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ECONOMIC IMPACT OF COAL MINING INVESTMENT IN EAST KALIMANTAN: AN INPUT-OUTPUT APPROACH

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ABSTRACT
Research Originality — This research distinguishes itself from existing literature by offering a novel empirical assessment of the economic impact of coal mining investment in East Kalimantan, the province with Indonesia's largest coal reserve and major contributor to national investment. It further contributes originality by employing an updated 2022 Input-Output Table to estimate sectoral output, employment, and fiscal contributions.
Research Objective — This research aims to measure the impact of coal mining investment on the economy of East Kalimantan in 2022. The economic impact will be examined through output, employment, and the potential state revenue from taxation and non-taxation.
Research Methods — The study employs the input-output table (IO Table) analysis technique for East Kalimantan in 2016, updated using the RAS approach to create the IO Table for the year 2022. The economic shock utilized is the realization of investments in coal and lignite mining from foreign direct investment (FDI) and domestic investment in East Kalimantan.
Empirical Results — The findings reveal that coal and lignite mining investments in 2022 could increase output by Rp20 trillion, employ 7,323 individuals, and potentially generate state revenues of Rp619,18 billion from the taxation sector and Rp960,64 billion from the non-taxation sector. The research also indicates that the mining and quarrying sector, encompassing coal and lignite mining, effectively stimulates downstream industries, suggesting that downstream output from the mining and quarrying sector can provide added value to the economy.
Implications — The study demonstrates that coal mining investment generates significant multiplier effects on output, employment, and fiscal revenue. Accordingly, effective policies to enhance investment, encourage industrialization, and ensure sustainable resource use are essential for translating these impacts into stronger regional economic growth and long-term development in East Kalimantan.

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INTRODUCTION

Background

As economic growth, industrial activity, and household consumption tend to increase, the need for energy consumption has also increased, especially electricity (Rahman, 2020; Usman et al., 2021). Data from the International Energy Agency (2021) shows that in 2019, there was an electricity consumption of 22,847.66 terawatt hours (*TWh*), an increase of 88% in the last 20 years. The industrial sector dominated the electricity consumption with 41.87%. The household sector then ranks second with 26.58% of all global electricity consumption.

The high demand for electricity also increases the number of raw materials used to generate electricity, especially coal. Based on data from the International Energy Agency (2023), coal still supplies more than a third of electricity capacity worldwide. Nationally, 49.75% or almost half of PLN's installed capacity comes from coal-fired steam power plants (*Badan Pusat Statistik*, 2022). This figure shows that coal is the largest contributor to electricity capacity generation worldwide, despite being categorized as the largest emitter of carbon dioxide compared to other fossil fuels (Hassen et al., 2023; Howie &

Atakhanova, 2022). This is because coal remains the lowest-cost energy source compared to other fuels (Masood et al., 2020).

This high demand for coal can be an opportunity for Indonesia. The main factor is Indonesia's position as one of the world's largest contributors to coal commodities. A report issued by the International Energy Agency (2022) shows that Indonesia will be the third coal producer in the world by 2022. Moreover, Indonesia has 3.2% of coal reserves of all coal reserves in the world (BP, 2021).

Information released by the *Kementerian Energi dan Sumber Daya Mineral* (2021) shows that Indonesia had a total of 38.8 billion tons of coal recorded as reserves in 2020. The data also revealed that of the total reserves, around 41.43% found in East Kalimantan Province. This crowns East Kalimantan as the region with the largest coal resources in Indonesia.

APPLICATION IN PRACTICE

- The mining and quarrying sector, especially coal, is still the largest contributor to the economy in East Kalimantan.
- Investment in the coal mining sector in East Kalimantan has proven to have a multiplier effect on the overall economy.
- The investment also contributes to the state revenue, both in tax revenue and non-tax state revenue (PNBP).
- The development of a conducive investment climate, as well as downstream and industrialization policies, can be the answer to increasing the added value of the economy.

The significant coal reserves in East Kalimantan Province also affect the province's economy. Data from the East Kalimantan Central Bureau of Statistics (BPS) shows that the average contribution of coal and lignite mining to East Kalimantan's GRDP is 36.37% from 2018 to 2022. The highest contribution of coal and lignite mining to the economy occurred in 2022 with a value of 44.56%. This is in line with the increase in coal production and prices in that year (Bank Indonesia, 2022).

As the province that ranks number one in coal reserves in Indonesia, East Kalimantan is an attractive place for investment in the mining and coal industry. Data obtained from the National Single Window for Investment (NSWI) portal, Ministry of Investment/Investment Coordinating Board (BKPM), shows an increase in investment in coal mining in East Kalimantan Province. When accumulated, the total value of coal mining investment realization in East Kalimantan Province in 2022 amounted to IDR14,237.40 billion or around 24.60% of the entire investment realization in East Kalimantan, which amounted to IDR57,875.50 billion (converted using the average middle value of the US$ exchange rate in 2022). This makes coal mining the investment with the largest realization in East Kalimantan Province.

In a macroeconomic review, an economic activity is related to other economic activities (Kusuma et al., 2019). The progress of an economic sector is difficult to implement without the support of other sectors. This also applies vice versa; when an economic sector is disrupted or lost, it will impact other economic or regional sectors. In line with this, investment in coal mining in East Kalimantan has an economic impact on other regional sectors. Other economic sectors affected by coal mining investment show direct and indirect relationships with other economic sectors. Thus, it is necessary to examine the extent of the economic impact arising from the realization of coal mining investment on other economic sectors in East Kalimantan.

The economic impact of investment can be viewed in terms of output, labor, and state revenue. One of the direct impacts of investment is economic progress, which can be seen from the increase in gross domestic product, which describes the increase in output in the economy (Febiyansah, 2017; Yuliana et al., 2019). Increasing business capital through investment will also increase the use of labor to produce output in an economy (Sholihah et al., 2017). The increase in output in the economy due to investment serves as one of the footholds for the government to obtain state revenue in the form of taxes and PNBP (profit sharing/royalty) (Direktorat Jenderal Mineral dan Batubara, 2023; Surbakti & Wijaya, 2023).

To analyze the economic impact arising from the realization of coal mining investment, this study uses the IO table analysis technique with the East Kalimantan IO table of domestic transactions at producer prices (17 business fields) in 2016. The IO table is an analytical technique because it shows two-way interactions and close linkages within sectors of an economy as a whole (Miller & Blair, 2009; Yanti, 2017). The IO table analysis technique also does not require complete and comprehensive data compared to the computable general equilibrium (CGE) model, which can also be used to measure economic impacts (Koks et al., 2015).

