The impact of green innovation on environmental performance of SMEs in an emerging economy

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Abstract. The role of business entities in achieving sustainable development goals has been studied in terms of environmental performance. However, the integration of the model by involving an environmental strategy and green innovation is still rare. The purpose of this study is to examine and explain the role of environmental strategy and green innovation in building SMEs' environmental performance. This study uses a survey method on 177 managers and assistant managers of export SMEs who are concerned with efforts to save the environment. The results showed that environmental strategy had a significant effect on green innovation in realizing environmental performance.

1 Introduction

Research on environmental performance has been carried out and requires attention from various perspectives [1] which encourages companies to improve and harmonize relationships with the natural environment [2]. One of the important determinants of building environmental performance is a strategic initiative that prioritizes problems and formulates environmental strategies [3] by reducing operational impacts to build environmental performance [4-5]. One of the implementations of environmental strategy is green innovation which is considered a significant predictor in determining company performance [6] and achieving sustainable performance [7]. This research attempts to bridge the research gap. First, previous research was conducted from a regulatory perspective on the environment but has not examined it from a strategic point of view based on increasing internal capabilities [1]. This means that it is necessary to maximize the capabilities of the organization in achieve environmental performance, namely how to initiate existing environmental strategies. Second, several studies [8-9] indicate that several gaps have not been researched, including the role of combined corporate resources in promoting green concepts in enterprises [10].

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Third, the relationship between environmental strategy and performance is still contradictory based on the review of the existing literature [3] so in our point of view, it is necessary to add mediating variables to explain these conflicting findings and build a more integrative conceptual framework model. Based on the input-process-output logic pattern, this study examines the effects of two implementation variables, namely environmental strategy and environmental performance as well as the mediating role played by green innovation. Fourth, in the best knowledge, empirical testing of this relationship has not been investigated and has not taken into account the realities of developing countries, such as Indonesia. However, the literature suggests that more research is needed to understand the Indonesian situation in terms of concepts and practices related to sustainability [8]. The motivation behind this research is that researchers pay less attention to environmental strategies to determine environmental performance in SMEs in Indonesia with the mediating role of green innovation. The main research objectives are as follows: to examine the relationship between environmental strategies, green innovation, and environmental performance; to test whether green innovation acts as a mediating variable in the relationship between environmental strategy and environmental performance.

This study offers several contributions and implications. For example, this pioneering research builds a research framework by integrating environmental strategies, green innovation, and environmental performance that previous researchers have ignored [11]. Meanwhile, in the context of managerial implications, leaders can use environmental strategies and green innovation in improve the environmental performance of export SMEs in Indonesia as a developing country.

2 Literature Review and Hypothesis Development

2.1 Environmental strategy and Green Innovation

Research that links environmental strategy as a determinant of green innovation has not been extensively studied. Green innovation can be achieved by creating regulations and strategies that support saving the environment [12]. Environmental strategies enables companies to integrate various ecological issues into business operations by implementing environmental incentive programs to promote the sustainable development of new environmentally friendly products and green processes as well as paying attention to the alignment of resources that have an environmental impact [13]. As a driving force, environmental strategy plays an important role in strengthening green innovation, especially focusing on the impact on the internal and external environments [14]. Based on this description, the hypothesis is formulated as follows;

H1. The environmental strategy has a significant effect on green innovation

2.2 Green innovation and Environmental Performance

In various empirical studies, green innovation has been investigated as a determinant that has a positive effect on overall company performance [6];[11]. Through the green innovation strategy, companies can increase productivity and focus on improving products and processes that are environmentally friendly [15] so that they can change existing operating methods and significantly reduce their negative impact on the environment. In addition, green innovation leads to the creation of new products and processes that can contribute to environmental restoration which has implications for competitive advantage [16]. Based on this description, the hypothesis is formulated as follows;

H2. Green innovation has a significant effect on environmental performance

2.3 Environmental Strategy and Environmental Performance

The strategic plan established by the organization influences the environmental strategy. In this case, environmental interpretations such as opportunities and threats have an effect on the scope for adopting an environmental strategy [1]. As a result, the implementation of environmental strategies and strategies provides opportunities that promote corporate development and minimize environmental threats in operational activities.

Companies that have a proactive strategy are directed at improving environmental performance through the use of environmental performance indicators [17]. Various empirical studies also found that environmental strategy has a significant effect on environmental performance [8-11]. Based on this description, the hypothesis is formulated as follows;

H3. The environmental strategy has a significant effect on environmental performance

2.4 Green Innovation as Mediating Variable between Environmental Strategy and Environmental Performance

Previous discussions about the relationship between environmental strategy, green innovation, and environmental performance recommended that environmental strategy influences green innovation which leads to improved environmental performance. Although there is not much literature discussing the relationship between environmental strategy and green innovation, organizational strategies that lead to saving the environment encourage the creation of green innovation. On the other hand, literature has confirmed that environmental strategy significantly improves environmental performance [8-11]. However, there is a significant relationship between green innovation and environmental performance [6] which has implications for sustainable competitive advantage [18]. Thus, green innovation is used as a mediating variable between environmental strategy and environmental performance. Based on this description, the hypothesis is formulated as follows:

H4. Green innovation mediates the relationship between environmental strategy and environmental performance.

