



The Effect of Material Flow Cost Accounting on Environmental Performance with Green Accounting as a Moderator

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Abstract

The aim of this research is to determine the effect of Material Flow Cost Accounting on Environmental Performance with Green Accounting as a moderating variable. This research uses a quantitative type of research using a purposive sampling method as data analysis. This research uses secondary data in the form of documentation obtained on websites, namely the company's annual report (Annual Report), financial report (Financial Report) and sustainability report (Sustainability Report) obtained from the Indonesian Stock Exchange website and the websites of the companies that is the research sample. The number of mining companies included in the research sample criteria is 12 companies listed on the Indonesia Stock Exchange with the observation year 2015-2020. The results of this research show that Material Flow Cost Accounting does not have a significant positive effect on Environmental Performance. Meanwhile, Green Accounting as a moderating variable cannot strengthen the relationship between Material Flow Cost Accounting and Environmental Performance. The capability of the regression model is that only 11.7% of the variation in the value of the Environmental Performance variable can be explained by variations in the independent variables, while the remaining 88.3% is influenced by other variables not examined by this research.

1. INTRODUCTION

Companies operating in the mining sector are known for their substantial contributions to economic growth. This phenomenon is attributed to the surging global demand for mining commodities, driven by the increasing need for energy resources like natural gas, petroleum, and coal. Mining activities, as defined in Law Number 4 of 2009, concerning Mineral and Coal Mining (UU No. 4/2009), encompass a wide spectrum of operations, including general investigations, exploration, feasibility studies, construction, mining, processing, refining, transportation, sales, and post-mining activities.

Despite the positive impact of mining sector companies on a nation's economic growth, it is essential to acknowledge the detrimental effects they can have. These negative impacts stem from the exploitation of natural resources during mining operations and have severe consequences for the environment, as reported by Kompas in 2021. Mining activities alter the geographical landscape, leading to soil degradation. They also contribute

to air and water pollution through residue and smoke emissions, water wastage, and the release of dangerous substances in tailings and mining waste. Furthermore, mining activities can lead to geographical conditions that increase the risk of landslides, create large, irreversible holes in the earth's surface, and disrupt the natural ecosystem's balance in the surrounding areas, as noted by Listiyani in 2017. In essence, while the mining sector plays a crucial role in driving economic growth, it must be managed responsibly to mitigate its adverse environmental impacts.

The East Kalimantan Mining Advocacy Network (Jatam) has uncovered a distressing revelation: former mining pits in East Kalimantan have tragically claimed the lives of 32 individuals over the past seven years. In addition to these fatalities, the region has witnessed the discovery of 632 excavation sites left behind, evident marks of the mining industry's impact on the local population. Moreover, the expansion of mining activities has placed significant pressure on agricultural lands in East Kalimantan, compelling rice fields



to be relocated. This displacement, in turn, has led to a reduction in available agricultural land. Furthermore, the adverse effects of mining waste directly threaten the sustainability of rice cultivation in the region, rendering ex-mining areas unsuitable for rice farming.

The situation is particularly dire in Bahodopi, East Bungku, Bungku Pesisir, and Menui Islands sub-districts of Morowali Regency. Additionally, most coastal areas in East Bungku and Bungku Pesisir sub-districts have fallen victim to pollution from mining waste carried by water during the rainy season. This pollution has resulted in murky waters, with remnants of ore settling into the seabed and severely contaminating the delicate mangrove ecosystems, as reported by Kompas in 2021. These distressing developments underscore the urgent need for responsible mining practices and environmental safeguards to protect both lives and the fragile ecosystems in East Kalimantan.