As an abundant natural resource, coal is one of the largest mining commodities in Indonesia. Coal mining is also one of the economic sources in East Kalimantan, so it occupies the top position in terms of the amount of coal reserves in Indonesia. Investment in the coal management sector is an important part of the main economic driver of East Kalimantan Province. This is reflected in the increase in investment realization from year to year. However, throughout the researcher's search for empirical literature using

the IO table, no research has been found that specifically analyzes the impact of coal mining investment on the economy of East Kalimantan Province. This does not rule out the possibility that there are studies that have been carried out using different data or approaches.

This study is intended to explore the economic impact of coal mining investment on various other economic sectors in East Kalimantan Province. The economic impact will be examined regarding output, employment, and potential state revenue from taxation and non-taxation. This study also aims to fill the research gap that previous researchers have not addressed, namely, the impact of coal mining investment on the economy of East Kalimantan Province.

The results of this study are expected to recommend to the government, both at the central and regional levels, how to evaluate the impact of coal mining investment in East Kalimantan. This study aims to produce policy advice for stakeholders in developing Indonesia's coal investment climate, especially in East Kalimantan Province.

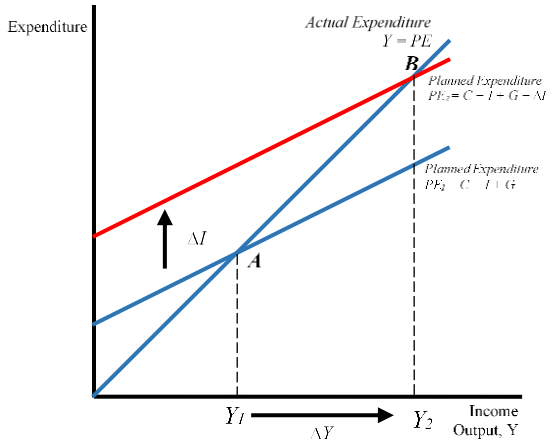
LITERATURE REVIEW

Economic Growth and Investment

In 1936, a British economist, John M. Keynes, revolutionized economic theory by releasing the book *The General Theory of Employment, Interest, and Money*. Keynes argued that in the short term, national income (which indicates economic growth) is determined by household consumption, business (investment), and government expenditure. The higher the level of consumption, the more goods and services businesses sell. An increase in sales by businesses will lead to an increase in output/products and the use of labor. An understanding of Keynes' theory is then outlined in a model called the Keynesian cross.

The Keynesian Cross can also explain the effect of investment on economic growth. Initially, economic equilibrium occurs at point A, with total national output at Y1. An increase in investment (I) will increase planned expenditure (PE), shifting the PE curve by ΔI. The shift in the PE curve will form a new equilibrium point at point B, which increases total national output by ΔY at Y2. The shift of total national output (ΔY) in the Keynesian cross represents the economic growth that occurs ina region. Figure 1 shows the Keynesian Cross adjustment due to an increase in investment that results in a change in total national output.

Figure 1 Keynessian Cross Adjustment Due to Increased Investment



Source: Processed by Researcher

General Equilibrium

The general equilibrium model refers to a framework for analyzing relationships between sectors or markets that further explain the interactions between industries, resource factors, and institutions (Amelia, 2023). Explicitly, the general equilibrium model shows the interaction/relationship of different economic sectors or different markets in an economy. In an economic system, a shock to the equilibrium of one economic sector will also affect the equilibrium of other economic sectors through input-output linkages (Suryadi, 2019; Wang, 2018).

Previous Research

Several previous studies have revealed the economic impact caused by investment in the mining sector. Some of these economic impacts are supporting other economic sectors (Asher & Novosad, 2014; Thompson, 2023), job creation (Ejdemo & Söderholm, 2011; Hilson & Maconachie, 2020), driving economic growth (Sun et al., 2020; Upadhyay et al., 2021; Worlanyo & Jiangfeng, 2021), and increasing state revenue (Monteiro et al., 2019; Oyarzo & Paredes, 2021). Therefore, every country with natural resources of mining commodities tries to maximize its natural wealth to improve its economy.

Further research on the impact of the mining sector on the economy was also carried out using the IO table analysis tool, one of which was by Zhang et al. (2022) to analyze the impact of the mining sector on the economy in China in 2007-2017. The study revealed that every US$1 investment made in the mining sector will increase US$0.862-US$1.171 production, US$0.271-US$0.333 value added, and US$0.106-

US$0.125 wages/salaries. The results also show that a shortage of a mining supply of US$1 will cause economic failure in China, costing US$4,383-US$5,949.

Kim et al. (2020) also showed similar research results, which examined the impact of mining on the South Korean economy. This research, which also uses IO table analysis, shows that every US$1 investment in trade deposits creates US$1.81 production, US$0.85 value added, and US$0.33 wages/salaries. The results also show that a US$1 shortfall in mining supply will cause a US$2.24 failure in national production.

METHODS

Quantitative research using the IO table analysis technique was the approach used in this study. This study used secondary data that relevant agencies officially released, so it has data reliability, namely

1. East Kalimantan IO table of domestic transactions at producer prices (17 business fields) in 2016, released by the East Kalimantan Central Bureau of Statistics (BPS) on May 28, 2021;
2. The realization value of coal and lignite mining investment in East Kalimantan Province for PMA and PMDN in 2022 obtained from the NSWI of the Ministry of Investment / Investment Coordinating Board; and
3. The number of the working population for the period of August 2022 in East Kalimantan Province was released by the Ministry of Manpower of the Republic of Indonesia on February 14, 2023.

Input-Output Table Analysis

The analysis technique applied in the study was input-output analysis, which utilized the IO table. Input-output analysis explains the linkages between industrial economic sectors (Cheng & Daniels, 2017). General equilibrium theory provides the theoretical basis for the formation of input-output analysis. This analysis technique is also used to measure the impact of shocks that result in changes in final demand (Papadas & Dahl, 2008).

Miller & Blair (2009), in the book *Foundation of Input-Output Analysis,* describe the operational equations contained in input-output analysis. Mathematically, the operational equation of the input-output matrix is described as follows.

$$\boldsymbol{x = Ax + f}$$
$$\boldsymbol{(I - A)x = f}$$
$$\boldsymbol{x = f(I - A)^{-1} = Lf} \qquad \text{..... (1)}$$

where *x* is the total output matrix, *A* is the technical coefficient matrix, *L* is the total demand matrix or Leontief inverse, and *f* is the final demand matrix.

