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Profit Increase Efficiency Analysis: Production Approaches and Profit Approaches (Study on the Mining Sector in Indonesia)

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ABSTRACT

Efficiency is the company's ability to maximize output by using certain inputs. This study aims to determine the level of efficiency and causes of inefficiency in mining sector companies listed on the IDX using the production approach and profit approach using quantitative Data Envelopment Analysis (DEA) methods and panel regression as measured using Eviews. The research object consists of 23 companies with data on the results of annual financial reports from 2017 to 2021. The test results show that there are differences in the results of company efficiency scores in the mining sector using the Production Approach and Profit approach. The results showed that from the production approach, only 2 companies were efficient and the remaining 21 companies were still experiencing inefficiencies from the results of cost of goods sold, selling expenses, operating expenses, and net sales which had a significant effect on efficiency, but total assets and general expenses & adm had no significant effect on efficiency. The results of the study using the profit approach were only 1 efficient company and the remaining 22 companies were still experiencing inefficiency, only total equity, selling expenses, and profit had a significant effect on efficiency, but the cost of sales, general & administrative expenses, operating expenses did not have a significant effect to be efficient. The number of companies that were not declared efficient in the year the company was researched had to do potential improvement by increasing assets, and equity, reducing the cost of goods sold, reducing selling expenses, general & administrative expenses, and operating expenses, and had to increase sales to increase profits and achieve efficiency in the company.

INTRODUCTION

The mining sector in industrial companies is one of the pillars of a country's economic development, because of its role as a provider of energy resources that are very necessary for a country's economic growth.

Survey of the Business World Activity Survey (SKDU) released by Bank Indonesia. The results of a survey by Indonesian Companies indicate that business activities will slow down in the third quarter of this year amid the implementation of emergency Community Activity Restrictions or PPKM. Only the mining and quarrying, construction and service sectors improved in the third quarter. The

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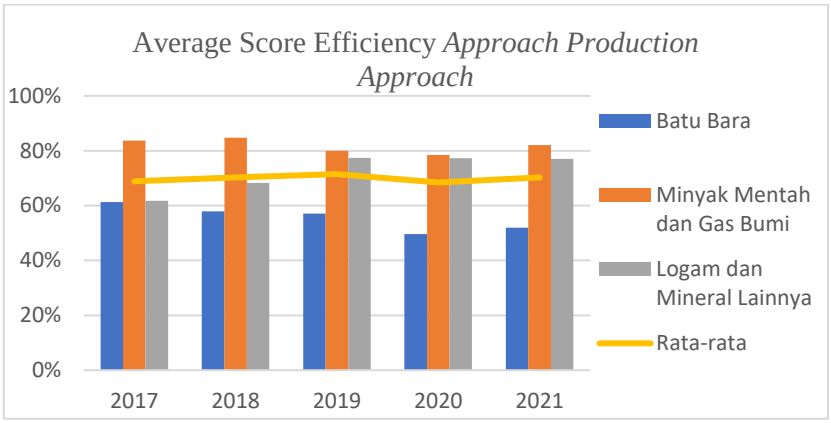
construction sector entered into an expansionary phase with a WNB of 0.44% after being minus in the previous quarter. While the mining and quarrying sector and the service sector have the potential to increase with WNB 8.71% and 0.83% respectively

Improvements in the mining and quarrying sector are the key to growth in business activity this year. The BI survey also noted that business activity shot up in the second quarter with WNB reaching 18.98y%, up from 4.5% in the previous quarter. The mining and quarrying sector led the acceleration with a WNB value of 8.5% in the second quarter. In the previous period, this sector also had the highest WNB at 2.93% (www.CNBCIndonesia.com).

Efficiency is the company's ability to use minimal input to produce maximum output. The company's ability to utilize existing resources at the lowest possible cost and produce the maximum possible income output gives birth to efficiency (At-thohiroh 2022)

Various sectors in mining were able to survive in the periods before and underway the implementation of restrictions on the activities of the emergency PPKM community. So the researchers conducted tests with Data *Envelopment Analysis* (DEA) to prove the level of efficiency with the two *production approaches* and *the profit approach* for 23 mining sector companies listed on the Indonesia Stock Exchange for the period 2017 to 2021.

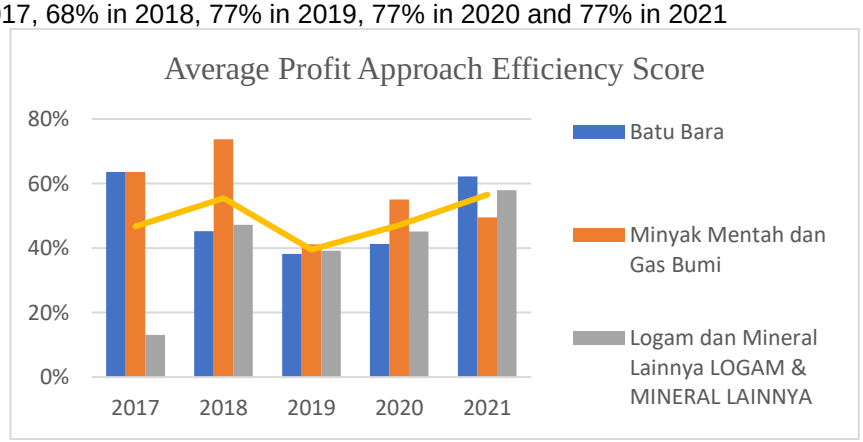


Source: Data processed using MAXDEA

Figure 1. Average *Production Approach Company Efficiency Score for the* 2017-2021 Mining Sector

