Sustainable development goals in Sumatera Island: Poverty, Economic growth, and Environment

Tiara Meinisa¹, Azwardi Azwardi ²*

¹,²Department of Economic and Development, Faculty of Economics, Sriwijaya University, Indonesia.

Abstract. This article discusses the three pillars of the Sustainable Development Goals (SDGs): poverty, economic growth, and the environmental quality index (EQI). Utilizing secondary data from the Ministry of Environment and the Central Statistics Agency covering the 2018-2022 period across 10 provinces in Sumatra, the research employs panel data regression and Cartesian analysis techniques. Poverty and economic growth exert partial and simultaneous influences on the environmental quality index. A decrease in poverty correlates with improved environmental quality, likely due to heightened environmental awareness alongside increased prosperity. Conversely, rising economic growth leads to environmental quality deterioration, attributed in part to heightened industrial and transportation activities. Cartesian analysis indicates the Riau Islands Province holds potential as the top-performing region in SDG achievement on Sumatra Island.

1 Introduction

The United Nations (UN) adopted the Sustainable Development Goals (SDGs) in September 2015 as joint development goals until 2030. SDGs is a UN initiative involving 194 countries, civil society and various global economic actors consisting of 17 global goals with 169 targets. The SDGs aim to reduce poverty levels, overcome disparities, and face the challenges of climate change through implementing concrete actions [1]. SDGs are very important for every country, especially Indonesia. Through achieving these sustainable development goals, Indonesia has the potential to become a developed country that develops in all fields. In addition, implementing the concept of a sustainable economy as a whole can advance Indonesia as a whole, bringing the country towards a higher level of progress [2].

In the SDGs development concept, there are three indicator pillars. The first indicator relates to human development, such as schools and medical care. The second indicator relates to aspects of social economic development, such as economic growth and the availability of environmental facilities. Meanwhile, the third indicator focuses on broader aspects of environmental development [3]. Goal 1 of SDGs, namely No Poverty. Shows that poverty is a major problem that requires serious attention in the context of sustainable development,
both in cities and rural areas. Poverty is a major issue because it is related to fulfilling basic human needs. Additionally, because poverty occurs in many countries around the world, it is a global problem [4]. Goal 8 of the SDGs, Decent Work and Economic Growth, is one of the SDGs focuses that requires special attention because there are still many problems that have not been resolved. Economic growth is a long-term economic problem, and economic growth is an important phenomenon experienced throughout the world [5]. Some of the problems that still exist include lack of investment, lack of sustainable decent work opportunities, government policies that are not yet optimal, and a number of other problems [6].

One of the big problems that is of common concern throughout the world is environmental problems [7]. In an effort to deal with climate change, various programs have been initiated to improve environmental quality by involving various parties. So climate issues become the 13th SDGs goal, namely Climate Action. At the global level, efforts to plan and restore the environment, with the aim of achieving sustainable environmental governance, have become the main focus in a number of programs implemented by different sectors involving various parties in synergy [7]. SDG Goal 6, Clean Water and Sanitation, targets achieving sustainable management and availability of clean water and sanitation by 2030 [8]. Ensuring fair access to water for current and future generations is a human responsibility crucial for maintaining living standards and quality of life [9]. Lack of clean water and sanitation can negatively impact the economy and welfare. To attain SDG Goal 6, reducing pollution and waste discharge into rivers is imperative [10]. National water and sanitation policies aim to promote conservation-oriented development and environmental balance, underscoring the significance of addressing pollution and water scarcity issues [11].

SDG Goal 14 focuses on life below water, recognizing the significance of marine ecosystems, given that two-thirds of the Earth's surface is covered by water. Indonesia, with vast territorial waters, surpasses its land area. These oceans harbor abundant natural resources, yet much of their depths remain unexplored by humans[12]. Marine debris is a problem that creates urgency globally and nationally as Indonesia is also a contributor to plastic waste which can endanger health and safety [13]. Terrestrial ecosystems encompass diverse communities and environments on Earth, influenced primarily by temperature and rainfall. They are integral to the 15th Sustainable Development Goal (SDG) concerning Life on Earth. Inadequately managed waste, particularly plastic waste, poses a significant threat to land ecosystems by clogging waterways and rivers and posing ingestion risks to animals, given its inability to decompose in soil[14].

In sustainable development, regional success hinges on environmental resilience. The Environmental Quality Index (EQI) serves as an initial indicator for assessing environmental conditions over time and often guides regional development efforts. [15].

