demonstrated by Cai and Li (2018); Zhang et al. (2019) can improve both the company's environmental and financial performance. While the research presented by Madaleno et al. (2020) describes different outcomes, where green innovation has a detrimental impact on firm performance regardless of company size. The gap which occurred in previous studies, makes the researchers add ISO 14001 as a moderation variable that can strengthen the relationship of green innovation to company performance. Cai and Li (2018) in their research said that to support the companies to implement green innovation, the government is expected to encourage businesses to do ISO 14001 certification in their companies. Furthermore, Li et al. (2019); Duque-Grisales et al. (2020) in their research said that ownership of ISO 14001 certification in companies can support companies to do green innovation. Similarly, Inoue et al. (2013) in their research said that the company can significantly improve the company's R&D with the ownership of ISO 14001 certification.

Based on the explanations outlined above, the purpose of this study is to gather empirical evidence of the influence of green innovation, consisting of green processes and green products, on the financial performance proxied by return on assets (ROA). Then, obtaining empirical evidence of ISO 14001 moderates the influence of green process innovation and green product innovation on a company's financial performance.

The natural resource-based view (NRBV) theory put forward by Hart (1995) emphasizes sustainable competitive advantages related to its resources and environment. In their research, Hart and Dowell (2011) suggested that the company proved to be able to increase its profitability when it can utilize its resources efficiently. According to Hart (1995) theory of natural resource-based view, a company's performance can improve when it can carry out resource-efficient economic activities while also caring for the environment. Green innovation implementation hopes to solve environmental problems that arise due to the

product cycle as well as possible (Wong et al., 2012). Green innovation involves updating a company's manufacturing process to make its products more ecologically friendly (Cheng et al., 2014). New technologies that use resources and energy more efficiently help to pollution reduction and are required to promote the deployment of green innovation in businesses (Küçükoğlu and Pınar, 2015). The efficiency of resources and energy consumption, as well as lower pollution levels in businesses, can minimize operating costs (Hart, 1995) and increase the company's performance (Xue et al., 2019).

Previous research was done by Küçükoğlu and Pınar (2015); Chen et al. (2006) found that green process innovation has a considerable positive impact on the company's competitiveness. Furthermore, Xie et al. (2019) discovered that green process innovation performed by the company had a considerable favorable impact on the company's performance. Green process innovation in the workplace can boost the company's success as evaluated by return on assets (ROA). Several other studies have found a substantial positive association between green process innovation and firm performance (Sezen and Çankaya, 2013; Cheng et al., 2014; Tang et al., 2018). Based on the explanations already outlined above, therefore the researchers propose the following hypotheses:

H1: Green process innovation positively affects the company's financial performance

Green product innovation as an innovation carried out on products makes the company's products more environmentally friendly (Wong et al., 2012). Products that are the outcome of green product innovation can have a longer useful life. In addition, the product does not contain materials that can harm the environment and can be more easily recycled (Durif et al., 2012). Green product innovation gives companies a competitive advantage because their products are more ecologically friendly (Chen et al., 2006). According to a previous study, green product innovation performed by businesses has a considerable positive effect on the company's performance (Xie et al., 2019). Research conducted by Tang et al. (2018) showed the same results as Xie et al. (2019), where green product innovation improves firm performance. Several previous studies have found a significant beneficial association between green product innovation and firm performance (Ar, 2012; Cheng et al., 2014; Lin et al., 2014). Based on the explanations given above, it can be concluded that green product innovation can improve the company's performance so researchers propose the following hypotheses:

H2: Green product innovation has a positive effect on a company's financial performance

ISO 14001 can increase a company's green image, assist the company in tackling environmental impacts (Duque-Grisales et al., 2020), reduce its operating costs, and increase the company's competitive advantage and performance. Arocena et al. (2020) in their research said that ISO 14001 contributes to reducing carbon emissions produced by companies and can increase corporate profitability. ISO 14001 certification owned by the company will cause the company to make savings in the cost of energy consumption, raw materials, and waste management in order to improve the company's performance (Ann et al., 2006). ISO 14001 certification will strengthen the company's green innovation and performance relationships through a commitment to continuous improvement in the company's business lines (Duque-Grisales et al., 2020). A company can improve its environmental and business performance only if it adopts ISO 14001 and conducts extensive monitoring of the company's impact on its environment (Ferrón-Vílchez, 2016). ISO 14001 certification will strengthen the company's green innovation and performance relationships through a commitment to continuous improvement in the company's business lines (Duque-Grisales et al., 2020). According to Arocena et al. (2020) in their research, ISO 14001 contributes to minimizing carbon emissions produced by the company and can boost the company's profitability. Ownership of ISO 14001 certification is predicted to strengthen the

