

# Do Natural Resources Affect Unemployment? Evidence from Indonesian Province Panel Data

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## Abstract

*Since the stipulation of regional autonomy in the early 2000s, local governments have managed their revenues and expenditures independently, in direct or revenue-sharing funds from the Central Government, including income from natural resource exploitation. This study aims to identify the region with high natural resources, especially from the mining and quarrying sectors, expected to improve its human resources quality, focusing on the employment sector. In addition, this study identifies the impact of natural resources on reducing unemployment in 34 provinces in 2015-2021. A previous study implemented natural resources rent to proxy natural resources in a region. However, identification of this proxy has been challenging due to the considerable informality in Indonesia. This study employs mining and quarrying sectors to proxy natural resources as a comprehensive output of a region. The data used in this study was secondary data sourced from the National Statistics Board (BPS). The analysis method of this study was fixed effect with the Human Development Index (HDI) and the unemployment rate as the dependent variable. The results of this study revealed that regional natural resources did not impact HDI or reduce the unemployment rate in a province, indicating that the mining and quarrying sectors did not contribute to improving the quality of human resources and reducing unemployment significantly.*

## Keywords:

natural resources; unemployment rate; human development index; panel data

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## INTRODUCTION

Indonesia is acknowledged as a country rich in natural resources. Some critical and particular natural resources are found in Indonesia, such as nickel and bauxite. Indonesia's government policy regarding downstream nickel ore provides the opportunity for a better economic contribution with rigorous management (Pandyaswargo et al., 2021). Overall, Indonesia's natural resources provide significant economic development opportunities despite posing challenges in terms of sustainability, environmental protection, and social equity. In the renewable energy sector, Indonesia has wind, solar, and bioenergy resources that are still in their early utilization stages. Moreover, Indonesia has one of the largest geothermal reserves in the world, with significant potential for producing clean energy.

Discussion regarding the relationship between natural resource exploitation and economic growth was initiated when Simon Kuznets introduced the inverted U curve. EKC exhibits a two-axis relationship between the environmental Kuznets Curve (EKC), a hypothesized relationship among various indicators of environmental degradation (Majid et al., 2020; Shahbaz et al., 2019). Indirectly, the EKC also indicates a relationship between the exploitation of natural resources, per capita income (Stern, 2018), and inequality (Wu et al., 2021). Although the EKC does not explicitly describe a relationship between the exploitation of natural resources and unemployment, numerous prior studies revealed that unemployment has a direct impact on economic growth (Dankumo et al., 2019; Fung & Nga, 2022; Soylyu et al., 2018). In addition, economic growth affects the condition of a country's human resources (Mahmood et al., 2019; Zallé, 2019).

Previous studies generally agree that higher exploitation of natural resources contributes to reducing unemployment (Ali & Kalsoom, 2018; Advisor & Ankenman, 2015). However, debates remain, indicating whether the relationship will be different when investigated by considering the time frame. Specific results reported that the exploitation of natural resources did not significantly impact in the short term, and the impact only occurred in the long term (Fattah, 2017). Current research issue has previously been conducted in Indonesia, reporting that natural resource revenue-sharing has an indirect impact on reducing the unemployment and poverty rate (Majid et al., 2020). An indication of the different impact of natural resources on unemployment was due to the structure of the labor market in a country. As a developing country, Indonesia has a majority informal workforce group (Gunawan, 2018; Günther & Launov, 2012; Hohberg & Lay, 2015). Thus, it was assumed that informality presents a distortion because it did not follow the general labor market (Husmanns, 2004). Informality is described as a dual economy in the labor market, lacking the standard employment relationship as a core legal and economic institution of a market economy (Adams & Deakin, 2014; Alatas & Cameron, 2008). However, the treatment of the informal labor sector is relatively different in the economy context. Previous research did not describe informal labor activities related to natural resources exploitation, solely applying natural resources rent to proxy natural resources variable. Unfortunately, the natural resources rent usually does not cover the informal activity. Previous research results indicated that many natural resource management, especially C excavation, were illegally committed in

Indonesia (Cerya & Khaidir, 2021). The relationship in the EKC for the environmental degradation variable in an area is proxied by the percentage of natural resource exploitation (Sunday, 2015). The variable percentage of natural resource exploitation in this study is proxied from the percentage of GRDP from the mining and quarrying sectors. However, the added value of a production process as a whole economic activity should be identified and reflected in the components of GDP (Murshed et al., 2020), although managing natural resources becomes an integral part of a country's political economy (Gylfason, 2018). In Indonesia, natural resource management policies can only be carried out after a while and sectorally.