Based on **Graph 1** above, shows that the average efficiency level results in 23 (twenty-three) mining sector companies from 2017 to 2021 using the *Profit Approach approach*, namely:

1. There are 14 (fourteen) companies in the coal sub-sector with an average efficiency score of 61% in 2017, 58% in 2018, 57% in 2019, 50% in 2020 and 52% in 2021.
2. The crude oil and natural gas sub-sector have 6 (six) average efficiency scores in 2017 of 84%, 2018 of 85%, 2019 of 80%, and 2020 of 78%.
3. The metal and other minerals sub-sector consist of 3 (three) companies with an average score of 62% in 2017, 68% in 2018, 77% in 2019, 77% in 2020 and 77% in 2021



Source: Data processed using MAXDEA

Figure 2. Average *Profit Approach Company Efficiency Score in the Mining Sector* for the 2017-2021 Period

Based on **Graph 2.** above, shows that the average efficiency level results in 23 (twenty-three) mining sector companies from 2017 to 2021 using the *Profit Approach*, namely:

1. The coal sub-sector has 14 (fourteen) companies with an average score of 64% in 2017, 45% in 2018, 38% in 2019, 41% in 2020, and 62% in 2021.
2. The crude oil and gas sub-sector consist of 6 (six) companies with an average score of 64% in 2017, 74% in 2018, 41% in 2019, 55% in 2020 and 50% in 2021.
3. The metal and other minerals sub-sector have 3 (three) companies with an average score of 13% in 2017, 47% in 2018, 39% in 2019, 45% in 2020 and 58% in 2021.

In Widodo's research (2019) entitled Analysis of Efficiency in Mining Companies in the Metal and Mineral Sector Registered on the IDX using the data envelopment analysis method and its effect on market value, a comparison of efficiency based on the category of company ownership found that the average efficiency level of state-owned companies (BUMN) is above the average private company.

Paida et al. (2021) in their research entitled Analysis of the Efficiency of the Base Metal Industry in Indonesia, said that the base metal industry in Indonesia from 2001 to 2018 was in an inefficient condition at the 93% level.

In Setiasih's research (2015) entitled Analysis of Company Efficiency Using the Data Envelopment Analysis (Dea) Approach, Case Studies in Mining, Manufacturing, Trading, and Real Estate Companies Registered in Bei for the 2008–2012 Period. Said that the average technical efficiency and efficiency scale of the four industrial groups had not yet reached 100 percent technical efficiency even though several companies in each industry group had achieved 100 percent technical efficiency and DMU had worked optimally throughout the year.

This researcher takes the title "Analysis of the Efficiency of Companies in the Mining Sector Using the Data *Envelopment Analysis* (DEA) Method" with the *Production Approach* and *Profit Approach*

METHOD

This type of research used is quantitative research. The type of data is panel data, which is a combination of cross-sectional data from 23 mining sector companies and time series data for the annual period from 2017 to 2021. The data source is secondary data in the form of documentation of published financial reports for annual financial reports from 2017 to 2021 obtained from the official website of each of these companies. The model used in the Data Envelopment Analysis (DEA) approach in this study is Variable *Return to Scale* (VRS).

Variable Definitions and Operations

The input and output variables used in the first stage use the data envelopment analysis (DEA) method using two approaches, namely:

a. Production Approach
   1. Input variables: total assets, total equity, cost of goods sold, selling expenses, administrative and general expenses, and other operational expenses.
   2. Output variable: net sales

b. Prof Approach
   1. Input variables: total assets, total equity, cost of goods sold, selling expenses, administrative and general expenses, and other operational expenses.
   2. Output variable: total comprehensive income

Meanwhile, in the second stage the dependent and independent variables used in the influence test between variables are as follows:

a. Dependent variable: Mining Sector company efficiency with production approach and Mining Sector company efficiency with *profit approach*.
b. Independent variables: total assets, total equity, cost of goods sold, selling expenses, administrative and general expenses, and other operational expenses.

Analysis Method

Data Event Analysis (DEA) Analysis

DEA is used to measure the level of efficiency and answer the problem formulation points 1 to 4. This study uses the Data *Envelopment Analysis* (DEA) method, which is a management of data in the form of input and output, this is used to measure the relative efficiency level of a company.

