

# Gender diversity, renewable energy consumption, and financial performance: a study of Indonesian energy companies

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## ABSTRACT

This study aimed to examine the effect of gender diversity and renewable energy consumption on financial performance, gender diversity on renewable energy consumption, and mediation of renewable energy consumption in the relationship between gender diversity and financial performance in the perspective of stakeholder theory. The population of this study was energy sector companies listed on the Indonesia Stock Exchange in 2020-2022, with total samples obtained based on purposive sampling technique were 58 observation data. The results of PLS-SEM analysis using WarpPLS 8.0 software showed that gender diversity had a significant negative effect on renewable energy consumption and financial performance, while renewable energy consumption had a significant positive effect on financial performance. Furthermore, renewable energy consumption was not proven to significantly mediate the effect of gender diversity on financial performance.

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## 1. Introduction

The progress of a company can be assessed by reviewing aspects of its financial performance (Purba et al., 2021). According to Laura et al. (2023), financial performance is the company's ability to manage and control its resources. Financial performance includes information that reflects the financial condition and fundamental performance of the company (Arifianti & Widianingsih, 2022). This information is needed by external and internal users in order to make decisions. In its development, the goal of maximizing wealth in the latest economic concepts is now closely related to the concept of sustainability because companies are required to focus not only on economic perspectives, but also environmental and social perspectives (Khunkaew et al., 2023). This is a form of ethical behavior of an organization that is shown through its concern for environmental and community aspects in order to maintain long-term sustainability (Anggraini et al., 2020).

The energy sector is one of the sectors facing rapid changes in the business environment due to sustainability issues. Based on the IDX Industrial Classification Guide released by the Indonesia Stock Exchange (2021), the energy sector includes companies that sell products and services related to energy extraction which includes non-renewable energy (fossil fuels) as well as service providers that support the industry. Energy companies themselves are often involved in various negative cases related to environmental pollution around the world, such as cases of oil spills from tankers and wells, as well as air pollution from refineries (Lee, 2021). According to Mezher et al. (2010), the main source of air pollution in Abu Dhabi comes from the energy industry, namely oil and gas, followed by electricity and water desalination production. Another case occurred in Nigeria, where the operations of multinational companies in the oil and gas industry in the Niger Delta region have brought various negative impacts such as cases of gas flaring, oil spills, environmental pollution, negative social impacts, conflict and violence (Ekhatior, 2014). The similar thing happened in Indonesia as shown by data from the Mining Advocacy Network (JATAM), which

recorded 45 conflicts throughout 2020 involving mining industry companies in Indonesia. If summed up with the total number of cases since 2014, an accumulation of 116 mining conflicts has occurred in Indonesia in the 2014-2020 period (JATAM, 2020).

The various cases above prove that the concern of energy companies around the world for sustainability issues is an important issue to examine. Moreover, previous research on corporate social responsibility is still mostly conducted on non-energy sector companies even though the energy sector is considered sensitive regarding its impact on the environment (Lee, 2021). In the global context, the United Nations has released the 2030 Sustainable Development Agenda, which contains 17 Sustainable Development Goals and 169 global targets covering social, economic, environmental, legal and governance pillars (United Nations, 2015). The Government of Indonesia through the Financial Services Authority or Otoritas Jasa Keuangan (OJK) also demonstrated its commitment by issuing regulation, such as Peraturan Otoritas Jasa Keuangan (POJK) Number 51/POJK.03/2017 on the Implementation of Sustainable Finance for Financial Services Institutions, Issuers, and Public Companies. The regulation is a legal umbrella that requires the preparation of a Sustainability Report for public companies (Otoritas Jasa Keuangan, 2017) and has been implemented in stages.