IO Table Update: RAS Approach

In several writings, Richard Stone initiated the IO table update technique using the RAS approach (Miller & Blair, 2009). The RAS approach is a method to change the row and column values in the intermediate demand of the IO table using the diagonal matrices R and S (Hiramatsu et al., 2016). R represents the diagonal matrix as the row adjustment parameter, while S represents the diagonal matrix as the column adjustment parameter. The RAS approach requires less information than the survey method in forming the IO table. For this reason, the RAS approach is often called the partial survey or non-survey method.

Linkage Analysis

Linkage analysis in the input-output model refers to the interdependence between different sectors in the economy, so that the output of one sector will become the input of another sector (Liu & Shi, 2020). Linkages in economic sectors are divided into backward linkages and forward linkages. The mathematical equation for direct backward linkages is mathematically

$$BL(t)_j = \sum_{i=1}^{n} l_{ij} \qquad \text{.... (2)}$$

where *BL(t)(j)* is the total backward linkage number and *lij* is the total demand matrix element (matrix *L*) in columns.

The total forward linkage is formulated in the equation

$$FL(t)_j = \sum_{i=1}^{n} g_{ij} \qquad \text{.... (3)}$$

where *FL(t)(j)* is the total forward linkage rate and *gij* is the row-wise element of the total demand matrix (matrix *L*).

Dispersion and Sensitivity Analysis

Dispersion analysis (index of the power of dispersion) and sensitivity analysis (index of sensitivity of dispersion) are analyses developed by P. Nørregaard Rasmussen in 1957 (Miller & Blair, 2009). Dispersion analysis refers to the ability of a sector to boost the ability of its upstream economic sectors. In contrast, sensitivity analysis is the ability of a sector to boost the output of other sectors that utilize its products as inputs (Arifin & Suryawati, 2017). This analysis is derived from normalizing total backward linkages (for dispersion index) and total forward linkages (for sensitivity index) by dividing the average of the total demand matrix (Rafiqah et al., 2018).

Leading Sector Analysis

Miller & Blair (2009) revealed that backward and forward linkages (in normalized form) can be used to identify leading sectors in the economy. This suggests that dispersion and sensitivity analyses can identify key economic sectors. A business sector with a high dispersion index and sensitivity index can be categorized as a key sector or priority sector in the economy (Rafiqah et al., 2018).

Multiplier Analysis

Multiplier effect analysis refers to the total change in output, income, and employment in a region due to changes in final demand (Ciaschini & Socci, 2007). The multiplier analysis calculates the direct, indirect, and induced effects (tertiary effects) of demand changes (Baranov & Goreev, 2022). Output multiplier refers to the change in the output of the economy due to a change in the final demand of a sector. The output doubling analysis can be formulated mathematically through the equation

$$m(o)_j = \sum_{i=1}^{n} l_{ij} \quad \text{.... (4)}$$

where *m(o)(j)* is the output doubling rate and *lij* is the total demand matrix element (matrix *L*) in columns.

Labor doubling is a change in labor demand due to a change in the final demand of a sector. The labor doubling analysis can be formulated mathematically through equation

$$E_j = \sum_{i=1}^{n} w_i l_{ij} \quad \text{.... (5)}$$

where *Ej* is the labor doubling rate, *wj* is the labor coefficient (the ratio of labor and total input in the sector), and *lij* is the element of the total demand matrix (matrix *L*) by column.

Economic Sector Analysis

The economic impact analysis was conducted to observe the total impact of the investment shock in coal mining on the East Kalimantan economy. The economic impact that will be observed is the increase in output in the economy, the increase in labor, and the potential state revenue that may arise. The economic impact in potential state revenue is measured by the increase in coal output and the output of the entire economic sector, which can be taxed or is the government's share based on legislation (royalties). The potential state revenue due to the shock consists of state revenue from taxation and non-tax revenue. The shock data used is the realization of investment in coal mining in East Kalimantan in 2022.

RESULT AND DISCUSSION

Results

Updating the East Kalimantan IO table in 2016 was the first step in analyzing the economic impact of coal mining investment in the province. This is intended to describe the current economy of East Kalimantan and the use of comparable data, namely, data from 2022. The update of the East Kalimantan IO table was carried out using the RAS method with economic references in accordance with the GRDP of East Kalimantan Province in 2022. Iterations of the RAS method in the process of updating the East Kalimantan IO table occurred as many as 25 until the convergence value requirement was met. Table 1 shows the increase and contribution of business sector output based on the East Kalimantan IO table in 2022 after being updated using the RAS method.

The update of the East Kalimantan IO table becomes the basis for conducting a linkage analysis of each economic business sector. The linkage analysis used is total linkage, which is the sum of rows and columns of the total demand matrix or Leontief matrix (L matrix). There are two types of linkage analysis: backward and forward. The calculated figures of the backward and forward linkage analysis become the basis for calculating the dispersion and sensitivity analysis. In addition to being used in the dispersion and sensitivity analysis, the Leontief matrix can also be the basis for calculating the multiplication analysis. Table 2 shows the results of the calculation of backward linkages, forward linkages, dispersion analysis,

Table 1 Increase and Contribution of Business Sector Output Based on the East Kalimantan IO

Sector Code	Sector Name	Output Value 2016 *(Million Rupiah)*	2022 Output Value *(Million Rupiah)*	Output Contribution
B	Mining and Quarrying	335,435,331	767.851.074	46.33%
C	Processing Industry	244,275,033	345.950.354	20.87%
F	Construction	89,512,973	173.816.391	10.49%
A	Agriculture, Forestry and Fisheries	53.114.138	86.958.282	5,25%
G	Wholesale and Retail Trade; Repair of Cars and Motorcycles	47.647.727	81.320.897	4,91%
H	Transportation and Warehousing	44.750.804	65.714.689	3,96%
O	Government Administration, Defense and Compulsory Social Security	14.155.234	25.913.364	1,56%
P	Education Services	9.970.612	20.181.566	1,22%
J	Information and communication	13.226.443	18.206.195	1,10%
I	Provision of Accommodation and Meals	13.402.142	17.010.131	1,03%
K	Financial and Insurance Services	10.631.015	17.002.279	1,03%
Q	Health Services and Social Activities	5.096.849	13.093.091	0,79%
R, S, T, U	Other Services	5.693.280	8.389.637	0,51%
L	Real Estate	10.404.085	8.182.327	0,49%
D	Electricity and Gas Supply	8.615.110	4.398.977	0,27%
M, N	Company Services	7.804.626	2.769.717	0,17%
E	Water Supply, Waste Management, Wastewater and Recycling	666.488	657.082	0,04%
	Total	914.401.889	1.657.416.053	100,00%
	Output Growth			81,26%

Source: Processed by Researcher

sensitivity analysis, output multipliers, and labor multipliers of the East Kalimantan economic sector in 2022.

