

Environmental Investment on Economic Growth and Sustainable Development: A Case Study of North Sumatra

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Abstract

Purpose – This study aims to analyze the effect of environmental investment on economic growth and sustainable development in North Sumatra during the period 2011–2024. **Methodology/approach** – The research employs a quantitative approach using time series data analyzed through simple linear regression. Prior to hypothesis testing, classical assumption tests were conducted, including normality, heteroskedasticity, and autocorrelation tests. Hypothesis testing was carried out using the partial t-test and the coefficient of determination (R^2). **Findings** – Hypothesis testing was carried out using the partial t-test and the coefficient of determination (R^2). The results indicate that environmental investment has a positive and significant effect on both economic growth and sustainable development. The coefficient of determination shows that environmental investment has a strong explanatory power in explaining variations in economic growth and sustainable development. **Novelty/value** – that environmental investment not only plays a role in environmental preservation but also serves as an important instrument in promoting sustainable economic growth and development in North Sumatra

Keywords: Environmental Investment, Economic Growth, Sustainable Development

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INTRODUCTION

Sustainable economic development has become a strategic issue in national development planning. High economic growth is no longer considered sufficient if it is not balanced with environmental protection and an improvement in the quality of life (Hermawati, 2021; Samita et al., 2022; Zulu-Chisanga et al., 2020). Therefore, environmental investment has become a vital instrument in supporting sustainable development, as it plays a key role in maintaining the balance between economic growth, environmental conservation, and social welfare. (*United Nations Environment Programme, 2021*).

Between 2011 and 2024, the government demonstrated a relatively consistent commitment to increasing environmental investment. This is reflected in the value of environmental investment, which has shown an upward trend year over year. In 2011, environmental investment was recorded at IDR 1,250 billion and continued to rise, reaching IDR 2,320 billion by 2024. This increase in investment is expected to support economic growth while simultaneously driving improvements in the quality of sustainable development. (Asian Development Bank, 2022).

However, the dynamics of economic growth have shown significant fluctuations. Economic growth remained relatively stable in the range of 5-6% before experiencing a sharp contraction in 2020 due to the

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COVID-19 pandemic, with growth reaching -1.1%. This condition demonstrates that despite continuous environmental investment, external and structural factors still influence national economic performance. (*International Monetary Fund, 2021*). Meanwhile, the Sustainable Development Index showed a relatively consistent upward trend throughout the observation period, rising from 61.2 in 2011 to 68.1 in 2024 (World Bank, 2023). This indicates that environmental investment has a positive contribution toward sustainable development achievements, although it does not always align directly with short-term economic growth (Xu et al., 2025)(Zhong et al., 2022)

To provide an empirical overview of the developments in environmental investment, economic growth, and sustainable development, the data are presented in the following table (BPS Sumut, 2025).

Table 1. Trends in Environmental Investment, Economic Growth, and Sustainable Development (2011-2024)

Year	Environmental Investment (IDR Billion)	Economic Growth (%)	Sustainable Development (Index)
2011	1.250	6,1	61,2
2012	1.320	6,3	61,8
2013	1.410	6	62,4
2014	1.480	5,8	63
2015	1.520	5,2	63,5
2016	1.610	5,4	64,1
2017	1.720	5,6	64,8
2018	1.850	5,2	65,4
2019	1.930	5,1	65,9
2020	1.800	-1,1	65,6
2021	1.880	2,6	66,2
2022	2.050	4,7	66,9
2023	2.180	5	67,5
2024	2.320	5,2	68,1

Source: Statistics Indonesia (BPS) and the Ministry of Environment and Forestry (KLHK), processed by the researcher (2025).

The table 1 above presents the trends in environmental investment, economic growth, and the Sustainable Development Index over the 2011–2024 period. Environmental investment is measured in billions of rupiah, economic growth is expressed as a percentage, and the Sustainable Development Index reflects the annual achievements in sustainable development. The data in this table are used to analyze the dynamics between increasing environmental investment and economic growth, as well as its impact on the level of sustainable development.

Previous studies have largely examined the relationship between environmental investment and economic performance at the national or cross-country level (Herman, 2021; Indrajaya et al., 2026; Iskanto, 2023), with less attention to regional contexts in Indonesia. Existing research also tends to treat economic growth and sustainable development separately, so little is known about how the same environmental investment affects both outcomes. In addition, the 2020 pandemic contraction suggests that investment effects on short-term growth may differ from those on long-term sustainability. This difference has not been examined empirically for North Sumatra. This gap limits the evidence available to regional policymakers when allocating environmental budgets.