![Environmental Quality Index on Sumatra Island](source: Central Statistics Agency and Ministry of Environment and Forestry, Data Processed (2023)).
The EQI graph for Sumatra's provinces from 2018 to 2022 depicts stable values consistently above 50, suggesting a fairly good environmental quality. Aceh Province, for instance, saw an increase from 75.34 in 2018 to 78.29 in 2022, indicating yearly improvements. Overall, most Sumatra provinces show an upward trend in environmental quality, urging further examination of factors and policy effectiveness. Several studies suggest that economic growth may lead to resource redistribution, potentially fostering environmental balance, sparking debates on complementary and conflicting perspectives in the environmental-growth nexus [16]. Poverty emerges as a significant contributor to environmental degradation [17]. In Finanda & Gunarto's study, they found that poverty exerts a negative and substantial influence on the Environmental Quality Index (EQI), indicating that rising poverty levels may correspond to decreased EQI values within a region [18]. Nurhamidah & Suwandana's research indicates a 95% confidence level in the reduction of environmental quality with increasing economic growth, measured by income indicators [19]. They stress the necessity of adopting sustainable economic principles by diverse stakeholders, including the government and economic actors, to address the escalating environmental pollution stemming from economic development [20]. To prevent a decline in environmental quality due to economic growth, implementing a green economy is essential, facilitating simultaneous economic development and environmental enhancement [21].

2 Methods

This article analyzes the impact of poverty and economic growth on Sumatra's environment using secondary panel data from 10 provinces spanning 2018-2022, totalling 50 observations. It employs descriptive analysis with Cartesian techniques via IBM SPSS Statistics 22 and panel data analysis with Eviews 10. Cartesian analysis assesses SDG achievements in economic growth, poverty, and environment across Sumatra's provinces, while panel data regression investigates the influence of poverty and economic growth on the environment in Sumatra. Where environmental variables include environmental quality indices, the model in this research is:

$$EQI = \beta_0 + \beta_1 \text{Povit} + \beta_2 \text{EGit} + e$$  \hspace{1cm} (1)

Where:

- $EQI$ = Environmental Quality Index
- $\beta_0$ = Constant
- $\beta_1$ = Regression Coefficients
- $Povit$ = Poverty (%)
- $\beta_2$ = Regression Coefficients
- $EG$ = Economic Growth (%)
- $i$ = Cross Section
- $t$ = Time Series
- $e$ = Error

In research that uses panel data, three models are tested, namely the common effect model (CEM), fixed effect model (FEM) and random effect model (REM), which include the Chow test, Hausman test and Lagrange Multiplier test if the model chosen is common effect CEM) or random effects model (REM). Followed by classical assumption testing and hypothesis testing.
3 Result and Discussion

3.1 Panel data regression model estimation testing

There are three ways to estimate panel data regression models, namely the common effect model (CEM), fixed effect model (FEM), and random effect model (REM). Next, tests were carried out between CEM and FEM (Chow Test) and REM (Hausman Test) and also CEM and REM (Lagrange Multiplier test).

<table>
<thead>
<tr>
<th>Test</th>
<th>H0</th>
<th>H1</th>
<th>Test Statistics</th>
<th>P-Value</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chow test</td>
<td>CEM</td>
<td>FEM</td>
<td>47.943195</td>
<td>0.0000</td>
<td>FEM</td>
</tr>
<tr>
<td>Hausman test</td>
<td>REM</td>
<td>FEM</td>
<td>17.173806</td>
<td>0.0002</td>
<td>FEM</td>
</tr>
</tbody>
</table>

Source: Eviews 10, Processed Data (2023).

The Chow test shows a cross-sectional F probability value of 0.0000, indicating acceptance of the alternative hypothesis (Ha) and rejection of the null hypothesis (Ho), which supports the fixed effects model (FEM) for the regression. Similarly, the Hausman test shows a cross-sectional probability of 0.0002, also supporting the fixed effects model (FEM) for panel data regression by rejecting Ho. Thus, the fixed effects model (FEM) is considered the most appropriate. Given that both models provide the same results, there is no need to conduct additional tests such as the Lagrange Multiplier (LM) Test.