These challenges have prompted external stakeholders such as communities, environmental agencies, and the government to demand that mining companies become more environmentally conscious in their operations and disclosure practices. Previously, many companies in the mining sector primarily adhered to traditional accounting principles with limited regard for environmental concerns. However, there is a noticeable shift towards the adoption of management accounting concepts that take into account environmental impacts. This shift is encapsulated by the concept known as Environmental Management Accounting (EMA). According to IFAC (2005), EMA refers to the management of both environmental and economic performance through the implementation of accounting practices and systems that are specifically designed to address environmental issues. The successful implementation of EMA principles within a company is reflected in its Environmental Performance, which measures how effectively the company contributes to environmental preservation. A company's strong

environmental performance can significantly influence its reputation among stakeholders. Handayani (2010) asserts that as companies become more actively engaged in environmental initiatives, they are compelled to provide greater transparency regarding their environmental performance in their annual reports. This heightened transparency demonstrates the company's commitment to taking responsibility for the environmental consequences of its operational activities (as cited in Putra, 2017). As a result, EMA not only benefits the environment but also enhances a company's image and accountability to its stakeholders.

To enhance a company's success in improving its Environmental Performance, there is a valuable tool at its disposal known as Material Flow Cost Accounting (MFCA). The International Organization for Standardization (ISO) has established the ISO 14051 standard, which defines MFCA as an Environmental Management Accounting tool designed to address environmental issues by identifying material flow costs incurred during the production process, including production costs. Loen (2018), in his research, highlights that Material Flow Cost Accounting (MFCA) represents one of the environmental management accounting methods specifically aimed at simultaneously reducing costs and environmental impacts. The concept of Material Flow Cost Accounting involves the identification of production costs associated with the utilization of materials, such as raw materials, as well as system and energy costs. This approach helps companies gain a deeper understanding of the potential environmental consequences and waste generated during their production processes. Consequently, it encourages greater attention to waste management practices, ultimately contributing to environmental sustainability.

Previous research has shown variations in the independent variable, specifically Sustainable Development, while the common factor underlying this research is environmental damage. The results of



Selpiyanti & Fakhroni (2020) and those of Loen (2018) both indicate that the implementation of Green Accounting and Material Flow Cost Accounting exerts a positive and significant impact on the enhancement of Sustainable Development. This contrasts with the findings of Loen (2019), which suggest that Material Flow Cost Accounting does not yield a positive effect on Sustainable Development.

In the endeavor to align company production processes with the goal of mitigating environmental impacts, companies can employ not only Material Flow Cost Accounting but also the concept of Green Accounting. Green Accounting serves as a valuable tool for evaluating environmental activities in terms of costs, referred to as environmental costs, and their associated benefits or economic gains. Additionally, it assesses the environmental protection effects of these activities (Almilia & Wijayanto, 2007). Green Accounting can be defined as an accounting approach that identifies, measures, evaluates, and discloses costs linked to organizational activities related to the environment (Kusumaningtias, 2013). This technique takes into account assets, environmental aspects, and changes with the primary aim of enhancing revenue and aligning with ongoing developments while considering both current and future needs (Dewi & Narayana, 2020). Green Accounting serves as a complementary concept to Material Flow Cost Accounting, as it aids in the identification of material flow costs associated with adverse environmental consequences. This, in turn, assists management in making informed decisions to enhance material flow efficiency with the objective of minimizing adverse environmental impacts. In doing so, companies can proactively address the waste generated as a result of their activities, demonstrating their commitment to environmental responsibility.

Previous research conducted by Abdullah & Amiruddin (2020) has demonstrated that Green Accounting plays a significant role in strengthening the relationship between Material Flow Cost Accounting and expanding an organization's carrying capacity.

Additionally, Nuryanti et al. (2019) have found that Green Accounting exerts a substantial influence, amounting to 97.4%, on Environmental Performance within textile companies operating in the Bandung area that adhere to the PROPER (Program Penilaian Peringkat Kinerja Perusahaan dalam Pengelolaan Lingkungan Hidup) framework. However, contrasting results have been observed in other studies. For instance, Hernawati (2018) has shown that Green Accounting weakens the relationship between Material Flow Cost Accounting and enhancing a company's sustainability. Given the background outlined above, which underscores the importance of environmental consideration for mining companies, as evidenced by their environmental performance, and the existing gaps in prior research regarding the impact of Material Flow Cost Accounting and Green Accounting on Environmental Performance, the researcher is motivated to conduct an empirical study. The study aims to investigate the Effect of Material Flow Cost Accounting on Environmental Performance, with Green Accounting serving as the moderator. This empirical research will focus on mining companies listed on the Indonesia Stock Exchange during the period from 2015 to 2020.