This study offers three contributions. First, it provides province-level evidence from North Sumatra, a region whose environmental investment dynamics are rarely analyzed. Second, it tests the effect of environmental investment on economic growth and on sustainable development simultaneously, using the same 2011–2024 observation period. Third, the period spans the COVID-19 shock, so the findings show whether the investment-growth-sustainability relationship holds under economic disruption.

Therefore, this study aims to analyze the effect of environmental investment on economic growth and sustainable development in North Sumatra during 2011–2024. Specifically, it examines (1) the effect of environmental investment on economic growth and (2) the effect of environmental investment on the Sustainable Development Index.

LITERATURE REVIEW

Sustainable Economic Development

Sustainable economic development is a development approach that emphasizes the balance between economic growth, environmental sustainability, and social welfare. This concept evolved as a response to conventional development models, which focused solely on economic growth without considering environmental carrying capacity. Sustainable development requires that current economic activities do not compromise the ability of future generations to meet their own needs (Mensah, 2020).

In its implementation, sustainable economic development places the quality of growth as the primary indicator of developmental success. High economic growth is considered insufficient if it is accompanied by environmental degradation and social inequality. Therefore, sustainable development requires the integration of economic policies with environmental protection and the simultaneous improvement of the community's quality of life (Bansal et al., 2021).

Environmental Investment

Environmental investment is defined as the allocation of financial resources aimed at environmental protection activities, natural resource management, and the mitigation of negative environmental impacts caused by economic activities. This investment encompasses the development of eco-friendly infrastructure, clean technology, and long-term oriented environmental conservation programs (Zhang et al., 2022). Economically, environmental investment is viewed as a strategic instrument in driving the transformation toward a green economy. This investment not only provides ecological benefits but also has the potential to enhance economic productivity through resource efficiency, technological innovation, and the creation of new job opportunities. Consequently, environmental investment acts as a catalyst in supporting sustainable economic development (Taghizadeh-Hesary & Yoshino, 2020).

Economic Growth

Economic growth reflects the increase in the productive capacity of a region, as demonstrated by the rise in the output of goods and services within a specific period. In a modern development perspective, economic growth is measured not only by the magnitude of the increase in Gross Domestic Product (GDP) but also by the sustainability of that growth process (Panayotou, 2021). However, economic growth is dynamic and highly influenced by various internal and external factors, such as fiscal policy, investment, global economic stability, and health crises. The experience of the COVID-19 pandemic demonstrates that economic growth can undergo a sharp contraction due to external shocks, even when investments in strategic sectors—including the environment—are maintained (Fernandes, 2020).

The Relationship Between Environmental Investment and Economic Growth

The relationship between environmental investment and economic growth can be explained through the green economy approach, which posits that investment in the environmental sector is capable of driving economic growth by enhancing efficiency and innovation. Environmental investment encourages the adoption of cleaner and more efficient technologies, thereby increasing productivity and economic competitiveness in the long run (OECD, 2021). Although its impact on short-term economic growth is not

always significant, environmental investment is proven to contribute to economic stability and the reduction of environmental risks that could hinder future growth (Alvarado et al., 2021).

The Relationship Between Environmental Investment and Sustainable Development

Environmental investment is closely linked to the achievement of sustainable development, as it directly supports the environmental and social dimensions of development. Investment in environmental management contributes to improving the community's quality of life through a healthy and sustainable environment, while simultaneously supporting the attainment of Sustainable Development Goals (SDGs) (UNDP, 2022). Furthermore, environmental investment plays a role in strengthening development resilience against environmental risks and climate change. By increasing adaptation and mitigation capacities, environmental investment helps ensure that the development process can continue sustainably in the long run, even when faced with global economic and environmental pressures (Sachset et al., 2023).

METHOD

This study employs an associative quantitative approach using time series data from 2011 to 2024 to analyze the influence of environmental investment on economic growth and sustainable development in North Sumatra. The analysis is conducted using linear regression, preceded by classical assumption tests, including normality, heteroscedasticity, and autocorrelation (Durbin-Watson) tests. Hypothesis testing is performed through the t-test and the coefficient of determination (R^2) (Machali, 2021). Based on the theoretical review described earlier, the conceptual framework of this study is presented in the following figure.

