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The Mediating Role of Green Innovation in the Relationship between Critical Success Factors and Sustainability Performance of Energy Firms in Indonesia

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Abstract: This research aims to investigate the relationship between critical internal and external success factors with Green Innovation and Sustainability Firm Performance of energy companies in Indonesia. The research method used is SEM-PLS path analysis using data from 96 energy companies in Indonesia. The results show that Internal Success Factors have a significant influence on Green Innovation and Sustainability Firm Performance. Likewise, external factors also have a significant influence on Green Innovation and Sustainability Firm Performance. Apart from that, Green Innovation has a significant influence on Sustainability Firm Performance. Path analysis also shows that Internal Success Factors and External Factors have an influence not only directly, but also through the mediator Green Innovation on Sustainable Firm Performance. These results underline the importance of internal and external success factors in driving Green Innovation and Sustainability Firm Performance in the context of the energy industry in Indonesia. The practical implication of this research is that energy companies need to pay attention to sustainability factors in their business strategies to achieve better sustainability performance.

Keywords: Green Innovation, Relationship between Critical Success Factors, Sustainability Firm Performance, Energy Firms in Indonesia.

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1. Introduction

Over the past few years, companies around the world have taken substantial action to pay attention to environmental and sustainability aspects. They are aware that their business activities impact not only their economic profits but also the environment in which they operate. One sector that requires special attention in this regard is the energy sector. Activities related to energy production, distribution and consumption have a major impact on the environment, including greenhouse gas emissions, air pollution, habitat destruction and increased global warming. In facing these environmental challenges, many energy companies are starting to adopt sustainable strategies, such as reducing carbon emissions, increasing energy efficiency, and developing renewable energy sources. However, while these efforts are important, there is still a need for a deeper understanding of how critical success factors (CSFs) and green innovations (GIs) can play a key role in achieving sustainability performance for energy companies. By better understanding the relationship between these factors, energy companies can develop more effective strategies to maintain a balance between business growth and environmental conservation and ensure that the energy produced and consumed is sustainability in the long term.

Companies in Indonesia, including energy companies, are faced with major challenges in achieving success and improving performance, as well as maintaining their level of sustainability amidst

increasingly fierce market competition. One strategy that can be used by energy companies is to implement Critical Success Factors (CSF) and Green Innovation (GI). CSFs are key elements that must be met for a project or initiative to be successful, while GIs are new processes or products that have a positive impact on the environment. However, although both approaches are considered as potential solutions, the effects of CSF and GI implementation on the sustainability performance of energy companies have not yet been accepted by consensus. Problems arise in understanding the relationship between CSF, GI, and the sustainability performance of energy companies. Some parties question the extent to which the implementation of CSF and GI is able to make a significant contribution to achieving energy companies' sustainability goals, such as energy efficiency, reducing carbon emissions and better waste management (Rokhmawati et al., 2015). In addition, the lack of understanding of the mediating role of Green Innovation in the relationship between CSFs and the sustainability performance of energy companies is one of the main concerns (German et al., 2023). How green innovation mediates the relationship between critical success factors and sustainable performance of energy companies in Indonesia is a central point that has not been clearly resolved (Srimulyani et al., 2023).

In Indonesia, the energy sector is still dominated using fossil energy, such as coal, petroleum and natural gas. This phenomenon poses major challenges regarding environmental impacts, including greenhouse gas emissions, air pollution and land degradation. Therefore, significant initiatives are needed in developing and implementing green innovation in the energy sector (Fernando et al., 2019). Green innovation is an approach that integrates environmental sustainability into business processes, products and services. Thus, green innovation can help utilize natural resources more efficiently, reduce carbon emissions, and minimize negative impacts on the environment (Yadav et al., 2024). However, to successfully implement green innovation in the energy sector in Indonesia, strong support from internal and external companies is needed. From an internal perspective, company management must have a strong commitment to investing in research and development of green innovation, as well as to changing existing business practices to be more environmentally friendly (Yusr et al., 2020). This requires changes in organizational culture, employee training, and development of supporting infrastructure.

External support is also important in the form of supportive government policies and incentives to encourage the adoption of green innovation in the energy sector (Masudin et al., 2024). Clear and consistent policies, including strict environmental regulations and fiscal incentives for sustainable investment, can accelerate the shift towards clean and sustainable energy. In addition, cooperation between the government, private sector and non-governmental organizations is also needed to address common challenges and promote green technology transfer.

With strong internal and external support, green innovation can be an important catalyst in the transformation of the energy sector in Indonesia towards greater environmental sustainability (Ye et al., 2023). Green innovation is not just about improving the environment, it is also an opportunity to increase efficiency, reduce operational costs and create added value for energy companies and society as a whole (Fernando et al., 2021).