Discussion

The results of the East Kalimantan IO table update in 2022 in Table 1 show an increase in output of Rp550,659,547.14 million or around 49.75% and align with the increase in the Indonesian economy when measured by gross domestic product (GDP) based on current prices in 2016 and 2022, which increased by Rp7,186,717.10 billion or around 57.95%. Based on the composition of economic sector output, the mining and quarrying sector will still be the largest contributor to the East Kalimantan economy in 2022. The contribution of the mining and quarrying sector reached Rp767,851,074 million or around 46.33% of all economic output in East Kalimantan and with the abundant mining resources in the province.

When viewed using the linkage analysis in Table 2, the mining and quarrying sector shows a low backward linkage value but a high forward linkage value. The backward linkage of the mining and quarrying sector is ranked thirteenth out of seventeen economic sectors with a value of 1,407. This value reflects that this sector is cannot support other sectors used as inputs. This condition is quite reasonable because the output produced by the mining and quarrying sector comes from natural resources and is not an input from other sectors.

Contrary to the backward linkage analysis, the forward linkage of the mining and quarrying sector is in second place with a value of 3,299. This value indicates that the products produced by the sector are effectively used to produce output in other sectors. This figure also shows that the output of the mining and quarrying sector can be properly processed domestically to produce products that have more added value. This is in line with the government's downstream commitment to Indonesia's natural products, especially mining products (Illahi, 2022).

In line with the linkage analysis, the distribution and sensitivity analysis of the mining and quarrying sector also show the same condition. This happens because the dispersion and sensitivity analysis are the normalized values of the values in the linkage analysis. The dispersion analysis figure is in line with the backward linkage analysis, which illustrates the ability of the mining and quarrying sector to be ineffective in encouraging its downstream sectors. On the other hand, the sensitivity analysis is in line with the forward linkage analysis which shows that the mining and quarrying sector is effectively able to drive its downstream sectors. The results of the distribution and sensitivity analysis of economic sectors in Table 2 are also the basis for classifying the leading economic sectors in East Kalimantan. The leading sectors in the economy are divided into four quadrants based on the dispersion and sensitivity index numbers. An

index with a value greater than one (above average) is classified as a high index, while an index with a value less than one (below average) is classified as a low index (Mumtaz & Sukarsih, 2022).

Table 3 identifies leading sectors in the East Kalimantan economy based on dispersion and sensitivity analysis. Based on the classification of leading economies, the mining and quarrying sector is included in priority III. Sectors that are included in priority III are sectors that are able to encourage downstream industries, but are less able to encourage upstream industries. These sectors can encourage downstream industries, but are less able to encourage upstream industries. Sectors identified as priority III play a supporting role to other sectors in the economy (Sutrisno, 2023). Ambya (2022) also revealed that economic sectors included in priority III are potential sectors that can spur economic growth.

Table 2 Calculation Results of Backward Linkages, Forward Linkages, Spread Analysis, Sensitivity Analysis, Output Multiplier, and Labor Multiplier of East Kalimantan Economic Sectors in 2022

Sector Code	Backward Linkage	Forward Linkage	Spread	Sensitivity	Output Doubling	Labor Multiplication
A	1,320	1,974	0,854	1,278	1,320	0,0047
B	1,407	3,299	0,911	2,136	1,407	0,0005
C	1,590	3,796*	1,029	2,457*	1,590	0,0011
D	2,528*	1,539	1,636*	0,996	2,528*	0,0031
E	1,601	1,005	1,037	0,651	1,601	0,0150
F	1,501	1,471	0,972	0,953	1,501	0,0013
G	1,488	1,466	0,963	0,949	1,488	0,0049
H	1,760	1,552	1,140	1,005	1,760	0,0023
I	1,638	1,139	1,060	0,737	1,638	0,0092
J	1,448	1,418	0,938	0,918	1,448	0,0012
K	1,248	1,230	0,808	0,796	1,248	0,0017
L	1,355	1,067	0,877	0,691	1,355	0,0014
MN	1,486	1,083	0,962	0,701	1,486	0,0210*
O	1,507	1,044	0,975	0,676	1,507	0,0055
P	1,327	1,032	0,859	0,668	1,327	0,0058
Q	1,605	1,056	1,039	0,683	1,605	0,0043
RSTU	1,451	1,089	0,940	0,705	1,451	0,0102
Average	1,545	1,545	1,000	1,000	1,545	0,005

Source: Processed by the author

Table 3 Identification of Leading Sectors in the East Kalimantan Economy Based on Spread and Sensitivity Analysis

		Sensitivity Index	
		High (> 1)	Low (< 1)
Spread Index	High (> 1)	Priority I C and H	Priority II D; E; I; and Q
	Low (< 1)	Priority III A and B	Priority IV F; G; J; K; L; M, N; O; P; and R, S, T, U

Source: Processed by the author

The economic impact of coal mining in East Kalimantan is measured using the multiplication rate in Table 2. Based on the output multiplication rate, the mining and quarrying sector ranks thirteenth with a value of 1,407. This figure indicates that adding Rp1 million to the final demand of the mining and quarrying sector will increase the output of the entire economy by Rp1,406 million. When viewed based on the labor multiplication rate, the mining and quarrying sector has the lowest multiplication rate compared to other sectors in East Kalimantan, with a value of 0,0005. This result illustrates that the mining and quarrying sector is less effective in generating employment. The mining and quarrying sector has the smallest labor multiplier rate because it tends to use technology and machinery in its production (Brodny & Tutak, 2019). The mining and quarrying sector also requires labor with specialized knowledge and skills, so it cannot absorb a wide range of labor (Ruban et al., 2021; Tepavicharova et al., 2019).

The doubling of output and labor is then given a stimulus in the form of additional investment in 2022 to measure the economic impact in output growth, employment (labor), and potential state revenue. The investment value used is the realization of investment in coal and lignite mining for PMDN and PMA in 2022. Based on NSWI data from the Ministry of Investment/Investment Coordinating Board, investment realization in coal and lignite mining in 2022 from PMDN amounted to Rp 10.086.918,9 million, while investment realization from PMA amounted to US$279.107 thousand, which, when converted using the average middle value of the US$ exchange rate in 2022, amounted to Rp4.150.490 million. Total investment realization in coal and lignite mining in 2022 in East Kalimantan amounted to Rp14.237.409,3 million.