3 Methodology

3.1 Population and sample

The population of the study were 69 export SMEs in Bali, Indonesia. The sample frame was selected by a simple random sampling method to 59 SMEs. Then three respondents - a total of 177 – from each SMEs were asked to fill out the research questionnaire, namely supervisors, assistant managers, and managers because they played an important role in initiating and strategic policies related to green innovation and environmental performance.

3.2 Measurements

The questionnaire in this study used a Likert scale of 1- strongly disagreed to 7 strongly agreed. The environmental strategy variable is measured by 3 indicators [15, 17-18]. Green innovation with 8 indicators [15]. Environmental performance with 5 indicators [15, 24-26].

4 Result and Discussion

4.1 Outer Model Measurement

Based on the concept of measuring reliability, this study uses three measurement methods, namely convergent validity, discriminant validity, and composite reliability. Convergent validity is used to measure the validity of indicators as a measure of a construct which can be indicated by the outer loading factor value above 0.60.

Table 1. Construct Reliability and Validity.

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
EP	0.792	0.794	0.857	0.546
ES	0.915	0.920	0.946	0.855
GI	0.943	0.945	0.953	0.719

Discriminant validity used to measure the validity of an indicator in a variable can be done with another method, namely comparing the coefficient of the square root average of variance extracted (√AVE) of each latent variable with the correlation coefficient between other latent variables in the model. The recommended AVE value is greater than 0.50. This indicates that the indicators in this study have good discriminant validity.

Composite reliability is a measure of the reliability value between the indicators of the variables that make it up. The results of indicator testing are said to be reliable if the composite reliability and Cronbach alpha have a value> 0.70. The results of the calculation of the composite reliability value range from 0.857 - 0.953 (> 0.70), which reflects the variable indicator are reliable. Likewise, the Cronbach alpha value shows a value ranging from 0.792 - 0.943 (> 0.70) (see Table I) so the indicators are reliable so that they can be declared free from random error problems [19].

4.2 Inner Model Measurement

The research model was tested by evaluating the feasibility of the model through the results of the R^2 and Goodness of Fit (GoF) analysis. Q^2 and GoF calculations use the R-square coefficient (R^2) which indicates the strength and weakness of the research model. The R^2 value of 0.67 is classified as strong, 0.33 is classified as a moderate model and 0.19 is classified as a weak model [20].

Table 2. R2 and R2 Adjusted.

Variables	Results	
	R^2	R^2 Adjusted
Green innovation (Y1)	0.446	0.440
Environmental Performance (Y3)	0.864	0.861
Average	0.655	0.650

Based on Table 2, the R2 value of green innovation is 0.446 and the environmental performance is 0.864 so that the R2 value is classified as a strong model because it is above 0.67. The average value of 0.655 means that the model of the relationship between constructs is explained by 65.5 percent, while the remaining 34.5 percent is explained by other variations outside the model. The distribution of R2 Adjusted values is smaller than the distribution of R2 values, which means that changes or expansion of the research model to include other latent variables are still possible [21].

The next step is to measure the Q Square Predictive Relevance (Q^2), namely how well the observations are generated by the research model. Q^2 has a range of values ranging from 0 to 1. The closer to 1 means that the model has the better predictive ability. The value of Q2 is calculated by the formula:

$$Q^2 = 1 - [(1-R^2y1)\ (1-R^2y2)] \quad (1)$$

The results of the calculation of Q^2 show a value of 0.924656 (Q^2 =1 - [((1-0,446) (1-0,864)]) (very good predictive relevance) which means that the model shows very good observations, namely 92.47% the relationship between variables can be explained by the model while the remaining 7.53% is a factor of error or other factors not included in the research model. The next step is to validate the model as a whole with the following calculations.

$$GoF = \sqrt{com\ x\ R^2} = \sqrt{0,573\ x\ 0,655} \quad (1)$$

The results of the GoF= √0,529 = 0,496 calculation show a value of 0, which is close to 1 (one), which means it is a very fit model and has very good measurement accuracy because it has a value above 0.36 (GoF large). Furthermore, testing the effect size (f^2) to predict the variation in the value of the independent variable on the dependent variable in a system of structural equations [22]. The effect size criteria (f^2) are 0.02-0.15 (weak impact), 0.15 - 0.35 (moderate impact) and > 0.35 (strong impact) [20].

Table 3. Cohen Effect Size.

Variables	Results				
	Original *Sample (O)*	Sample *Mean (M)*	*Standard Deviation (STDEV)*	*T Statistics (|O/STDEV|)*	*P Values*
ES -> EP	0.482	0.491	0.061	7.877	0.000
Mean	0.482	0.491	0.061	7.877	0.000

The results of the analysis as shown in Table 3 with a mean of 0.482 can be concluded that it is predicted that a strong mediation relationship pattern is predicted in this study.

