

Research Article

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Analysis of the Impact of Green Policy and Environmentally Friendly Supply Chain Management on Competitive Advantage through Green Technology Adaptation as an Intervening Variable in Manufacturing Companies in North Sumatra

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Received: January 2, 2025; Accepted: January 11, 2025; Online: January 16, 2025 | DOI: <https://doi.org/10.47353/ijema.v2i8.230>

Abstract: *This study aims to analyze the impact of green policies and environmentally friendly supply chain management on the competitive advantage of manufacturing companies in North Sumatra through the adaptation of green technology as an intervening variable. The method used in this study is quantitative with the Structural Equation Modeling (SEM) approach using Smart PLS software. The data used in this study were obtained through a survey involving manufacturing companies in North Sumatra. The results of the study indicate that green policies and environmentally friendly supply chains have a significant effect on the adaptation of green technology, which in turn has a positive impact on the company's competitive advantage. This study also found that the adaptation of green technology acts as a mediator that strengthens the relationship between green policies, environmentally friendly supply chains, and competitive advantage. These findings indicate that manufacturing companies that implement green policies and manage their supply chains with an environmentally friendly approach can strengthen their competitive position through more efficient and environmentally friendly technological innovations. The implication of this study is the importance of green policies that support the adoption of green technology and environmentally friendly supply chain management in increasing the company's competitiveness in an increasingly competitive market.*

Keywords: *Green Policy, Environmentally Friendly Supply Chain, Competitive Advantage, Green Technology Adaptation, Manufacturing Company, Structural Equation Modeling (SEM).*

Introduction

In the era of globalization, competition between companies is getting tighter, especially in the manufacturing sector. Companies are not only faced with the challenge of increasing product efficiency and competitiveness, but also with global demands to adapt to the principles of sustainability. Green policies that are increasingly developing in various countries encourage companies to consider the environmental impact in their business operations. In Indonesia, especially in North Sumatra, sustainability is becoming an increasingly relevant issue, both in terms of the environment and the regulations that support it. The Indonesian government and many countries in the world have begun to implement green policies that aim to reduce negative impacts on the environment. These policies include waste management, reducing carbon emissions, using renewable energy, and increasing the efficiency of natural resources. These policies affect manufacturing companies, which are expected to adapt environmentally friendly production processes. Companies that comply with these policies will not only benefit in terms of reputation, but can also achieve better competitive advantages.

Green supply chain management refers to practices that integrate sustainability principles into supply chain management, from selecting environmentally friendly raw materials, managing efficient transportation, to reducing waste and emissions generated during the distribution process. This requires a transformation in the way companies interact with suppliers, distributors, and consumers. To achieve success in implementing green policies and managing an environmentally friendly supply chain, manufacturing companies need to adopt green technologies that can support operational efficiency, reduce environmental impacts, and improve overall performance. The adoption of green technologies, such as renewable energy technologies, efficient production processes, and more environmentally friendly waste management technologies, can be factors that increase a company's competitive advantage. Competitive advantage in the manufacturing business increasingly depends not only on product costs and quality, but also on the company's ability to implement environmentally friendly and socially responsible practices. Companies that are able to effectively adapt green technologies have a great opportunity to create product differentiation that attracts consumers, gain support from governments and funding institutions, and improve brand reputation which is very important in today's market.

