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The Effect of Green Intellectual Capital, Green Accounting, and Material Flow Cost Accounting on the Environmental Performance of Mining Companies in the period 2019-2023

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ABSTRACT : *This study aims to explore various factors supporting environmental performance in the mining sector. Among these factors, green intellectual capital, green accounting, and material flow cost accounting have been identified as effectively enhancing environmental performance. Therefore, this research examines the effect of Green Intellectual Capital, Green Accounting, and Material Flow Cost Accounting on the Environmental Performance of Mining Companies Listed for the 2019-2023 Period and have participated in PROPER for the 2019-2023 period. This study is quantitative, using secondary data in the form of annual reports and sustainability reports from 12 companies that published annual reports and sustainability reports during 2019-2023 consecutively and have participated in PROPER for the 2019-2023 period. The sample of this study was selected using the purposive sampling method. Data analysis was carried out using the SPSS version 26 analysis tool and using multiple linear regression techniques. The results showed that the application of green intellectual capital has a significant positive effect on environmental performance, then the application of green accounting has a significant positive effect on environmental performance, and the application of material flow cost accounting has a significant positive effect on environmental performance.*

Keywords : *Green Intellectual Capital, Green Accounting, Material Flow Cost Accounting, Environmental Performance*

I. INTRODUCTION

The mining industry in Indonesia has experienced rapid growth in recent years and has become one of the industries favored by investors to invest their capital. The activities of companies operating in the mining industry not only bring positive impacts on the national economy but also have negative effects, especially on the environment. Mining is directly related to natural resources, where the operations of the mining industry have the potential to cause pollution or environmental damage if not managed properly. Exploitation of natural resources without proper or adequate waste management becomes a major trigger for environmental pollution, such as air and water pollution, chemical waste contamination, radiation, noise, and other forms of pollution. Corporate sustainability practices encompass three aspects that must be considered: environmental, economic, and social. Among these three aspects, the environmental aspect requires companies to maximize their environmental performance (Marota, 2017). To enhance environmental performance, accounting concepts must be involved in the process. Green intellectual capital, green accounting, and material flow cost accounting are parts of improving environmental performance from an accounting perspective and can be achieved effectively if the company has the right strategies to realize them. The knowledge, abilities, and skills that allow firms to develop and implement environmentally friendly technologies, processes, and products are referred to as "green intellectual capital" (Qin, 2019) (Zhan, 2023). This aligns with the assertion made by Chen (2008) regarding the vital role of intellectual capital in enhancing environmental performance. Green intellectual capital is comprised of three key components: green human capital, green structural capital, and green relational capital. Research by López-Gamero et al. (2011), Sidik et al. (2019), Yusliza et al. (2019), and Yusoff et al. (2019) emphasizes that the implementation of green intellectual capital within organizations can significantly optimize their

environmental performance. This particular form of intellectual capital has been shown to positively influence sustainable outcomes, enabling companies to improve both their environmental and economic performances concurrently (Yusliza et al. , 2019).

The idea behind green accounting is that it helps businesses reduce the number of environmental issues they confront. Many businesses in the consumer goods and mining sectors have already adopted environmental accounting. In 2022, Sumiati et al. Green accounting is an efficient and eco-friendly accounting technique that can help enhance environmental performance. Environmental accounting, often known as green accounting, is one of the elements that can improve environmental performance, according to De Beer & Friend in (Ulupui et al., 2020). Green accounting incorporates environmental concerns into the business's operational activities. In order to reduce the adverse effects of the business's activities and to promote environmental conservation, it is accomplished by releasing information. A company's annual report or sustainability report's Global Reporting Initiative (GRI) index serves as the basis for the data revealed in green accounting. Green accounting serves as both an assessment tool for environmental preservation and an accounting instrument that enhances environmental performance as a means of corporate responsibility. According to (Aniela, 2012; Kusumaningtias, 2013), businesses will adhere to government regulations to protect the environment without being forced to do so.

Material flow cost accounting is an accounting concept that connects both the economy and the environment, and aims to minimize costs associated with inefficient products (waste) (Ulrupui et al, 2020) Implementing material flow costs balance sheets allows businesses to reduce environmental pollution and environmental costs Calculating material flow costs minimizes the use of unnecessary energy resources (raw materials), which reduces the waste generated by the company

Research conducted by (Doorsamy, 2014) explains that companies implementing material flow cost accounting can save 20% of the fuel used, whereas in conventional accounting systems, this 20% of fuel would be considered waste produced by the company. This finding aligns with the research conducted by (Alfian et al., 2020; Leon, 2018; Marota et al., 2015; Salim et al., 2017), which stated that implementing material flow cost accounting can increase company profits while reducing negative environmental impacts.