In this case, this research aims to analyze the relationship between internal and external critical success factors and the success of companies that rely on green innovation in the Indonesian energy sector.

ResearchKhanh Chi (2022);Kellard et al. (2023); Lee et al. (2024);Tseng & Lin (2024) has explained that the implementation of CSF can influence the success and sustainability firm performance (SFP). However, the shortcoming of previous research is that it does not examine the direct effects of CSFs on companies that focus on green innovation. Then research some research (Kushwaha & Sharma, 2016;Huang et al., 2022;Mady et al., 2023;Xu et al., 2023;Nadiri et al., 2024) have studied the relationship between GI and SFP. However, a shortcoming of previous research is that it has not examined the mediating effect of GI on the relationship between CSF and SFP.

This shows the need to conduct further research regarding the effects of CSF and GI on the sustainability performance of energy companies. This study will identify the direct effects of CSF on GI and SFP

2. Theoretical Overview of the Main Concepts

a. Green Innovation

Green innovation is a plan to achieve the company's strategic targets with techniques, systems and practices to reduce the impact of environmental damage (Dewi & Rahmianingsih, 2020). According to Mastarida(2022), green innovation refers to various innovations that enable the reduction of negative impacts on the environment, thereby providing great opportunities for companies to achieve environmental performance targets and benefits both the natural environment and the social environment. Green innovation is not only a vital means for competitive advantage but an important prerequisite for holding legitimacy (Li et al., 2017).

Green innovation is very important for green innovation in organizations because of several important things as follows: First, organizational activities that focus on the environment have an important function in the needs of the current business world. Second, with the green marketing movement which is not only an engine that drives economic growth but can also be used as an active field for finding, growing and developing business opportunities and achieving business value. Third, in the case of a strategy that relies on unique activities, the company must consciously choose a series of activities to provide a combination of value. Fourth, the organization develops green innovation, stakeholders are ready to integrate all organizational resources to reduce environmental risks and impacts thereby strengthening the identity, capabilities of a conscious organization and expanding new markets (Mastarida, 2022).

According to Agustia et al., (2019), to measure green innovation, we use an index consisting of two dimensions, namely Green Process Innovation and Green Product Innovation, which consists of 3 indicators for each dimension. Through green innovation, a company can optimize productivity and generate market opportunities.

b. Energy Company

A company is an organization founded by a person or group of people or other bodies whose activities carry out production and distribution to meet human economic needs (Hasanah & Putri, 2018). A company can also be referred to as an activity that is continuously carried out to gain profit. There are various types of companies, including energy companies.

The energy sector is one of the industrial fields that specifically influences increasing company production and generally influences the country's economy. Energy sector companies are companies that include coal, crude oil & products, natural gas & product, hydropower, geothermal, solar PV, wind, biomass, biofuel, biogas, other Renewable Energies, and other solar (Ministry of Energy and Mineral Resources Indonesia, 2021). Energy sector companies are the originators of the market on the IDX which is also one of the biggest opportunities in boosting the national economy. The use of energy sector companies as research subjects is because these companies experience additional companies from year to year, which indicates that energy sector companies have good prospects for continuing to develop (Imanullah & Syaichu, 2023).

Examples of energy companies include oil and natural gas drilling, mining, power generation, biofuel or renewable energy, oil processing and refining, oil and gas refining, and many more. The transportation sector is the sector that uses the most energy (Hasan & Widayat, 2022).

c. Critical Factors for Company Success

The success of a business is a major part of a company because all business activities aim at achieving success. The company's success factors are not limited to monetary capital alone because companies are a dynamic world so adaptation, innovation is needed, and of course you must have an attitude to improve and develop the company.

The longer a company has been around, the more investors are interested in investing capital in the company compared to other newly established companies. The success of a company that has been

around for a long time shows the company's high ability to remain competitive. The continuity of life that has been maintained while the company was established will attract the interest of investors so that this will increase the value of the company (Yulianto, 2020).

According to Yulianto(Yulianto, 2020), company age, profitability, financial leverage and dividend policy influence company value, where company value greatly influences the success of a company. Dividend policy and profitability influence company value. This finding is interesting, because it proves that the success of increasing company value depends on the company's ability to maximize its resources and the company's success in implementing established policies (Mahpudin, 2016).

d. Sustainability Firm performance

Sustainability performance is a performance that influences stakeholders in decision making. A sustainability report is a report used to increase the public's perception of a company's sustainability performance. Companies that carry out high quality reporting such as relevant and reliable disclosure of financial and non-financial data.