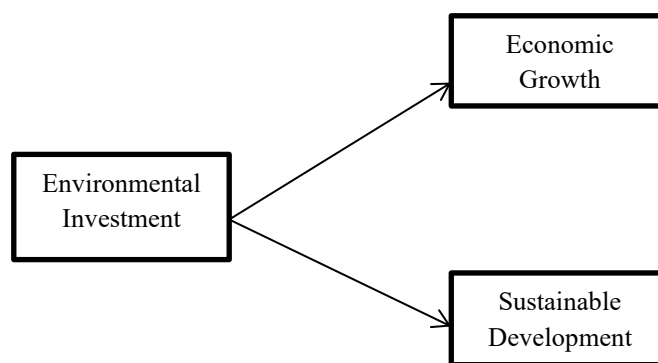


Figure 1 : Research Framework

RESULT AND DISCUSSION

Result

Normality Test

The normality test is used to determine whether the data or residuals in the regression model are normally distributed, which is a requirement for fulfilling classical assumptions. This ensures that the results of the regression analysis and hypothesis testing are valid and reliable (Sidik Priadana, 2021).

Table 2. Normality Test Results

One-Sample Kolmogorov-Smirnov Test				
		environmental investment	economic growth	sustainable development
Normal Parameters ^{a,b}	Mean	1.7371	40.8571	606.9286
	Std. Deviation	.32298	6.30875	56.47992
Most Extreme Differences	Absolute ^c	.106	.112	.112
	Positive ^c	.106	.112	.112
	Negative ^c	-.077	-.110	-.090
Test Statistic		.106	.112	.112
Asymp. Sig. (2-tailed)		.200 ^{c,d}	.200 ^{c,d}	.200 ^{c,d}
a. Test distribution is Normal.				
b. Calculated from data.				
c. Lilliefors Significance Correction.				
d. This is a lower bound of the true significance ^c .				

Source: Processed Results *SPSS 25*

Based on the results of the normality test, the Asymp. Sig. (2-tailed) values for the environmental investment, economic growth, and sustainable development variables are each 0.200, which is greater than the significance level of 0.05. Consequently, all variables in this study are normally distributed; thus, the normality assumption is fulfilled, and the data are suitable for regression analysis and further hypothesis testing.

Heteroscedasticity Test

The heteroscedasticity test is used to determine whether there is an inequality of variance in the residuals within a regression model. This ensures that the model fulfills the classical assumptions and produces unbiased estimates. (Firdaus, 2021).

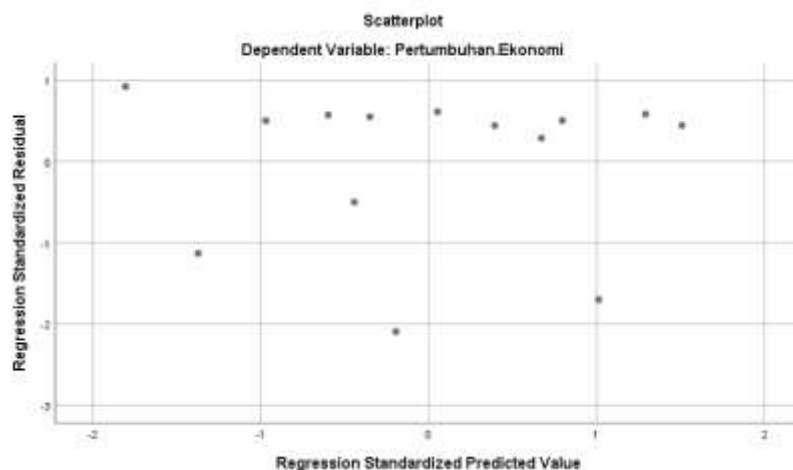


Figure 2. Heteroscedasticity Test Results for Economic Growth

Source: Processed Results *SPSS 25*

Based on the results of the heteroscedasticity test on the regression model of environmental investment towards economic growth, the distribution of the residual points appears to be scattered randomly and does not form any specific pattern. Therefore, it can be concluded that the regression model does not suffer from heteroscedasticity