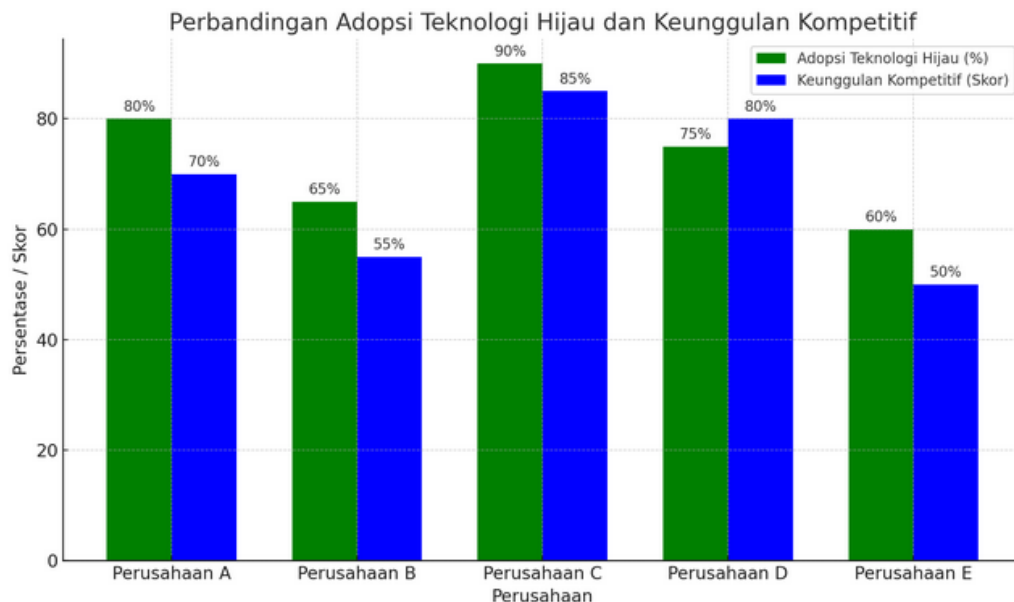


Figure 1. Comparison of Green Technology Adoption and Competitive Advantage

In this graph, we can see that there is a positive relationship between the level of green technology adoption and the competitive advantage achieved by these companies. The higher the adoption of green technology, the higher the competitive advantage score obtained by the company. North Sumatra, as one of the provinces with a rapidly growing manufacturing sector, also faces challenges related to sustainability. Manufacturing companies in this region need to be more sensitive to green policies and their impacts on their operations and business strategies. This study is relevant to provide an understanding of how environmentally friendly supply chain management and green technology adaptation can contribute to increasing the competitive advantage of manufacturing companies in North Sumatra. Manufacturing companies in North Sumatra often face obstacles in implementing green policies and managing environmentally friendly supply chains, both in terms of cost, technology, and knowledge. Therefore, this

study focuses on analyzing how these factors can be overcome, as well as the important role of green technology adaptation as a bridge to achieving sustainable competitive advantage.

According to Porter & van der Linde (2020) Green policies can stimulate innovation that leads to the development of technologies that not only focus on environmental protection but also create competitive advantages for companies. In this context, green technology plays an important role in supporting operational efficiency and meeting stringent environmental standards. According to Srivastava (2020) Green Supply Chain Management focuses on improving environmental efficiency throughout the supply chain by reducing negative impacts on the environment through the application of green technology and responsible management. According to Barney (2020) Competitive advantage is achieved by utilizing unique resources that are difficult for competitors to imitate, such as the ability to adapt to green policies or implement environmentally friendly technologies that can reduce operational costs and improve the company's reputation. According to Jabbour et al. (2020) Adapting green technology in company operations can increase efficiency, reduce production costs, and increase the company's competitiveness in a market that is increasingly concerned about environmental issues.

North Sumatra is one of the provinces in Indonesia that has a rapidly growing manufacturing industry sector, covering various fields such as food, textiles, automotive, and chemical products. Competition in this sector is increasingly fierce, with companies having to face global and domestic challenges that affect their sustainability and performance. Competitive advantage is the main key to ensuring the continuity and growth of manufacturing companies. This advantage can be achieved through innovation, cost efficiency, product quality, and differentiation. However, amidst global pressures on environmental and sustainability issues, companies also need to adjust their business strategies to global trends, such as the implementation of green technology. Green technology is a technological innovation that focuses on energy efficiency, reducing greenhouse gas emissions, and environmentally friendly waste management. The implementation of green technology in manufacturing companies can be a factor that supports companies to reduce negative impacts on the environment and increase production efficiency. This allows companies to remain competitive in a market that is increasingly paying attention to sustainability aspects. Green technology can function as an intervening variable in achieving competitive advantage. This means that by adopting green technology, manufacturing companies can improve their performance in terms of cost savings, improving corporate image, and product competitiveness. This study aims to explore how the adaptation of green technology can affect the competitive advantage of manufacturing companies in North Sumatra.