Companies that have superior sustainability performance prefer to use high quality sustainability reporting so that it can reflect actual performance. Company involvement in sustainability disclosure will further reduce the practice of sustainability performance in expressing corporate social responsibility more transparently (Ghozali & Rohman, 2019).

According to Saputri(2019) profitability, capital adequacy, operational performance efficiency, liquidity and problematic financing have an influence on the company's sustainability. Disclosure of Sustainability Reports carried out by companies that are able to provide information on sustainability performance in the Sustainability Report is more than companies that do not publish Sustainability Reports (Ghozali & Rohman, 2019).

3. Methodology

The research location was conducted in Indonesia, with a population consisting of energy companies in Indonesia. In this study, a stratified random sample was used, with a proportion of 8% for renewable energy companies that focus on alternative power and 92% for fossil fuel energy companies. The total sample used was 96 companies.

To collect data, a questionnaire consisting of six parts was used, with variables measured using a 5point Likert scale. This questionnaire was sent via email or represented directly to contacts at the selected companies (Memon et al., 2021).

After the data was collected, descriptive analysis was carried out using SPSS and partial correlation structural analysis (PLS-SEM) to determine the relationship between the variables included in the research. Apart from that, correlation, mediation and moderation analyzes were also carried out to explore the relationship between these variables.

The research philosophy or paradigm follows positivism with a quantitative approach. The aim of this research is descriptive and explanatory, namely to describe current conditions and seek explanations for the phenomena studied.

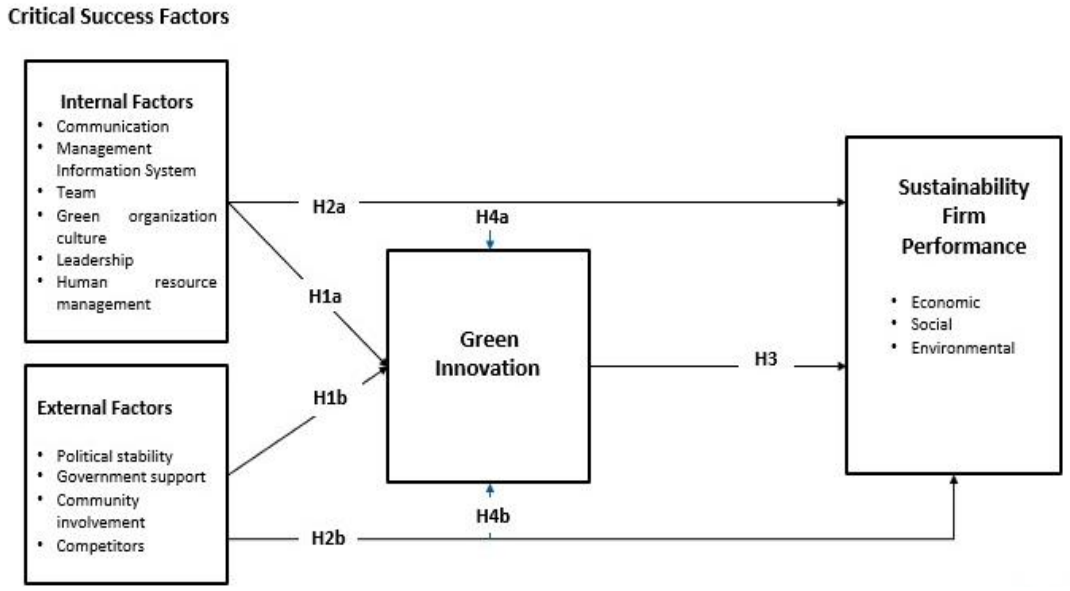

Figure 1: Research Paradigm

4. Result

The survey was conducted from September to December 2023. Four hundred and eighty questionnaires (92 companies and 5 representatives) were distributed to respondents located in Indonesia. Three hundred and sixty questionnaires were returned, and only 350 usable questionnaires were deemed usable for analysis.

Table 1:Number and Percentage of Respondents Based on Energy Business Sector

Major Activities of Company	**Frequency**	**Percentage (%)**
Biofuel	10	3
Coal	66	19
Crude Oil and Product	83	24
Geothermal	20	6
Natural Gas and Product	68	19
Other Fossil Fuel Energies	73	21
Other Renewable Energies	10	3
Solar	20	6
Total	350	100

Source: Processed Data.