According to Khunkaew et al. (2023), one of the quantitative indicators considered by the Global Reporting Initiative (GRI) Standards is the aspect of energy use or consumption. The increasing energy needs of society as the population increases have the potential to increase greenhouse gas emissions, so these environmental impacts must be managed through energy recovery or the use of renewable energy (Vlaviorine & Widianingsih, 2023). Therefore, conventional energy companies need to adjust their strategies and prepare for new market conditions, including the renewable energy market (Westerman et al., 2020). Based on the Ministry of Energy and Mineral Resources of Indonesia's data, renewable energy share in the total final energy consumption is increasing every year, from 8.60% in 2018, 9.19% in 2019, 11.27% in 2020, 12.16% in 2021, and 12.30% in 2022 (Indonesian Ministry of ESDM, 2023). This data shows that there is a positive trend in the use of renewable energy in various sectors in Indonesia. However, some previous studies that examine the impact of renewable energy use on company performance in terms of its financial aspects still show mixed results. Research by Shin et al. (2018) and Issa & Hanaysha (2023) showed a positive relationship between utilization and consumption of renewable energy on financial performance. These findings contradict the research of Ruggiero & Lehkonen (2017) which reported that increasing renewable energy has a negative effect on financial performance. Other studies actually prove that there is no significant influence between renewable energy and company financial performance (Hulshof & Mulder, 2020; Vlaviorine & Widianingsih, 2023).

In relation to corporate performance and sustainability, an interesting determinant for further study is gender diversity. Gender diversity in corporate boards has attracted considerable attention from many parties including policy makers and shareholders regarding its impact on corporate governance (Kılıç, 2016). In Indonesia itself, gender equality is a hot topic that continues to be discussed. Based on the World Economic Forum report in 2021, Indonesia is ranked 107 out of 156 countries in the Global Gender Equality Index and is below several other countries in ASEAN such as Philippines, Laos, and Vietnam which stand on top 100 rank (Nurhidayat, 2021). However, the gender inequality index in Indonesia also continues to decline every year, showing that the position of women and men is becoming more equal, including in terms of opportunities to occupy important positions in an institution or political position (BPS, 2022). Furthermore, gender diversity has become an important topic of study in corporate performance regarding the perceived relevance of board roles in risk-taking, compliance, strategy, governance, chief executive development, and stakeholder management (Marquez-cardenas et al., 2022). Previous research has proven that board gender diversity positively affects financial performance (Francisco, 2015; Galletta et al., 2022; Khunkaew et al., 2023; Kılıç, 2016). However, these results are inconsistent given that other studies report a negative effect (Adams & Ferreira, 2009; Tania & Hesniati, 2022) or no significant effect (Abdullatif et al., 2018; Marquez-cardenas et al., 2022; Mohsni et al., 2021; Provasi & Harasheh, 2020). Joecks et al. (2013) proposed another view that gender diversity initially has a negative impact on company performance, but after passing a point called "critical mass" in the range of 30%, the composition of women on the board of directors will improve company performance.

Research on board gender diversity and sustainability has also continued to increase this decade (Khatri, 2023). Both gender equality and clean and affordable energy are goals of the Sustainable Development Goals (SDGs) at goals 5 and 7 (United Nations, 2015). Furthermore, the presence of women on boards of directors is one of the governance mechanisms that plays a crucial role in terms of sustainability reporting and corporate performance (Khunkaew et al., 2023). In addition, gender is one of the most studied factors in research related to the topic of ethical behavior (Chen et al., 2016). Liu (2018) proves that female

directors are more concerned about social and environmental issues. This is reinforced by the results of research by Atif et al. (2021) which shows a significant positive effect of gender diversity on renewable energy consumption by companies. Several other studies have also reported a positive influence between gender diversity and sustainability, social and environmental performance (Galletta et al., 2022; Khatri, 2023; Kyaw et al., 2017; Opoku et al., 2021; Provasi & Harasheh, 2020), although inconsistent research results are also still found such as negative effects (Cucari et al., 2017) or no significant effect (Manita et al., 2018).