Table 4 shows the economic impact on output and labor from coal and lignite mining investment in 2022. Shock in the form of investment realization in coal and lignite mining gives an increase in total output of Rp20.029.309,47 million in the economy of East Kalimantan. This figure illustrates an increase in total *output* by 1,208% from the previous amount of Rp1.657.416.053 million. Suppose the value of investment realization is reduced from the total mining output. In that case, it can be concluded that new coal and lignite mining investment has a multiplier effect of Rp5.791.900,08 million on the economy of East Kalimantan.

Table 4 Economic Impact on Output and Labor of Coal and Lignite Mining Investment in 2022

Sector Code	Sector Name	*Shock* *(Million Rupiah)*	*Output* Impact on *Output* *(Million Rupiah)*	Impact on Labor *(Person)*
A	Agriculture, Forestry, and Fisheries		147.624,86	593,2
B	Mining and Quarrying	14.237.409	17.301.341,58	2.941,9
C	Processing Industry		1.103.004,45	418,9
D	Electricity and Gas Procurement		17.792,77	30,5
E	Water Procurement, Waste Management, Waste and Recycling		146,06	2,1
F	Construction		490.168,87	297,2
G	Wholesale and Retail Trade; Repair of Cars and Motorcycles		274.558,00	1.183,1
H	Transportation and Warehousing		390.348,77	619,8
I	Provision of Accommodation and Drinking Food		22.462,63	175,4
J	Information and Communication		76.068,93	45,8
K	Financial and Insurance Services		122.199,14	149,2
L	Real Estate		7.644,10	8,2
M, N	Corporate Services		32.854,57	653,2
O	Government Administration, Defense and Compulsory Social Security		15.744,75	68,0
P	Education Services		7.676,39	38,3
Q	Health Services and Social Activities		13.578,53	43,9
R, S, T, U	Other Services		6.095,08	54,6
	Total		**20.029.309,47**	**7.323,46**

Source: Processed by the author

Investment in coal mining increases the output in the economy which indicates economic growth in East Kalimantan. This is in line with previous research conducted by Dinh et al. (2019) and Ertika et al. (2022), which revealed that investment positively affects economic growth. The results of the study are also in line with the Harrod-Domar and Keynes economic growth theories, which reveal that an increase in investment will trigger economic growth in a region.

The increase in output due to shocks in the mining and quarrying sector impacts all other sectors/industries in the East Kalimantan economy. This result is also in line with the general equilibrium theory, which shows that there are linkages between sectors/industries in the economy. Each sector/industry will provide support to other sectors and also require support from other sectors. A shock to a sector will cause changes in other sectors to form a new equilibrium.

Economic growth must be managed properly to create economic planning in the community. Increased economic capacity due to economic growth will create a trickle-down effect, namely the benefits received by low-income people, and ultimately improve the welfare of all communities (Pemerintah Provinsi Kalimantan Timur, 2022). Sustainable development can be a step so that economic growth is enjoyed not only by high-income people today but also by low—and middle-income people and future generations (Hulu & Wahyuni, 2021).

Table 4 also shows the economic impact on labor due to coal and lignite mining investment in East Kalimantan in 2022. Coal and lignite mining investment provides additional employment to 7,323 people in all economic sectors. The additional labor shows an increase in the workforce of 0.419% from the previous 1,746,920 workers. The largest increase in labor occurred in the mining and quarrying sector, which received a direct effect from investment, amounting to 2,941 workers.

The economic impact in the form of additional output in the economy then becomes the basis for estimating state revenue from coal and lignite mining investment. The state revenue that will be estimated is state revenue from taxation and non-tax revenues. State revenue in the form of tax is tax revenue with the type of value-added tax (VAT) imposed on transactions of goods and/or services represented by

output. Non-tax state revenue is state revenue from royalties on utilizing natural resources in the form of coal.

The calculation of the VAT estimate is based on research conducted by Setiawan & Ariutama (2023). The study revealed that there are nine business fields (sectors) that produce taxable goods (BKP) and taxable services (JKP). These sectors are also undergoing adjustments because goods and/or services are not BKP/JKP or do not get VAT facilities. In this study, the mining and quarrying sector is added to the calculation because coal mining products have been subject to VAT in accordance with Law Number 11 of 2020 concerning Job Creation. Table 5 shows the estimated VAT revenue from coal and lignite mining investment in East Kalimantan in 2022.

Table 5 Estimated VAT Revenue from Coal and Lignite Mining Investment in East Kalimantan in 2022

(Million Rupiah)

Sector Name	***Output Impact***	***Adj.***	**Tax Base**	**Potential VAT**
Mining and Quarrying	17.301.341,58	27%	4.671.362,23	424.669,29
Processing Industry	1.103.004,45		1.103.004,45	100.273,13
Electricity and Gas Procurement	17.792,77	49%	8.718,46	792,59
Construction	490.168,87		490.168,87	44.560,81
Wholesale and Retail Trade; Repair of Cars and Motorcycles	274.558,00		274.558,00	24.959,82
Transportation and Warehousing	390.348,77	36%	140.525,56	12.775,05
Information and Communication	76.068,93		76.068,93	6.915,36
Real Estate	7.644,10		7.644,10	694,92
Corporate Services	32.854,57		32.854,57	2.986,78
Other Services	6.095,08		6.095,08	554,10
Total	19.699.877,11		6.811.000,23	619.181,84

Source: Processed by the author

The mining and quarrying sector received an adjustment of 27%. This adjustment is based on the contribution of coal and lignite mining to the East Kalimantan economy, based on the East Kalimantan GRDP in 2022, which is 84%. The adjusted percentage figure is then adjusted again by 32% because the majority (around 68%) of Indonesia's coal production is sold through export mechanisms (Kementerian Energi dan Sumber Daya Mineral, 2023). Export transactions are subject to a tariff of 0% in accordance with Law Number 8 of 1983 concerning Value Added Tax on Goods and Services and Sales Tax on Luxury Goods, as last amended by Law Number 11 of 2020 concerning Job Creation, so there is no potential for state revenue.