Of the 350 respondents who participated in this study, there was significant variation in the type of energy they identified as a primary focus. Crude Oil and Products was the biggest focus, acknowledged by 83 respondents (24%). In addition, there is considerable interest in other types of energy, with 73 respondents (21%) citing other fossil fuel energies as their main focus. Meanwhile, natural gas power and its products (Natural Gas & Products) are also a significant focus, acknowledged by 68 respondents (19%), followed by coal with 66 respondents (19%). Geothermal and solar energy were each recognized by 20 respondents (6%) as their main focus in this research. However, biofuels (bioenergy) and other renewable energies have a relatively lower number of respondents, each acknowledged by 10 respondents (3%), but still make an important contribution to the diversity of focus of energy research

conducted.

Table 2: Summary on the Rate of Return of Questionnaires

Description	Number of Questionnaire	Percentage
Total questionnaires distributed	480	100 %
Completed questionnaires received	360	75 %
Unusable questionnaires	10	2.08%
Usable questionnaires	350	72.9%

Source: Processed Data.

The table above shows a summary of the success rate of returning questionnaires from a study. A total of 480 questionnaires were distributed and 360 questionnaires were successfully returned and can be used. This shows a successful return percentage of 75%.

Of the number of questionnaires returned, 350 questionnaires (72.9%) were deemed sufficient to be used in research, while 10 questionnaires (2.08%) were incomplete and could not be used. Apart from that, the number of questionnaires that cannot be used also includes questionnaires with answers that are irrelevant or not in accordance with the research objectives.

In this table, the number of questionnaires received as a total of all returned questionnaires is also listed, as well as the percentage of the total questionnaires received compared to the total targeted questionnaires.

This summary is important to provide researchers with an idea of the success of data collection, as well as to determine the number of samples that can be used in analysis. This can help researchers make decisions regarding the strengths and weaknesses of the data collected.

a. Evaluation of Measurement Models

The results of factor analysis or structural analysis, where there are several loading values. Loadings are measures that show the relationship between items (measured variables) and factors (hidden variables) that represent them. Loadings values can be values between 0 and 1, and values closer to 1 indicate that the item is more closely related to that factor.

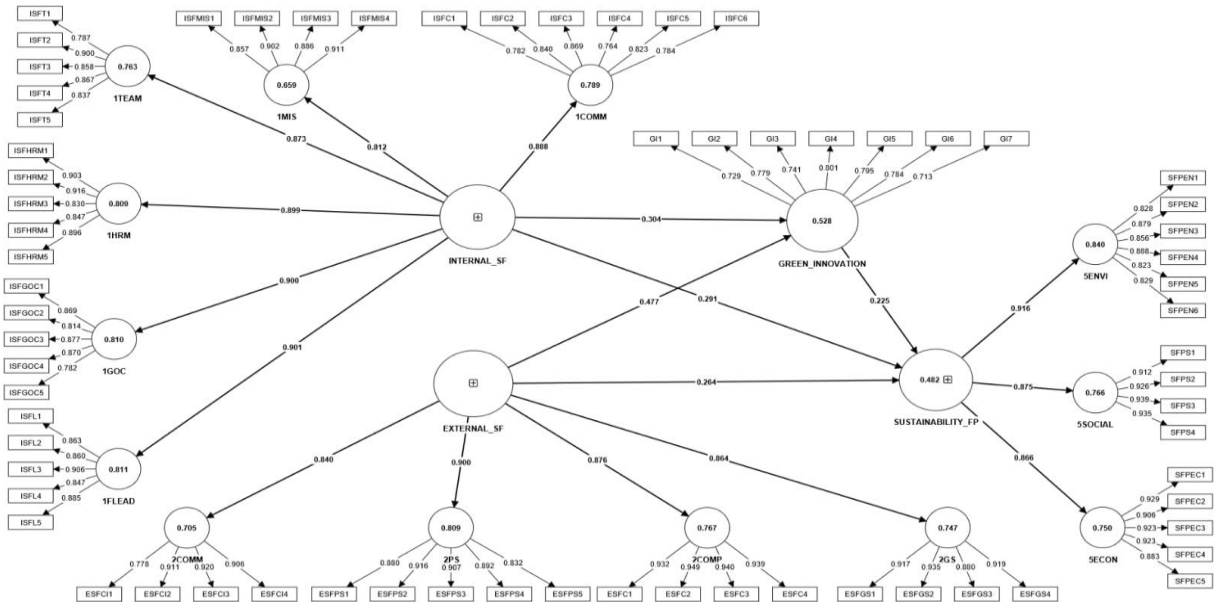

Figure 2: Evaluation of the Measurement Model

The table shows the results of the validity measurement model analysis by showing the outer loading of each indicator on the relevant factors. Outer loading is a measure of how well an indicator measures the desired construct, with a higher value indicating a greater level of contribution of the indicator to the construct being measured. From the results of this analysis, all outer loading values of the indicators on the relevant factors have values above 0.4, which shows that all indicators have a significant contribution in measuring the desired construct. Because all variables have an outer loading value above 0.4 (Ghozali, 2016). These results show that all indicators in the valid measurement model have been proven to be quite valid in measuring the desired construct. Thus, the results of this analysis provide an indication that the measurement instruments used in this research are reliable and can be used to validly evaluate critical factors and sustainability performance of energy companies in Indonesia.