Based on the discussion that has been described, there are still gaps in phenomena and inconsistencies in the results of previous studies. Conditions in Indonesia which show a positive trend in gender equality and concern for environmental sustainability with the use of renewable energy have not been studied specifically enough, including their impact on company performance in Indonesia. In addition, previous research findings that prove the effect of gender diversity on financial performance, the effect of gender diversity on renewable energy consumption, and the effect of renewable energy consumption on financial performance show that there is an unclear concept of the relationship between the three variables. Therefore, this study will examine the effect of gender diversity on financial performance, the effect of gender diversity on renewable energy consumption, the effect of renewable energy consumption on financial performance, and the effect of renewable energy consumption in mediating the effect of gender diversity on financial performance in energy sector companies on the Indonesia Stock Exchange in 2020-2022.

From theoretical point of view, stakeholder theory will be used as an underlying theory that elaborates the association among the variables in this research. Stakeholder theory proposed by Freeman (1984) states that a business has the main goal of creating value for all stakeholders, which includes all parties who affect or are affected by the business. The stakeholder theory has a different perspective in assessing the context of sustainability in business, which is often understood only in relation to financial value and tends to only accommodate one group of stakeholders, namely shareholders (Schaltegger et al., 2019). One of the key ideas of stakeholder theory is integrating business and ethical decisions as aspects of value creation activities, so that the cooperation of stakeholders who determine the company goals will be more than just seeking profit (Hörisch et al., 2020). Therefore, this research will analyze the sustainability aspect in terms of gender equality on company boards, its relationship with environmental aspects in terms of sustainable energy, while still emphasizing to financial aspects of the company as reflects in financial performance. From the perspective of stakeholder theory, companies that accentuate about sustainability, both in terms of gender equality in their board of directors and environmental and energy sustainability, will influence their financial performance.

This research will contribute to the literature related to financial performance studies, corporate governance, especially board gender diversity, and corporate sustainability in the perspective of stakeholder theory and environmental ethics. Thus, it is hoped that this research can be a reference for companies and other stakeholders in considering policy making, investment decisions, credit, and other crucial decisions in running their business. Based on this research results obtained, energy companies which are the main focus of this research can reconsider and review the composition of female directors on their boards and the amount of renewable energy used in the company. This will influence the direction of the company's crucial policies that will impact on the company's performance, especially from a financial perspective. In this way, the company can accommodate and integrate the interests of stakeholders for the company's progress and sustainability.

## 2. Research Method

This study uses a quantitative approach with an associative type that examines the effect of the gender diversity as independent variable towards financial performance as dependent variable, with renewable energy consumption as an intervening variable. The research population is energy sector companies listed on the Indonesia Stock Exchange in the 2020-2022 period. The energy sector was chosen considering its relevance to sustainability issues, as well as its sensitivity to crises and global financial conditions (Adityaningrum et al., 2024). Sampling of the population was carried out through purposive sampling technique with the following criteria: 1) energy sector companies listed on the Indonesia Stock Exchange in 2020-2022, 2) companies publish sustainability reports in the study period, 3) companies provide all the data needed in the study. Based on these criteria, 20 companies that met the criteria were obtained with a total sample size for the 3-year observation period of 58 observation data.

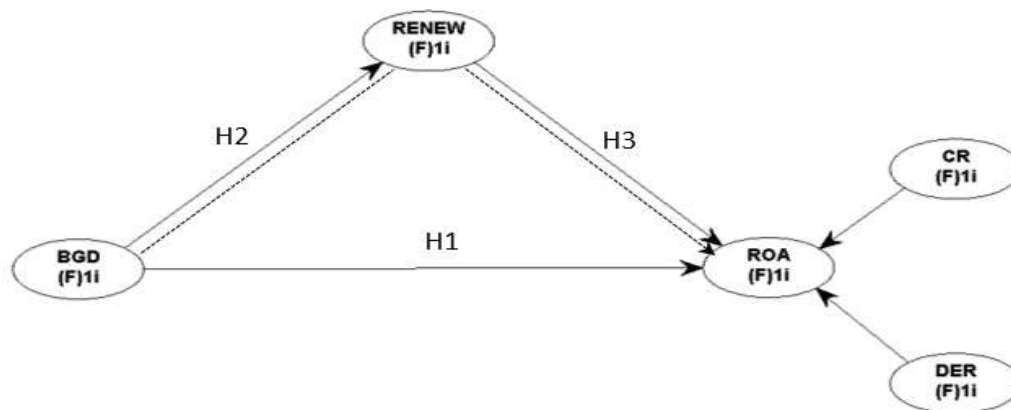
The type of data used in this study is secondary data which is a combination of cross-section data and time series data. Data collection was carried out using documentation techniques, namely collecting all data on research variables from annual reports, financial reports, and sustainability reports published by