The electricity and gas procurement sector received an adjustment of 49%. The first adjustment comes from the electricity sub-sector, which accounts for 96% of the sector based on East Kalimantan's 2022 GRDP. The electricity sub-sector then receives an adjustment of 51%, representing electricity consumption by industries and businesses. Electricity consumption by households, in general, is below 6,600 VA and thus subject to VAT exemption facilities in accordance with Government Regulation Number 49 of 2022 on Exempted Value Added Tax and Value Added Tax or Value Added Tax and Sales Tax on Luxury Goods Not Collected on Import and/or Delivery of Certain Taxable Goods and/or Delivery of Certain Taxable Services and/or Utilization of Certain Taxable Services from Outside the Customs Area. The contribution of the gas procurement sub-sector is ignored when calculating the electricity and gas procurement sector. This is because the gas procurement sub-sector contributes very little to the sector's output. The government subsidizes the majority of its consumption, so there is no potential for VAT in accordance with Minister of Finance Regulation Number 62/PMK.03/2022 of 2022 concerning Value Added Tax on Delivery of Certain *Liquefied Petroleum Gas.*

The transportation and storage sector received an adjustment of 36%. This adjustment is based on the transportation sub-sector, which covers 64% of the transportation and warehousing sector and receives a VAT exemption facility in accordance with Government Regulation Number 49 Year 2022, which generally regulates VAT facilities exempted or not levied on imports or delivery of certain taxable goods and/or delivery or utilization of certain taxable services.

The impact of investment on output also includes the value of VAT (Setiawan & Ariutama, 2023). For this reason, the calculation of the estimated value of VAT is carried out by excluding the value of VAT from

the value of economic impact on output (economic impact × 10%/110%). The calculation of the estimated value of VAT is carried out using a 10% rate to simplify the calculation. However, there is a change in the VAT rate to 11% in accordance with Law Number 7 of 2021 concerning Harmonization of Tax Regulations. Based on this calculation, the estimated VAT revenue is IDR619,181 billion.

Table 6 Estimated PNBP due to Investment in Coal and Lignite Mining in East Kalimantan in 2022

(1)	Impact on Mining and Quarrying Sector *Output*	Rp17.301,34 billion
(2)	Share of Coal and Lignite Mining in Mining and Quarrying Sector by GRDP 2022	84%
(3) = (1) x (2)	Impact on Coal and Lignite Mining *Output*	Rp14.533,12 billion
(4)	PNBP Coal Royalty Indonesia 2022	Rp85.700,00 billion
(5)	GDP of Coal and Lignite Mining Sub-sector 2022	Rp1.296.911,90 billion
(6) = (4) : (5)	Proportion PNBP to GDP	6,61%
(7) = (3) x (6)	Estimated PNBP	Rp960,64 billion

Source: Processed by the author

Table 6 shows the estimated PNBP due to coal and lignite mining investment in East Kalimantan in 2022. The estimated PNBP is calculated based on the proportion of coal royalty PNBP to the value of Indonesia's coal and lignite mining GDP in 2022. The proportion is used to simplify the calculation for three reasons: the unit value of output in rupiah (royalty calculation in tons), fluctuating selling prices, and different regulations regarding tariffs during 2022 (Government Regulation Number 81 of 2019 and Government Regulation Number 26 of 2022). The calculation resulted in an estimated PNBP of Rp960,64 billion.

However, calculating estimated VAT and PNBP revenues due to coal mining investment can be overestimated. This condition can be due to several reasons, one of which is the high number of Indonesia's *shadow economy* (*unrecorded* and *unreported economy*) (almost 20% of GDP) that cannot be taxed (Dahlan, 2020; Medina & Schneider, 2019). In addition, most of Indonesia's economy consists of micro, small, and medium enterprises (MSMEs), which are not required to collect VAT under tax regulations (Maretanidanini et al., 2023). In terms of PNBP, the government can also provide a 0% coal royalty rate facility in the context of downstreaming in accordance with the mandate of Government Regulation Number 26 of 2022 concerning Types and Tariffs on Types of Non-Tax State Revenue Applicable to the Ministry of Energy and Mineral Resources.

CONCLUSION

Increased electricity consumption, along with increased economic activity, drives an increase in raw materials used to generate electricity, especially coal. This is an opportunity for East Kalimantan Province, the largest contributor to coal mining in Indonesia. Investment in the mining and quarrying sector is attractive in the province, which also has a multiplier effect on other sectors.

Based on input-output analysis, investment realization in the mining and quarrying sector in 2022 added value (multiplier effect) to the economy of Rp5.791.900,08 million. The investment also provides employment opportunities for 7323 people in various sectors of the economy. Regarding state revenue, the investment has potential tax revenue of IDR619,181 billion and potential non-tax state revenue of IDR960,64 billion.

All stakeholders, especially the government, must maximize the economic impact of coal mining investment on the economy. The development of a conducive investment climate, as well as downstream and industrialization policies, can be the answer to increasing the added value of the economy, especially in East Kalimantan Province. The government and mining corporations must also maintain wise and responsible utilization of natural resources to create sustainable economic growth.

This study still has several limitations, one of which is the use of the RAS approach, which is a non-survey method, so it has not yet described the full economic structure of East Kalimantan Province in 2022. The calculation of potential state revenue also tends to be overestimated due to several variables, including the *shadow economy*. Future research can use other general equilibrium analysis techniques such as the Industrial IO 52 Table, *Inter-Regional Input Output* (IRIO), or the *Computable General Equilibrium* (CGE) model.

REFERENCES

Ambya. (2022). Percepatan pembangunan berbasis sektor kunci di Provinsi Lampung tahun 2018 (analisis input output). *Jurnal Ekonomi Pembangunan*, *11*(1), 32–41. https://doi.org/10.23960/jep.v11i1.433

Amelia, D. (2023). Keseimbangan umum. In Elfiswandi (Ed.), *Ekonomi Makro: Teori-Teori Pengantar*. Gita Lentera.

Arifin, T., & Suryawati, S. H. (2017). Analisis peranan sektor perikanan dalam mendukung program minapolitan di Provinsi Gorontalo: Model input-output. *Jurnal Sosial Ekonomi Kelautan Dan Perikanan*, *8*(2), 129–143. https://doi.org/10.15578/jsekp.v8i2.5667

Asher, S., & Novosad, P. (2014). *Digging for development: Mining booms and local economic development in India*. https://api.semanticscholar.org/CorpusID:198943772

Badan Pusat Statistik. (2022). *Statistik listrik 2017-2021*. Badan Pusat Statistik.

Bank Indonesia. (2022). *Laporan perekonomian Provinsi Kalimantan Timur Februari 2022*.

Baranov, A. O., & Goreev, A. V. (2022). Analysis of the multiplier effects produced by investment in a dynamic input–output model. *Studies on Russian Economic Development*, *33*(6), 687–696. https://doi.org/10.1134/S107570072206003X

BP. (2021). *Statistical review of world energy 2021*.