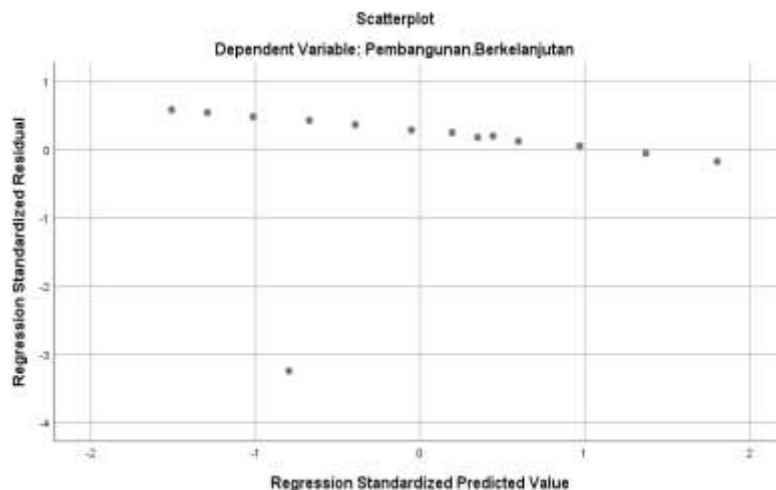


Figure 3. Heteroscedasticity Test Results for Sustainable Development
Source: Processed Results *SPSS 25*

Based on the results of the heteroscedasticity test on the regression model of environmental investment towards sustainable development, the random and patternless distribution of residuals indicates that the regression model is free from heteroscedasticity issues.

Autocorrelation Test

The autocorrelation test is used to determine whether there is a correlation between residuals across different time periods in a regression model, particularly in time series data. In this study, the autocorrelation test is conducted using the Durbin-Watson method.(Machali, 2021).

Table 3. Autocorrelation Test Results for Economic Growth

Model Summary ^b					
Model	R	R Square	Adjusted Square	R Std. Error of the Estimate	Durbin-Watson
1	.983 ^a	.966	.963	1.20898	2.314

a. Predictors: (Constant), Environmental Investment

b. Dependent Variable: Economic Growth

Source: Processed Results *SPSS 25*

Based on table 3 the results of the autocorrelation test using the Durbin–Watson method on the economic growth regression model, the Durbin–Watson value is 2.314. Since this value falls within the range of 1.5 to 2.5, it can be concluded that there is no autocorrelation in the regression model

Table 4. Autocorrelation Test Results for Sustainable Development

Model Summary ^b					
Model	R	R Square	Adjusted Square	R Std. Error of the Estimate	Durbin-Watson
1	.991 ^a	.983	.981	7.68540	2.293

a. Predictors: (Constant), Environmental Investment

b. Dependent Variable: Sustainable Development

Source: Processed Results *SPSS 25*

Based on table 4 the results of the autocorrelation test on the sustainable development regression model, the Durbin–Watson value is 2.293. This value falls within the acceptable range, thus the regression model is declared free from autocorrelation.

Hypothesis Test t-Test (Partial Test)

The t-test (partial test) is used to examine the significance of the influence of environmental investment on economic growth and sustainable development. The test results show that the significance value of the environmental investment variable is less than 0.05. Therefore, it can be concluded that environmental investment has a significant influence on both dependent variables.

Table 5. t-Test Results for Economic Growth

Coefficients ^a					
Model		Unstandardized Coefficients		Standardized Coefficients	Sig.
		B	Std. Error	Beta	
1	(Constant)	264.886	30.376		8.720
	Environmental investment	199.218	17.212	.958	11.574

a. Dependent Variable: Economic Growth

Source: Processed Results SPSS 25

Based on table 5 the results of the t-test on the regression model of environmental investment towards economic growth, the significance value is less than 0.05. This indicates that environmental investment has a positive and significant influence on economic growth in North Sumatra.

Table 6. t-Test Results for Sustainable Development

Coefficients ^a					
Model		Unstandardized Coefficients		Standardized Coefficients	Sig.
		B	Std. Error	Beta	
1	(Constant)	305.757	11.647		26.252
	Environmental Investment	173.372	6.600	.991	26.270

a. Dependent Variable: Sustainable Development

Source: Processed Results SPSS 25

Based on table 6 the results of the t-test on the regression model of environmental investment towards sustainable development, the test results show a significance value below 0.05 with a positive coefficient. This means that environmental investment has a positive and significant influence on sustainable development.