T-test Different Test Analysis

The T-test difference test is used to measure the level of efficiency and measurement of H1. From the results of calculations using Data *Envelopment Analysis* (DEA), a different test will be carried out on the average score of *production efficiency* and *profit.*

Data Testing Methods

Model Fit Test

The procedure for testing the data used in this research is the panel data regression method. The purpose of this method is to analyze the data and test how the influence of the variables in this study. Common effects, fixed effects, and random effects are the regression models that exist in Panel Data regression. Furthermore, the data that has been collected will be processed and tested using the E-views 10 software

RESULTS AND DISCUSSION

Mining Sector Company Efficiency Ranking in Indonesia

Analysis of the results in this study includes *a production approach* and *profit approach* in mining sector companies for the period 2017 to 2021. DEA analysis is a programming technique used to measure the level of efficiency of a set of decision-making units in managing inputs to produce outputs. Efficiency values are calculated with a variance of 0-100%. It can be said to be efficient if the efficiency value is getting closer to 100% (> 90%). Conversely, it is said to be inefficient if the value is close to 0

Table 1. Mining Sector Company Efficiency Ranking From the *Production Approach*

Rank	Company Name	2017	2018	2019	2020	2021	Average
1	Elnusa Tbk.	100%	100%	100%	100%	100%	100%
2	Radiant Utama Interinsco Tbk.	100%	100%	100%	100%	100%	100%
3	Indo Tambangraya Megah Tbk.	96%	100%	100%	100%	100%	99%
4	Mitra Energi Persada Tbk.	100%	94%	100%	100%	100%	99%
5	Cita Mineral Investindo Tbk	89%	100%	100%	100%	100%	98%
6	AKR Corporindo Tbk.	82%	100%	92%	90%	100%	93%
7	Bayan Resources Tbk.	100%	79%	100%	51%	91%	84%
8	Borneo Olah Sarana Sukses	100%	100%	87%	61%	37%	77%
9	Baramulti Suksessarana Tbk.	81%	79%	72%	54%	93%	76%
10	Aneka Tambang Tbk	58%	71%	81%	76%	86%	75%
11	Mitrabara Adiperdana Tbk.	86%	100%	59%	71%	57%	75%
12	TBS Energi Utama Tbk.	73%	58%	84%	88%	41%	69%
Rank	Company Name	2017	2018	2019	2020	2021	Average
13	Golden Energy Mines Tbk.	59%	70%	61%	56%	93%	68%
14	Surya Esa Perkasa Tbk	84%	100%	91%	14%	23%	62%
15	Medco Energi Internasional Tbk	10%	100%	16%	45%	69%	48%
16	Indika Energy Tbk.	41%	61%	59%	29%	39%	46%
17	Timah Tbk	39%	34%	51%	55%	45%	45%
18	Bukit Asam Tbk.	39%	38%	34%	32%	44%	37%
19	Harum Energy Tbk.	52%	31%	25%	58%	16%	36%
20	Resource Alam Indonesia Tbk.	38%	21%	39%	29%	43%	34%
21	United Tractors	34%	32%	37%	26%	31%	32%
22	Dian Swastatika Sentosa Tbk	21%	23%	19%	22%	31%	23%
23	Perdana Karya Perkasa Tbk	39%	19%	22%	16%	11%	21%
Average Efficient		**66%**	**70%**	**66%**	**60%**	**63%**	**65%**

Source: Data processed using MAXDEA

Table 1 above shows an efficient score using the *production approach* for the period 2017 to 2021,

namely:

1. The average efficiency level for 23 (twenty-three) mining sector companies from 2017 to 2021 is 65%. The highest average efficiency level was obtained in 2018, namely 70%.
2. On average from 2017 to 2021, there are 2 (two) companies, namely: PT Elnusa Tbk and PT Radiant Utama Interinsco Tbk, which consistently have the highest efficiency value, reaching 100%.
3. On average from 2017 to 2021, 4 (four) companies have relatively good efficiency values (above 90%).

Table 2. Ranking of Added Sector Company Efficiency from the *Profit Approach*

Rank	Company Name	2017	2018	2019	2020	2021	Average
1	Radiant Utama Interinsco Tbk.	100%	100%	100%	100%	100%	100%
2	Indo Tambangraya Megah Tbk.	100%	93%	100%	100%	100%	99%
3	Bayan Resources Tbk.	100%	96%	84%	49%	100%	86%
4	Cita Mineral Investindo Tbk	16%	100%	100%	100%	100%	83%
5	AKR Corporindo Tbk.	88%	100%	38%	83%	78%	77%
6	TBS Energi Utama Tbk.	81%	87%	61%	60%	92%	76%
7	Borneo Olah Sarana Sukses	100%	29%	3%	100%	100%	66%
8	Mitrabara Adiperdana Tbk.	68%	100%	33%	36%	72%	62%
9	Baramulti Suksessarana Tbk.	71%	54%	22%	21%	97%	53%
10	Elnusa Tbk.	100%	39%	58%	29%	35%	52%
11	Harum Energy Tbk.	39%	21%	13%	100%	55%	46%
12	Golden Energy Mines Tbk.	43%	32%	18%	27%	100%	44%
13	Medco Energi Internasional Tbk	73%	6%	7%	84%	40%	42%
14	Indika Energy Tbk.	100%	27%	5%	43%	22%	39%
15	Surya Esa Perkasa Tbk	21%	97%	11%	26%	24%	36%
16	Perdana Karya Perkasa Tbk	56%	18%	100%	0%	3%	35%
17	Mitra Energi Persada Tbk.	0%	100%	33%	7%	19%	32%
18	Bukit Asam Tbk.	31%	43%	31%	9%	43%	32%
19	Resource Alam Indonesia Tbk.	66%	2%	11%	14%	42%	27%
20	United Tractors	19%	25%	42%	12%	24%	24%
21	Aneka Tambang Tbk	3%	24%	0%	27%	45%	20%
22	Timah Tbk	20%	18%	17%	8%	29%	19%
23	Dian Swastatika Sentosa Tbk	17%	6%	10%	5%	20%	12%
Average Efficiency		**57%**	**53%**	**39%**	**45%**	**58%**	**51%**