connection between green process innovation and firm performance, or the following hypotheses can be established:
H3: ISO 14001 moderates the effect of green process innovation on a company's financial performance

Ownership of ISO 14001 certification in addition to being used as environmental impact management can also be used to help the company communicate to its stakeholders that the company has committed to maintaining its environment (Ann et al., 2006). The company will implement green product innovation to increase its environmental performance (Li et al., 2019) and achieve sustainable growth (Inoue et al., 2013). Research put forward by Ferrón-Vílchez (2016) revealed that ownership of ISO 14001 can positively affect a company's performance. Companies that implement ISO 14001 certification will operate with higher efficiency to achieve better company performance (Arocena et al., 2020). The company's ISO 14001 accreditation helps increase the link between green innovation and business performance (Duque-Grisales et al., 2020). The possession of ISO 14001 certification is believed to moderate the relationship between green product innovation and firm performance, or the following hypotheses might be formulated:
H4: ISO 14001 moderates the influence of green product innovation on a company's financial performance.

II. Research Method

2.1 Population and Sample

This study employs a quantitative approach, drawing on secondary data obtained from the company's annual report for the period 2012-2019. The research data is analyzed by using descriptive statistics, Pearson Correlation, and Moderated Regression Analysis (MRA) found in STATA software. This study's population consists of all manufacturing companies registered on the Indonesia Stock Exchange (IDX) between 2012 and 2019. Purposive sampling, which is a sampling strategy based on certain criteria, is used to determine the research sample. The criteria for defining the sample in this research are companies that publish annual reports for the period 2012-2019 and have complete data. The results of sampling based on the criteria were obtained from as many as 184 observations.

2.2 Dependent Variable

The performance of the company is the dependent variable in this study. According to Xie et al. (2019), the performance of the company is proxied by return on assets (ROA). ROA is more stable when used to measure the company's performance compared to other ratios. ROA is calculated by dividing net income by total assets.

2.3 Independent Variable

Green process innovation and green product innovation are independent variables in the study. Green process innovation emphasizes the efficient use of raw materials and energy resources, as well as the reuse of the remaining products of the production process to reduce pollution (Chiou et al., 2011). Green process innovation in companies can be measured by the company's efficiency in using raw materials and energy divided by sales (Peters., 2005). Green product innovation focuses on the creation of products that use the fewest polluting materials and consume the least amount of energy (Chen et al., 2006). The company's awareness to create environmentally friendly products, causes the company to conduct research and development every time which is characterized by the allocation of research and development expenses (Simeth and Cincera, 2016). Green product innovation is measured by research and development expenses divided by total assets.

2.4 Moderation Variable

ISO 14001 is a moderation variable. Ownership of ISO 14001 certification can encourage companies to implement green innovation (Li et al., 2019). A dummy variable is used to measure this variable. If the company possesses ISO 14001 certification, it receives a score of 1, otherwise it receives a score of 0.

2.5 Control Variable

This research is controlled by some variables. Firm age is one of the control variables in this study. Older companies tend to have qualified resources and capabilities that can be used in the application of green innovation (Pan et al., 2020). The company's lifespan may be calculated from the year the company was established to the year the study was conducted (Xue et al., 2019). Leverage is also one of the control variables. Leveraged companies can generate additional funds obtained from external parties. So that with these funds the company can allocate them for the application of green innovation (Pan et al., 2020). Total liabilities divided by total assets equals leverage. The size of the company is also a control variable. Larger firm sizes will be more profitable and will be able to research and development to achieve green innovation. The natural logarithm (ln) of the company's total assets is used to calculate its size. The type of industry is another control variable, according to Purwanto (2011) high profile industry is a company with a high vulnerability to the environment, so it tends to reveal more responsibility. A dummy variable is used to measure this variable. If the company is in the high-profile industry, it receives a score of 1, otherwise it receives a score of 0.