2. LITERATURE REVIEW

2.1 Environmental Management Accounting Theory

Environmental management costs stemming from waste or refuse are not solely limited to waste levy expenses; they encompass a broader spectrum of related costs. These include outlays for personnel responsible for waste handling, internal transportation expenses, expenditures for storage and handling facilities, energy costs, expenses for purchased materials that eventually become waste, and the depreciation of equipment related to waste management. These costs collectively represent hidden expenditures within environmental management. To address these challenges, Environmental Management Accounting (EMA) was developed (Cahyandito,



2009). EMA, as defined by the International Federation of Accountants (IFAC) and the United Nations Division for Sustainable Development (UNSD), involves the systematic and monetary management of environmental aspects. This is achieved through the implementation of appropriate accounting frameworks and practices that entail the identification, collection, measurement, processing, characterization, and reporting of ecological data—both physical and financial. This data assists in navigating the intricacies of environmental considerations. This theoretical framework serves as the foundation for studies supporting the concept of Material Flow Cost Accounting (MFCA). As per the ISO (International Organization for Standardization) official website, ISO 14051 standardizes Material Flow Cost Accounting (MFCA) and elucidates that MFCA is one of the tools within the realm of environmental management accounting. It is specifically designed to address environmental challenges by tracking material flows and associated costs comprehensively

2.2 Material Flow Cost Accounting

The standardization of Material Flow Cost Accounting (MFCA) is elucidated by ISO (International Organization for Standardization), which is a federation of national standards bodies (ISO member bodies). ISO 14051, part of the ISO 14000 family of environmental management standards, was officially published in 2011 under the purview of the International Organization for Standardization (ISO 14051, 2021). This international standard serves as a comprehensive framework for MFCA and is instrumental in helping organizations gain insights into the potential environmental and financial ramifications of their material and energy utilization practices. By implementing MFCA, organizations can identify opportunities for simultaneous environmental and financial improvements through modifications in these practices (ISO 14051, 2021).

Material Flow Cost Accounting involves the identification of material flow costs, including those related to energy, water, and system expenses, and their integration into production costs. This enables organizations to assess the efficiency of their production processes. If a company produces excessive waste relative to its output, it signifies inefficient production practices that have adverse environmental consequences. The aim of MFCA is to facilitate decision-making that enhances production process efficiency, thereby reducing the environmental footprint and minimizing excessive costs (ISO 14051, 2021).

Loen (2018) has emphasized that the adoption of the MFCA model can yield internal benefits and efficiency improvements while simultaneously reducing adverse environmental impacts. This, in turn, advances overall company management. By identifying material flow costs, MFCA enables the formulation of decisions that carry significant environmental implications, ultimately aimed at minimizing negative environmental impacts and addressing waste generation resulting from operational activities. This serves as a model for detecting material losses, assessing production efficiency, and, consequently, enhancing production performance with the objective of reducing material waste and, in other words, mitigating negative environmental impacts.

Previous research conducted by Selpiyanti & Fakhroni (2020) has indicated that both Green Accounting and Material Flow Cost Accounting have a positive and significant impact on the enhancement of Sustainable Development. When a company aligns its activities with the goal of promoting sustainable development, a key factor in achieving this is the improvement of the company's Environmental Performance. It is essential to recognize that taking resources from nature, without proper measures to restore equilibrium, can result in environmental damage that adversely affects various stakeholders.

Reinforcing these earlier findings, Loen (2018) conducted research and found a positive



influence of Material Flow Cost Accounting (MFCA) and the implications of Green Accounting on Sustainable Development (SDv). Additionally, Resource Efficiency was identified as a moderating variable that strengthens the relationship between Material Flow Cost Accounting and Green Accounting with Sustainable Development.

