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The Effect of The Implementation of Green Accounting and Material Flow Cost Accounting on Profitability (A Study on Mining Companies Listed on The Indonesia Stock Exchange)

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ABSTRACT

Green accounting and material flow cost accounting are approaches in accounting that are a manifestation of the company's concern in managing environmental impacts in its operational activities. This study aims to determine the effect of the implementation of *green accounting* and *material flow cost accounting* on profitability in mining companies listed on the Indonesia Stock Exchange (IDX) for the 2019-2023 period.

The research method used is quantitative with an associative approach. This study takes a sample of companies listed on the Indonesia Stock Exchange (IDX) for the 2019-2023 period using secondary data obtained through the annual *report* and *sustainability report* for the 2019-2023 period and the data is tested using descriptive statistical analysis, classical assumption test in the form of normality test, multicollinearity test, autocorrelation test and heteroscedasticity test, regression analysis test linear and hypothesis tests in the form of determination coefficient test (*Adjust R2*), t test and F test.

The results obtained from this study are normally distributed data. Partially, *green accounting* has a significant effect on the company's profitability. Meanwhile, *material flow cost accounting* partially does not show a significant influence on profitability. Simultaneously, *green accounting* and *material flow cost accounting* together affect the company's profitability. The determination coefficient test showed that some of the variation in profitability could be explained by the two independent variables, while the rest was influenced by other variables. These results reinforce the importance of the comprehensive application of environmental accounting practices in the planning and management of the company's operational activities, especially in the mining industry sector that has a major impact on the environment.

Keywords: Green Accounting, Material Flow Cost Accounting, Profitability

INTRODUCTION

Optimal use of resources can provide maximum profits for the company. The higher the achievement of a company, the more attractive it is for investors to invest in the company. However, along with the increase in the production of mining products, the company's responsibility to preserve the environment and natural resources is also increasing. From an economic point of view, the company's goal is to obtain optimal profits (profit oriented). Profitability reflects the extent to which a company is able to generate profits, as well as being a measure to assess the effectiveness of its financial performance. One of the measuring tools used is the profitability ratio, which is a ratio that shows how much a company is able to make a profit taken from the income statement. If the profitability value is high, it means that the company has a good ability to create profits, on the other hand, low profitability indicates a weak profit-making ability. A company is considered to have good financial performance if it is able to generate large profits, this is because profitability is the end result of various policies and decisions taken by the company's management.[1]

In additon to the purpose of making a profit, the company is also required to have a social obligation to pay attention to environmental stakeholders around the company. The role of the mining sector certainly has a direct or indirect impact on the causes of pollution and environmental damage. Environmental damage can be caused by mining companies, for example the impact of coal mining such as changes in landforms, decreased soil fertility levels, threats to biodiversity, deterioration of water quality, decreased air quality and environmental pollution due to waste generated by mining activities.[2] Mining companies are companies that in their activities are openly related to nature.[3]

Law Number 32 of 2009 explains the importance of balancing natural resource management, the use of natural resources and human interests.[4] However, in reality, there are still violations in the use of Indonesia's nature such as damage or environmental pollution carried out by companies. For example, PT Vale Indonesia, the activities of this company caused the degradation of Lake Mahalona, Tole village, East Luwu Regency, South Sulawesi. From the results of the investigation by WALHI South Sulawesi, the waste from PT Vale Indonesia has accelerated the sedimentation process in the lake so that it forms a new land area filled with fine mud deposits on the shores of Lake Mahalona. This environmental damage not only alters the landscape, but also threatens local biodiversity, as evidenced by the declining population of butini fish which is the third endemic species of lakes in the region.[5]

Companies need to have environmental responsibility as a form of balance that is mutually beneficial, both for the community and the surrounding environment. In this case, green accounting emerged as a solution that can balance the interests of the company with concern for environmental impacts. Through this approach, the company is expected to no longer unilaterally manage resources without paying attention to the social impact of its operational activities.[6] The development of the increasingly advanced world has also encouraged the emergence of new useful science, including in the field of accounting. One of these innovations is Material Flow Cost Accounting (MFCA). Companies generally have various types of environmental costs that need to be managed efficiently, such as waste management and disposal costs, installation construction, costs to third parties, and licensing costs.

Previous research conducted by Roudhatul Amalia et al., shows that green accounting has a

[1] Andi Ayu Frihatni, "The Effect of Profitability Moderation on the Relationship Between Social Responsibility and Corporate Value in the Midst of the Global Economic Crisis," *JIAFE (Scientific Journal of Accounting, Faculty of Economics)* 4, no. 2 (2018): 285–294.