Source: Data processed using MAXDEA

Table **2** shows the efficient score using the *Profit Approach* for the period 2017 to 2021, namely:

1. The average efficiency level for 23 (twenty-three) mining sector companies from 2017 to 2021 is 51%. The highest average efficiency level is obtained in 2021, which is 58%.
2. On average, from 2017 to 2021 there is 1 (one) company, namely: PT Radiant Utama Interinsco Tbk, which consistently has the highest efficiency value, reaching 100%, and PT Indo Tambangraya Megah Tbk, a company that has a relatively good efficiency value (above 90%).
3. On average, from 2017 to 2021, 21 (twenty-one) companies are not yet efficient (efficiency score below 90%).

Potential Improvement of Mining Sector Companies in Indonesia

Based on data from mining sector companies, which is a comparison between the variables used to refer to companies with the highest average efficiency scores for the period 2017 - 2021, both using the *production approach* and *profit approach*, namely Radiant Utama Interinsco Tbk and PT Elnusa Tbk, it can be seen from the results of the efficiency level of other companies that are inefficient need to carry out *Potential Improvement* to achieve high-efficiency values.

Table 3. *Potential Improvement* of Mining Sector Companies in 2017-2021 from the aspect of *Production Approach* with a level of efficiency (<50%)

Year	Company name	Efficiency Score	TA	TE	HPP	BP	BUA	BOP	PN
2017	Indika Energy Tbk.	41%	44%	43%	0%	0%	0%	68%	-144%
	Bukit Asam Tbk.	39%	0%	54%	66%	78%	57%	80%	-156%
	Perdana Karya Perkasa Tbk	39%	35%	47%	0%	0%	91%	93%	-158%
	Timah Tbk	39%	0%	30%	52%	0%	50%	0%	-159%
	Resourse Alam Indonesia	38%	0%	64%	38%	0%	28%	0%	-161%
	United Tractors	34%	0%	95%	79%	59%	21%	61%	-194%
	Dian Swastatika Sentosa Tbk	21%	0%	50%	62%	92%	23%	95%	-380%
	Medco Energi Internasional	10%	21%	21%	0%	0%	20%	2%	-860%
2018	Bukit Asam Tbk.	38%	0%	57%	69%	76%	65%	76%	-160%
	Timah Tbk	34%	0%	26%	64%	0%	50%	0%	-193%
	United Tractors	32%	0%	45%	78%	43%	10%	58%	-217%
	Harum Energy Tbk.	31%	0%	68%	77%	91%	58%	71%	-222%
	Dian Swastatika Sentosa Tbk	23%	0%	41%	67%	93%	26%	91%	-344%
	Resourse Alam Indonesia	21%	0%	64%	67%	63%	66%	84%	-376%
	Perdana Karya Perkasa Tbk	19%	86%	88%	0%	0%	70%	95%	-417%
2019	Resourse Alam Indonesia	39%	0%	64%	84%	74%	58%	72%	-154%
	United Tractors	37%	0%	41%	37%	0%	0%	0%	-171%
	Bukit Asam Tbk.	34%	0%	57%	69%	74%	62%	42%	-194%
	Harum Energy Tbk.	25%	0%	70%	74%	88%	60%	30%	-294%
	Perdana Karya Perkasa Tbk	22%	40%	0%	0%	0%	47%	86%	-349%
	Dian Swastatika Sentosa Tbk	19%	0%	40%	62%	94%	92%	87%	-418%
	Medco Energi Internasional	16%	29%	12%	0%	0%	31%	10%	-525%
	Company name	**Efficiency Score**	**TA**	**TE**	**HPP**	**BP**	**BUA**	**BOP**	**PN**
2020	Medco Energi Internasional	45%	66%	45%	0%	0%	32%	81%	-120%
	Bukit Asam Tbk.	32%	0%	59%	69%	98%	57%	6%	-216%
	Indika Energy Tbk.	29%	16%	0%	54%	0%	0%	0%	-244%
	Resourse Alam Indonesia	29%	0%	65%	79%	60%	59%	96%	-248%
	United Tractors	26%	0%	57%	74%	63%	22%	58%	-282%
	Dian Swastatika Sentosa Tbk	22%	0%	52%	67%	95%	42%	94%	-346%
	Perdana Karya Perkasa Tbk	16%	0%	47%	0%	0%	26%	92%	-519%
	Surya Esa Perkasa Tbk	14%	31%	53%	63%	2%	0%	2%	-624%
	Timah Tbk	45%	0%	30%	77%	0%	65%	17%	-123%
2021	Bukit Asam Tbk.	44%	0%	24%	0%	75%	52%	0%	-126%
	Resourse Alam Indonesia	43%	0%	64%	82%	58%	41%	74%	-131%
	TBS Energi Utama Tbk.	41%	40%	59%	21%	0%	0%	0%	-141%
	Indika Energy Tbk.	39%	5%	0%	80%	35%	16%	0%	-154%
	Borneo Olah Sarana Sukses	37%	66%	0%	0%	0%	16%	89%	-173%
	Dian Swastatika Sentosa Tbk	31%	0%	55%	73%	95%	48%	91%	-222%
	United Tractors	31%	0%	58%	77%	52%	20%	60%	-227%
	Surya Esa Perkasa Tbk	23%	21%	36%	0%	0%	0%	0%	-344%
	Harum Energy Tbk.	16%	0%	64%	39%	79%	13%	74%	-530%
	Perdana Karya Perkasa Tbk	11%	84%	89%	0%	0%	90%	97%	-843%
Average Potential Improvement		**30%**	**14%**	**47%**	**46%**	**40%**	**39%**	**52%**	**289%**