4.3 Hypotheses testing

Hypothesis testing in this study was carried out in two stages, namely testing the direct effect and testing the role of mediation. In Table 4, the results of the analysis using SmartPLS 3.2.9 are presented.

Table 4. Direct Relationships among Variables.

Construct	P Values					
	Original *Sample (O)*	Sample *Mean (M)*	*Standard Deviation (STDEV)*	*T Statistics (|O/STDEV|)*	*P Values*	Remarks
ES-> GI	0.668	0.673	0.076	8.729	0.000	H1-Supported
GI -> EP	0.722	0.730	0.039	18.457	0.000	H2-Supported
ES -> EP	0.276	0.265	0.054	5.153	0.000	H3-Supported

The relationship between environmental strategy and green innovation with a value of 0.668 with t statistics 8.729> 1.96 hypothesis 1 is accepted. The results of the study confirm the findings [12] that the effectiveness of green innovation can be achieved by formulating

appropriate regulations and strategies by paying attention to the alignment of environmentally friendly resources [13]. The relationship between green innovation and environmental performance with a value of 0.722 with t statistics 18.457> 1.96 hypothesis 2 is accepted. The results of the study are in line with (Qiu et al., 2020 [6]; Kraus et al., 2020 [11] that companies can increase productivity and focus on improving environmentally friendly products and processes [15] towards environmental restoration which has implications for competitive advantage [16]. The relationship between environmental strategy and environmental performance with a value of 0.276 with t statistics 5.153> 1.96 hypothesis 3. The results are accepted. The results are in line with Kraus et al. (2020) [11]; (Latan et al., 2018)[8] that companies that have a proactive strategy have implications for improving environmental performance [17].

After knowing the direct relationship between variables, the next step is to examine the role of green innovation as a mediator for the relationship between environmental strategy and environmental performance through Variance Accounted For (VAF) with the formula:

$$VAF = Indirect\ effect/Total\ Effect \quad (3)$$

Table 5. Indirect Relationships among Variables.

	Mediation Test					
	Model	*Original Sample (O)*	*T Statistics (|O/STDEV|)*	*T table*	*VAF*	*Remarks*
a	ES-> GI	0.668	8.729	> 1,96	0,758	H4-Partial Mediation= supported
b	GI -> EP	0.722	18.457	> 1,96		
c	ES -> EP	0.276	5.153	> 1,96		

Based on the criteria, it was determined that the VAF value < 0.20 was non-mediated, 0.20 - 0.80 was partial mediation, and greater than 0.80 was fully mediated [21]. From Table V it can be concluded that green innovation acts as a partial mediation of the relationship between environmental strategy and environmental performance (hypothesis 4 is accepted). This is an important research finding that strengthening environmental performance can be achieved through the relationship of green innovation.

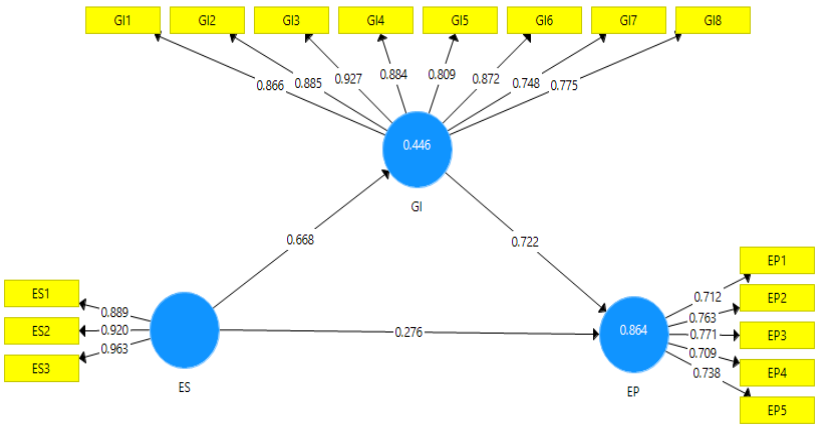

Fig.1. Research Model Analysis.

5 Conclusion

Small and medium enterprises play an important role in society, especially responsible for economic development, innovation, and social change. This study has answered the first research gap that an organization that has a proactive strategy for the environment will improve environmental performance. Furthermore, the research results also answer the second gap that organizational resources (environmental strategy) encourage the implementation of the green concept in the company [8–9]. Third, this study also succeeded in closing the literature gap by proving to test the mediating role of green innovation between environmental strategy and environmental performance. Fourth, the research results provide insight that the empiric relationship between variables is tested in developing countries, especially Indonesia. This study has limitations, namely: a relatively small sample frame and using a self-assessment report. Future research could consider the role of sharing knowledge between companies on environmental strategy and making comparisons between SMEs and other sectors such as manufacturing and the food and beverage industry.

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