Brodny, J., & Tutak, M. (2019). Analysing the utilisation effectiveness of mining machines using independent data acquisition systems: A case study. *Energies*, *12*(13), 2505. https://doi.org/10.3390/en12132505

Cheng, D., & Daniels, P. W. (2017). Input–output analysis. In *International Encyclopedia of Geography* (pp. 1–8). Wiley. https://doi.org/https://doi.org/10.1002/9781118786352.wbieg0071

Ciaschini, M., & Socci, C. (2007). Final demand impact on output: A macro multiplier approach. *Journal of Policy Modeling*, *29*(1), 115–132. https://doi.org/10.1016/j.jpolmod.2006.07.002

Dahlan, M. (2020). Shadow economy, aeoi, dan kepatuhan pajak. *Scientax*, *2*(1), 39–56. https://doi.org/10.52869/st.v2i1.51

Dinh, T. T.-H., Vo, D. H., The Vo, A., & Nguyen, T. C. (2019). Foreign direct investment and economic growth in the short run and long run: Empirical evidence from developing countries. *Journal of Risk and Financial Management*, *12*(4), 176. https://doi.org/10.3390/jrfm12040176

Direktorat Jenderal Mineral dan Batubara. (2023). *Investasi dan PNBP subsektor mineral dan batubara tahun 2022 melampaui target*. https://www.minerba.esdm.go.id/berita/minerba/detil/20230131-investasi-dan-pnbp-subsektor-mineral-dan-batubara-tahun-2022-melampaui-target

Ejdemo, T., & Söderholm, P. (2011). Mining investment and regional development: A scenario-based assessment for Northern Sweden. *Resources Policy*, *36*(1), 14–21. https://doi.org/10.1016/j.resourpol.2010.08.008

Ertika, Y., Fakhrurrazi, K., Risma, O. R., Zhafira, N. H., & Juliansyah, R. (2022). Pendekatan autoregressive distributed lag trade-openness dan foreign direct investment terhadap pertumbuhan ekonomi Indonesia. *Jurnal Investasi Islam*, *7*(2), 125–133. https://doi.org/10.32505/jii.v7i2.5148

Febiyansah, P. T. (2017). Indonesia's FDI – exports – GDP growth nexus: Trade or investment - driven? *Buletin Ekonomi Moneter Dan Perbankan*, *19*(4), 469–488. https://doi.org/10.21098/bemp.v19i4.696

Hassen, B. N., Surroop, D., & Praene, J. P. (2023). Phasing-out of coal from the energy system in Mauritius. *Energy Strategy Reviews*, *46*, 101068. https://doi.org/https://doi.org/10.1016/j.esr.2023.101068

Hilson, G., & Maconachie, R. (2020). Artisanal and small-scale mining and the sustainable development goals: Opportunities and new directions for sub-Saharan Africa. *Geoforum*, *111*, 125–141. https://doi.org/10.1016/j.geoforum.2019.09.006

Hiramatsu, T., Inoue, H., & Kato, Y. (2016). Estimation of interregional input–output table using hybrid algorithm of the RAS method and real-coded genetic algorithm. *Transportation Research Part E: Logistics and Transportation Review*, *95*, 385–402. https://doi.org/10.1016/j.tre.2016.07.007

Howie, P., & Atakhanova, Z. (2022). Assessing initial conditions and ETS outcomes in a fossil-fuel dependent economy. *Energy Strategy Reviews*, *40*, 100818. https://doi.org/https://doi.org/10.1016/j.esr.2022.100818

Hulu, P. K., & Wahyuni, K. T. (2021). Kontribusi pembangunan infrastruktur terhadap pertumbuhan ekonomi dan ketimpangan pendapatan di Indonesia tahun 2010-2019. *Seminar Nasional Official Statistics*, *2021*(1), 603–612. https://doi.org/10.34123/semnasoffstat.v2021i1.979

Illahi, A. R. (2022). hilirisasi pertambangan dan dampaknya terhadap aspek ekonomis lingkungan hidup di Indonesia. *JUSTITIA : Jurnal Ilmu Hukum Dan Humaniora*, *9*(3), 1436–1444. https://doi.org/10.31604/justitia.v9i3.1436-1444

International Energy Agency. (2021). *Electricity consumption*. Electricity Information: Overview. https://www.iea.org/reports/electricity-information-overview/electricity-consumption

International Energy Agency. (2022). *Coal 2022*.

International Energy Agency. (2023). *Electricity*. Energy System. https://www.iea.org/energy-system/electricity

Kementerian Energi dan Sumber Daya Mineral. (2021). *Road map pengembangan dan pemanfaatan batubara 2021 - 2045*. Direktorat Jenderal Mineral dan Batubara.

Kementerian Energi dan Sumber Daya Mineral. (2023). *Handbook of energy and economic statistics of Indonesia 2022*.

Kim, K.-H., Kim, J.-H., & Yoo, S.-H. (2020). An input-output analysis of the economic role and effects of the mining industry in South Korea. *Minerals*, *10*(7), 624. https://doi.org/10.3390/min10070624

Koks, E., Carrera, L., Jonkeren, O., Husby, T., Thissen, M., Standardi, G., & Mysiak, J. (2015). Regional disaster impact analysis: Comparing input-output and computable general equilibrium models. *Natural Hazards and Earth System Sciences Discussions*, *3*(11), 7053–7088. https://doi.org/10.5194/nhessd-3-7053-2015

Kusuma, H., Sulistyono, S. W., & Priyanto, J. (2019). *Modul ekonomi regional* (Vol. 1). Universitas Muhammadiyah Malang.

Liu, X., & Shi, J. (2020). A new method for interindustry linkage analysis based on demand-driven and multisector input-output model and its application in China's manufacturing and producer services. *Complexity*, *2020*, 3857981. https://doi.org/10.1155/2020/3857981

Maretanidanini, S. T., Wicaksana, R., Tsabita, Z. A., & Firmansyah, A. (2023). Potensi kepatuhan pajak UMKM setelah kenaikan tarif pajak pertambahan nilai: Sebuah pendekatan teori atribusi. *Educoretax*, *3*(1), 42–55. https://doi.org/10.54957/educoretax.v3i1.372

Masood, N., Hudson-Edwards, K., & Farooqi, A. (2020). True cost of coal: Coal mining industry and its associated environmental impacts on water resource development. *Journal of Sustainable Mining*, *19*(3), 135–149. https://doi.org/10.46873/2300-3960.1012

Medina, L., & Schneider, F. G. (2019). Shedding light on the shadow economy: A global database and the interaction with the official one. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3502028