This research aims to identify the impact of natural resource exploitation in reducing unemployment with the presence of the informal sector in the labor market. The novelty of this study lies in the application of the Gross Regional Domestic Product (GRDP) of the mining and quarrying sectors as a proxy for natural resources by considering that it is relatively challenging to comprehensively identify the impact of profit-sharing funds at the provincial and district/city levels due to high informality in Indonesian mining, quarrying, and labor markets. GRDP considers all mining and quarrying activities comprehensively in both formal and informal sectors. The panel regression model includes other policies that are assumed to affect improving human resource quality and alleviating unemployment. Variables that are considered to have an impact on the main variables include GRDP and GRDP per capita (Sinaga, 2020), foreign direct investment (FDI) value (Alam et al., 2020), domestic investment, minimum wage (Lemos, 2009; Meer & West, 2016; Siregar, 2020; Soares, 2005), labor force, and net enrollment rate at the vocational high school level as a proxy of human capital quality in the region.

## METHODS

The data used in this study was regarded as secondary data sourced from the Indonesian National Statistics (BPS), which was the exploitation of natural resources proxied from the GRDP of the mining and quarrying sectors. Data regarding unemployment was obtained from the National Labor Force Survey (Sakernas) publication in August each year. Meanwhile, other variables included the Human Development Index (HDI), labor force, GRDP, per capita GRDP, provincial minimum wage, foreign direct investment (FDI), domestic investment, and vocational high school net enrollment rate (APM) as a proxy for human capital in a region. The HDI, minimum wage, and APM are published annually; GRDP, per capita GRDP, FDI, and domestic investment are published quarterly.

As it publishes twice a year, this paper utilized the August Sakernas data, considered to have a more significant number of samples than the February data. In this research, the authors employed the vocational high school net enrollment rate due to the high unemployment related to this education level. The unemployment rate of vocational high school graduates in 2020 was 8.49 percent (Miko et al., 2021).

The analytical method used in this paper was panel analysis with regional analysis units. Meanwhile, during 2015-2021, complete data was available for 34 provinces starting

in 2015. The last period utilized the 2021 data due to the unavailability of FDI data for 2022. Panel data analysis generally implements the method of fixed effect, random effect, or pooled least square. The procedure for selecting the best model as the primary model implements the Hausman, Chow, and Lagrange Multiplier test (Kabdrakhmanova et al., 2021). The Hausman, Chow, and Lagrange Multiplier test results indicate that the model fixed effect depicts the best model that can be used on data in research (Widiastuti et al., 2022). The influence of a phenomenon associated with employment is often implemented with independent variables representing regional macro conditions (Herreño & Ocampo, 2023). The complete model of the panel data is illustrated in the following equation:

$$HDI_{it} = \beta_0 + \beta_1 Mining_{it} + \beta_2 GRDP_{it} + \beta_3 \ln LabourForce_{it} + \beta_4 Per\ Capita_{it} + c'X + e \quad (1)$$

$$Unemployment_{it} = \beta_0 + \beta_1 Mining_{it} + \beta_2 Per\ Capita_{it} + \beta_3 GRDP_{it} + \beta_4 \ln LabourForce_{it} + \beta_5 HDI_{it} + c'X + e \quad (2)$$

In equation (2), referred to as equation (1), HDI is influenced by several independent variables, including Mining which is the GRDP value variable from the mining and quarrying sectors in units of millions of rupiah; GRDP refers to the gross regional domestic product in units of billions of rupiah; Ln Labour Force refers to the logarithm of the number of the labor force; and per capita refers to the income per capita of the population in a million rupiahs. Meanwhile, other control variables are included in the model, such as LnMW, indicating the logarithm of the provincial minimum wage; APM refers to the pure enrollment rate at the vocational high school level; FDI refers to the value of incoming foreign direct investment to the province in a million rupiahs; and domestic refers to the value of the domestic investment in million rupiahs. Meanwhile, in equation (2), unemployment refers to the unemployment rate in province *i* in year *t* in percent units. All control variables in the second model are similar to the first model except for the HDI variable, included in this model. Regression model interpretation on fixed effect can be made according to the interpretation in the OLS. Partial effects are marked from the value of the regression coefficient of each variable.