research sample companies. These reports are accessed through the Indonesia Stock Exchange website [www.idx.co.id](http://www.idx.co.id) and the relevant company website pages. The data that has been collected is then analyzed using the Partial Least Square - Structural Equation Modeling (PLS-SEM) technique with the help of WarpPLS 8.0 software. The variables used in this study along with their operational definitions and measurements are shown in Table 1.

**Table 1.** Research variables

Variable	Proxy	Measurement
Dependent Variable : Financial Performance	ROA	Return on asset is calculated by dividing net income to the company's total assets expressed as a percentage. (Arifianti & Widianingsih, 2023)
Internening Variable : Renewable Energy Consumption	RENEW	Percentage of renewable energy to total energy consumed by the company. (Atif et al., 2021)
Independent Variable : Gender Diversity	BGD	Percentage of female directors to total number of directors in a company. (Atif et al., 2021; Issa & Hanaysha, 2023)
Control Variable : Liquidity	CR	Current Ratio is calculated by dividing current liabilities by current assets. (Adielyani & Pangestuti, 2023)
Leverage	DER	Debt to Equity Ratio is calculated by dividing total liabilities by total equity of the company. (Adielyani & Pangestuti, 2023)

Furthermore, the empirical research model and research hypotheses are shown as follows.



**Figure 1.** Empirical research model

- H1. Gender diversity has a significant effect on financial performance  
H2. Gender diversity has a significant effect on renewable energy consumption  
H3. Renewable energy consumption has a significant effect on financial performance  
H4. Renewable energy consumption mediates the effect of gender diversity on financial performance

### 3. Results And Discussions

#### 3.1 Descriptive Analysis

**Table 2.** Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
ROA	58	-38.4%	59.3%	0.109	0.183
BGD	58	0.0%	50.0%	0.131	0.162
RENEW	58	0.0%	100.0%	0.261	0.366
CR	58	27.0%	364.3%	1.669	0.783
DER	58	-407.3%	2,484.9%	1.421	3.379

Source : Output WarpPLS 8.0, data processed (2023)

Based on Table 2, ROA has a minimum value of -38.4%, a maximum value of 59.3%, an average value of 0.109, and a standard deviation of 0.183. BGD has a minimum value of 0.0%, a maximum value of 50.0%, an average value of 0.131, and a standard deviation of 0.162. RENEW has a minimum value of 0.0%, a maximum value of 100.0%, an average value of 0.261, and a standard deviation of 0.366. CR has a

minimum value of 27.0%, a maximum value of 364.3%, an average value of 1.669, and a standard deviation of 0.783. DER has a minimum value of -407.3%, a maximum value of 2,484.9%, an average value of 1.421, and a standard deviation of 3.379.

### 3.2 Inner Model Test

#### a. Goodness of Fit

The first stage in evaluating the structural model (inner model) in SEM-PLS is to assess whether the research model has met the criteria for model feasibility or goodness of fit. According to Kock (2021), there are several criteria that must be considered in assessing model fit. The recommended Average Path Coefficient (APC), Average R-Square (ARS), and Average Adjusted R-Square (AARS) values are less than or equal to 0.05 at 5% significance. Meanwhile, the ideal Average Variance Inflation Factor (AVIF) and Average Full Collinearity VIF (AFVIF) values are  $\leq 3.3$  and are still acceptable at  $\leq 5$ , especially for models where all variables consist of a single indicator. The next indicator, namely Tenenhaus GoF, is a measurement of the explanatory power of the research model with small criteria  $\geq 0.1$ , medium  $\geq 0.25$ , and large  $\geq 0.36$ .