Studies such as those conducted by Hernandez et al. (2017) discuss the implementation of green technology in the manufacturing industry globally, but few discuss the Indonesian context, especially in North Sumatra. Most studies in Indonesia are still limited to the energy and agriculture sectors, with little attention to the manufacturing sector. Further research is needed to explore the implementation and challenges faced by manufacturing firms in North Sumatra in adopting green technology, and how this affects their competitive advantage in the local context. Research conducted by Madhavaram et al. (2005) emphasizes the importance of local factors (such as government policies and market preferences) in decision-making regarding green technology adoption. However, studies that focus on the influence of these local factors on competitive advantage in North Sumatra manufacturing firms are limited. Further research is needed to identify the influence of government policies, market conditions, and consumer preferences on the adoption of green technology in North Sumatra manufacturing firms, and how these factors contribute to the achievement of competitive advantage.

Method

This study uses a quantitative method that focuses on statistical analysis to test the relationship between existing variables, namely green policies, environmentally friendly supply chain management, green technology adaptation, and competitive advantage. In this case, Smart PLS (Partial Least Squares Structural Equation Modeling) is used to test the relationship model between these variables. According to Hair et al. (2020) Smart PLS is used to estimate structural and measurement models in the context of quantitative research that focuses on exploring the relationship between latent variables, which in this case are green policies, environmentally friendly supply chain management, green technology, and competitive advantage.

In this research model, green technology adaptation serves as an intervening variable. This means that green technology mediates the relationship between green policies, environmentally friendly supply chain management, and competitive advantage of manufacturing companies. Smart PLS allows researchers to test the role of green technology in improving the relationship between independent variables (green policies, environmentally friendly supply chain management) and dependent variables (competitive advantage). According to Henseler et al. (2020) Smart PLS can be used to test models with intervening variables because it is able to estimate direct and indirect relationships between variables with high precision.

CollectionData were collected through questionnaires distributed to manufacturing companies in North Sumatra. Respondents consisted of managers or staff who were directly involved in decision making related to green policies, supply chain management, and green technology in their companies. Validity and Reliability TestUsing convergent and discriminant analysis to test construct validity and item reliability for each variable. PLS Analysisusing Smart PLS to estimate the measurement model and structural model, and to evaluate the direct and indirect effects of green policies and environmentally friendly supply chain management on competitive advantage through green technology adaptation. Evaluation of Model musing the R-squared (R^2) value to evaluate the structural model, as well as the T-statistics value to test the significance of the influence between variables.

By using the Smart PLS approach in this study, the analysis of the impact of green policies, environmentally friendly supply chain management, and green technology on competitive advantage can be carried out in depth and comprehensively. This model will provide important insights into how manufacturing companies in North Sumatra can utilize green technology to improve their competitiveness in an increasingly sustainability-focused market.

Results and Discussion

Evaluation of Measurement Model (Outer Model)

The measurement model (outer model) is confirmatory factor analysis (CFA) by testing the validity and reliability of latent constructs. The following are the results of the outer model evaluation in this study.

Validity Test

This study uses the help of Smart PLS 3.0 software to test the validity and reliability of the research instrument. To test the validity of data, convergent validity can be used to see the loading factor value and discriminant validity by looking at the cross loading value.