The results of the reliability analysis show that all dimensions have Cronbach's alpha and Composite reliability values that exceed 0.7. This shows that all dimensions in this study have a high level of consistency in measuring the desired construct. This consistent measurement ensures that the research instrument is reliable and can provide consistent results over time (Iqbal et al., 2020). Thus, the results of this reliability analysis provide confidence that the data collected from this research instrument can be trusted and valid for use in analyzing critical factors and sustainability performance of energy companies in Indonesia.

b. Structural Model Evaluation

The Structural Model Evaluation in this analysis aims to test the validity and suitability of the proposed model in explaining the relationship between critical success factors, green innovation, and the sustainability performance of energy companies in Indonesia. The evaluation results show that this structural model has a good level of fit with the observed data.

1) Collinearity Test

A variable can be used in a model if there is no high collinearity with a VIF value < 5. If the VIF value is > 5 then the variable must be removed from the research model (Russo & Stol, 2021).

Table 3: Inner VIF

Variable	VIF
Internal Success Factors -> Green Innovation	2,066
Internal Success Factors -> Sustainability Firm Performance	2,261
External Success Factors -> Green Innovation	2,066
External Success Factors -> Sustainability Firm Performance	2,547
Green Innovation -> Sustainability Firm Performance	2,117

Source: Processed Data.

Based on the VIF (Variance Inflation Factor) values in the Inner VIF table, it can be concluded that all VIF values are less than 5. This shows that there are no signs of significant collinearity problems between the variables used in the analysis.

Collinearity is a phenomenon where two or more independent variables in a regression model have a strong linear relationship, causing difficulties in assessing the significance and estimating the weight of these variables. However, with the low VIF values as seen in the table (all below 5), there is no strong evidence for significant collinearity between the variables used in the analysis. Thus, the conclusion that can be drawn is that the regression model built with the variables These variables tend to be stable and reliable in assessing the significance and estimating variable weights. This indicates that the analysis

results will not be significantly affected by high collinearity, and the interpretation of the results can be considered an accurate reflection of the relationship between the variables under study.

2) Test the Inner Model

a) F Square

Researchers will see the substantive influence of endogenous conceptions which are influenced by exogenous conceptions through values $F2$. The amount of substantive influence is classified into 3, namely 0.02; 0.15; and 0.35 respectively fall into the categories of small, medium and large influence (Setiaman 2023). Value data$F2$ can be seen in the table.

Table 4: F Square

	f-square
Internal Success Factors -> Green Innovation	0.094
Internal Success Factors -> Sustainability Firm Performance	0.072
External Success Factors -> Green Innovation	0.233
External Success Factors -> Sustainability Firm Performance	0.053
Green Innovation -> Sustainability Firm Performance	0.046

Source: Processed Data.

Value data $F2$ shows the substantive influence of endogenous conceptions that are influenced by exogenous conceptions in the model. Based on value $F2$ listed in the table, we can evaluate how much substantive influence each relationship in the model has.

For the relationship between "Internal Success Factors" and "Green Innovation", value $F2$ is 0.094. This indicates that this relationship has a moderate substantive effect, as its value falls between the ranges established for small (0.02) and medium (0.15) effects.

Next, for the relationship between "Internal Success Factors" and "Sustainability Firm Performance", assess $F2$ is 0.072. The substantive influence of this relationship can be classified as small, because its value is below the threshold for a moderate influence (0.15).

For the relationship between "External Factors" and "Green Innovation", value $F2$ is 0.233. This indicates that this relationship has a large substantive effect, as its value is well above the threshold for a large effect (0.35).

Meanwhile, for the relationship between "External Factors" and "Sustainability Firm Performance", value $F2$ is 0.053. The substantive influence of this relationship can be classified as small, because its value is below the threshold for a moderate influence (0.15).

Finally, for the relationship between "Green Innovation" and "Sustainability Firm Performance", value $F2$ is 0.046. The substantive effect of this relationship can also be classified as small, because its value is below the threshold for a moderate effect (0.15).

