The Influence of Natural Resource Curse (NRC) on Economic Development in the Provinces of Sumatra

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Abstract. This study aims to analyze the extent of the Natural Resource Curse (NRC) in the provinces of the Sumatra Region from 2018 to 2023. Using a descriptive quantitative approach, the research applies the Geometric Mean formula with the Conditional Weighted Product Method (CWPM). The analysis is based on the Regional Resource Curse Index (RRCI), along with two sup-porting indices: the Natural Resource Dependency Index (NRDI) and the Regional Sustainable Development Index (RSDI). The findings show that higher dependence on natural resources (NRDI) negatively impacts sustainable development (RSDI). The Riau Islands Province and Bangka Belitung Islands Province have high RRCI values of 1.39, NRDI values of 54.43 and 52.81, and RSDI values of 50.90 and 49.87.

Keywords: NRC, RRCI, NRDI, RSDI.

1 Introduction

Indonesia's oil and gas sector significantly contributes to the economy, yet resource management is seen as less competitive due to the export of raw materials. Despite considerable revenue, regions like Sumatra—with poverty rates around 5 percent—have not seen substantial poverty reduction or economic growth. Sumatra, Indonesia's second-largest island, relies heavily on oil, gas, and minerals, and its economic growth has returned to pre-pandemic levels, now contributing 21 percent to the national economy, second only to Java.

Figure 1 shows South Sumatra and Riau leading GRDP contributions from mining at 22.36% and 22.18%, with DBH SDA allocations of IDR 840 billion and IDR 720 billion, respectively. Yet, Riau's economic growth remains the lowest in Sumatra at 2.69%, below the national average, while South Sumatra grows above average at 4.25%. Similarly, despite high DBH, Aceh contributes just 7.49% to GDP from mining, highlighting a gap between resource revenue and growth, indicative of the Natural Resource Curse (NRC). The first researcher to introduce the NRC hypothesis was Auty [1]. Auty stated that countries with abundant natural resources often fail to fully capitalize on this advantage. According to him, the main problem contributing to the poor

E. P. Kusumah and Y. Yanto (eds.), *Proceedings of the 1st International Conference of Economics, Management, Accounting, and Business Digital (ICEMAB 2024)*, Advances in Economics, Business and Management Research 311,
https://doi.org/10.2991/978-94-6463-614-7_22

economic performance of many developing countries in the natural resource sector lies in the production function of the mining sector, particularly the distribution of mineral revenues, domestic linkages, and the capital-to-labor ratio [2].

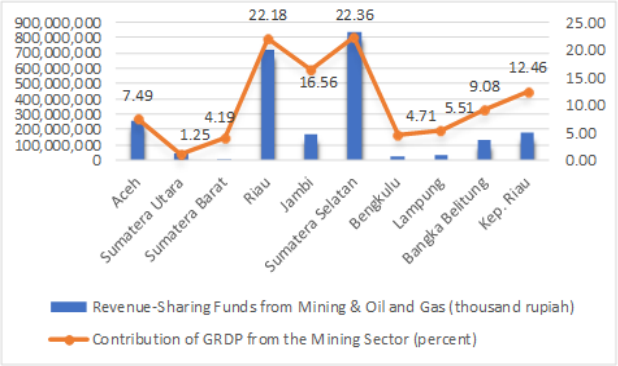

Fig. 1. Average Contribution of the Mining Sector to GRDP and Average Revenue-Sharing Funds from Natural Resources for the Years 2018-2023

A study by Rahma et al. [3] also examined the NRC phenomenon in Indonesian provinces using the Regional Sustainable Development Index (RSDI) and Natural Resource Dependency Index (NRDI). They found that provinces with abundant resources, especially in oil and gas, are more prone to the NRC compared to provinces with fewer natural resources. Generally, oil and gas-producing provinces are more affected by this curse than those focused on minerals or coal.

2 Research Method

This research used a descriptive quantitative approach, focusing on all provinces in the Sumatra Region from 2018-2023. Data were sourced from official websites such as the Central Bureau of Statistics (BPS RI), the Ministry of Finance (KEMENKEU RI), the Ministry of Environment and Forestry (KLHK RI), and related literature. The analysis was conducted in MS Excel and followed three main stages, as follows:

2.1 Natural Resource Dependency Index (NRDI)

The first step in this study involves calculating the Natural Resource Dependency Index (NRDI), following the methodology used by Rahma et al. [3]. In their research, NRDI was measured using resource revenue per capita [4] and natural resource GDP per capita [5]. Natural resource revenue per capita is calculated using the Revenue Sharing Fund (DBH), DBH includes fixed fees and royalties from resources like minerals, coal, oil, and natural gas. Natural resource GDP per capita is measured by the Gross Regional Domestic Product (PDRB) per capita in the mining sector, adjusted to 2010 constant prices. These indicators are referred to as PDRBT (mining GRDP) and DBHT (natural

resource revenue), which are then standardized into the PDRBT Index (IPDRBT) and DBHT Index (IDBHT) using the following formula:

$$\text{IPDRBT}_i = \frac{(PDRBT_{it} - PDRBT_{min})}{PDRBT_{max} - PDRBT_{min}} \; x \; 100 \quad \text{.....(2.1)}$$

$$\text{IDBHT}_i = \frac{(DBHT_{it} - DBHT_{min})}{DBHT_{max} - DBHT_{min}} \; x \; 100 \quad \text{.....(2.2)}$$

After obtaining the values of both indices, the next step is to input these values into the following formula to calculate the NRDI for each province:

$$\text{NRDI}_i = \frac{IPDRBT_i + IDBHT_i}{2} \quad \text{.....(2.3)}$$

Explanation:

NRDI : Natural Resource Dependency Index
i : Province
(I)PDRBT: Indeks Gross Regional Domestic Product of the mining sector per capita
(I)DBHT : Indeks Revenue Sharing Fund of the mining sector per capita
max/ min : The highest/ the lowest value of each variable in every province

According to Rahma et al. [3], the NRDI is measured on a scale from 0 to 100. A higher NRDI means greater dependency on natural resources, while a lower value indicates less reliance. A high NRDI can negatively affect a region, as it shows a strong dependence on natural resources, which may limit sustainable development.

2.2 Regional Sustainable Development Index (RSDI)

The second stage measures the Regional Sustainable Development Index (RSDI), adapted from Rahma et al. [6] and calculated using composite indicators common to show regional development. The most widely used sustainability concept considers three key aspects [7]. Fauzi and Oxtavianus [8] also used six indicators representing these three dimensions: Economic Dimension (Economic Growth Rate, Unemployment Rate, Poverty Rate), Social Dimension (Human Development Index, Gini Index), and Environmental Dimension (Environmental Quality Index).

There are three indicators in this study that are not in the form of indices, namely the Economic Growth Rate (LPE), the Unemployment Rate (TP), and the Poverty Rate (TK). According to [6], these three indicators must first be normalized using specific formulas provided in equations (2.4) to (2.6). The normalization process involves calculating the maximum and minimum values for each indicator during the period from 2018 to 2023, ensuring that the data across provinces can be compared and accurately incorporated into the composite RSDI calculation.

$$\text{ILPE} = \frac{(LPE_i - LPE_{min})}{(LPE_{max} - LPE_{min})} \quad \text{.....(2.4)}$$

$$\text{ITPT} = \frac{(TPT_i - TPT_{min})}{(TPT_{max} - TPT_{min})} \quad \text{.....(2.5)}$$

$$\text{ITK} = \frac{(ITK_i - ITK_{min})}{(ITK_{max} - ITK_{min})} \quad \text{.....(2.6)}$$

After obtaining the values from the indices, you can insert these values into the following formula to calculate the RSDI for each province:

$$\text{RSDI} = \sqrt[6]{ILPE\ x\ IKLH\ x\ IPM\ x\ (1 - ITK)\ x\ (1 - IG)\ x\ (1 - ITPT)} \text{ ..... (2.7)}$$

Explanation:

RSDI	: Regional sustainable Development Index
(I)LPE	: Economic Growth (Index)
IKLH	: Environmental Quality Index
IPM	: Human Development Index
(I)TK	: Poverty Level (Index)
IG`	: Gini Index
(I)TPT	: Unemployment Rate (Index)
max/ min	: Highest/ Lowest value per variable in each province

Based on the research by Rahma et al. [3], the level of sustainable development (RSDI) can be viewed on a scale ranging from 0 to 100. This means that the higher the RSDI value, the better the performance of development. Conversely, a lower value indicates poor sustainable development in that region. Unlike NRDI, a higher RSDI value has a positive impact on the province.