[2] Susi Marlina and M Hafizul Furqan, "The Impact of Coal Mining on the Environment in Gampong Penaga Cut Ujong, West Aceh," *Geosphere Education Journal* Specifically for MBKM USK, no. 2 (2024): 267–278.

[3] Roudhatul Amalia, Muhammad Riza Hafizi, and Arif Mubarok, "The Influence of Implementation *Green accounting* and environmental performance on profitability in mining companies listed on the Indonesia Stock Exchange," *Accounting Journal of Ibrahimy (AJI)* 2, no. 1 (2024): 22–37.

[4] Republic of Indonesia, "Law of the Republic of Indonesia Number 32 of 2009 concerning Environmental Protection and Management" (Jakarta, 2009).

[5] Andhika Indris Bidol, "WALHI South Sulawesi, Demands PT Vale Indonesia's Responsibility for Forest Damage, Lakes, and the Threat of Endemic Biodiversity Loss," Online24Hours, 2019.

[6] Roudhatul Amalia, Muhammad Riza Hafizi, and Arif Mubarok, "The Effect of the Implementation *of Green Accounting* and Environmental Performance on Profitability in Mining Companies Listed on the Indonesia Stock Exchange," *Accounting Journal of Ibrahimy (AJI)* 2, no. 1 (2024): 22–37.

positive and significant effect on profitability.[7] However, there are studies that are contrary to this research such as research conducted by Rusmaida Silalahi showing that green accounting has no effect on company profitability.[8] Meanwhile, material flow cost accounting has a negative effect on the company's profitability. Based on the problems and differences in existing research results, a similar study was conducted with the title "The Effect of the Implementation of Green Accounting and Material Flow Cost Accounting on Profitability in Mining Companies Listed on the Indonesia Stock Exchange".

METHOD

This study uses an associative quantitative method. Associative research is defined as a type of research that utilizes existing data to find and analyze the causal relationship of two or more variables between independent variables and bound variables.[9] This research uses financial statement data or annual reports of mining companies for 2019-2023 which are published through the official *website of* the Indonesia Stock Exchange and the company's website. The data management of this study will use the SPSS Version 25 application. In this study, the population used is all mining companies listed on the Indonesia Stock Exchange in 2019-2023. The *purposive sampling* technique is used in sample selection. Purposive *sampling technique* is a technique for determining samples based on certain criteria or considerations that have been pre-determined.[10]

RESULTS

1. Description of Research Data

The Data used in this study is secondary data in the form of annual report data and sustainability reports of mining companies accessed through the Indonesia Stock Exchange website and the website of each company. The data obtained was then processed to get answers to the formulation of the problems contained in this study, namely whether there is an effect of the implementation of *green accounting* and *material flow cost accounting* on profitability. The object of this study is mining companies listed on the Indonesia Stock Exchange during 2019-2023. A total of 6 mining companies were listed on the Indonesia Stock Exchange for five consecutive years and met the *purposive sampling* criteria used in this study, including: Adaro Energy Tbk (ADRO), Aneka Tambang Tbk (ANTM), Vale Indonesia Tbk (INCO), Medco Energi Internasional (MEDC), Bukit Asam Tbk (PTBA), Timah Tbk (TINS).

2. Variable X Data

The following is the calculation of the return on asset, material flow cost accounting (MFCA) and PROPER rating achieved by the company.

Table 3.1 Return *On Asset Data, Material Flow Cost Accounting* and *Green Accounting* Data used in the study

Yes	Company Name	Stock Code	Year	ROA	GA	MFCA
1	Adaro Energi Tbk	ADRO	2019	6.03	5	0.07
			2020	2.48	5	0.04
			2021	13.56	5	0.09
			2022	26.26	5	0.10
			2023	17.92	5	0.11
2	Aneka	ANTM	2019	0.64	4	0.26

[7] Amalia, Hafizi, and Mubarok, "The Influence of Application" *Green accounting* and environmental performance on profitability in mining companies listed on the Indonesia Stock Exchange," *Accounting Journal of Ibrahimy (AJI)* 2, no. 1 (2024): 22–37.

[8] Rusmaidah Please, please, "Influence" *Green accounting* and material flow cost accounting on the company's profitability (in food and beverage sector companies listed on the Indonesia Stock Exchange)", (STIE Pembangunan Tanjung Pinang, 2023).

[9] Ma'ruf Abdullah, *Quantitative Research Methods* (Yogyakarta: Aswaja Pressindo, 2015), p. 123

[10] Suggestion, *Qualitative Quantitative Research Methods and R&D* (Bandung: CV Alfabeta, 2013) , p. 81.