Source: Data processed with MAXDEA

Based on the results of the DEA analysis in Table 3**.** Shows that as many as 41 companies experience a level of efficiency. On average, the company's potential improvement is suggested to utilize and increase the total assets owned by 14%, optimize equity management by 47%, reduce HPP by 46%, reduce selling expenses by 40%, reduce administrative and general expenses by 39%, reduce other operating expenses by 52%, and increase net sales by 289%. To achieve a high level of

efficiency with a score of 100%.

For example, PT Perdana Karya Perkasa Tbk with an average efficiency score of 11% achieved a high level of efficiency with a score of 100%. So companies need to carry out potential improvements by increasing total assets owned by 84%, optimizing equity management by 89%, reducing administrative and general expenses by 90%, reducing other operating expenses by 97%, and increasing net sales by 843%.

Table 4. *Potential Improvement* of Mining Sector Companies in 2017-2021 from the *Profit Approach aspect* with a level of efficiency (<50%)

Year	Company name	Efficient	TA	TE	HPP	BP	BUA	BOP	PROFIT
2017	Golden Energy Mines	**43%**	1%	0%	3%	0%	10%	0%	-133%
	Harum Energy Tbk.	**39%**	24%	39%	0%	0%	67%	0%	-155%
	Bukit Asam Tbk.	**31%**	0%	64%	70%	90%	55%	0%	-219%
	Surya Esa Perkasa Tbk	**21%**	97%	95%	0%	0%	86%	0%	-381%
	Timah Tbk	**20%**	10%	11%	0%	0%	47%	0%	-391%
	United Tractors Tbk	**19%**	0%	94%	42%	0%	20%	0%	-431%
	Dian Swastatika Sentosa	**17%**	0%	6%	2%	0%	31%	0%	-493%
	Cita Mineral Investindo	**16%**	21%	10%	0%	16%	0%	0%	-527%
	Aneka Tambang Tbk	**3%**	49%	64%	0%	0%	46%	0%	-3126%
	Mitra Energi Persada Tbk.	**0%**	0%	59%	71%	59%	45%	0%	-92527%
18	Bukit Asam Tbk.	**43%**	0%	67%	72%	89%	64%	0%	-131%
	Elnusa Tbk.	**39%**	0%	3%	26%	0%	6%	71%	-157%
	Golden Energy Mines	**32%**	0%	0%	12%	8%	9%	3%	-217%
	Borneo Olah Sarana Sukses Sports Means of Success	**29%**	0%	8%	21%	0%	58%	0%	-242%
	Indika Energy Tbk.	**27%**	35%	0%	21%	0%	42%	0%	-266%
	United Tractors	**25%**	0%	31%	22%	0%	7%	0%	-293%
	Aneka Tambang Tbk	**24%**	0%	40%	68%	0%	49%	0%	-312%
	Harum Energy Tbk.	**21%**	0%	33%	37%	0%	68%	0%	-384%
	Prime Work Mighty	**18%**	70%	85%	0%	0%	42%	59%	-463%
	Timah Tbk	**18%**	8%	0%	0%	0%	41%	0%	-471%
	Dian Swastatika Sentosa	**6%**	24%	0%	19%	0%	44%	0%	-1507%
	Medco Energi Internasional	**6%**	60%	46%	0%	0%	65%	0%	-1517%
	Resourse Alam Indonesia	**2%**	0%	60%	51%	0%	67%	0%	-4258%
2019	United Tractors	**42%**	27%	37%	0%	0%	37%	0%	-138%
	AKR Corporindo	**38%**	10%	6%	0%	0%	20%	0%	-165%
	Adiperdana Partners	**33%**	0%	25%	66%	71%	59%	21%	-201%
	Mitra Energi Persada Tbk.	**33%**	0%	41%	34%	0%	67%	0%	-203%
	Bukit Asam Tbk.	**31%**	0%	23%	15%	0%	62%	0%	-221%
	Baramulti Success means	**22%**	0%	9%	74%	76%	45%	59%	-360%
	Golden Energy Mines	**18%**	0%	0%	12%	17%	0%	20%	-441%
	Timah Tbk	**17%**	47%	0%	69%	0%	63%	0%	-474%
	Harum Energy Tbk.	**13%**	0%	45%	31%	0%	68%	0%	-671%
	Resourse Alam Indonesia	**11%**	0%	53%	73%	0%	61%	0%	-782%
	Surya Esa Perkasa Tbk	**11%**	84%	86%	67%	0%	77%	0%	-809%
	Dian Swastatika Sentosa	**10%**	21%	0%	0%	3%	94%	0%	-868%
	Medco Energi Internasional Tbk	**7%**	48%	25%	0%	0%	67%	0%	-1251%
	Indika Energy Tbk.	**5%**	39%	0%	27%	0%	49%	0%	-1897%
	Borneo Olah Sarana Sukses Tbk.	**3%**	37%	0%	13%	0%	19%	0%	-3317%
	Various Mines	**0%**	0%	57%	73%	0%	42%	0%	-85969%
2020	Bayan Resources	**49%**	24%	0%	42%	26%	0%	0%	-104%
	Indika Energy Tbk.	**43%**	35%	0%	39%	0%	35%	0%	-131%
	Adiperdana Partners	**36%**	0%	18%	27%	92%	44%	0%	-177%
	Elnusa Tbk.	**29%**	15%	7%	36%	0%	0%	35%	-244%