Miller, R. E., & Blair, P. D. (2009). *Input-output analysis*. Cambridge University Press. https://doi.org/10.1017/CBO9780511626982

Monteiro, N. B. R., da Silva, E. A., & Moita Neto, J. M. (2019). Sustainable development goals in mining. *Journal of Cleaner Production*, *228*, 509–520. https://doi.org/10.1016/j.jclepro.2019.04.332

Mumtaz, H., & Sukarsih, I. (2022). Taksiran matriks teknologi untuk menentukan sektor unggulan di suatu wilayah menggunakan metode RAS. *Jurnal Riset Matematika*, *1*(2), 137–144. https://doi.org/10.29313/jrm.v1i2.485

Oyarzo, M., & Paredes, D. (2021). The impact of mining taxes on public education: Evidence for mining municipalities in Chile. *Resources Policy*, *70*, 101207. https://doi.org/10.1016/j.resourpol.2018.05.018

Papadas, C. T., & Dahl, D. C. (2008). Supply-driven input-output multipliers. *Journal of Agricultural Economics*, *50*(2), 269–285. https://doi.org/10.1111/j.1477-9552.1999.tb00813.x

Pemerintah Provinsi Kalimantan Timur. (2022). *Analisis ketimpangan wilayah Provinsi Kalimantan Timur Tahun 2022*. Pemerintah Provinsi Kalimantan Timur.

Rafiqah, I. W., Darsono, & Sutrisno, J. (2018). Daya penyebaran dan derajat kepekaan sektor pertanian dalam pembangunan ekonomi di Provinsi Jawa Tengah. *AGRARIS: Journal of Agribusiness and Rural Development Research*, *4*(1), 51–58. https://doi.org/10.18196/agr.4160

Rahman, M. M. (2020). Environmental degradation: The role of electricity consumption, economic growth and globalisation. *Journal of Environmental Management*, *253*, 109742. https://doi.org/10.1016/j.jenvman.2019.109742

Ruban, D. A., Ermolaev, V. A., & van Loon, A. J. (Tom). (2021). Exploitation of mineral resources requires proper people: Expectations of the world's top mining companies. *Resources*, *10*(10), 101. https://doi.org/10.3390/resources10100101

Setiawan, T. A., & Ariutama, I. G. A. (2023). Mengukur dampak annual meetings IMF-WB 2018 terhadap ekonomi regional dan nasional. *Indonesian Treasury Review Jurnal Perbendaharaan Keuangan Negara Dan Kebijakan Publik*, *8*(2), 137–147. https://doi.org/10.33105/itrev.v8i2.536

Sholihah, I. M., Syaparuddin, & Nurhayani. (2017). Analisis investasi sektor industri manufaktur, pengaruhnya terhadap pertumbuhan ekonomi dan penyerapan tenaga kerja di Indonesia. *Jurnal Paradigma Ekonomika*, *12*(1), 11–24. https://doi.org/10.22437/paradigma.v12i1.3930

Sun, H., Pofoura, A. K., Adjei Mensah, I., Li, L., & Mohsin, M. (2020). The role of environmental entrepreneurship for sustainable development: Evidence from 35 countries in Sub-Saharan Africa. *Science of The Total Environment*, *741*, 140132. https://doi.org/10.1016/j.scitotenv.2020.140132

Surbakti, S. P. P., & Wijaya, S. (2023). Pengaruh foreign direct investment dan urbanisasi terhadap penerimaan pajak dengan moderasi pengendalian korupsi pada negara ASEAN. *Journal of Law, Administration, and Social Science*, *3*(2), 133–147. https://doi.org/10.54957/jolas.v3i2.477

Suryadi. (2019). *Model keseimbangan umum perekonomian Indonesia: Teori dan aplikasi dampak perubahan harga dan produksi padi terhadap kinerja ekonomi sektoral dan kesejahteraan*. Delta Pijar Khatulistiwa.

Sutrisno, H. (2023). Identifikasi sektor unggulan dan simulasi kebijakan pembangunan suatu perekonomian: Sektor unggulan, model input- output, simulasi kebijakan. *EBA Journal: Journal Economic, Bussines and Accounting*, *8*(1), 60–80. https://ejournal.undar.or.id/index.php/eBA/article/view/197

Tepavicharova, M., Dikova, L., & Zahars, V. (2019). Development of a competency model for selection of human resources in the mining and quarrying sector in Bulgaria. *E3S Web of Conferences*, *105*, 04029. https://doi.org/10.1051/e3sconf/201910504029

Thompson, S. (2023). The living dead of the mining industry: Deindustrialisation, sheltered workplaces and the re-employment of disabled miners in post-war Wales. *The Welsh History Review / Cylchgrawn Hanes Cymru*, *31*(3), 468–493. https://doi.org/10.16922/whr.31.3.6

Upadhyay, A., Laing, T., Kumar, V., & Dora, M. (2021). Exploring barriers and drivers to the implementation of circular economy practices in the mining industry. *Resources Policy*, *72*, 102037. https://doi.org/10.1016/j.resourpol.2021.102037

Usman, A., Ozturk, I., Hassan, A., Maria Zafar, S., & Ullah, S. (2021). The effect of ICT on energy consumption and economic growth in South Asian economies: An empirical analysis. *Telematics and Informatics*, *58*, 101537. https://doi.org/10.1016/j.tele.2020.101537

Wang, S. (2018). General equilibrium theory. In S. Wang (Ed.), *Microeconomic Theory* (pp. 95–126). Springer Singapore. https://doi.org/10.1007/978-981-13-0041-7_4

Worlanyo, A. S., & Jiangfeng, L. (2021). Evaluating the environmental and economic impact of mining for post-mined land restoration and land-use: A review. *Journal of Environmental Management*, *279*, 111623. https://doi.org/10.1016/j.jenvman.2020.111623

Yanti, T. S. (2017). Analisis perubahan potensi unggulan Kota Bandung melalui model input output menggunakan indeks Le Masne. *ETHOS (Jurnal Penelitian Dan Pengabdian)*, *5*(1), 30–36. https://doi.org/10.29313/ethos.v0i0.2224

Yuliana, S., Bashir, A., & Rohima, S. (2019). The effect of investment toward economic growth in the local economy. *Jurnal Ekonomi Dan Studi Pembangunan*, *11*(1), 28–39. https://doi.org/10.17977/um002v11i12019p028

Zhang, B., Yao, J., & Lee, H.-J. (2022). Economic impacts and challenges of Chinese mining industry: An input–output analysis. *Frontiers in Energy Research*, *10*. https://doi.org/10.3389/fenrg.2022.784709