Furthermore, in a separate study by Marota (2017), which focused on companies involved in the manufacturing of medical equipment, hospital equipment, and furniture, it was observed that Green Accounting and Material Flow Cost Accounting had a significant influence on the dimension of sustainability. Specifically, MFCA was instrumental in assessing the magnitude of material loss costs and production waste, highlighting its role in promoting sustainability. Based on the aforementioned observations, the following hypothesis is formulated:

H1: Material Flow Cost Accounting has a significant positive effect on Environmental Performance

2.3 Green Accounting

The concept of Green Accounting complements Material Flow Cost Accounting by aiding in the identification of material flows and systems, such as energy and water usage, as well as other costs associated with production processes related to the environment. The primary objective is to facilitate decision-making aimed at increasing production efficiency while minimizing adverse environmental impacts and effectively managing generated waste.

As described by Aniela (2012), Green Accounting entails an accounting approach that recognizes, measures, assesses, and discloses costs linked to organizational activities related to the environment (as cited in Hardianti, 2017). It serves as a means for corporations to enhance their environmental responsibility, expand ecological transparency, and develop strategies to address environmental challenges within their corporate relationships.

Additionally, it enables organizations to cultivate a positive image, which fosters credibility with external stakeholders. Material losses, as assessed by Material Flow Cost Accounting, represent a tangible manifestation of negative environmental impacts in the form of waste generation. The fundamental goal of the Green Accounting concept is to facilitate the identification and treatment of these impacts by approaching environmental activities through the lens of ecological costs (environmental costs) and the associated benefits or economic gains. Furthermore, it aims to produce environmental protection effects.

Hernawati's research in 2018 has demonstrated that Green Accounting, when introduced as a moderating variable, has the capacity to strengthen the relationship between Material Flow Cost Accounting and the enhancement of a company's sustainability. Green Accounting assists Material Flow Cost Accounting in recognizing and quantifying costs related to environmental aspects. Building on this, subsequent findings by Abdullah & Amiruddin (2020) suggest that Green Accounting can moderate the impact of Material Flow Cost Accounting on the improvement of a company's sustainability. This emphasizes the importance of having accurate information about the quantity and rationale for the utilization of energy, water, and materials to reduce the ecological footprint throughout the production cycle.

Green Accounting plays a pivotal role in identifying energy and water use efficiency, land utilization, and other factors, all aimed at guiding decisions to enhance production efficiency while minimizing environmental impacts. Nuryanti et al.'s research in 2019 found that Green Accounting exerted a significant influence, amounting to 97.4%, on Environmental Performance within textile companies operating in the Bandung area, which adhere to the PROPER (Program Penilaian Peringkat Kinerja Perusahaan dalam Pengelolaan Lingkungan Hidup) framework. In contrast, Hernawati's research in 2018, specifically in hypotheses 4 and 5, yielded



different outcomes, indicating that Green Accounting weakened the relationship between Material Flow Cost Accounting (MFCA) – encompassing production costs and factory area – and the enhancement of company sustainability. Given the diverse findings outlined above, the following hypothesis is formulated:

H2: Green Accounting strengthens the relationship between Material Flow Cost Accounting and Environmental Performance

3. RESEARCH METHODS

The research method employed in this study is quantitative research, which, as per Sugiyono (2017), is based on the philosophy of positivism. It is utilized to investigate specific populations or samples, involving the collection of data through research instruments. This method primarily deals with quantitative or statistical data analysis, with the goal of describing and testing pre-established hypotheses. In this research, the author utilizes quantitative data, represented in numerical form. Secondary data serves as the source of information for this study.

The secondary data sources include financial reports, annual reports, and sustainability reports from mining companies listed on the Indonesia Stock Exchange (IDX) during the 2015-2020 period. These data were obtained from financial reports and annual reports available on the IDX website (www.idx.co.id), as well as sustainability reports from each company's official website. The research population consists of 49 mining companies listed on the IDX for the aforementioned period. For the sample selection, a purposive sampling method was employed. This method is a tool for selecting research samples with the intention of ensuring the data collected is more representative.

The sample selection criteria for this study are as follows: 1) Mining companies listed on the Indonesia Stock Exchange (BEI) during the 2015-2020 period. 2) Companies that have published complete annual financial reports on

the IDX website during the 2015-2020 period. 3) Companies with comprehensive data corresponding to the variables needed for the study during the 2015-2020 research period. Based on the above criteria, a total of 12 companies met the requirements, resulting in a sample size of 72 observations over the 6-year period from 2015 to 2020. The following is the list of companies selected for the research during the 2015-2020 period: [Insert list of selected companies]:

Table 1.