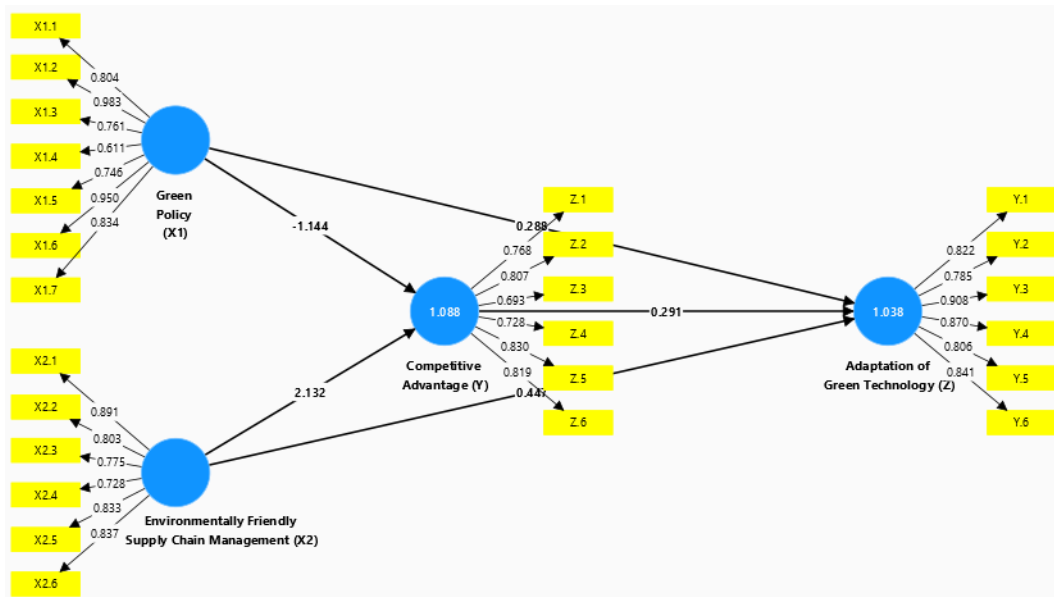


Figure 2. Outer Model

1. Convergent Validity

Convergent validity of the measurement model with the reflective indicator model is assessed based on the correlation between item score/component score and construct score calculated by PLS. Based on Figure 4.1 above, it can be seen that all loading factor values have passed the limit of 0.7 so that it can be concluded that each indicator in this study is valid. Therefore, these indicators can be used to measure research variables.

2. Discriminant Validity

Discriminant validity compares values Average Variance Extracted (AVE) of each construct with the correlation between other constructs in the model. Based on Figure 4.1 above, it can be seen that all cross loading values of each targeted indicator have a higher correlation with each variable compared to other variables. It can be concluded that the indicators above are valid as a whole.

Reliability Test

An instrument can be said to be reliable by looking at the value of Average Variance Extracted more than 0.5, Cronbach Alpha more than 0.6 and Composite Reliability more than 0.7.

Table 1. Calculation of AVE, Cronbach Alpha, and Composite Reliability

	<i>Cronbach's Alpha</i>	<i>rho_A</i>	<i>Composite Reliability</i>	<i>Average Variance Extracted (AVE)</i>
Green Technology Adaptation (Z)	0.934	0.936	0.935	0.705
Competitive Advantage (Y)	0.900	0.903	0.900	0.602
Green Policy (X1)	0.920	0.923	0.921	0.660
Eco-Friendly Supply Chain (X2)	0.932	0.945	0.934	0.674

Source: Processed primary data (2025)

Based on Table 1 above, it can be seen that the Cronbach Alpha value of the Competitive Advantage variable (Y) is 0.900, the Green Technology Adaptation variable (Z) is 0.934, the Green Technology Adaptation variable (Z) is 0.935, and the Green Technology Adaptation variable (Z) is 0.939. Green Policy (X1) of 0.920, the Eco-Friendly Supply Chain variable (X2) is 0.932. From the calculation results above, it can be seen that all indicators are reliable in measuring their latent variables.

Structural Model Evaluation (Inner Model)