This study was conducted among companies in the mining industry during 2019 to 2023. Mining activities are directly related to natural resources and have the potential to cause pollution and environmental damage. In 2023, the mining area in Indonesia is expanded 97,767,729.55 hectares, and emissions from the mining sector were estimated to be the largest contributor, totaling more than 536 million tons of CO2-e. As a result, companies are required to pay attention to and report their environmental performance due to the impact of these activities, one way being through participation in the PROPER program by the Ministry of Environment. Currently, the number of companies reporting their environmental performance is increasing although it seems that many of them do the report merely to fulfill environmental responsibility obligations to the stakeholders. Based on the environmental performance data from the Ministry of Environment, the average PROPER rating for mining companies falls under the blue category (moderate) and green category (good), and some achieving gold. However, there are also companies experiencing a decline in their ratings. For instance, PT Aneka Tambang Tbk and PT Barito Tbk saw their PROPER ratings drop from gold in 2021 to green in 2022. Similarly, PT Vale Tbk., which received a green rating in 2019, dropped to blue in 2020 and has remained there since. This declination can occur because companies need to allocate more resources to meet compliance requirements under PROPER (Yosi, 2023). Meanwhile, issues stemming from mining activities continue to arise. For example, PT Vale Indonesia, which has been operating for 50 years, has caused environmental damage and conflicts. Waste disposal from PT Vale Indonesia has increased sedimentation rates, forming new muddy land along the lake's edge and threatening the preservation of flora and fauna. The company has also caused deforestation over an area of 4,449.22 hectares. If it is left unaddressed, this could result in significant losses. Achieving environmental performance requires corporate attention and care for the environment, which has led to the emergence of a new concept that combines corporate green behavior and intellectual capital. By implementing green intellectual capital and green accounting in business strategies, companies can rebuild public trust (Chandra & Augustine, 2019).Proper calculations in material flow cost accounting can improve the efficiency of product systems, reducing actual costs, material handling expenses, and waste disposal costs (Scavone, 2006). Many large companies have adopted material flow cost accounting to enhance their environmental performance.

This study aims to explore how green intellectual capital, green accounting, and material flow cost accounting impact the environmental performance of mining companies listed on the Indonesia Stock Exchange. The findings of this research are noteworthy, indicating that by adopting these practices, mining companies can enhance their environmental performance significantly.

Currently, research discussing the relationship between green intellectual capital, green accounting, material flow cost accounting, and environmental performance in developing countries remains limited. Previous studies have generally analyzed environmentally friendly accounting practices in developed countries.

Additionally, a common phenomenon is that many companies have adopted environmentally friendly accounting; however, the effectiveness of its implementation is often overlooked. Therefore, this study can contribute to filling the research gap.

II. LITERATUR REVIEW

2.1 Legimaticy Theory

Dowling & Pfeffer (1975) originally proposed legitimacy theory, characterizing legitimacy as a substitute for businesses to continue operating. According to Ranking et al. (2018), corporate actions or activities concerning social and environmental issues are understood through the usage of legitimacy theory. Legitimacy theory clarifies how businesses interact with society and how they carry out a social contract.

2.2 Green Intellectual Capital

According to Stewart (1997), cited by Chang and Chen (2012), intellectual capital encompasses the collective knowledge, information, technology, intellectual property rights, experience, organizational learning, competencies, team communication systems, customer relationships, and brands that contribute to a company's added value. Chen (2008) introduced the concept of green intellectual capital, which merges traditional intellectual capital with environmental concerns. López-Gamero et al. (2011) define green intellectual capital as the total knowledge an organization employs to manage environmental issues effectively and gain a competitive edge.

Chen (2008) identifies three types of green intellectual capital: relational, structural, and human. Chang and Chen (2012) emphasize that every employee within a company embodies human capital, and the departure of employees leads to a loss of this crucial asset. This intangible capital, which includes knowledge, skills, and talents applicable in green strategies, is referred to as "green human capital" (Yusliza et al. , 2019). Essentially, green human capital represents the innate resources that employees possess and utilize to protect the environment. Furthermore, green intellectual capital encompasses the expertise, competencies, and capabilities that empower organizations to develop and implement eco-friendly technologies, processes, and products (Qin, 2019; Zhan, 2023).

2.3 Green Accounting

An accounting concept known as "green accounting" helps businesses reveal their financial, social, and environmental contributions to environmental management. The following comment by Lako (2017) supports this idea: *Green accounting incorporates financial, social, and environmental accounting information recognition, value measurement, recording, summarization, and reporting into the accounting process. The goal is to provide the stakeholders involved in judgment and decision-making with integrated, pertinent, trustworthy, and practical accounting information.*

Accordingly, green accounting is the process of identifying, quantifying, documenting, summarizing, and informing external parties (society) about financial, social, and accounting data pertaining to transactions, events, or the environmental effects of operations. The GRI index, which appears in the company's sustainability and annual reports, serves as the basis for the data revealed in green accounting. A standard for sustainability reporting on economic, environmental, and social consequences, GRI (Global Reporting Initiative) aims to evaluate the substantial implications that businesses have on society, the economy, and the environment. The GRI index improves information quality and global comparability, which affects the company's accountability and transparency. Lako (2017)

Stakeholders in assessment and decision-making may benefit from the publication of environmental accounting data. This supports the claim made by Ulupui et al. (2020) that green accounting is a business practice that incorporates environmental costs and benefits as crucial data in the organization's decision-making process.