No	Code	Company name
1	ADRO	PT. Adaro Energy Tbk
2	ANTM	PT. Aneka Tambang Tbk
3	EARTH	PT. Bumi Resources Tbk
4	BYAN	PT. Bayan Resources Tbk
5	GEMS	PT. Golden Energy Mines Tbk
6	HRUM	PT. Harum Energy Tbk
7	INCO	PT. Vale Indonesia Tbk
8	ITMG	PT. Indo Tambangraya Tbk
9	KKGI	PT. Resource Alam Indonesia Tbk
10	PTBA	PT. Bukit Asam Tbk
11	TINS	PT. Timah Tbk
12	TOBA	PT. Toba Bara Sejahtera Tbk

The operational variables used aim to determine the measurement scale of each variable, so that hypothesis testing using tools can be carried out appropriately in this research.

Table 2.

Variables	Indicators	Scale
Material Flow Cost Accounting (X)	<div style="border: 1px solid black; padding: 5px; display: inline-block;">MFCA = BP</div> Information : Production costs (Morata, 2017)	Interval s
Environmental Performance (Y)	Score : Gold = 5 Greens = 4 Blue = 3 Red = 2 Black = 1 (Son & Utami, 2017)	Nominal



Green Accounting (Z)	$GA = \frac{\text{Jumlah skor yang diperoleh}}{\text{Jumlah skor pengungkapan}}$ <p>(Puspita Maharani & Susi Handayani, 2021)</p>	Nomina 1
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The data analysis technique employed in this research involved the utilization of a simple linear regression analysis tool to test the hypotheses. Several tests were conducted to assess data quality, encompassing classic assumption tests such as normality, multicollinearity, heteroscedasticity, and autocorrelation tests. The generation of hypotheses was facilitated through partial tests, also known as t-tests, which aimed to measure

the extent to which an individual independent variable influences variations in the dependent variable (Ghozali, 2016). Additionally, an interaction test of moderating variables was conducted using Moderated Regression Analysis (MRA).

4. RESULTS AND DISCUSSION

4.1 Research results

4.1.1 Simple Linear Regression Analysis

In simple linear regression analysis the relationship between variables is linear, where changes in X will be followed by changes in variable Y permanently.

Table 3.

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,786	,059		30,324	,000
	SQRT_X	3.827E-5	,000	,224	1,905	,061

a. Dependent Variable: SQRT_Y

4.1.2 Results of Simple Regression Analysis

$$Y = 1.786 + 3.827 + e$$

The simple linear regression equation obtained can be explained as follows:

1. The constant value (α) of 1.786 shows that if the Material Flow Cost Accounting variable as an independent variable has a value of zero (0), then there is no additional average increase in environmental performance (Environmental Performance) of 1.786.
2. The regression coefficient β The regression coefficient is positive, so that if there is a change in increasing Material Flow Cost Accounting it will be followed by a change in increasing Environmental Performance.

4.1.3 t test

Next, to find out whether this influence is significant or not, the regression coefficient value of the Material Flow Cost Accounting variable will be tested for significance as follows:

1. H0: Material Flow Cost Accounting (X) has no significant positive effect on Environmental Performance (Y).

2. H1: Material Flow Cost Accounting (X) has a significant positive effect on Environmental Performance (Y).

The basis for making significant influence decisions is as follows:

1. If the sig value is > 0.05 then H0 is accepted and H1 is rejected
2. If the sig value < 0.05 then H0 is rejected and H1 is accepted

Based on the results of the partial test (t test) regression analysis obtained a significant value of $0.061 > 0.05$. Thus, it can be concluded that Material Flow Cost Accounting (X) does not have a significant positive effect on Environmental Performance (Y). So, the conclusion is the first hypothesis (H1) is rejected.

4.1.4 Moderated Regression Analysis (MRA)

Test

Table 4.