	Tambang Tbk		2020	3.62	4	0.26
			2021	5.66	5	0.16
			2022	11.36	4	0.20
			2023	7.18	5	0.20
3	Vale Indonesia Tbk	INCO	2019	2.58	4	0.36
			2020	3.58	3	0.36
			2021	6.70	4	0.33
			2022	7.54	4	0.35
			2023	9.38	4	0.36
4	Medco Energy International	MEDC	2019	-0.34	3	0.57
			2020	-2.89	3	0.55
			2021	0.95	3	0.55
			2022	7.76	4	0.48
			2023	4.64	4	0.58
5	Bukit Asam Tbk	PTBA	2019	15.48	5	0.24
			2020	10.01	5	0.22
			2021	22.25	5	0.24
			2022	28.17	5	0.33
			2023	16.23	5	0.29
6	Timah Tbk	TINS	2019	-3.00	4	0.86
			2020	-2.35	4	0.72
			2021	8.87	5	0.47
			2022	7.97	5	0.57
			2023	-3.50	5	0.47

Data Source: Financial Statements and sustainability reports (already processed)

a. Profitability

The results of the Return on Assets (ROA) calculation of the six mining companies show a difference in performance that reflects the condition of each company. PT Adaro Energi Indonesia Tbk (ADRO) experienced a sharp decline in 2020 (2.48%) from 6.03% in 2019 due to the COVID-19 pandemic which suppressed global coal demand. However, from 2021 to 2022, ROA increased dramatically to 26.26% thanks to the recovery in coal prices and increased energy demand, before falling to 17.92% in 2023 which was most likely due to the correction in commodity prices and increased production costs. PT Aneka Tambang Tbk (ANTM) recorded a positive trend from 0.64% (2019) to 11.36% (2022) driven by a surge in nickel prices and operational improvements, but it had decreased to 7.18% in 2023 due to cost pressures and fluctuations in base metal prices. Vale Indonesia Tbk (INCO) showed stable ROA growth from 2.58% (2019) to 9.38% (2023), reflecting improved production efficiency and high demand for nickel for the electric vehicle battery industry.

PT. Medco Energi Internasional Tbk (MEDC) showed significant performance fluctuations with negative ROA in 2019 and 2020 (-0.34% and -2.89%) due to falling oil prices and production disruptions, but improved from 2021 to 2022 due to the recovery of the global energy market. The decline back to 4.64% in 2023 can be attributed to the correction in oil prices and rising exploration costs. PT Bukit Asam Tbk (PTBA), although indirectly referred to in the context of ROA (data is referred to as MFCA but the context and figures show that it is ROA), showed high and stable performance with the highest ROA of 28.17% in 2022, reflecting production optimization and high coal prices. In contrast, PT Timah Tbk (TINS) faced heavy pressure with a negative ROA in 2019–2020 and a negative return in 2023 (-3.50%), caused by low tin prices, high production costs, and structural problems such as overproduction and low

operational efficiency. This shows that each company has a different sensitivity to external factors and internal capabilities in managing assets and responding to industry dynamics.

b. Green Accounting

Green accounting can be measured by looking at the company's environmental performance. Environmental performance can be measured using the PROPER (Company Performance Rating Assessment Program) program conducted by the Ministry of Environment (KLH) to encourage business actors in Indonesia together with the government in creating a sustainable environment.[11]Based on the data obtained, the companies in the research sample showed that the acquisition of PROPER varied at the blue, green and gold levels or in other words had average scores in categories 3,4 and 5. This shows that in general, companies have achieved sufficient to excellent compliance levels in environmental management. This condition supports the assumption that companies that demonstrate good environmental performance tend to have an awareness of efficiency and sustainability, which can contribute to increased long-term profitability.

c. Material Flow Cost Accounting

Material Flow Cost Accounting (MFCA) is a management tool in environmental management that aims to increase the use of materials or production effectively to minimize waste emissions. MFCA is essentially a tool to reduce costs through waste reduction which can ultimately lead to increased business productivity.[12] The results of the material *flow cost accounting* (MFCA) calculation of the six mining companies sampled in this study show significant differences in values between companies and between observation years, namely 2019-2023.