Table 3 shows the results of goodness of fit testing on SEM-PLS conducted on research data. Based on the data in Table 3, all goodness of fit criteria have been met so that the structural model can be said to be fit.

**Table 3.** Goodness of fit

Indicator	Value	Prob.	Rule of Thumb	Note
Average Path Coefficient (APC)	0.299	P=0,004	$P \leq 0,05$	Accepted
Average R-Square (ARS)	0.288	P= 0.005	$P \leq 0,05$	Accepted
Average Adjusted R-Square (AARS)	0.261	P= 0.008	$P \leq 0,05$	Accepted
Average Variance Inflation Factor (AVIF)	1.405		Ideal $\leq 3,3$ ; Accepted $\leq 0,05$	Ideal
Average Full Collinearity VIF (AFVIF)	1.196		Ideal $\leq 3,3$ ; Accepted $\leq 0,05$	Ideal
Tenenhaus GoF	0.537		$\geq 0,1$ small; $\geq 0,25$ medium; $\geq 0,36$ large	Large

Source : Output WarpPLS 8.0, data processed (2023)

#### b. Coefficient of Determination R-squared dan Q-squared

The next stage of structural model evaluation is to assess how much the model's ability to explain the dependent variable. This assessment can be done by looking at the coefficient of determination R<sup>2</sup> (R-squared) and Q<sup>2</sup>-predictive relevance (Hair et al., 2019) as summarized in Table 4 as follows :

**Table 4.** R-squared and Q-squared

Indicator	Value	Rule of Thumb	Category
R-squared	0.485	$\leq 0,75$ strong; $\leq 0,50$ medium; $\leq 0,25$ weak	Strong
Q-squared	0.429	$Q^2 > 0$ shows that the model has a predictive relevance $Q^2 < 0$ shows that the model has not a predictive relevance	Has a predictive relevance

Source : Output WarpPLS 8.0, data processed (2023)

Based on Table 4, it can be seen that the coefficient of determination R-squared is 0.485. This value indicates that the variation in purchasing decision variables as the dependent variable can be explained by 48.5% by a combination of gender diversity variables as independent variables, renewable energy consumption as an intervening variable, and liquidity and leverage as control variables. Meanwhile, the remaining 51.5% is explained by other variables not examined in this study. Furthermore, the Q-squared value of 0.429 or greater than 0 indicates that this research model has predictive relevance.

#### c. Path Analysis

The final stage of evaluating the PLS-SEM structural model is to report the results of the analysis by looking at the path coefficient and P-value (Latan & Ghazali, 2016). Figure 2 displays the full structural model of PLS-SEM research along with the path coefficient and P-value of each path.

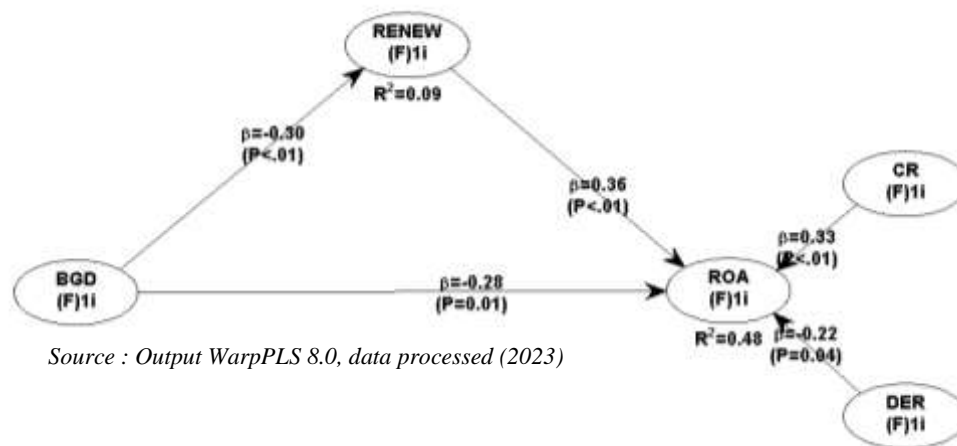


Figure 2. PLS-SEM analysis result

The interpretation of path analysis results and its relation to the research hypothesis is described in Table 5.