	Golden Energy Mines	**27%**	6%	0%	9%	24%	0%	0%	-264%
	Aneka Tambang Tbk	**27%**	0%	29%	8%	0%	57%	0%	-272%
	Surya Esa Perkasa Tbk	**26%**	49%	55%	0%	0%	31%	0%	-285%
	Baramulti Success means	**21%**	0%	14%	63%	69%	43%	43%	-383%
	Resourse Alam Indonesia	**14%**	0%	60%	69%	0%	26%	0%	-608%
	United Tractors	**12%**	0%	43%	16%	0%	22%	0%	-728%
	Bukit Asam Tbk.	**9%**	0%	5%	28%	88%	70%	0%	-1005%
	Timah Tbk	**8%**	13%	0%	59%	0%	42%	0%	-1086%
	Mitra Energi Persada Tbk.	**7%**	13%	27%	0%	0%	36%	0%	-1263%
	Dian Swastatika Sentosa	**5%**	1%	0%	0%	16%	41%	0%	-1768%
	Prime Work Mighty	**0%**	0%	66%	36%	46%	17%	68%	-73432%
2021	Aneka Tambang Tbk	**45%**	0%	39%	74%	0%	72%	0%	-124%
	Bukit Asam Tbk.	**43%**	6%	0%	0%	81%	68%	0%	-131%
	Resourse Alam Indonesia	**42%**	0%	59%	71%	0%	44%	0%	-136%
	Medco Energi Internasional Tbk	**40%**	60%	44%	20%	0%	67%	64%	-152%
	Elnusa Tbk.	**35%**	26%	15%	37%	0%	15%	0%	-183%
	Timah Tbk	**29%**	0%	0%	26%	0%	45%	0%	-242%
	Surya Esa Perkasa Tbk	**24%**	52%	51%	0%	0%	54%	0%	-311%
	United Tractors	**24%**	0%	48%	29%	0%	19%	0%	-319%
	Indika Energy Tbk.	**22%**	40%	0%	70%	0%	55%	0%	-363%
	Dian Swastatika Sentosa	**20%**	0%	0%	15%	16%	53%	0%	-392%
	Mitra Energi Persada Tbk.	**19%**	0%	40%	21%	0%	49%	0%	-414%
	Prime Work Mighty	**3%**	77%	89%	0%	19%	86%	88%	-2775%
Average Potential Improvement		**22%**	**17%**	**29%**	**29%**	**14%**	**44%**	**8%**	**-4449%**

Source: Data processed using MAXDEA

Based on the results of the DEA analysis in Table 4. Shows that as many as 66 company data experience a high level of efficiency. The average potential improvement for these companies is suggested to utilize and increase total assets owned by 17%, optimize equity management by 29%, reduce COGS by 29%, reduce selling expenses by 14%, reduce administrative and general expenses by 44%, reduce other operating expenses by 8%, and increase current year's comprehensive profit by 449%.

For example, PT Dian Swastika Sentosa Tbk in 2020 with an average efficiency score of 11% achieved a high level of efficiency with a score of 100%. So the company needs to carry out potential improvements by increasing the total assets owned by 1%, reducing sales expenses by 16, general & administrative expenses by 41%, and increasing profits by 1768%.

Results Test of Different Efficiency Levels of Mining Sector Companies Between Production Approach and Profit Approach

Table 5. Different Test Results

		Paired Differences					t	df	Sig
		Means	std. Dev	std. Mean error	Lower	Upper			
Pair 1	EFF-PRODUCTION - EFF PROFIT	0.145	0.339	0.0316	0.083	0.208	4,591	114	0

Source: Data processed using SPSS

The results of the efficiency T-test different test between the *production approach* and the *profit* approach show that the sig value (0.000) is smaller than alpha 5%, so H0 is rejected and H1 is accepted which states that there is a difference in the level of efficiency of mining sector companies using the (DEA) approach between *production* and *profit* with a p-value of 0.006. Based on these results it can be seen that the regression model is fit with the data used in this study.