The company with the lowest MFCA score consistently is PT Adaro Energi Tbk (ADRO), with values ranging from 0.04 to 0.11 during the 2019-2023 period. on the other hand, the company with the highest MFCA is PT Timah Tbk (TINS), especially in 2019 with a value of 0.86, although it shows a gradual decline to 0.47 in 2023. Other companies such as PT Aneka Tambang Tbk (ANTM) and PT Bukit Asam Tbk (PTBA) show fluctuating MFCA trends. ANTM recorded a decrease in the MFCA value from 0.26 in 2019 to 0.16 in 2021, but then increased again to 0.20 until 2023, indicating that there are inconsistent efficiency improvement efforts. Meanwhile, PTBA experienced an increase in MFCA in 2022 by 0.33, after previously being in the range of 0.22-0.24. PT Vale Indonesia Tbk (INCO) tends to maintain the MFCA value in the range of 0.33-0.36, which indicates stability in material management even though it has not reached optimal efficiency. Meanwhile, PT Medco Energi Internasional Tbk (MEDC) showed a fairly high and fluctuating MFCA value, from 0.57 in 2019, had decreased to 0.48 in 2022, then increased again to 0.58 in 2023, which indicates that costs related to non-product output are still high.

3. Hypothesis Testing

a. Coefficient of Determination (R2)

Table 3. 2 Determination Coefficient Test Results

Model Summaryb

Type	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.597a	.356	.307	6.24867	1.604
a. Predictors: (Constant), MFCA, *Green accounting*					
b. Dependent Variable: Profitability					

Data Source: SPSS 25 output results, data processed by the author 2025.

[11] O'Neill & O'Neill, "The Impact of Globalization" *Green accounting*, material flow cost accounting, and environmental performance to the company's profitability," *Al-Kharaj : Journal of Sharia Economics, Finance & Business* 6, no. 3 (2023): 2896–2909.

[12] Christine Jach, *Environmental and Material Flow Cost Accounting Principles and Procedures*, 1st ed. (Springer Science & Business Media, 2010), p. 2.

The R Square value is 0.356 or 35.6%. The value of the determination coefficient shows that the *variables of Green Accounting* (X1) and *Material Flow Cost Accounting* (X2) are able to explain the profitability variable (Y) of 35.6% while the remaining 64.4% is explained by other variables.

b. Partial Test

The t-test or partial test is used to find out whether or not there is an effect of the relationship between independent variables on the partially dependent variable. Independent variables are said to have a partial effect on dependent variables if the value of t is greater than t of the table (t count > t table) and the significance value is less than 0.05 (<0.05). The value t of the table can be obtained by the formula.

t = (a/2; n-k-1) with the description:

a = 95% confidence level = 0.05

n = Number of samples

k = Number of independent variables

From the results of the partial test using SPSS, it can be analyzed as follows:

Table 3.3 Partial Test Results (t-test)

Coefficient

Type		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-4.197	4.394		-.955	.348
	Green accounting	3.941	.861	.471	4.577	.000
	MFCA	-15.732	2.901	-.559	-5.423	.000
a. Dependent Variable: Profitability						

Data Source: SPSS 25 output results, data processed by the author 2025.

a) The Effect of Green Accounting variable on the Profitability variable

Based on the data above, it can be seen that a = 0.05 with the calculation that t table = (0.05/ 2 ; 30 -2 -1) with a result (0.025 ; 27 = 2.05183), then the results of the t test on *the green accounting* variable partially show that the significant value of *the green accounting* variable (X1) against the profitability variable (Y) is 0.000 < 0.05 and the t-value is calculated 4.577 > the t-value of the table is 2.051. The results of this test mean that *the green accounting* variable has a significant effect on the profitability variable. The effect of *the Material Flow Cost Accounting* variable on the Profitability variable.

b) The effect of the Material Flow Cost Accounting

Based on the data above, it can be seen that a = 0.05 with the calculation that t table = (0.05/ 2 ; 30 -2 -1) with a result (0.025 ; 27 = 2.05183), then the results of the t test on the *Material Flow Cost Accounting* variable partially show that the significant value of the *Material Flow Cost Accounting* variable (X2) to the profitability variable (Y) is 0.000 < 0.05 and the t-value is calculated -0.559 < the table t-value is 2.0518. The results of this test mean that the *Material Flow Cost Accounting* variable has no effect on the profitability variable.

c. Simultaneous Test (F)

The F test aims to determine the influence of independent variables on dependent variables. The test is performed by comparing the F calculation with the F value of the table and looking at the significance value. If the value of F is greater than the F of the table (F is calculated > F table) and the significance value is less than 0.05 (<0.05), then simultaneously there is a significant influence of the independent variable on the dependent variable.