Thus, based on value data $F2$, we can see that some relationships in the model have different substantive influences, ranging from small to large, depending on the strength and direction of the relationship between the variables involved.

b) R Square

The results of the R-square value test will later illustrate the strength of the endogenous variables in making predictions in the structural model. The R-square value will show the strength of the model which

is classified into 3 parts, namely weak, moderate and strong respectively with an R-square value of 0.19; 0.33; and 0.67 (Setiaman 2023). The results of the R-square value are contained in the following table:

Table 5: R Square

	R-square	**R-square adjusted**
Green Innovation	0.528	0.525
Sustainability Firm Performance	0.482	0.478

Source: Processed Data.

The results of the R-square test value are used to describe the strength of endogenous variables in making predictions in the structural model. Based on the R-square value obtained from the table, we can evaluate the overall strength of the model.

For the "Green Innovation" variable, the R-square value is 0.528, while the adjusted R-square value is 0.525. This indicates that approximately 52.8% of the variation in the green innovation variable can be explained by exogenous variables or predictors in the model. Thus, it can be classified as moderate model strength, as it falls between the R-square value range of 0.33 to 0.67.

Meanwhile, for the "Sustainability Firm Performance" variable, the R-square value is 0.482, and the adjusted R-square value is 0.478. This indicates that approximately 48.2% of the variation in corporate sustainability performance can be explained by the predictor variables in the model. As before, this can also be classified as moderate model strength, as the R-square value falls between the range of 0.33 to 0.67.

Although these two variables have moderate model power, it is important to remember that the R-square value does not reflect the individual strength of the variable, but rather how well it can explain variation in the endogenous variable. Therefore, these results indicate that the model is overall quite good at explaining the relationship between green innovation and corporate sustainability performance.

c) Q Square

Q2 is known as Stone-Geisser, intended to explain the model's prediction capability if the value is above 0. This value is obtained using the formula: (Hussein, 2015: 25).

Q2 = 1– (1 – R12) (1 – R22) … (1 – Rp2).

Where R12, R22…Rp2 is the R-square of the exogenous variable in the equation model. If Q2 > 0 indicates that the model has predictive relevance and if the Q2 value < 0 indicates that the model lacks predictive relevance (Ghozali and Latan, 2015: 81).

Table 6. Q Square

	SSO	**SSE**	**Q^2 (=1-SSE/SSO)**
Green Innovation	2,296	1,598	0.304
Sustainability Firm Performance	4,920	3,459	0.297

Source: Processed Data.

From the table above, for the "Green Innovation" variable, the Q2 value is 0.304, while for the "Sustainability Firm Performance" variable, the Q2 value is 0.297. Both Q2 values are positive, which indicates that the model has predictive relevance in predicting these two endogenous variables. Therefore, this model is considered capable of predicting "Green Innovation" and "Sustainability Firm Performance" based on the exogenous variables in the model.

d) Goodness of fit index

This GoF index is a single measure used to validate the combined performance of the measurement model and the structural model. The purpose of this assessment is to assess the performance of the PLS model by focusing on predicting the overall performance of the model which can be searched through the following equation:

Criteria for a value of 0.10 (GoF small), a value of 0.25 (GoF medium), and a value of 0.36 (GoF large) (Yusof et al., 2021).

Table 7:Goodness of Fit Index

Dimensions	**Original sample (O)**	**Communality**		**R-square**	**GoF Index**
Internal Success Factors -> Communication	0.888	0.789	Green Innovation	0.528	
Internal Success Factors -> Leadership	0.901	0.812	Sustainability Firm Performance	0.482	
Internal Success Factors -> Green Organization Culture	0.9	0.810			
Internal Success Factors -> Human Resources Management	0.899	0.808			
Internal Success Factors -> Management Information System	0.812	0.659			
Internal Success Factors -> Team	0.873	0.762			
Internal Success Factors -> Community Involvement	0.84	0.706			
Internal Success Factors -> Competitors	0.876	0.767			
External Success Factors -> Government Support	0.864	0.746			
External Success Factors -> Political Stability	0.9	0.810			
Sustainability Firm Performance -> Economy	0.866	0.750			
Sustainability Firm Performance -> Environmental	0.916	0.839			
Sustainability Firm Performance -> Social	0.875	0.766			
GI1 <- Green Innovation	0.729	0.531			
GI2 <- Green Innovation	0.779	0.607			
GI3 <- Green Innovation	0.741	0.549			
GI4 <- Green Innovation	0.801	0.642			

Dimensions	Original sample (O)	Communality		R-square	GoF Index
GI5 <- Green Innovation	0.795	0.632			
GI6 <- Green Innovation	0.784	0.615			
GI7 <- Green Innovation	0.713	0.508			
		0.705		0.505	**0.597**

Source: Processed Data.

Based on the table above, the GoF Index is obtained with a value of 0.597. This shows that the combined performance between the measurement model and the structural model in PLS path modelling can be classified as large, because the value is between the ranges determined for large model performance.