Table 5. Path coefficient and p-value

Hypothesis	Variable	Path coefficient	P-value	Interpretation
Direct Effect				
H1	BGD → ROA	-0.284	0.010***	Significant negative effect
H2	BGD → RENEW	-0.303	0.006***	Significant negative effect
H3	RENEW → ROA	0.356	0.002***	Significant positive effect
	CR → ROA	0.334	0.003***	
	DER → ROA	-0.217	0.040**	
Indirect Effect				
H4	BGD → RENEW → ROA	-0.108	0.116	Does not mediate

Source : Output WarpPLS 8.0, data processed (2023)

### 3.3 Discussion

The results of hypothesis testing using the PLS-SEM path analysis method are shown in Figure 2 and Table 5. The first hypothesis of this study states that gender diversity has a significant effect on ROA as a proxy for financial performance. The path analysis results show a P-value of 0.010 which meets the significance criteria at 1% alpha, meaning that gender diversity has a significant effect on financial performance so that H1 can be accepted. Furthermore, the negative path coefficient of -0.284 indicates that the direct effect of gender diversity on financial performance is negative. This means that the higher gender diversity will reduce financial performance. This finding is in line with the results of Adams & Ferreira (2009) and Tania & Hesniati (2022), but contradicts the research of Francisco (2015), Galletta et al. (2022), Khunkaew et al. (2023) and Kılıç (2016).

The negative effect of gender diversity on financial performance can be caused by the relatively small proportion of female directors in each company, making it difficult for companies to take advantage of the benefits of gender diversity in achieving improved company performance (Tania & Hesniati, 2022). The results of descriptive statistical analysis of gender diversity variable data in Table 2 show that the highest value of the percentage of female directors in the company is only 50% with an average of 0.131. In other words, the average company only has 13.1% women on its board of directors. This figure is relatively low and still below the "critical mass" of 30% or at least 3 female directors on the board of directors of a company which has been proven to ensure the representation of women's voices in decision making and improve company performance (Brahma et al., 2021; Joecks et al., 2013). Gender diversity in this study is proven not to improve performance but instead has the potential to increase conflict and dissent within the board of directors due to existing differences (Adams & Ferreira, 2009).

The second hypothesis of this study states that gender diversity has a significant effect on renewable energy consumption. The results of the path analysis show a P-value of 0.006 which is significant at 1% alpha so that H2 can be accepted. Furthermore, the path coefficient of -0.303 indicates that the direct effect of gender diversity on renewable energy consumption is negative. This means that the higher gender diversity

will reduce the company's renewable energy consumption. This finding contradicts the research of Atif et al. (2021) which shows that gender diversity has a significant positive effect on renewable energy consumption by companies. This finding is also not in line with most other studies that prove the positive effect of gender diversity on sustainability performance (Galletta et al., 2022; Khatri, 2023; Kyaw et al., 2017; Opoku et al., 2021; Provasi & Harasheh, 2020). However, the results of this study are in line with Cucari et al. (2017) who found that gender diversity negatively affects environmental, social, and corporate governance performance.

As hypothesized earlier, the average proportion of female directors shown in Table 2, 13.1%, is still relatively low and less than the 30% "critical mass" standard, so it has not been able to realize the positive benefits of having women on the board of directors (Joecks et al., 2013). In relation to sustainability issues and the use of renewable energy, female directors may not necessarily think differently and be more environmentally oriented than male directors (Cucari et al., 2017). The low number of women on corporate boards has proven unable to provide better attention to the welfare of stakeholders and encourage better corporate behavior on social and environmental issues (Handajani et al., 2014). In addition, some public companies in Indonesia are still under family control, so the presence of women on the board of directors is more due to family ties in the context of shareholder control and not based on experience or expertise (Claessens et al., 2000; Darmadi, 2011). Therefore, the low gender composition is unable to encourage the company's ethical behavior, including in the strategy and formulation of company policies, which has a negative impact on company sustainability (Cucari et al., 2017).