Table 3.4 Simultaneous Test Results (F Test)

NEW ERA

Type		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	721.145	2	360.573	7.687	.002b
	Residual	1266.484	27	46.907		
	Total	1987.630	29			
a. Dependent Variable: Profitability						
b. Predictors: (Constant), MFCA, *Green accounting*						

Data Source: SPSS 25 output results, data processed by the author 2025.

Based on the table above, it shows a significance value of 0.002, so this value is smaller than the significance level of 0.05 (0.002 < 0.05). For the results of the comparison of F calculation and F tables as follows:

F count = 7,687
F table = F(a; n-k-1)
= F (0.05; 30-2-1)
= F (0.05; 27)
F table = 3.35

It can be concluded that F counts (7.68) > F tables (3.35). Based on this data, it can be said that the results of testing the variables of *green accounting* and *material flow cost accounting* have a simultaneous effect on profitability.

DISCUSSION

The Influence of Green Accounting on Profitability

Based on the results of partial testing on the green accounting variable, it shows that the green accounting variable has a significant effect on the profitability variable. Increasing the implementation of green accounting, which in this study is measured through the PROPER indicator, can encourage increased profitability. The implementation of green accounting allows companies to effectively manage environmental costs, improve operational efficiency, and improve the company's image in the eyes of stakeholders.

The results of this study are in line with the research conducted by Roudhatul Amalia, Muhammad Riza Hafizi and Arif Mubarok who obtained research results that show that green accounting has a positive and significant influence on profitability.[13] This research is also in line with research conducted by Ezra Pasaribu who explained that green accounting has an effect on profitability.[14] The results of this consistent research mean that green accounting is not only an obligation to comply with environmental regulations, but also a business strategy that supports the achievement of financial performance.

The Effect of Material Flow Cost Accounting on Profitability

Based on the results of partial testing on the Material Flow Cost Accounting variable, it shows that the Material Flow Cost Accounting variable has no effect on the profitability variable. These findings mean that although MFCA is an approach that focuses on material management efficiency and waste reduction, its impact is not necessarily directly reflected in the increase in the company's profit. This indicates that the benefits of MFCA may be more visible in the long term or in non-financial aspects such as production process efficiency and environmental management.

The result of this study are in line with the research conducted by Rani Melati Oktadifa and Tituk Diah Widajantie who obtained research results that show that material flow cost accounting has no

[13] Amalia, Hafizi, and Mubarok, "The Influence of Application" *Green accounting* and environmental performance on profitability in mining companies listed on the Indonesia Stock Exchange."

[14] Ezra Pasaribu, "The Influence of Implementation *Green accounting* On the profitability of food and beverage companies listed on the Indonesia Stock Exchange in 2016-2020."

effect on profitability.[15] This research is also in line with the research conducted by Muhammad Ilyas who explained that material flow cost accounting has no effect on profitability.[16] MFCA requires an understanding of the method in calculating the cost of production materials, if it does not run smoothly, it will not produce profitability.

The Effect of Green Accounting and Material Flow Cost Accounting on Profitability

Based on the results of the calculation of the F test, it can be seen that the Green Accounting variable and the Material Flow Cost Accounting variable have a simultaneous significant influence on profitability measured by ROA. This means that the application of the two approaches can complement each other in companies' efforts to increase efficiency, reduce waste and increase economic and environmental value simultaneously. In a capital-intensive mining industry with high environmental risks, the implementation of sustainable accounting is a strategic step to reduce waste and increase operational effectiveness.

The results of this study are consistent with the research conducted by Anugerah Alif Putera, where the results of the study show that green accounting and material flow cost accounting have a simultaneous effect on profitability.[17] Mining companies that integrate green accounting and MFCA not only demonstrate compliance with environmental regulations, but also optimize efficient internal processes. The combination of these two approaches strengthens the company's sustainability management system, which in turn contributes to the improvement of overall financial performance.

CONCLUSION

Based on the results of the research conducted ""The Effect of the Implementation *of Green Accounting* and *Material Flow Cost Accounting* (MFCA) on Profitability (Study on Mining Companies Listed on the Indonesia Stock Exchange)", it can be concluded:

a. Based on research conducted by *Green accounting, partial green accounting* has a significant influence on profitability in mining companies listed on the Indonesia Stock Exchange in 2019-2023.
b. Based on the research conducted, it is known that *Material Flow Cost Accounting* partially has no effect on profitability in mining companies listed on the Indonesia Stock Exchange in 2019-2023.
c. Based on research conducted by *Green accounting* and *Material Flow Cost Accounting*, they have a simultaneous effect on the Profitability of mining companies listed on the Indonesia Stock Exchange in 2019-2023.

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