The model in the table that was built has a fairly good ability in predicting the overall performance of the model, but there is still room for improvement in improving the overall prediction. Thus, the GoF Index value provides a useful indication in evaluating the quality and validity of the PLS model.

e) Hypothesis testing

After the data analysis process was carried out, the results were used to test various hypotheses in this research. Hypothesis testing is carried out by examining the resulting T-Statistics values and P-Value values. When the t-value reaches or exceeds a certain critical threshold, in this case 1.972, and the probability value (P-Values) is less than or equal to 0.05, then the hypothesis can be declared accepted; conversely, if the t-value is less than the critical threshold and the P-Values value is greater than 0.05, the hypothesis can be rejected.

The following are the results of hypothesis testing which has been carried out using the bootstrapping technique with SmartPLS software:

Table 8: Direct Effect Hypothesis Test

Hypothesis	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
H1a: Internal Success Factors -> Green Innovation	0.304	0.303	0.050	6.045	0.000
H1b: External Success Factors -> Green Innovation	0.477	0.477	0.048	9.850	0.000
H2a: Internal Success Factors -> Sustainability Firm Performance	0.291	0.291	0.058	4.978	0.000
H2b: External Success Factor -> Sustainability Firm Performance	0.264	0.263	0.064	4.131	0.000
H3:Green Innovation-> Sustainability Firm Performance	0.225	0.227	0.054	4.179	0.000

Source: Processed Data.

The results of hypothesis testing carried out using bootstrapping techniques with SmartPLS software show important results in explaining the relationship between various variables in the context of this research.

First, the hypothesis 1a shows that the internal success factors variable has a significant influence on

green innovation. The results of the analysis show that the resulting t-value (6.045) exceeds the critical threshold (1.972), and the P-Values (0.000) is less than 0.05. This shows that the hypothesis is acceptable. This means that there is a significant relationship between the internal success factors and green innovation variables.

The hypothesis 2a also shows similar results, with the internal success factors also having a significant influence on sustainability firm performance. The resulting t-value (4.978) exceeds the critical threshold, and the P-Values value (0.000) is also smaller than 0.05. This confirms that the relationship between internal success factors and sustainability firm performance variables is acceptable.

Furthermore, the hypotheses 1b and 2b show the influence of external factors on green innovation and sustainability firm performance respectively. Both hypotheses were also accepted with significant t-values and P-Values of less than 0.05.

Finally, thehypothesis 3 tests the effect of green innovation on sustainability firm performance. The test results show that the relationship between these two variables is also significant, with a t-value that is quite large (4.179) and a P-Values value that is smaller than 0.05.

Overall, these results confirm the importance of sustainability factors, both internal and external, in supporting green innovation and sustainability firm performance in this research. It provides a deeper understanding of the factors that influence companies' sustainability performance, particularly in sectors related to green innovation.

Table 9: Mediation Test

	Original sample (O)	**Sample mean (M)**	**Standard deviation (STDEV)**	**T statistics (|O/STDEV|)**	**P values**
Internal Success Factors -> Green Innovation -> Sustainability Firm Performance	0.068	0.069	0.020	3.413	0.000
External Success Factors -> Green Innovation -> Sustainability Firm Performance	0.107	0.108	0.028	3.871	0.000

Source: Processed Data.

The results of hypothesis testing carried out using bootstrapping techniques with SmartPLS software show significant results related to the influence of internal success factors and external success factors on green innovation which in turn influences sustainability firm performance.

First, the hypothesis that tests the influence of internal success factors on green innovation, which then has an impact on Sustainability Firm Performance, shows important results. The resulting T statistics value (|O/STDEV|) is 3.413, with a P value of 0.000. This shows that the influence of Internal Success Factors on Green Innovation and then on Sustainability Firm Performance is declared significant, because the T statistics value exceeds the set critical threshold (1.972) and the P value is smaller than 0.05.

Furthermore, the hypothesis that tests the influence of external success factors on green innovation, which also has an impact on sustainability firm performance, also shows significant results. The T statistics value is 3.871, with a P value of 0.000. This shows that the influence of External Success Factors on Green Innovation and then on Sustainability Firm Performance is also significant.

Overall, these results emphasize the importance of critical factors, both internal and external, in supporting green innovation and sustainability firm performance in the context of this research. It provides a deeper understanding of the factors that influence companies' Sustainability Firm Performance, particularly in sectors related to green innovation.