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,967	,119		16,477	,000
	SQRT X	-7.583E-5	,000	-,443	-1,339	,185
	SQRT Z	-,287	,257	-,480	-1.115	,269
	SqrtXZ	,000	,000	1,139	1,762	,083

a. Dependent Variable: SQRT Y

Moderated regression analysis regression equation:

$$Y = 1.967 - 7.583 - 0.287 + 0.000 + e$$

moderated regression analysis (MRA) equation obtained can be interpreted that from the results of the interaction of the multiplication of the independent variables Material Flow Cost Accounting with the Green Accounting moderating variable (X*Z) has a

significant value of 0.083 > 0.05. Thus, it can be concluded that the Green Accounting variable cannot strengthen the relationship between Material Flow Cost Accounting and Environmental Performance. So, the conclusion is that the second hypothesis (H2) is rejected.

4.1.5 Test of the Coefficient of Determination (R²)

Table 5.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,342 ^a	,117	,077	,17425

a. Predictors: (Constant), SqrtXZ, SQRT_X, SQRT_Z

Based on Table 5 above, it shows that the R square value is 0.117 or 11.7%. This means that 11.7% of the variation in the value of the Environmental Performance variable can be explained by variations in the independent variables, namely Material Flow Cost Accounting and Green Accounting, while the remaining 88.3% is influenced by other variables not examined in this research.

4.2 Research Discussion

4.2.1 Effect of Material Flow Cost Accounting on Environmental Performance

Based on the aforementioned results, it can be elucidated that Material Flow Cost Accounting does not possess the capability to influence an enhancement in the company's Environmental Performance. Material Flow Cost Accounting primarily serves the purpose of

identifying material flow cost efficiency and assisting companies in making informed decisions in this regard. However, this process remains in the identification stage, lacking a definitive resolution to implement such efficiency. Moreover, material flow efficiency is associated with a significantly negative impact on the environment. Specific disclosures regarding this efficiency are absent, making it challenging for stakeholders to discern these efforts as activities aimed at minimizing negative environmental impacts and enhancing the company's environmental performance.

Consequently, it can be concluded that Material Flow Cost Accounting does not exert a significant positive effect on Environmental Performance. Environmental Management Accounting theory, as delineated by the International Federation of Accountants (IFAC)



and the United Nations Division for Sustainable Development (UNSD), encompasses the implementation of ecological and financial management through the establishment of accounting frameworks and practices. These frameworks and practices serve the purpose of distinguishing, collecting, measuring, processing, categorizing, and analyzing data related to the environment (both physical and financial).

They are instrumental in facilitating both internal and external oversight. The International Organization for Standardization (ISO) has further standardized this concept with ISO 14051, which elucidates Material Flow Cost Accounting as one of the tools within Environmental Management Accounting for addressing environmental issues by identifying material flow costs within the production process in accounting practices (production costs).

According to Hyršlová et al. (2011), the fundamental concept of Material Flow Cost Accounting (MFCA) is centered around the notion that all potential data sources, encompassing materials, energy, water, and other information sources, are not comprehensively resolved by a specific community or entity. Instead, estimates are made regarding the costs associated with materials, energy, and resources consumed in various processes, including material losses, as emphasized by Loen (2019). Material Flow Cost Accounting functions to identify and quantify material flows, including energy and water flows, as well as system costs integrated into the overall production costs. By examining production costs, companies can pinpoint material flow costs occurring throughout the production process. It is essential to acknowledge that the concept of Material Flow Cost Accounting remains in the identification stage, with no finalization of efficiency or the disclosure of material flow cost efficiencies.

The outcomes of this research are corroborated by the findings of Loen (2019), which indicated that Material Flow Cost Accounting (MFCA) does not exhibit a

discernible impact on Sustainable Development (SDv). Loen's research in 2018 revealed that the significance level obtained was smaller than the required threshold, leading to the conclusion that Material Flow Cost Accounting does not significantly affect Sustainable Development. Sustainable Development, characterized by its commitment to preserving environmental well-being for future generations, necessitates that companies go beyond the pursuit of profits and actively engage in environmental improvement efforts. Consequently, Loen (2018) investigated the application of the Material Flow Cost Accounting concept in environmental improvement but found that it did not yield a significant influence on Sustainable Development.