3.2 Classical assumption test results

3.2.1 Normality test

![Fig. 2. Normality Test Results. Source: Eviews 10, Processed Data (2023).](image)

The normality test using Jarque-Bera yields a probability value of 0.790170, which is greater than the significance level of 0.05 (α). Thus, the null hypothesis (H0) is accepted. Thus, it can be concluded that the residuals in this model fulfil the assumption of normality (normally distributed).
3.2.2 Multicollinearity test

The multicollinearity test revealed that the correlation values between independent variables were all less than 0.8, indicating no violation of multicollinearity requirements among the independent variables.

Table 2. Multicollinearity Test.

<table>
<thead>
<tr>
<th></th>
<th>X1</th>
<th>X2</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>1.000000</td>
<td>0.048543</td>
</tr>
<tr>
<td>X2</td>
<td>0.048543</td>
<td>1.000000</td>
</tr>
</tbody>
</table>

Source: Eviews 10, Processed Data (2023).

3.2.3 Heteroscedasticity test

Based on the heteroscedasticity test using the Glejser test, it shows that the probability value for each independent variable is greater than α=0.05 so in this study there is no heteroscedasticity problem.

Table 3. Heteroscedasticity Test.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Prob.</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty (POV)</td>
<td>0.3805</td>
<td>Heteroscedasticity does not occur</td>
</tr>
<tr>
<td>Economic Growth (EG)</td>
<td>0.4457</td>
<td>Heteroscedasticity does not occur</td>
</tr>
</tbody>
</table>

Source: Eviews 10, Processed Data (2023).

3.3 Hypothesis test

Table 4. Hypothesis test.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-statistics</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>136.2334</td>
<td>8.693663</td>
<td>0.0000</td>
</tr>
<tr>
<td>POV</td>
<td>-6.767986</td>
<td>-4.182545</td>
<td>0.0002</td>
</tr>
<tr>
<td>EG</td>
<td>-0.866201</td>
<td>-3.973309</td>
<td>0.0003</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.645635</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.543055</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>6.293992</td>
<td></td>
<td>0.000009</td>
</tr>
</tbody>
</table>

Source: Eviews 10, Processed Data (2023).

Based on the results of the table above, the panel data regression equation can be formed as follows:

\[ EQI = 136.2334 \times Pov - 6.767986 \times EG + e \]

From the regression equation above, it can be explained: (1) The coefficient value of the constant variable is 136.2334, which means that if all the independent variables (poverty and economic growth) have no change or are equal to zero then the dependent variable (EQI) is 136.2334; (2) The coefficient value of the poverty variable (pov) is -6.767086, while the Prob T-statistic value is 0.0002, less than α=0.05, so H0 is rejected and H1 is accepted, which means poverty has a negative effect on EQI; (3) The coefficient value of the growth variable (eg) is -0.866201, while the Prob T-statistic value is 0.0003, less than α=0.05, so H0 is rejected and H1 is accepted, which means that economic growth has a negative effect on EQI.
3.3.1 T-test

The t-table value can be seen in the statistical t table at df 1 = n-k or 50-3 = 47 with a significance level of 0.05, so the result is t table = 2.011741. Judging from the t-statistics of each independent variable, poverty is -4.182545 and economic growth is -3.973309, while for the T table, it is 2.011741, so t statistics > t table which means H0 is rejected and H1 is accepted which states that the independent variables poverty and growth) partially have an influence on the dependent variable (EQI).

3.3.2 F-test

The F-table value can be seen in the F statistical table at df 1 = k-1 or 3-1 = 2 and df 2 = n-k or 50-3 = 47 with a significance level of 0.05, so the result is F table = 3.199582. Judging from the F-statistic value, which is 6.293992 and for the F-table it is 3.195056, so F-statistic > F-table means that H0 is rejected and H1 is accepted, which states that the independent variables (poverty and growth) together or simultaneously have an influence on the dependent variable (EQI).

3.4 Analysis of the relationship between economic growth, poverty and environmental quality index

Various tests have revealed that economic growth and poverty significantly impact the environmental quality index. Utilizing mapping results to bolster research findings via a Cartesian diagram, the study evaluates SDG achievements across regions. Figures 2, 3, and 4 depict the plotted average values of economic growth, poverty, and the environmental quality index from 2018 to 2022. Sumatra's provinces are categorized into four groups based on this research. Subsequently, the economic analysis of the research variables is elaborated upon.