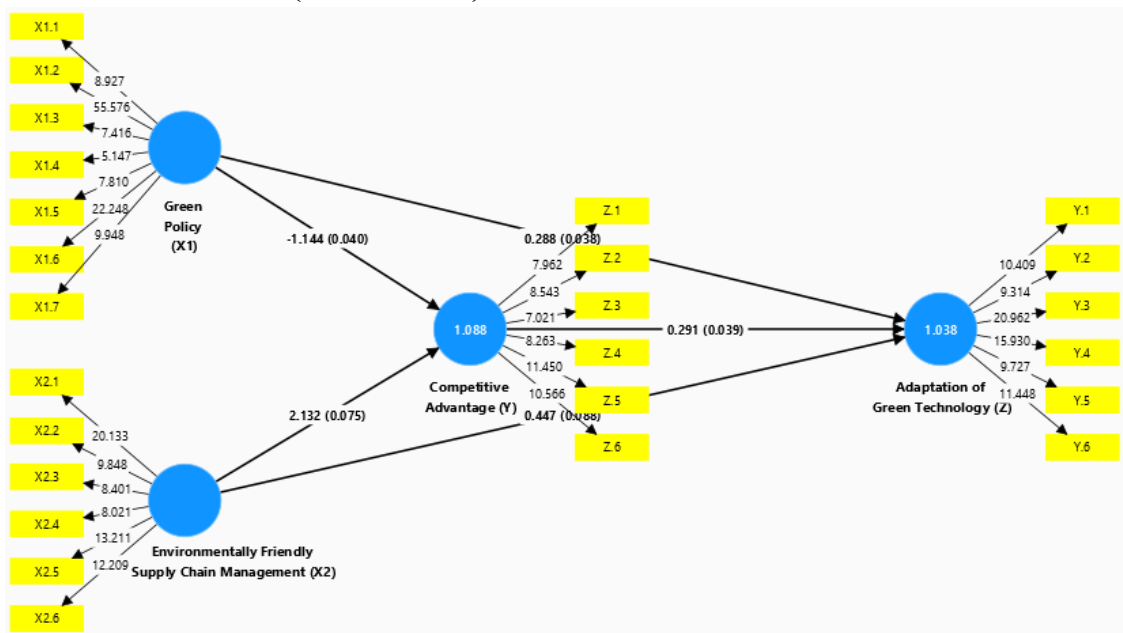


Figure 3. Structural Model (Inner Model)
 Source: Primary data processed by Smart PLS 4 (2025)

Evaluation of the inner model can be seen from several indicators including the coefficient of determination (R²), Predictive Relevance (Q²) and Goodness of Fit Index (GoF) (Hussein, 2015). The results of the structural model displayed by Smart PLS 3.0 in this study are as follows:

R² (R-square) results

In assessing the model with PLS, it begins by looking at the R-square for each dependent latent variable. The results of the r² calculation in this study are as follows:

Table 2. Correlation Value (r²)

	R-square	Adjusted R-square
Green Technology Adaptation (Z)	0.938	0.942
Competitive Advantage (Y)	0.908	0.993

Source: Processed primary data (2025)

Based on the calculation results using bootstapping in Table 2 above, it is known that the r² value of the Green Technology Adaptation variable (Z) is 0.942, which means that the Green Technology Adaptation variable (Z) influenced by variables Green Policy (X1) and Eco-Friendly Supply Chain (X2) of 94.2% or in other words the contribution of the Green Technology Adaptation variable (Z) is 94.2%.

The r^2 result of the Competitive Advantage variable (Y) is 0.903, which means that the Competitive Advantage variable (Y) is influenced by Green Technology Adaptation (Z). influenced by variables Green Policy (X1) and Eco-Friendly Supply Chain (X2) of 99.3% or in other words the contribution of the Competitive Advantage variable (Y) is 99.3%.

Hypothesis Testing

Based on the results of the outer model conducted, all hypotheses tested have met the requirements, so they can be used as analysis models in this study. Hypothesis testing in this study uses alpha 5% which means if the t-statistic value ≥ 2.048 or the probability value \leq level of significance ($\alpha = 5\%$). The limit of 0.05 means that the magnitude of the chance of deviation is only 5% and the remaining 95% is indicated to accept the hypothesis.

Hypothesis testing in this study is divided into two parts, namely direct effect testing and indirect effect testing (mediation). Direct effect testing will use bootstrapping on Smart PLS 3.0 software, while indirect effect testing will use t-statistics on the indirect effect.