Table 6. Table of Panel Regression Analysis Results for *Production Approach* Efficiency

Variable		coefficient	Std. Error	t-Statistics	Prob.
	C	-0.810871	0.881408	-0.919973	2.50138889
Total Equity	LOG(X1)	-0.007361	0.036187	-0.203421	5.82847222
Cost of goods sold	LOG(X2)	-0.073971	0.035925	-2,059,055	0.29513889
Selling expenses	LOG(X3)	-0.134625	0.020280	-6,638,370	0.0000
General & Administrative Expenses	LOG(X4)	0.012553	0.037565	0.334168	5.13263889
Other Op Expenses	LOG(X5)	-0.044418	0.011395	-3,897,879	0.0002
Net Sales	LOG(X6)	0.282947	0.039878	7,095,388	0.0000
R-Squared		0.880776			
Adjusted R-squared		0.841959			
SE of regression		0.12040			
Prob(F-statistic)		0.000000			
Durbin-Watson stat		2,085,011			

Source: Data processed using Eviews

Regression Equation :
Y : -0.810871 – 0.007361 LOG(X1) – 0.073971 LOG(X2) – 0.0134625 LOG(X3) + 0.012553 LOG(X4) – 0.044418 LOG(X5) + 0.282947 LOG(X6)

Coefficient of Determination (R2)
Based on Table 6, it can be seen that the coefficient of determination (R2) is 88.07%, meaning that the diversity that can be explained by the factors in the model to the efficiency value is 88.07% while the remaining 11.93% is explained by other factors outside the model

T Test Results (Partial)

1. The X1 variable, namely "Total Equity, obtained a probability value of 0.8393, because the significance level (0.8393) is greater than alpha 5%, H0 is accepted, meaning that the X1 variable, namely "Total Equity" has no significant effect on the efficiency level. The regression coefficient is -0.007361 meaning that a 1% increase in Total Equity can reduce efficiency by 0.007361% assuming ceteris paribus.
2. Variable X2, namely "Cost of Goods Sold" obtained a probability value of 0.0425 because the significance level (0.0425) is smaller than alpha 5%, so H0 is rejected, meaning that the variable X2, namely "Cost of Goods Sold" has a significant effect on the level of efficiency. The regression coefficient is -0.073971 meaning that a 1% increase in Total Equity can reduce efficiency by 0.073971% assuming ceteris paribus.
3. Variable X3, namely "Selling Expenses, obtained a probability value of 0.0000, because the significance level (0.0000) is smaller than alpha 5%, H0 is rejected, meaning that the X3 variable, namely "Selling Expenses" has a significant effect on the level of efficiency. The regression coefficient is -0.134625 meaning that a 1% increase in Total Equity can reduce efficiency by 0.134625% assuming ceteris paribus.
4. Variable X4, namely "General & Administrative Expenses, obtained a probability value of 0.7391, because the significance level (0.7391) is greater than alpha 5%, H0 is accepted, meaning that the X4 variable, namely "General & Administrative Expenses" has no significant effect on the level of efficiency. The magnitude of the regression coefficient is 0.012553 meaning that a 1% increase in Total Equity can reduce efficiency by 0.012553% assuming ceteris paribus.
5. The X5 variable, namely "Other Operating Expenses, obtained a probability value of 0.0002, because the significance level (0.0002) is smaller than alpha 5%, H0 is rejected, meaning that the X5 variable, namely "Other Operating Expenses" has a significant effect on the level of efficiency. The regression coefficient is -0.044418 meaning that a 1% increase in Total Equity can reduce efficiency by 0.044418% assuming ceteris paribus.

6. Variable X6, namely "Net Sales, obtained a probability value of 0.000, because the significance level (0.0000) is smaller than alpha 5%, H0 is rejected, meaning that the X6 variable, namely "Net Sales", has a significant effect on the level of efficiency. The magnitude of the regression coefficient is 0.282947 meaning that a 1% increase in Total Equity can reduce efficiency by 0.282947% assuming ceteris paribus.

F Test Results (Simultaneous)
Prob value. (F-statistic) of 0.000000 <0.05, then H0 is rejected, meaning that the diversity that can be explained by the factors in the simultaneous model has a significant effect on the production efficiency of mining sector companies

Table 6. Table of Panel Regression Analysis Results for *Profit Approach* Efficiency

Variable		**coefficient**	**Std. Error**	**t-Statistics**	**Prob.**
	C	4,720,875	1,883,250	2,506,770	0.09791667
Total Equity	LOG(X1)	-0.151632	0.077623	-1,953,446	0.34722222
Cost of goods sold	LOG(X2)	-0.016826	0.063806	-0.263701	5.50416667
Selling expenses	LOG(X3)	-0.091467	0.039777	-2,299,486	0.16597222
General & Administrative Expenses	LOG(X4)	0.050749	0.079694	0.636798	3.65208333
Other Operating Expenses	LOG(X5)	-0.014407	0.023971	-0.601029	3.81527778
Comprehensive Income for the year	(X6)	2,356,412	5,367,213	4,380,199	0.0000
R-Squared		0.622656			
Adjusted R-squared		0.499799			
SE of regression		0.255281			
Prob(F-statistic)		0.000000			
Durbin-Watson stat		2,545,665			

Source: Data processed using Eviews

Regression Equation :
Y : 4.720875 – 0.151632 LOG(X1) – 0.016826 LOG(X2) – 0.091467 LOG(X3) + 0.050749 LOG(X4) – 0.014407 LOG(X5) + 2.356412 X6

Coefficient of Determination (R2)
Based on Table 7, it can be seen that the coefficient of determination (R2) is 62.26%, meaning that the diversity that can be explained by the factors in the model to the efficiency value is 62.26% while the remaining 37.74% is explained by other factors outside the model.