## RESULT AND DISCUSSION

Prior to conducting inferential analysis on panel data, the initial procedure is conducted to perform a descriptive analysis of each variable. The total number of variables included in the first and second equations consists of ten variables. The formed panel data is strongly balanced with 238 observations on each variable or 34 units of cross-sectional provinces over seven years. The transformation is performed on the Labor Force and MW variables to facilitate the interpretation of the model.

The results of the descriptive analysis indicate that the range of data on the HDI variable is quite wide, with a standard deviation of 4.08 and an average of 70.19, depicting that human development in Indonesia is unequal. The highest score was achieved by the Province of DKI Jakarta in 2021. In comparison, the Province

of Papua obtained the lowest score in 2015. Referring to the HDI trend from year to year, the trend tends to rise steadily, along with the unemployment rate, which also tends to move constantly in contrast to the fluctuating contribution of mining and quarrying sectors to the provincial GRDP. The trend for this variable increased between 2015 and 2018 but tended to decrease during the COVID-19 pandemic. In the descriptive analysis section, it is identified that the changes in GRDP fluctuations in the mining and quarrying sectors had no impact on HDI and unemployment. On the other hand, unemployment and HDI had almost the same pattern, potentially indicating a relationship.

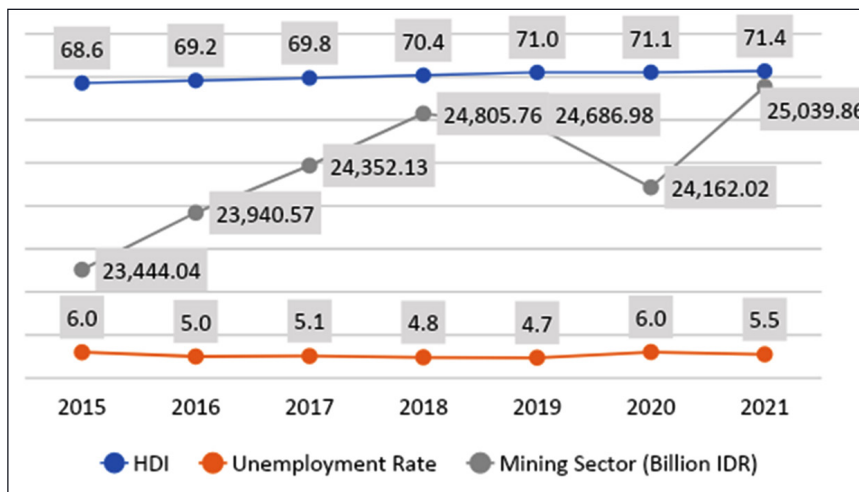
**Table 1. Descriptive Analysis**

Variable	Obs.	Max. Value	Min. Value	Average	Std. deviation
HDI	238	81,11	57,25	70,19	4,08
GRDP per capita (millions rupiahs)	238	174.941,72	11.087,91	41.368,75	31.040,56
Unemployment	238	10,95	1,40	5,30	1,88
Log Labour Force	238	17,02	12,55	14,57	1,02
APM	238	143,63	81,68	105,14	8,59
Log Minimum Wage	238	15,30	13,72	14,59	0,27
PMDN (billion rupiahs)	238	62.094,80	-	9.385,50	12.981,89
FDI (billion rupiahs)	238	5.881,00	2,00	872,92	1.200,45
GRDP (billion rupiahs)	238	1.856.075,82	20.380,30	303.377,60	428.600,14
Mining (billion rupiahs)	238	233.680,62	294,31	24.347,34	41.106,45

The procedure of inferential analysis for panel data was conducted to determine the best model. This research employed Lagrange Multiplier test, Chow and Hausman to identify the model (Kabdrakhmanova et al., 2021). Based on the results of the Lagrange Multiplier test, Chow and Hausman, it was found out that the best model used in the first model was the fixed effect, as well as for model 2. The pretest procedure as shown in Table 2 concludes that the testing pooled least squares and random effects using the Lagrange Multiplier test, model 1 and model 2 have a p-value of less than 5 percent alpha, similarly for model 2. Hence, it is concluded that the random effect model is better than the pooled least squares. Based on the Chow test, conducted to determine the best model between the pooled least squares and the fixed effect, the results are similar between models 1 and 2, which reject H<sub>0</sub>; thus the fixed effect is better than the pooled least squares. The final test was conducted by the Hausman test to determine the best model between the random and fixed effects, indicating that the p-value for both models is less than 5 percent alpha; thus the decision is to reject H<sub>0</sub>, which means that the fixed effect model is better than the random effect.