Table 3. Path Coefficients

	<i>Original Sample (O)</i>	<i>Sample Mean (M)</i>	<i>Standard Deviation (STDEV)</i>	<i>T statistics (O/STDEV)</i>	<i>P Values</i>
Green Policy (X1) -> Green Technology Adaptation (Z)	0.804	0.797	0.090	8,927	0.000
Eco-Friendly Supply Chain (X2) -> Green Technology Adaptation (Z)	0.761	0.757	0.103	7,416	0.004
Green Policy (X1) -> Competitive Advantage (Y)	0.611	0.610	0.119	5.147	0.013
Eco-Friendly Supply Chain (X2) -> Competitive Advantage (Y)	0.746	0.743	0.096	7,810	0.002
Green Technology Adaptation (Z) -> Competitive Advantage (Y)	0.834	0.830	0.084	9,948	0.000

Source: Processed primary data (2025)

Based on Table 3, the test results for each hypothesis are as follows:

a. Green Policy (X1) influence on Green Technology Adaptation (Z).

Based on the test results in Table 4.3, it can be seen that the t-statistic value of the relationship between the variables Green Policy (X1) on the Green Technology Adaptation variable (Z) is 8.927 with a sig. of 0.000. The test results show that the t-statistic ≥ 1.96 and the sig. value \leq level of significance ($\alpha = 5\%$). Thus the first hypothesis is accepted. Previous studies have also shown similar findings. For example, in the article "Indonesia's Green Growth Policy Strategy: In Adapting to Climate Change" published in May 2024, author Dewi Ayu Marchela Putri and colleagues highlighted the importance of green growth policies in driving climate change adaptation in Indonesia. The study emphasized that the success of green growth strategies depends heavily on multisectoral collaboration, increased public awareness, and strong political commitment.

b. Eco-Friendly Supply Chain (X2) influence on Green Technology Adaptation (Z).

Based on the test results in Table 4.3, it can be seen that the t-statistic value of the relationship between the Environmentally Friendly Supply Chain variable (X2) and the Green Technology Adaptation variable (Z) is 7.416 with a sig. of 0.004. The test results indicate that the t-statistic ≥ 1.96 and the sig. value \leq level of significance ($\alpha = 5\%$). Thus the second hypothesis is accepted. Research by González-Benito et al. (2021) in the article "Green supply chain management practices and their impact on competitive advantage: An empirical study of Spanish manufacturing companies" found that green supply chain management has a significant influence on sustainable technological innovation, which in turn improves the competitiveness of companies. The findings in this study, which show a significant influence of green supply chain on green technology adaptation, are in line with the results of previous studies. Both studies emphasize that the implementation of green supply chain management can trigger the adoption of green technology as part of a company's sustainability strategy.

c. Green Policy (X1) influence on Competitive Advantage (Y).

Based on the test results in Table 4.3, it can be seen that the t-statistic value of the relationship between the variables Green Policy (X1) on the Competitive Advantage variable (Y) is 5.147 with a sig. of 0.013. The test results show that the t-statistic ≥ 1.96 and the sig. value \leq level of significance ($\alpha = 5\%$). Thus the third hypothesis is accepted. This indicates that green policies implemented by companies can directly contribute to increasing the competitiveness or competitive advantage of companies, either through increasing operational efficiency, reducing costs, or by improving the company's image as an entity that cares about the environment. Research by Martínez-Jurado and Moyano-Fuentes (2021) in the article "The effect of green innovation on competitive advantage in SMEs: A case study of Spanish manufacturing companies" found that green policies driven by environmental innovation can increase the competitive advantage of companies, especially in the manufacturing sector. Thus, this study strengthens the findings of previous studies which show that green policies have a significant impact on increasing the competitive advantage of companies, through increased efficiency, innovation, and a better corporate image.

d. Eco-Friendly Supply Chain (X2) influence on Competitive Advantage (Y).