5. Discussion

a. Internal Success Factors on Green Innovation

Based on the direct effect hypothesis test table, the significant t-statistics value (T statistics= 6.045) and low p-value (0.000) indicate that the internal success factors variable has a significant influence on green innovation. This shows that Internal Success Factors within the company have a positive impact on green innovation efforts (Rentschler & Kornejew, 2017).

b. External Success Factors on Green Innovation

The results of the hypothesis test show that the external success factors variable has a significant effect on green innovation with a significant t-statistics value (T statistics = 9.850) and a low p-value (0.000). This confirms that external factors, such as government regulations or pressure from the market and society, can encourage companies to adopt green innovations (Ameer & Khan, 2023).

c. Internal Success Factors on Sustainability Firm Performance

The significant t-statistics value (T statistics= 4.978) and low p-value (0.000) indicate that the internal successfactors variable also has a significant influence on sustainability firm performance. This confirms that a company's internal success factors directly contributes to the company's overall sustainability performance (Ali et al., 2023).

d. External Success Factors on Sustainability Firm Performance

The external successfactors variable was also proven to have a significant influence on sustainability firm performance with a significant t-statistics value (T statistics = 4.131) and a low p-value (0.000). This shows that external success factors also have a direct impact on a company's sustainability performance (Khan et al., 2022).

e. Green Innovation on Sustainability Firm Performance

Based on the direct effect hypothesis test, green innovation has a significant influence on sustainability firm performance with a significant t-statistics value (T statistics= 4.179) and a low p-value (0.000). This confirms that green innovation efforts can contribute positively to a company's sustainability performance (Oh et al., 2024).

f. Internal Success Factors mediating Green Innovation on Sustainability Firm Performance

Through mediation analysis, it can be concluded that the internalsuccess factors variable has a positive effect on green innovation, which in turn contributes positively to sustainability firm performance. This shows that internal success factors have an effect not only directly, but also through green innovation mediation on sustainability firm performance (Yusr et al., 2020).

g. External Success Factors mediating Green Innovation on Sustainability Firm Performance

The variable external success factors also has an influence not only directly, but also through the mediator green innovation on sustainability firm performance. This shows that external success factors can influence a company's sustainability performance not only directly, but also through encouragement of green innovation (Mady et al., 2023).

6. Conclusions

Based on the research results, the following conclusions can be drawn:

1. Hypothesis test results show that the internal successfactors variable has a significant influence on green innovation. This shows that efforts to improve the company's internal success factors can encourage green innovation within the organization.
2. Hypothesis test results show that the external successfactors variable has a significant effect on green innovation. This confirms that external factors, such as government regulations or pressure

from the market and society, can encourage companies to adopt green innovations.

3. Internal success factors variables have also been proven to have a significant influence on sustainability firm performance. This shows that the company's internal success factors directly contributes to improving the company's overall sustainability firm performance.
4. External successfactors variables have also been proven to have a significant influence on sustainability firm performance. This shows that external factors also have a direct impact on a company's sustainability performance.
5. Hypothesis test results show that green innovation has a significant influence on sustainability firm performance. This confirms that green innovation efforts can contribute positively to a company's sustainability performance.
6. Through path analysis, it can be concluded that the internal successfactors variable has a positive effect on green innovation, which in turn contributes positively to sustainability firm performance. This shows that internal success factors have an effect not only directly, but also through green innovation mediation on sustainability performance.
7. The variable external success factors also has an influence not only directly, but also through the mediator green innovation on sustainability firm performance. This shows that external success factors can influence a company's sustainability performance not only directly, but also through encouragement of green innovation.

7. Limitations, Implications, and Further Directions of Research

Based on the findings of this research, several implications can be drawn for companies in the energy sector in Indonesia. First, companies need to focus on continuously improving internal success factors such as environmental policies, energy efficiency, and waste management. By fostering a supportive internal environment, companies can better encourage green innovation and enhance their sustainability performance. In addition, companies must pay attention to external factors such as government regulations, market demands, and community expectations around sustainability. By integrating these external success factors into their business strategies, companies can identify new opportunities for green innovation and position themselves more favorably in the market. Moreover, fostering a culture of green innovation is essential. Companies should incentivize employees to create environmentally friendly solutions through training, reward programs for innovative ideas, and investments in research and development for new technologies.

However, this study has certain limitations that should be acknowledged. The research only focuses on fossil fuel and renewable energy companies in Indonesia, which limits its generalizability. Additionally, there is a trend where renewable energy companies tend to demonstrate higher commitment to green innovation compared to fossil fuel companies. This imbalance in attention to green innovation across sectors could influence the findings and their broader application.

Future research should address these limitations by incorporating more relevant and up-to-date theories, expanding the scope of the study, and including a broader range of companies across different sectors. By increasing the research variables and the scope, future studies can provide a more comprehensive understanding of the role of green innovation and sustainability across a wider array of industries.

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