Albeit the pretest conclude that fixed effect is the best model, the inferential model result in Table 3 displays the result of random effect and pooled least square as a comparison. Panel data analysis employing the fixed effect in Model 1 with HDI as the dependent variable displays that only the labor force and minimum wage variables significantly impact to HDI, which is positive, with a coefficient value of 5, 00 and 3, 95 respectively. The interpretation of fixed effect coefficients for Labor Force variable is every one percent increase in the labor force in a province will increase the HDI by approximately 5 points. As for the minimum wage variable, every one percent increase in a province's minimum wage will have an impact on increasing HDI by 3.95 points. These results are in accordance with the previous studies concluding that minimum wage had the positive and significant impact to HDI (Cahyanti & Fevriera, 2020; Herman, 2021).

Figure 1. Average HDI, Unemployment, and GRDP of the Mining and Quarrying Sector 2015-2021



Source: BPS (Data processed)

Similar results are found for labor force variable in Model 1 utilizing random effect and pooled LS. Random effect and pooled LS indicate the different result for main variables (mining), minimum wage, GRDP per capita, PMDN, FDI, and GRDP in Model 1. Random effect model was significant for minimum wage, while pooled LS was significant in the rest of the variables. Although the result did not impact the whole model, but it indicates that the different treatment for the same data could generate the different conclusion.

Table 2. Best Model Conclusion

Test	Model 1			Model 2		
	Results	Decision	Conclusion	Results	Decision	Conclusion
Lagrange Multiplier	0,000	Reject H0	Random Effect	0,000	Reject H0	Random Effect
Chow	0,000	Reject H0	Fixed Effect	0,000	Reject H0	Fixed Effect
Hausman	0,022	Reject H0	Fixed Effect	0,0061	Reject H0	Fixed Effect

In Model 2, unemployment is presented as the dependent variable with all other variables include in the model. The fixed effect finds that the HDI variable, the vocational high school net enrollment rate, and the minimum wage significantly impact the unemployment rate. The HDI variable has a negative impact with a coefficient value of -0.64, indicating that every one-point increase in HDI would reduce the unemployment rate by 0.64 percent. The net enrollment rate variable for vocational high school has a significant impact with a coefficient value of -0.02, indicating that every one-point increase in the pure enrollment rate for vocational high school education would lessen the unemployment rate by 0.02 percent. In Model 2, only the minimum wage variable positively and significantly impacts the unemployment rate. The minimum wage variable has a coefficient of 3.04, indicating that every one percent increase in the minimum wage would increase unemployment by approximately 3 percent.

**Table 3. Panel Data Analysis Results**

Variables	Model 1			Model 2		
	Fixed Effect	Random Effect	Pooled LS	Fixed Effect	Random Effect	Pooled LS
HDI				-0,64 <sup>*)</sup>	-0,07	0,04
Mining (billion rupiahs)	5,86x10 <sup>-6</sup>	1,98x10 <sup>-6</sup>	-3,2x10 <sup>-5**)</sup>	1,32x10 <sup>-5</sup>	-4,04x10 <sup>-7</sup>	-2,00x10 <sup>-6</sup>
GRDP per capita (millions rupiahs)	9,41x10 <sup>-6</sup>	2,32x10 <sup>-5**)</sup>	1,1x10 <sup>-4**)</sup>	-1,86x10 <sup>-5</sup>	9,5x10 <sup>-6</sup>	1,05x10 <sup>-5</sup>
Log Labour Force	5,00 <sup>*)</sup>	3,03 <sup>*)</sup>	2,243 <sup>*)</sup>	-0,22	-0,19	0,07
APM	-0,0026	-0,027	-0,014	-0,02 <sup>)</sup>	-0,02	-0,004
Log Minimum Wage	3,95 <sup>*)</sup>	4,466 <sup>*)</sup>	-1,265	3,04 <sup>*)</sup>	-0,006	0,65
PMDN (billion rupiahs)	7,59x10 <sup>-6</sup>	8,41x10 <sup>-6</sup>	10 <sup>-4**)</sup>	2,15x10 <sup>-5</sup>	1,13x10 <sup>-5</sup>	3,57x10 <sup>-5</sup>
FDI (billion rupiahs)	-8,05x10 <sup>-5</sup>	-1,1x10 <sup>-4<sup>)</sup></sup>	-6x10 <sup>-4**)</sup>	-1,54x10 <sup>-4</sup>	-4,43x10 <sup>-5</sup>	5,59x10 <sup>-4**)</sup>
GRDP (billion rupiahs)	5,6x10 <sup>-7</sup>	-1,5x10 <sup>-6</sup>	-5,35x10 <sup>-6**)</sup>	1,96x10 <sup>-6</sup>	1,59x10 <sup>-6</sup>	-1,20x10 <sup>-6</sup>