T Test Results (Partial)
1. The X1 variable, namely "Total Equity, obtained a probability value of 0.0500, because the significance level (0.0500) is smaller than alpha 10%, H0 is rejected, meaning that the X1 variable, namely "Total Equity" has a significant effect on the level of efficiency. The magnitude of the regression coefficient is -0.151632 meaning that a 1% increase in Total Equity can reduce efficiency by 0.151632% assuming ceteris paribus.
2. Variable X2, namely "Cost of Goods Sold" obtained a probability value of 0.7926, because the significance level (0.7926) is greater than alpha 5%, H0 is accepted, meaning that the variable X2, namely "Cost of Goods Sold" has no significant effect on the level of efficiency. The magnitude of the regression coefficient is -0.016826 meaning that a 1% increase in Total Equity can reduce efficiency by 0.016826% assuming ceteris paribus.
3. Variable X3, namely "Selling Expenses, obtained a probability value of 0.0239, because the significance level (0.0239) is smaller than alpha 5%, H0 is rejected, meaning that the X3 variable, namely "Selling Expenses" has a significant effect on the level of efficiency. The magnitude of the regression coefficient -0.091467 means that a 1% increase in Total Equity can reduce efficiency by 0.091467% assuming ceteris paribus.
4. Variable X4, namely "General & Administrative Expenses, obtained a probability value of 0.5259, because the significance level (0.5259) is greater than alpha 5%, H0 is accepted, meaning that the X4 variable, namely "General & Administrative Expenses" has no significant effect on the

level of efficiency. The magnitude of the regression coefficient is 0.050749 meaning that a 1% increase in Total Equity can reduce efficiency by 0.050749% assuming ceteris paribus.

5. The X5 variable, namely "Other Operating Expenses" obtained a probability value of 0.5494, because the significance level (0.5494) is greater than alpha 5%, H0 is accepted, meaning that the X5 variable, namely "Other Operating Expenses" has no significant effect on the level of efficiency. The magnitude of the regression coefficient is -0.014407 meaning that a 1% increase in Total Equity can reduce efficiency by 0.014407% assuming ceteris paribus.
6. X6 variable namely "Current year's Comprehensive Profit" obtained a probability value of 0.000, because the significance level (0.0000) is smaller than alpha 5% then H0 is rejected meaning that the X6 variable namely "Current year's Comprehensive Profit" has a significant effect on the level of efficiency. The magnitude of the regression coefficient is 2.356412 meaning that a 1% increase in Total Equity can reduce efficiency by 2.356412% assuming cateris paribus.

F Test Results (Simultaneous)

Prob value. (F-statistic) of 0.000000 <0.05, then H0 is rejected, meaning that the diversity that can be explained by the factors in the simultaneous model has a significant effect on the profit efficiency of companies in the mining sector.

CONCLUSION

The results of the tests ranked the top 10 average efficiency levels of mining sector companies from the production approach and Production Approach aspects, namely: PT Elnusa, PT Radian Utama Interisnsco, PT Indo Tambangraya Megah, PT Mitra Energi Persada, PT Cita Mineral Investindo, PT AKR Corporindo, PT Bayan Resources, PT Borneo Olah Sarana Sukses Olah Saran Sukses, PT Barramulti Suksessarana, and PT Aneka Tambang, PT TBS Energi Utama. production approach and profit approach, it is necessary to carry out potential improvements by optimizing assets and equity owned in management, reducing selling expenses, general & admin expenses, and operational expenses, and increasing sales growth optimally in accordance with the targets set to *generate* profits *for* the *company on an* ongoing basis. Based on the average efficiency score from 2017 to 2021, there are only 2 (two) companies in the mining sector in Indonesia that are efficient based on *the production approach and 21 (twenty-one) inefficiencies.* Meanwhile, based on *the profit approach* of mining sector companies in Indonesia, only 1 (one) company is efficient and as many as 22 (twenty-two) companies have inefficiencies.

The results of the analysis from *the production approach* show that "Total Equity, General and Administrative Expenses" have no significant effect on the efficiency of *the production approach* while the cost of goods sold, selling expenses, other operating expenses, and net sales have a significant effect on efficiency. The results of the analysis from the *profit approach* show that "total equity, general and administrative expenses, and net sales" have a significant effect on efficiency, while the cost of goods sold, selling expenses, and operating expenses have no significant effect on efficiency.

There are limitations to this study, namely the minimum selection of input and output variables, research using VRS testing in DEA, and limitations on company samples so there is a possibility that it can reduce the validity of the research results. For further research, it is expected to use more than 1 company sector to analyze the level of efficiency between sectors, and adding testing years from this analysis can help to increase the efficiency of companies in Indonesia.

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