2.3 Regional Resource Curse Index (RRCI)

In the third stage, the measurement of the Natural Resource Curse (NRC) at the provincial level is conducted using the Regional Resource Curse Index (RRCI). The calculation of this index is based on the study by Rahma et al. [3], which states that the RRCI is determined by the strength of the relationship between the NRDI and RSDI variables. Based on this, the calculation of the NRC for a region or RRCI for province i in period t employs the Geometric Mean using the Conditional Weighted Product (CWPM) method as follows:

$$RRCI_{it} = \sqrt{X1_{it} \,.\, X2_{it}} \quad \text{.....(2.8)}$$

With $X1_{it}$ dan $X2_{it}$ representing the weighted products of NRDI (Natural Resource Dependency Index) and RSDI (Regional Sustainable Development Index), calculated using the following equation:

$$X1_{it} = \left(\frac{NRDI_{it}}{NRDI_{t\_min}}\right)^{w_1} \quad \text{.....(2.9)}$$

$$X2_{it} = \left(\frac{RSDI_{t\_max}}{RSDI_{it}}\right)^{w_2} \quad \text{.....(2.10)}$$

Explanation:

$RRCI_{it}$: Regional Natural Resource Curse Index in province *i* during period *t*
$NRDI_{it}$: Natural Resource Dependency Index in province *i* during period *t*
$NRDI_{t\_min}$: The minimum value NRDI for all provinces during period *t*
$RSDI_{it}$: Regional Sustainable Development Index in province *i* during period *t*
$RSDI_{t\_max}$: The maximum value of RSDI for all provinces during period *t*
w_1 ; w_2 : The weight for NRDI is 0,5; The weight for RSDI is 0,5

3 Results and Discussion

The findings of this study detail the progression of each research variable. The following sections discuss the calculation results of each index that supports the discovery of the natural resource curse in the provinces of the Sumatra region.

3.1 Natural Resource Dependency Index (NRDI)

Here are the results of the calculations for the Natural Resource Dependency Index (NRDI) in the Sumatra Region Provinces from 2018 to 2023:

Table 1. Calculation Results of the Natural Resource Dependency Index (NRDI) in the Sumatra Region Provinces, 2018-2023

No (1)	Province (2)	IPDRBT (3)	IDBHT (4)	NRDI (%) (5)
1	Kep. Riau	58,50	50,35	54,43
2	Aceh	59,15	46,51	52,83
3	Kep. Bangka Belitung	65,83	39,78	52,81
4	Lampung	49,64	49,02	49,33
5	Sumatera Utara	44,42	53,75	49,09
6	Sumatera Barat	48,79	35,40	42,10
7	Sumatera Selatan	41,21	42,79	42,00
8	Jambi	48,86	33,70	41,28
9	Riau	33,54	37,87	35,71
10	Bengkulu	36,50	29,48	32,99

Table 1 shows that from 2018 to 2023, the Riau Islands Province had a high natural resource dependence, at 54.43%. This aligns with the Central Bureau of Statistics (BPS) data ranking it fourth in the Sumatra Region for GRDP per capita, DBH, and mining's

GRDP contribution. The province's heavy reliance on natural resources suggests economic vulnerability to commodity price shifts and risks to long-term sustainability if resources diminish.

Aceh (52.83) and Bangka Belitung Islands (52.81) are also highly dependent on natural resources, alongside Riau Islands, which leads in DBH share (50.35). Aceh and Bangka Belitung score high in mining GRDP impact, with IPDRBT scores of 59.15 and 65.83, respectively. The Riau Islands and Aceh produce substantial oil and gas, while Bangka Belitung is a top tin and bauxite producer, led by PT. Timah Tbk. In contrast, Riau (35.71) and Bengkulu (32.99) have lower resource dependency, with Riau showing less reliance despite its large natural gas output, and Bengkulu producing fewer minerals overall.

3.2 Regional Sustainable Development Index (RSDI)

Here are the results of the calculation of the Regional Sustainable Development Index (RSDI) in the Sumatra Region Provinces from 2018 to 2023:

Table 2. Calculation Results of the Regional Sustainable Development Index (RSDI) in the Sumatra Region Provinces, 2018-2023

No (1)	Province (2)	RSDI (%) (3)
1	Bengkulu	59,63
2	Sumatera Utara	58,52
3	Sumatera Selatan	57,93
4	Aceh	57,06
5	Lampung	56,90
6	Sumatera Barat	56,40
7	Jambi	55,51
8	Riau	55,33
9	Kep. Riau	50,90
10	Kep. Bangka Belitung	49,87

Table 2 presents the calculation results of the Regional Sustainable Development Index (RSDI) for all provinces in the Sumatra Region from 2018 to 2023. Bengkulu Province has the highest RSDI value of 59.63 percent, followed by North Sumatra (58.52) and South Sumatra (57.93), which have the next highest RSDI values. This indicates that these three provinces demonstrate better economic performance compared to other provinces in the Sumatra Region, while the Bangka Belitung Islands Province has the lowest RSDI value of 49.87.