3.4.1 The relationship between poverty and the environmental quality index

The results show that poverty has a significant influence and is negatively correlated with the environmental quality index. People living in poverty tend to explore natural resources without a clear plan because governments in poor countries are often unable to adopt environmentally friendly technologies [22, 23]. Poverty can be caused by environmental degradation, and conversely, poverty can cause environmental degradation, forming a continuous cycle. This is in line with the goals of Sustainable Development, especially Goal 1, which is to eliminate poverty in all its forms. This includes not only social aspects, but also environmental protection. By 2030, the goal is to build resilience for the poor and vulnerable and reduce their vulnerability to disasters.
Based on Cartesian analysis, over 5 years, poverty and the environmental quality index show a significant negative correlation, suggesting that higher environmental quality corresponds to lower poverty rates. Riau Islands and West Sumatra are promising regions for balanced SDG achievement. Conversely, Aceh, despite its high environmental quality, tolerates significant poverty due to reliance on unsustainable natural resource exploitation.

### 3.4.2 The relationship between economic growth and the environmental quality index

Based on the results above, economic growth and the environmental quality index have a significant influence and are negatively correlated with the environmental quality index. In line with Malthus's theory, it states that if population growth decreases, IKLH increases, which means it has a negative influence [18]. Meanwhile, based on the Environment Kuznets Curve (EKC) hypothesis, there is a negative influence of economic growth on environmental quality, especially in developing countries. In developing countries, most economic growth is caused by the industrialization process. The industrialization process produces waste that leaks into the environment, causing the environment to deteriorate [24].
Belitung, and Riau suffer from low environmental quality due to rapid economic growth leading to environmental degradation [20].

### 3.4.3 The relationship between economic growth and poverty

![Diagram](image)

**Fig. 5.** Achievement of SDGs in 10 Provinces of Sumatra Island based on Economic Growth and Poverty.

Todaro & Smith [25] state that economic growth should ideally reduce poverty levels, in line with the "trickle-down" theory. However, in scenarios where economic growth is not matched by adequate employment opportunities, this can lead to income inequality, thereby exacerbating poverty levels despite overall economic growth. In addition, Saleem and Donaldson [26] highlighted that wage increases can play a role in poverty reduction. An increase in wages is expected to improve welfare levels, which in turn can reduce poverty levels. Provinces with high economic growth, such as Bengkulu and South Sumatra, also experience high poverty levels, while those with potential for SDG achievement include Bangka Belitung, Riau Islands, and Riau. Lampung and Aceh face both high poverty and low economic growth, while Jambi, West Sumatra, and North Sumatra have high economic growth with low poverty rates. Rising poverty levels correspond to increased poverty rates, ultimately diminishing regional consumption levels.

### 4 Conclusion

Emphasizing environmental factors, the regression equation yields a constant value of 136.2334, suggesting that when poverty and economic growth remain constant, the environmental quality index stands at 136.2334. The coefficient for poverty, -6.767086, indicates that for each increase in the environmental quality index, poverty decreases by 6.767086 per cent. Similarly, the coefficient for economic growth, -0.866201, suggests that economic growth decreases by 0.866201 per cent with each increase in the environmental quality index. Partially, poverty and economic growth influence the environmental quality index based on the t-test, while the F-test indicates their simultaneous influence on the environmental quality index. The results of mapping SDG indicators in order to achieve SDG targets are as follows: (1) Cartesian analysis spanning 5 years shows a significant negative correlation between poverty and the environmental quality index. Riau Islands and West Sumatra demonstrate potential for balanced SDG achievement, while Aceh faces high poverty levels despite acceptable environmental quality due to excessive natural resource use. (2) Over 5 years, provinces with high economic growth also exhibit high environmental
quality indices. However, West Sumatra shows high inequality, while Lampung, Bangka Belitung, and Riau suffer from low environmental quality due to rapid economic growth leading to environmental degradation. (3) Provinces with high economic growth, such as Bengkulu and South Sumatra, also experience high poverty levels, while those with potential for SDG achievement include Bangka Belitung, Riau Islands, and Riau. Lampung and Aceh face both high poverty and low economic growth, while Jambi, West Sumatra, and North Sumatra have high economic growth with low poverty rates. Rising poverty levels correspond to increased poverty rates, ultimately diminishing regional consumption levels.

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References

5. R. Syahputra, Jurnal Samudra Ekonomika 1, 2 (2017)
16. A. M. Estheher, A. Suparyati, Media Ek. 31, 1 (2023)
19. R. Nurhami, E. Suwandi, Publikasi Penelitian Terapan dan Kebijakan, 6, 1 (2023)