2.6 Analysis Technique

This study used descriptive statistics, the Pearson correlation test, and Moderated Regression Analysis (MRA). Hypothesis testing in this study used three regression equations. The first regression equation without involving moderation variables is used to determine the influence of the variables green process innovation and green product innovation on return on assets. The equation is as follows:

$$ROA = \alpha_1 + \beta_1 GPROC + \beta_2 GPROD + \beta_3 AGE + \beta_4 LEV + \beta_5 SIZE + \beta_6 TYPE \quad \ldots\ldots (1)$$

The second regression equation involves a moderation variable, used to determine the effect of the ISO 14001 variable on the return on assets. The equation is as follows:

$$ROA = \alpha_2 + \beta_7 GPROC + \beta_8 GPROD + \beta_9 ISO + \beta_{10} AGE + \beta_{11} LEV + \beta_{12} SIZE + \beta_{13} TYPE$$

…….……. (2)

The third regression equation involves moderation and interaction variables, used to determine whether ISO 14001 variables moderate the influence of green process innovation and green product innovation on return on assets. The equation is as follows:

$$ROA = \alpha_3 + \beta_{14} GPROC + \beta_{15} GPROD + \beta_{15} ISO + \beta_{16} GPROC * ISO + \beta_{17} GPROD * ISO + \beta_{18} AGE + \beta_{19} LEV + \beta_{20} SIZE + \beta_{21} TYPE$$

……...… (3)

III. Results and Discussion

3.1 Results

Return on Assets (ROA) is a dependent variable (Y), descriptive statistical results show that ROA has a minimum value of -0.097 in 2017 and a maximum value of 0.395 in 2013. In addition, the ROA variable has an average (mean) of 0.084 and a middle (median) value of 0.069. The greater value of ROA shows that more effectively the company uses the assets in generating profits. Green process innovation (GPROC) is an independent variable (X1), that has a minimum value of -1,052 in 2013 and a maximum value of 0.459 in 2016. In addition, the ROA variable has an average (mean) of 0.031 and a middle (median) value of 0.024. Green product innovation (GPROD) which is another independent variable (X2), has a minimum value of 0.000 in 2013 and a maximum value of 0.108 in 2016. In addition, the ROA variable has an average (mean) of 0.006 and a middle (median) value of 0.001. The greater value of GPROC and GPROD shows that the company can improve its financial performance. ISO 14001 becomes a moderation variable (Z), which has a minimum value of 0.000, a maximum value of 1,000, a mean value of 0.516, and a middle (median) value of 1,000.

Table 1. Descriptive Statistics

	Mean	Median	Min	Max
ROA	0.084	0.069	-0.097	0.395
GPROC	0.031	0.024	-1.052	0.459
GPROD	0.006	0.001	0.000	0.108
AGE	48.745	46.000	18.000	107.000
LEV	0.424	0.366	0.077	2.703
SIZE	28.378	28.716	18.549	32.011
TYPE	0.652	1.000	0.000	1.000
ISO	0.516	1.000	0.000	1.000

Source: STATA data processing, 2021

According to the Pearson correlation data provided in table 2, AGE has a substantial positive link with the company's financial success at a significance level of 1% and a coefficient value of 0.277. The results show that the older the age company will be able to increase the performance of the company. Furthermore, at a significance level of 1% and a coefficient value of 0.305, SIZE demonstrates a positive and substantial link with the company's financial success. Companies of progressively enormous sizes will be able to improve their financial performance. At the 1% level of significance, the LEV variable exhibits a negative and significant connection with ROA, with a coefficient of -0.332. Companies with declining performance cause the company's leverage to increase.