According to the study by Rahma et al. [6], there are three distinguishing indicators in determining the RSDI value, namely, the Economic Growth Rate (LPE), Poverty Rate (TK), and Unemployment Rate (TPT). Generally, a high RSDI value correlates with a high TPT and low TK and TPT. However, in this study, Bengkulu Province only fulfills two indicators that align with this hypothesis, having a relatively high LPE of 3.62 percent (after South Sumatra and Jambi) and the lowest TPT in the Sumatra Region at 3.07 percent. Meanwhile, Bengkulu's TK is significantly high at 14.93 percent, second only to Aceh among provinces in Sumatra. This indicates that regions with high LPE and low TPT do not necessarily experience reduced poverty. If economic growth

lacks equity, it can increase poverty in the area. Conversely, provinces with low RSDI values generally face low LPE, such as Riau (2.69), the Riau Islands (3.20), and the Bangka Belitung Islands (3.22); high TK, such as Aceh (15.12); and high TPT, such as the Riau Islands (7.68).

3.3 Regional Resource Curse Index (RRCI)

Here are the results of the calculation of the Regional Resource Curse Index (RRCI) in the Sumatra Region Provinces from 2018 to 2023:

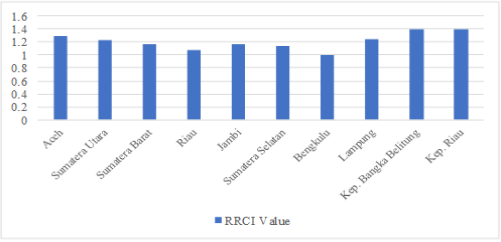

Fig. 2. Results of the Calculation of the Regional Resource Curse Index (RRCI) in the Sumatra Region Provinces for the Years 2018-2023

Figure 2 presents the results of the Natural Resource Curse (NRC) or Regional Resource Curse Index (RRCI) calculations for provinces in the Sumatra Region for the years 2018-2023. The Riau Islands Province and Bangka Belitung Islands Province are the two provinces with the highest RRCI values in the Sumatra Region, at 1.39. Although these two provinces have the highest RRCI values compared to other provinces in the region, the values are far from 100 percent. This indicates that the Sumatra Region is not significantly affected by the NRC, despite most of the provinces in the region having substantial mining and oil and gas resources.

However, when viewed from the perspective of the Regional Sustainable Development Index (RSDI), these two provinces have low scores, ranking last in terms of sustainable development. This suggests that the Riau Islands Province and the Bangka Belitung Islands Province are not effectively achieving sustainable development or improving the welfare of their populations. Additionally, based on the high Natural Resource Dependency Index (NRDI) values for these provinces, it is evident that their dependency on natural resources, particularly in the mining and quarrying sectors, is relatively high compared to other provinces.

Nevertheless, the values obtained from the RSDI and NRDI are insufficient to conclude that the provinces in the Sumatra Region are significantly affected by the NRC. This finding challenges the research of Rahma et al. [3], which stated that regions highly dependent on natural resources or with a significant contribution from the mining sector are more likely to experience the NRC. Based on this study, there is no strong evidence to suggest that the Sumatra Region is substantially impacted by the NRC.

4 Conclusions

Based on the results of the discussion and analysis of the research on the Effect of Natural Resource Curse (NRC) on Economic Development in the Provinces of the Sumatra Region, the following conclusions are obtained:

1. The results of the Natural Resource Dependency Index (NRDI) place the Riau Islands Province as the area with the highest percentage in the Sumatra Region at 54.43 percent, followed by Aceh Province in second place at 52.83 percent, and Bangka Belitung Province in third place at 52.81 percent. This indicates that these provinces have a dependency on natural resources within a scale of 52-100 percent, meaning their dependency on natural resources is quite high compared to other provinces in the Sumatra Region.
2. The results of the Regional Sustainable Development Index (RSDI) show that Bangka Belitung Province has the lowest sustainable development value in the Sumatra Region at 49.87 percent, followed by the Riau Islands Province at 50.90 percent. This indicates that both provinces have sustainable development ratings within a scale of 0-51 percent, meaning sustainable development in these provinces is relatively low compared to other provinces in the Sumatra Region.
3. The results of the Regional Resource Curse Index (RRCI) place the Riau Islands Province and Bangka Belitung Province as the areas with the highest percentage in the Sumatra Region at 1.39 percent. This figure is far from 100 percent, indicating that the provinces in the Sumatra Region are not experiencing the Natural Resource Curse (NRC).

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