Based on the test results in Table 4.3, it can be seen that the t-statistic value of the relationship between the Eco-Friendly Supply Chain variable (X2) and the Competitive Advantage variable (Y) is 7.810 with a sig. of 0.002. The test results indicate that the t-statistic ≥ 1.96 and the sig. value \leq level of significance ($\alpha = 5\%$). Thus, the fourth hypothesis is accepted. This shows that environmentally friendly supply chain management can strengthen a company's competitiveness by creating operational efficiency, reducing costs, and improving the company's positive image in the eyes of consumers and other stakeholders. Research by Rao and Holt (2021) in the article "The greening of industry and its impact on competitive advantage: Evidence from the manufacturing sector" shows that the implementation of an environmentally friendly supply chain contributes to reducing operational costs and increasing competitive advantage in the manufacturing sector. Thus, this study strengthens the findings of previous studies which show that environmentally friendly supply chain management contributes to increasing a company's competitive advantage through reducing costs, increasing operational efficiency, and improving reputation in the eyes of consumers.

e. Green Technology Adaptation (Z) influences Competitive Advantage (Y).

Based on the test results in Table 4.3, it can be seen that the t-statistic value of the relationship between the Green Technology Adaptation variable (Z) and the Competitive Advantage variable (Y) is 9.948 with a sig. of 0.000. The test results indicate that the t-statistic ≥ 1.96 and the sig. value \leq level

of significance ($\alpha = 5\%$). Thus, the fifth hypothesis is accepted. This indicates that the implementation of green technology in company operations directly contributes to increasing company competitiveness. Green technology can create cost efficiency, reduce environmental impact, and improve the company's reputation in the eyes of consumers and other stakeholders. Research by Chen et al. (2021) in the article "The impact of green technology adoption on firm performance: Evidence from Chinese manufacturing firms" reveals that wider adoption of green technology by companies can improve company performance, especially in terms of operational efficiency and competitive advantage.

Indirect Effect Testing

The indirect effect test is conducted by testing the strength of the indirect effect of the independent variable (variable X) to the dependent variable (variable Y) through the intervening variable (variable Z) with the condition that the t-statistic value is > 2.048 . The indirect effect can be stated as significant if both direct effects that form it are significant. The results of this test can be seen in the following table:

Table 4. Indirect Effect

	<i>Original Sample (O)</i>	<i>Sample Mean (M)</i>	<i>Standard Deviation (STDEV)</i>	<i>T statistics (O/STDEV)</i>	<i>P Values</i>
Green Policy (X1) -> Green Technology Adaptation (Z)->Competitive Advantage (Y)	0.693	0.686	0.099	7.021	0.000
Eco-Friendly Supply Chain (X2) -> Green Technology Adaptation (Z)->Competitive Advantage (Y)	0.728	0.724	0.088	8.263	0.000

Source: Processed primary data (2025)

Green Policy (X1) have a significant impact on Competitive Advantage (Y) through Green Technology Adaptation (Z)

Based on the test results in Table 4.4, it can be seen that the t-statistic value of the relationship between the Green Policy variable (X1) and the variable Competitive Advantage (Y) through variables Green Technology Adaptation (Z) is 7.021 with sig. of 0.000. The test results show that the t-statistic ≥ 1.96 and the sig. value \leq level of significance ($\alpha = 5\%$). Thus, the sixth hypothesis is accepted. This shows that green policies not only directly affect competitive advantage, but also through increasing the adoption of green technology that contributes to the company's competitiveness. The implementation of green policies can create incentives for companies to innovate with green technology, which in turn strengthens their competitive position. Research by Lee et al. (2021) in the article "The role of green policies in driving green technology adoption and competitive advantage" reveals that green policies driven by the government or companies serve as the main driver for the adoption of green technology, which in turn strengthens the company's competitive advantage. Thus, this study strengthens the results of previous studies which show that green policies play an important role in driving the adoption of green technology that contributes to

increasing the company's competitive advantage. The policy not only has a direct impact, but also through innovative green technology adaptation channels.

Eco-Friendly Supply Chain (X2) have a significant impact on Competitive Advantage (Y) through Green Technology Adaptation (Z).