Note: \*\*) significant at 5% alpha; \*) significant at 10% alpha; a total of 238 observations with a total of 34 cross-sectional units

Table 3 depicts that the main variable (mining) is not significant even for all three methods. Fixed effect model coefficient result has the different direction compared to random effect and pooled LS. The fixed effect has positive and insignificant result, while random effect and pooled LS have negative result, which are different from previous studies, indicating the significant impact of natural resources to unemployment (Ali & Kalsoom, 2018). However, this result indicates that the time frame of panel data matters for short and/or long term impact (Fattah, 2017), rather than for informal sector.

Based on the results of the fixed effect regression analysis, facts were obtained related to the various variables included in Models 1 and 2. In Model 1, it can be

proven that the variables, expected to support human development in a region, do not have a significant impact. Foreign and domestic investments are expected to boost the regional economy and to improve the quality of human resources, but they still need to meet expectations, indicating that the priority of FDI and domestic investment is currently focused on something other than increasing human resource capacity. However, instead of technology transfer (Su & Liu, 2016) the characteristics of the industry are more capital-intensive (Henok & Kaulihowa, 2022). In addition, FDI is more likely to implement skilled labor (Fagbemi & Osinubi, 2020) than workers with low skills. Thus, FDI cannot be utilized to improve the quality of human resources. Instead, the quality of human resources must be initially improved to align with incoming FDI (Dankyi et al., 2022). In Model 2, FDI and domestic investment are also evident to have no impact on reducing unemployment. Alike the case in Model 1, FDI tends to be capital intensive, prioritizing skilled workers, hindering workers with low skills.

The minimum wage variable has a significant impact on both models. In the first model (Model 1), the minimum wage variable has a positive impact, indicating that an increase in the minimum wage also increases the HDI of a region. The minimum wage becomes one of the components of the Gini ratio income, as an indicator of the HDI (Stewart, 2019). In Indonesia, the relationship between the minimum wage and HDI has been widely studied by including a combination of inflation (Herman, 2021) and regional income (Ali & Azhari, 2021). Meanwhile in Model 2, the relationship between the minimum wage and unemployment has been widely studied before, and the results tend to vary. In developed countries, the minimum wage tends to have a negative impact on unemployment (Azar et al., 2019; Campolieti et al., 2005; Dickens et al., 1999; Lee & Saez, 2012; Meer & West, 2016; Yuen, 2003). In Indonesia, the impact of the minimum wage tends to be anomalous. The minimum wage has a negative impact, especially on the formal sector, because this sector is covered by the minimum wage (Siregar, 2020). However, the minimum wage does not impact the informal sector (Wahyuningsih et al., 2020). On the mining variable, which is a proxy for regional natural resource resources, based on regression, it depicts insignificant results for both Models 1 and 2, indicating that the development priorities of areas rich in natural resources have yet to lead to an increase in HDI and a reduction in unemployment.

Natural resources are essential to a country's economy, especially in economic growth and job creation, because good natural resource management could benefit the society, including job creation. In addition, natural resource exploitation activities, such as mining or plantations, could provide numerous employment opportunities for local people, thereby reducing the unemployment rate in the area. Natural resources also boost state/province revenue, from which governments can earn significant revenue through exports of natural resources. This income can, thus, finance development and social welfare programs, such as building infrastructure and providing health and education services.