2.4 Material Flow Cost Accounting

Material Flow Cost Accounting (MFCA) is an essential tool for assessing the movement and stock of materials within a company, production process, or product, utilizing both physical and monetary metrics. Unlike traditional methods, which rely on input-output analysis, MFCA employs a unique cost allocation approach (Jash, 2009). This methodology is comprised of three key elements: materials, material flow, and cost accounting. "Materials" encompasses all raw inputs utilized in the production of goods. "Material flow" is concerned with monitoring the entirety of materials used throughout the production process, including not only the final products but also any material losses that the company incurs. Finally, cost accounting plays a crucial role in distributing all costs associated with material flow, offering a comprehensive view of how material inputs

are transformed into products and the corresponding monetary value of any material losses (Alfian et al. , 2020). The adoption of material flow cost accounting allows companies to minimize material losses and optimize their production processes. Additionally, it serves as an effective tool for assessing the effects of improvements.

2.5 Environmental Performance

Environmental performance refers to a comprehensive system within a company that evaluates the ecological effects of its activities. As noted by Ulupui et al. (2020), "Environmental performance is the result of environmental management, aiming to encourage companies to actively engage in the stewardship of the local environment. " In response to the growing need for corporate accountability towards the environment, the Ministry of Environment and Forestry has launched the PROPER program (Corporate Performance Rating Program for Environmental Management). This initiative underscores the government's commitment to environmental protection by pressuring companies to actively mitigate their environmental impacts and prioritize conservation efforts. According to the Ministry of Environment and Forestry of the Republic of Indonesia (2018), the PROPER assessment employs a five-color ranking system—gold, green, blue, red, and black. This assessment evaluates various factors, including compliance with environmental regulations, the effectiveness of environmental management systems, water conservation efforts, energy efficiency measures, and the management of hazardous waste.

2.6 The Effects of Green Intellectual Capital on Environmental Performance

Based on the legitimacy theory proposed by Dowling & Pfeffer (1975), companies must consistently demonstrate that their operational activities align with social values. Companies attempt to gain legitimacy from society, leading them to voluntarily disclose their green intellectual capital in the annual reports. Previous studies conducted by (Sidik et al., 2019; Yadiati et al., 2019; and Yusliza et al., 2019) have shown that green intellectual capital has a positive and significant effect on environmental performance. (Sidik et al., 2019) stated that green intellectual capital is an attribute of environmental management.

Green intellectual capital represents an intangible asset for companies that understand the crucial role the environment plays in ensuring their long-term sustainability. This awareness motivates businesses to enhance their environmental management practices. By leveraging this green intellectual capital, companies can assess the effects of their operations on environmental performance. Through such evaluations, they can implement strategies to improve their environmental impact effectively.

2.7 The Effects of Green Accounting on Environmental Performance

According to Suchman's legitimacy theory (1995), companies constantly strive to assure society that their operations align with the prevailing norms and boundaries of their operational environments. To uphold their legitimacy, organizations demonstrate a commitment to environmentally sound practices and disclose relevant environmental management information in their annual reports. Research by Wahyuni et al. (2019) highlights that the implementation of green accounting reflects a corporate responsibility toward both the environment and society. Further studies conducted by Aniela (2012), Homan (2016), Sidik et al. (2019), Ulupui et al. (2020), and Wahyuni et al. (2019) have shown that green accounting positively influences environmental performance. By adopting green accounting practices, companies can enhance both the effectiveness and efficiency of resource utilization while simultaneously contributing to environmental preservation. This approach serves as a valuable tool for assessing environmental conservation efforts. Additionally, the implementation of green accounting fosters transparency in accounting information related to sustainable resource management, motivating companies to voluntarily adhere to government regulations and effectively manage their environmental performance.

2.8 The Effects of Material Flow Cost Accounting on Environmental Performance

Legitimacy theory, as articulated by Suchman (1995), asserts that companies must consistently operate within established boundaries and norms. To uphold the legitimacy of their activities, organizations need to closely monitor their production processes to ensure compliance with these standards at every stage. Research by Doorasamy (2014) demonstrated that implementing material flow cost accounting can significantly reduce material losses, thereby minimizing waste. Furthermore, a study by Salim et al. (2017) highlighted the positive impact of material flow cost accounting on environmental performance. This finding is supported by Arieftiara et al. (2021), who revealed that the adoption of material flow cost accounting effectively reduces waste production, ultimately safeguarding the environment from harm.