The perspective of the Triple Bottom Line Theory emphasizes that for a company to achieve sustainable business and survival, it must prioritize the "3Ps": profit, people (community welfare), and planet (environment). Among these, the environment plays a crucial role. Exploiting natural resources without considering their negative impacts can be detrimental to external stakeholders, leading to a social contract that questions the company's existence. In this research, the failure to address the environmental aspect through Material Flow Cost Accounting poses a threat to the company's survival, as it cannot enhance its Environmental Performance. Various external stakeholders may perceive this as a threat to the company's existence. On the other hand, Stakeholder Theory distinguishes between internal and external stakeholders, with a focus on environmental concerns.

This theory asserts that if a company's activities harm external stakeholders, these external parties can jeopardize the company's existence. Stakeholder Theory underscores the importance of companies being attentive to the negative environmental consequences of their operations. The findings of this research demonstrate that Material Flow Cost Accounting does not lead to improvements in Environmental Performance. Consequently, the negative impacts persist, causing losses for



external stakeholders, particularly the community affected by adverse environmental effects. This situation can trigger a social contract and potentially legal action, further endangering the company's existence.

Conversely, the Legitimacy Theory underscores the importance of companies adhering to prevailing norms within the Indonesian community and environment where they operate. This concept asserts that companies should not only pursue maximum profits but also strive for accountability, environmental mitigation, and improvement to cultivate a positive image. This positive image is vital for gaining acceptance and legitimacy from external stakeholders.

However, in the context of this research, Material Flow Cost Accounting's inability to enhance Environmental Performance results in adverse impacts on stakeholders. This, in turn, leads to a social contract between the company and its stakeholders, culminating in disapproval of the company's existence—an effect known as a "legitimacy gap." Such a gap poses a significant threat to the company's survival, particularly if it faces legal repercussions due to the disapproval of its activities that may be deemed detrimental. All three theoretical perspectives described above underline the crucial importance of companies paying attention to the negative environmental impacts of their activities, as these impacts can harm external parties and jeopardize the company's legitimacy and existence.

4.2.2 The role of Green Accounting in strengthening the influence of Material Flow Cost Accounting on Environmental Performance

Aniela (2012) defines Green Accounting as an accounting practice that identifies, measures, assesses, and discloses activities related to a company's environmental impact (as cited in Hardianti, 2017). Green Accounting plays a crucial role in disclosing a company's activities related to the environment, contributing to its environmental performance reporting. The results of the interaction testing

for the moderating variable indicate that when Material Flow Cost Accounting is measured through production costs, it includes various non-environmental costs typical of the mining sector. This complexity makes it challenging for Green Accounting to identify activities related to the environment, hindering its ability to assist Material Flow Cost Accounting in analyzing environmental material flows.

Consequently, Green Accounting, as a moderating variable, does not strengthen the impact of Material Flow Cost Accounting on Environmental Performance. These findings are consistent with Hernawati's (2018) research, particularly hypotheses 4 and 5, which demonstrate that Green Accounting weakens the relationship between Material Flow Cost Accounting (including production costs and factory area) and a company's sustainability. In addition to financial performance, a company's sustainability is also influenced by its environmental performance.

Therefore, Hernawati (2018) examined Material Flow Cost Accounting with Green Accounting as a moderating variable, yielding similar results to this study—Green Accounting, as a moderating variable, does not enhance the influence of Material Flow Cost Accounting on Environmental Performance.

5. CLOSING

Based on the results of data analysis and the results of the discussion, the conclusions of this study are as follows: (1) Material Flow Cost Accounting has no significant positive effect on Environmental Performance. Identification of material flow costs during the production process cannot minimize negative environmental impacts and cannot improve environmental performance. (2) Green Accounting is unable to strengthen the relationship between Material Flow Cost Accounting and Environmental Performance. Material Flow Cost Accounting measurement proxy through production costs where the entire production cost includes several non-environmental costs, this makes Green Accounting have difficulties in helping Material



Flow Cost Accounting analyze material flows to improve Environmental Performance.

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