However, exploiting natural resources might lead to negative impacts if inappropriately. Excessive and poorly use of natural resources could lead to environmental degradation, such as forest destruction, water and air pollution, and ecosystem damage. Exploiting



natural resources could cause conflict among parties, companies, and local communities, thereby exacerbating the social and economic situation in the area. Exploitation of natural resources often only benefits a few people or companies, while local communities need more of these benefits. This situation could lead to social injustice and discontent public. To reduce these negative impacts, the government and companies are demanded to properly conduct the socially responsible management of natural resources. Furthermore, governments could also strengthen environmental regulation and protection by the provision of training and supports to local communities in order to develop other sectors which could potentially create new jobs.

Although several provincial governments in Indonesia have announced human resources as one of the priorities, results have been far from evident. Natural resources do not necessarily hamper human progress. However, poor governance could negatively impact HDI by not diverting the rents on the growth path. The results of this study suggests that an appropriate policy for the better utilization of resource rents with good governance will lead to inclusive growth and human development which are in accordance with prior study (Chen et al., 2023). Top-down policies and practices for citizen engagement and local involvement in natural resource governance do not sufficiently reduce power imbalances in extractive sector decision-making or enhance socially just and democratic processes as also reported by prior study (Kurniawan et al., 2022). The results of this study are expected to boost and influence governance capacities and resources, as well as capabilities, including local decision-makers and agents in proportion to their responsibilities. Inclusive governance of natural resources, thus, requires that legal governance mandates be matched to resources and powers for lower-level decision-making agents to complement and support their mandates and capabilities (Mustalahti & Agrawal, 2020). Hence, a more systematic and transparent management of natural resources and the involvement of local governments is deemed required to handle natural resources in their area directly.

Related to reducing unemployment, the handling is more complex because it covers cross-sectoral. Most important consideration is emphasized on the commitment to improve a region's human resources quality. The quality of human resources serves as a fixed price for developing a region. The common issues related to unemployment include the availability of a better education system and an excellent intermediary system between school and job transition. The rising level of education has provided the warranty of rising human capital (Becker, 1962). Therefore, if we have an educated labor force, half of our unemployment will automatically vanish (Ibupoto et al., 2018). Referring to the results of this study, the three issues were navigated in reducing unemployment in Indonesia: firstly, the high number of the low-skill labor force; secondly, a new culture of a young workforce expecting life work balance and work with high flexibility; and lastly, supply-demand mismatch. As we live in high technology and digitalization, our education system is currently prepared to anticipate the change. The labor market does not directly absorb output from our education system due to skill differences. On the other hand, industries run faster with a small group of workers with their world, high flexibility, and efficiency.

Indonesia's employment system also unfortunately creates an uncomfortable environment at work. Another labor problem that draws more serious attention includes the high percentage of workers who do not engage in a full-time job or are underemployed. This fact signifies that many workers undertake unproductive work, whatever available to survive, working for long hours with fewer wages and retaining their poor living condition (the working poor). On the other hand, real jobless people are only sometimes considered poor, in the case of Indonesia, who does not impose jobless security, in which people must work to make a living (Nagib & Ngadi, 2008). This problem causes a high turnover among formality, informality, and unemployed (Gunawan, 2017).

## CONCLUSION

The results of the analysis revealed that natural resources do not have a significant impact on the employment sector, especially in reducing unemployment. There are two possibilities on why natural resources have no impact. First, the portion of income from natural resources is minimally allocated to the regions. Second, local attention to reducing unemployment is also minimal considering that physical infrastructure projects are considered more attractive to increase public attention. Hence, it is deemed important to conduct an in-depth study regarding the portion of natural resources revenue-sharing funds to improve regional welfare. Likewise, strict supervision is required regarding the utilization of these funds, including for the non-physical sector such as employment.

During the reform period, regional financial management adhered to the principles of fairness and transparency, in which regions with high sources of natural resources would receive comparable profit-sharing funds. Regional development priorities play a key role in regional financial management. Based on the quantitative analysis of this study, it is apparent that the natural resources of the area have no impact either on the HDI or on reducing unemployment in a province. Although the relationship between natural resources and unemployment reduction could not be stated to be direct, the best way to reduce unemployment is by improving human resources' quality for better preparation to enter the labor market. Several regions have announced human resources as one of the priorities, despite unproven results. Consequently, it takes a more complicated effort and extended time to comprehend investment in human resources.

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