Based on the test results in Table 4.4, it can be seen that the t-statistic value of the relationship between the variables Eco-Friendly Supply Chain (X2) to the variables Competitive Advantage (Y) through variables Green Technology Adaptation (Z) is 8.263 with sig. of 0.000. The test results show that the t-statistic ≥ 1.96 and the sig. value \leq level of significance ($\alpha = 5\%$). Thus, the seventh hypothesis is accepted. This indicates that environmentally friendly supply chain management, which involves the application of green technology, can significantly increase the company's competitive advantage. Environmentally friendly supply chain management not only improves operational efficiency and reduces costs, but also strengthens competitive positions through increased innovation and a greener corporate image. Research by Zhang et al. (2021) in the article "Green supply chain management and competitive advantage: The mediating role of green technology adoption" found that environmentally friendly supply chain management, which involves green technology, helps companies reduce costs, improve product quality, and strengthen their competitive position. Thus, this study supports previous findings showing that Environmentally Friendly Supply Chain Management has a significant impact on Competitive Advantage through the adoption of Green Technology. Environmentally friendly practices in the supply chain contribute to operational efficiency, cost reduction, and increase the competitiveness of companies in the global market.

Conclusion

Based on the results of the analysis that has been carried out in this study, it can be concluded that all hypotheses proposed in the study regarding the impact of green policies and environmentally friendly supply chain management on competitive advantage through the adaptation of green technology as an intervening variable are accepted. The test results using Smart PLS show that each relationship between independent, intervening, and dependent variables has a significant influence, as follows:

1. Green Policy (X1) Influences Green Technology Adaptation (Z) The test shows that green policies have a significant effect on the adaptation of green technology. This result is proven by the t-statistic value of 8.927 and a significance of 0.000. This shows that green policies implemented by companies can encourage the adoption of green technology as part of the company's sustainability initiatives.
2. Environmentally Friendly Supply Chain (X2) Influences Green Technology Adaptation (Z) The test also shows that environmentally friendly supply chain management has a significant effect on the adaptation of green technology, with a t-statistic value of 7.416 and a significance of 0.004. This shows that the application of sustainability principles in the supply chain contributes to the adoption of green technology.
3. Green Policy (X1) Influences Competitive Advantage (Y) Green policy has a significant effect on the competitive advantage of companies, with a t-statistic of 5.147 and a significance of 0.013. These results confirm that green policy can increase the competitiveness of companies through the implementation of more efficient and environmentally friendly technologies.
4. Environmentally Friendly Supply Chain (X2) Influences Competitive Advantage (Y) The test shows that the environmentally friendly supply chain has a significant effect on competitive advantage, with a t-statistic of 7.810 and a significance of 0.002. This shows that environmentally friendly supply chain management can strengthen the company's competitive position in the market.

5. Green Technology Adaptation (Z) Influences Competitive Advantage (Y) Green technology adaptation has been proven to have a significant effect on the competitive advantage of companies. The t-statistic value of 9.948 with a significance of 0.000 indicates that companies that adopt green technology can improve their operational efficiency and competitiveness in the market.
6. Green Policy (X1) Has a Significant Influence on Competitive Advantage (Y) Through Green Technology Adaptation (Z) The test results show that green policy has a significant effect on competitive advantage through green technology adaptation, with a t-statistic of 7.021 and a significance of 0.000. This indicates that green technology acts as a mediator that strengthens the effect of green policy on competitive advantage.
7. Environmentally Friendly Supply Chain (X2) Has a Significant Influence on Competitive Advantage (Y) Through Green Technology Adaptation (Z) The final test shows that the green supply chain has a significant effect on competitive advantage through the adaptation of green technology, with a t-statistic of 8.263 and a significance of 0.000. This indicates that the adoption of green technology triggered by green supply chain practices can increase the company's competitive advantage.
8. Implementation of Green Policy and Environmentally Friendly Supply Chain Companies must adopt green policies that support environmental sustainability, as well as implement environmentally friendly supply chain management. This will not only improve environmental impacts, but also improve the company's competitive position in the market. Green Technology as a Catalyst The adaptation of green technology is a key factor in improving operational efficiency and effectiveness, which in turn contributes to increasing the company's competitiveness.
9. Competitive Advantage through Environmental Innovation Manufacturing companies in North Sumatra and other regions can consider green policies and environmentally friendly supply chain management as strategies that not only benefit the environment but also provide significant competitive advantages.

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