Table 2. Pearson Correlation

	ROA	GPROC	GPROD	AGE	LEV	SIZE	TYPE
ROA	1.000						
GPROC	0.072	1.000					
	(0.328)						
GPROD	0.113	-0.062	1.000				
	(0.127)	(0.403)					
AGE	0.277***	-0.056	-0.014	1.000			
	(0.000)	(0.449)	(0.847)				

LEV	-0.332***	0.135*	-0.202***	0.002	1.000		
	(0.000)	(0.067)	(0.006)	(0.982)			
SIZE	0.305***	-0.081	-0.128*	0.158**	-0.194***	1.000	
	(0.000)	(0.273)	(0.082)	(0.032)	(0.008)		
TYPE	0.023	-0.113	-0.149**	0.287***	0.081	0.025	1.000
	(0.753)	(0.127)	(0.043)	(0.000)	(0.272)	(0.739)	

Source: STATA data processing, 2021

At a significance level of 10% and a coefficient of 0.135, GPROC exhibits only a positive and significant connection with the LEV variable. These results show that samples that have greater GPROC values have greater LEV values. The negative and significant relationship is indicated by the GPROD variable with LEV at the significance level of the 1% level with a coefficient of -0.202. These results show the sample that has a smaller GPROD value is the company that has the larger LEV. In addition, a negative and significant relationship is indicated by the GPROD variable with SIZE at a significance level of 10% with a coefficient of -0.128. These results show the sample that has a smaller GPROD value is a larger-sized company. Other negative and significant relationships are also indicated by gprod variables with TYPE at a significance level of 5% with a coefficient of -0.149. These results show the sample that has a smaller GPROD value is companies with the type of companies that had a greater risk to the environment.

Table 3. Multiple Linear Regression

	(1)	**(2)**	**(3)**
	ROA	**ROA**	**ROA**
GPROC	0.100**	0.114***	0.159**
	(2.40)	(2.78)	(2.10)
GPROD	0.585*	0.767**	0.916***
	(1.94)	(2.54)	(2.84)
ISO		0.029***	0.039***
		(2.86)	(3.20)
GPROC_ISO			-0.063
			(-0.70)
GPROD_ISO			-1.549
			(-1.37)
AGE	0.001***	0.001***	0.001***
	(3.33)	(3.70)	(3.74)
LEV	-0.066***	-0.061***	-0.066***
	(-3.97)	(-3.72)	(-3.88)
SIZE	0.007***	0.007***	0.007***
	(3.56)	(3.73)	(3.61)
TYPE	0.007	0.015	0.021*
	(0.69)	(1.39)	(1.77)
_cons	-0.076	-0.107*	-0.106*
	(-1.26)	(-1.79)	(-1.76)
Year	Included	Included	Included
r2	0.358	0.388	0.396
r2_a	0.309	0.337	0.338
N	184	184	184

t statistics in parentheses

*t < 1.65, **t < 1.97, t < 2.60 with significance levels of 10%, 5%, 1%

Source: STATA data processing, 2021

The research hypotheses are tested using Moderated Regression Analysis (MRA). The first regression equation, which does not include moderation factors, is used to estimate the impact of green process and green product innovation on return on assets. According to the results of the first model regression test shown in table 3 above, with a coefficient value of 0.100 and a t value of 2.40, there is a significant positive influence between green process innovation and company performance as proxied by return on assets (ROA), with a significance level of 5%. Green product innovation (GPROD) has a favorable impact on company performance as proxied by return on assets (ROA), with a coefficient of 0.585 and a t value of 1.94. Where the estimated value of t exceeds the limit of the value of t, which is 1.65. This demonstrates that green product innovation has a considerable beneficial effect on firm performance, with a significance level of 10%.

The second regression equation involves a moderation variable, used to calculate the impact of the ISO 14001 variable on asset return. While the third regression equation involves moderation and interaction variables, used to find out whether the ISO 14001 variable moderates the impact of green process and green product innovation on return on assets. Table 3 shows the results of the third model regression test, it shows that there is no interaction between green process innovation (GPROC) and ISO 14001 (ISO 14001) ownership of the projected company's performance with return on assets (ROA). Based on the test results in the third model, a t-value of -0.70 and a coefficient value of -0.063 were obtained. This means that ISO cannot moderate the effect of GPROC on ROA. The test results shown in table 3 of the third model also show that there is no interaction between green product innovation (GPROD) and ownership of ISO 14001 (ISO 14001) to the projected performance of the company with a return on assets (ROA). The increase in the value of the company's shares, the higher the company value, the higher it will be (Katharina, 2021). In the current economic development, manufacturing companies are required to be able to compete in the industrial world (Afiezan, 2020). The existence of the company can grow and be sustainable and the company gets a positive image from the wider community (Saleh, 2019). Based on the test results below, a t value of -1.37 and a coefficient value of -1.549 were obtained. This means that ISO cannot moderate the effect of GPROC on ROA. However, from the second model in table 3 above, it can be seen that ISO 14001 as a moderation variable is a predictor or independent with a t value of 2.86 and a coefficient of 0.029, and the significance level is at the level of 1%.