Coefficient of Determination Test (R^2)

The coefficient of determination test (R^2) is used to measure how much of the variation in economic growth and sustainable development can be explained by environmental investment. The test results show an (R^2) value of 0.918 for the economic growth model and 0.983 for the sustainable development model. This means that 91.8% and 98.3% of the variation in the dependent variables, respectively, can be explained by environmental investment, while the remainder is influenced by other factors outside the research model

Table 7. Results of the Coefficient of Determination Test (R^2) for Economic Growth

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	

1	.958 ^a	.918	.911	20.04374
a. Predictors: (Constant), Environmental Investment				
Source: Processed Results <i>SPSS 25</i>				

Based on table 7 the results, the coefficient of determination for the economic growth regression model is 0.918. This indicates that 91.8% of the variation in economic growth can be explained by environmental investment, while the remaining portion is influenced by other factors outside the scope of this research model

Table 8. Results of the Coefficient of Determination Test (R^2) for Sustainable Development

Model Summary				
Model	R	R Square	Adjusted Square	Std. Error of the Estimate
1	.991 ^a	.983	.981	7.68540
a. Predictors: (Constant), Environmental Investment				
Source: Processed Results <i>SPSS 25</i>				

Based on table 8 the results, the coefficient of determination for the sustainable development regression model is 0.983. This value indicates that 98.3% of the variation in sustainable development can be explained by environmental investment, while the remainder is influenced by other variables outside the scope of this study

Discussion

The Influence of Environmental Investment on Economic Growth

The results of the hypothesis testing indicate that environmental investment has a positive and significant influence on economic growth. The positive regression coefficient suggests that an increased allocation of environmental investment can drive economic growth in North Sumatra. These findings demonstrate that environmental investment functions not only as an effort to protect ecosystems but also as a catalyst for economic activity through the development of green infrastructure, resource efficiency, and the creation of new employment opportunities.

Empirically, these results support the green economy development approach, which positions environmental investment as a core component of economic growth strategies. In the context of North Sumatra, environmental investment has the potential to enhance the sustainability of key sectors such as agriculture, forestry, and tourism, which are highly dependent on environmental quality. However, fluctuations in economic growth during certain periods—particularly during the COVID-19 pandemic—indicate that the impact of environmental investment on economic growth is also influenced by external conditions and global economic dynamics.

The Influence of Environmental Investment on Sustainable Development

The analysis results also indicate that environmental investment has a positive and significant influence on sustainable development. An increase in environmental investment is consistently followed by an improvement in the Sustainable Development Index throughout the research period. This finding suggests that environmental investment plays a crucial role in enhancing the quality of development, which is not only oriented toward economic growth but also takes social and environmental aspects into account.

Environmental investment contributes to improving the community's quality of life through enhanced environmental quality, better natural resource management, and the reduction of negative impacts from economic activities on the environment. This is in line with the concept of sustainable development, which emphasizes a balance between economic, social, and environmental dimensions. The high coefficient of determination in the sustainable development model indicates that environmental investment is a dominant factor in explaining the variation in sustainable development achievements in North Sumatra.

Policy Implications

The findings of this research provide important policy implications for local governments. Environmental investment is proven to provide double benefits, namely driving economic growth while simultaneously improving the quality of sustainable development. Therefore, local governments need to prioritize environmental investment in medium- and long-term development planning.

In addition to increasing budget allocations, the effectiveness of environmental investment must be supported by reinforcing policies, such as strengthening environmental governance, increasing community participation, and integrating environmental policies with other economic sectors. With an integrated approach, environmental investment is expected to provide a more optimal and sustainable impact on the development of North Sumatra

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that environmental investment has a positive and significant influence on economic growth and sustainable development in North Sumatra during the 2011–2024 period. The increase in environmental investment is proven to contribute to driving economic activity while simultaneously improving the quality of sustainable development. Consequently, environmental investment serves as a vital instrument in supporting sustainability-oriented regional development strategies. Based on the research findings, it is recommended that the local government increase and optimize environmental investment allocations as part of a long-term development strategy to foster sustainable economic growth. Furthermore, strengthening cross-sector coordination and enhancing the effectiveness of environmental investment management are necessary to ensure a more optimal impact on sustainable development. Future research is suggested to incorporate additional variables and utilize more diverse methodological approaches to gain a more comprehensive understanding of the factors influencing sustainable development.

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