The third hypothesis of this study states that renewable energy consumption has a significant effect on ROA as a proxy for financial performance. The results of the path analysis show a P-value of 0.002 which is significant at 1% alpha so that H3 can be accepted. Furthermore, the path coefficient number of 0.356 is positive, indicating that the direct and significant effect of renewable energy consumption on financial performance has a positive direction. That is, the higher the renewable energy consumption of a company will improve its financial performance. This finding supports the research results of Issa & Hanaysha (2023) which shows that renewable energy consumption has a positive effect on financial performance. However, the results of this study contradict the findings of Ruggiero & Lehkonen (2017) which reports that increasing renewable energy has a negative effect on financial performance, as well as research by Vlaviorine & Widianingsih (2023) and Hulshof & Mulder (2020) which prove that renewable energy has no effect on the company's financial performance.

The fourth hypothesis of this study states that renewable energy consumption mediates the effect of gender diversity on financial performance. Through indirect effect analysis in WarpPLS 8.0 software, the P-value for the indirect relationship for BGD → RENEW → ROA path is 0,116 which does not meet the significance criteria at either 1%, 5%, or 10% alpha so that H4 is rejected. In the other words, renewable energy consumption does not mediate the effect of gender diversity on financial performance. The path coefficient number shows a negative value of -0.108 so that the insignificant effect of gender diversity on financial performance through renewable energy consumption as an intervening variable has a negative direction. Based on the results of previous hypothesis testing, it is known that the BGD → RENEW path has a negative significant result, while the RENEW → ROA path has a positive significant result. Further testing of the indirect effect on this hypothesis then concludes that the relationship between the two paths of its constituent components is not in same direction so that RENEW cannot be said to mediate significantly in the BGD → RENEW → ROA path.

#### 4. Conclusion

This study aims to examine the effect of gender diversity on financial performance, gender diversity on renewable energy consumption, renewable energy consumption on financial performance, and the mediating role of renewable energy consumption in the effect of gender diversity on financial performance. PLS-SEM test results show that gender diversity has a significant negative effect both on financial performance and renewable energy consumption. The composition of female directors with an average of 13.1%, which is still quite far below the critical mass of 30%, has proven unable to give a positive impact on the presence of women on the board of directors towards financial performance or the level of renewable energy used by the company. However, renewable energy consumption has a significant positive effect on financial performance, means that the higher commitment about sustainability will increase a company's financial performance. Furthermore, renewable energy consumption does not mediate the effect of gender diversity on financial performance.

This study still has several limitations, including limited renewable energy consumption data. Energy consumption data is obtained from sustainability reports published by companies, but the regulation

of publishing these reports is still relatively new so not all companies have published sustainability reports. In addition, the data and information included in the sustainability report are also not uniform in format and not many companies include quantitative data on energy consumption used in detail, including details of the number of renewable energy elements, non-renewable energy, and total energy consumption. Another limitation faced by this study is the R-Square value which is still 48.5% while the remaining 51.5% is explained by other variables not examined in this study. Future research can expand the sample, not only in energy companies but add other sectors or other country stock exchanges, and also extend the research period to obtain more and general observational data. Future research can also test the effects of other variables not examined in this study, including adding moderation variables and other independent variables.

This research enriches the literature related to the application of stakeholder theory related to company financial performance, gender diversity, and environmental sustainability in terms of the use of renewable energy. Besides, this research provides empirical evidence regarding the number of female directors who form gender diversity in company directors, and how this impacts sustainability in terms of the use of renewable energy by companies, as well as its influence on the financial performance of energy companies in Indonesia. For companies, it is expected to be disciplined and detailed in listing and publishing their sustainability reports, including the quantitative amount of information described. The presence of women in the board of directors also still needs to be increased in order to fulfill the SDGs points related to gender equality, as well as to reach the "critical mass" value so that it can have a concrete positive impact on the company.

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