3.2 Discussion

Green process innovation has a considerable beneficial influence on financial performance, according to statistical analysis, hence H1 is approved. These results are supported by the research of Sezen and Çankaya (2013); Cheng et al. (2014); Tang et al. (2018); Xie et al. (2019) which found that green process innovation has a considerable beneficial influence on the financial performance of a company. The company's green process innovation makes the company's processes more ecologically friendly. In addition, companies with green process innovation can realize resource efficiency. The company's efficiency will have an influence on lowering operating expenses and improving performance (Xie et al., 2019). Cheng et al. (2014) has an impact on a company's performance. Green process innovation has a considerable beneficial influence on the company's success, it may be inferred.

Green product innovation has a major beneficial impact on financial performance, resulting in the acceptance of H_2. This is evidenced by the results of statistical analysis that has been done before. These findings are reinforced by studies by Ar (2012), Cheng et al. (2014); Lin et al. (2014); Tang et al. (2018); Xie et al. (2019), which show that green product innovation improves a company's financial performance. Green product innovation

implemented by the company will make the company's products more environmentally friendly and this pro can increase a company's competitive advantage also the company's financial performance proxied by ROA.

This research is in line with the natural resource-based view theory described earlier. Companies can achieve a competitive advantage when they can carry out sustainable economic activities. Sustainable economic activities are intended to streamline resources and care about the surrounding environment of the company.

ISO 14001 has no effect on moderating the positive impact of green process innovation on a company's financial performance, so H_3 is rejected. The implementation of green process innovation causes companies to use new technologies that are more efficient in using raw materials and energy resources. Innovation is carried out by companies by producing new products with more environmentally friendly processes, being a form of corporate response to changes that occur in the market regardless of the ownership or absence of ISO 14001 certification. As a result, a company's ISO 14001 certification may not necessarily improve the link between green process innovation and financial performance. The results of this research are supported by the research of Duque-Grisales et al. (2020) where ISO 14001 certification is only one way for companies to create a green image in their companies, but the ownership of ISO 14001 certification does not guarantee the company will manage environmental impacts.

The statistics also show that ISO 14001 does not moderate positive impact of green product innovation on a company's financial performance, so H_4 is rejected. The adoption of green product innovation is a deliberate move by the company in response to the needs of people who are more concerned about products that are more environmentally friendly. Whether or not the firm has ISO 14001 certification, the company will always do green product innovations to their products. Green product innovation makes the products sustainable and the company gets a competitive advantage. The possession of ISO 14001 in a firm does not necessarily increase the link between green product innovation and the company's financial performance.

The tendency of companies to implement ISO 14001 certification is just a green image to show their commitment to their environment, but the ownership of the certificate does not guarantee the company applies innovation to its environment (Duque-Grisales et al., 2020). Ownership of ISO 14001 according to Duque-Grisales et al. (2020) is also only oriented to short-term profits and does not evaluate changes that occur in the environment and profitability in the long term.

IV. Conclusion

The purpose of this study is to acquire empirical evidence regarding the influence of green processes and green product innovation on financial performance moderated by ISO 14001. The results obtained that green innovation implemented by the company, green process innovation and green product innovation, have a positive effect on the financial performance as proxied by return on assets (ROA). According to NRBV theory, companies can increase their performance when companies able to carry out sustainable economic. While ISO 14001 certification is not able to moderate the influence of green process innovation and green product innovation on financial performance. The company will continue to innovate as a form of corporate response to changes in markets that become more concerned with environmental issues.

The limitation of this study is that the researcher only focuses on manufacturing companies listed in Indonesia, so the results of the study are less generalized if implemented in all existing industrial sectors. Further research is recommended to use other industrial

sectors in other countries and add other variables in addition to green innovation that affects the company's performance.

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