Companies that implement material flow cost accounting in their operations can analyze and reduce material losses (waste), thereby maximizing the products. This application allows companies to analyze the environmental impacts that can be avoided by reducing waste, thus protecting the environment from harm and achieving sustainable environmental performance in the continuity of operations. Through this implementation,

companies can improve their environmental performance.

III. METHODOLOGY

This study employs a quantitative descriptive approach to examine the impact of green intellectual capital, green accounting, and Material Flow Cost Accounting on the environmental performance of mining companies listed on the Indonesia Stock Exchange (IDX) from 2019 to 2023. The research focuses on four key variables: green intellectual capital, green accounting, Material Flow Cost Accounting, and their contributions to environmental performance.

Green intellectual capital is evaluated by disclosure of three factors from Chang and Chen (2012) The Green Accounting aspect is evaluated according to the GRI standards for 2016 and 2021, and MFCA components (Material Flow Cost Accounting) highlights the efficiency of production costs for these companies In particular, MFCA variables measure effectiveness by examining production costs Environmental output is evaluated based on a ranking system set by the Ministry of the Environment To analyze the collected data, version 26 is used in SPSS studies 0 This analytical tool is intended to enable the collected data to be significantly informed and improved on the decision process

IV. RESULT AND DISCUSSION

Description of Data

The typicality of the information is evaluated based on the centrality esteem determined from the Kolmogorov-Smirnov test. Particularly, in the event that the importance esteem surpasses 0. 05, the leftover information is considered to be regularly conveyed. Then again, on the off chance that the centrality esteem falls underneath 0. 05, the leftover information is regarded not regularly disseminated. In this think about, the One-Sample Kolmogorov-Smirnov test yielded an Asymp. Sig. (2-tailed) esteem of 0. 716. Since
0. 716 is more noteworthy than 0. 05, we are able conclude that the leftover information takes after a typical dispersion, hence fulfilling the ordinariness presumption required for this examination.

The multicollinearity test is fundamental for surveying the relationship between autonomous factors inside a relapse show. The choice criteria for translating Change Swelling Calculate (VIF) and Resilience values are direct: multicollinearity is shown on the off chance that the VIF surpasses 10 or the Resilience falls underneath 0. 10. Alternately, in the event that the VIF is underneath 10 and the Resistance is over 0. 10, it recommends that multicollinearity isn't a concern.

In this study, the test results reveal that the VIF values for each independent variable—Green Intellectual Capital, Green Accounting, and Material Flow Cost Accounting—are all below the threshold of
10. Furthermore, the Tolerance values for these variables are all above 0. 10. Consequently, it can be confidently concluded that multicollinearity is absent in the regression model used in this analysis.

The autocorrelation test using the Run Test method produced a significance value of 0.853, which is greater than 0.05. Thus, it can be concluded that there is no autocorrelation issue, and the assumptions for the autocorrelation test have been satisfied.

The heteroshow test is used to determine whether the variance of residues gives inequality to others from observations within the regression model The Greater Test was run to test the results is assessed through the significance value, the significance values for Green Intellectual Capital, Green Accounting, and Material Flow Cost Accounting are respectively 0.997, 0.999, and 0.994. All significance values are greater than 0.05, indicating that none of the variables exhibit heteroscedasticity. Therefore, the assumption of the heteroscedasticity test has been satisfied.

In this ponder, the demonstrate exactness test utilized is the choice test (R^2 test) This ought to decide how well the variety within the subordinate variable is clarified by all autonomous factors The value of R^2 is within the run of to 1 In other words, the impact of the free variable on the subordinate variable is considered powerless Usually since free factors cannot be legitimately clarified Alternately, in case the estimation coefficient 1 is unequivocally considered, the impact of the independent variable on the subordinate variable is unequivocally considered The coefficient of assurance indicated within the adjusted R square esteem is 0.847 In other words, the commitment of the free variable to the subordinate variable is 847% at the same time This esteem appears the rate of budgetary execution vacillations of mining companies recorded on the Indonesian Trade (AT) from 2019 to 2023, and is clarified in both Green Bookkeeping and Natural Execution

The achievability test or F test of this consider in this consider is aiming to survey whether the relapse demonstrate utilized is appropriate for evaluating the impact of free factors on subordinate factors Theory tests are performed utilizing an F dispersion of α=5% (005) In case the centrality level of F is less than 005, this implies that the free factors together have a noteworthy impact on the subordinate variable In the event that the importance level of F surpasses 005, this implies that the free factors together don't have a noteworthy impact on the subordinate variable This appears that relapse models are suitable which variable green mental capital, green bookkeeping, and fabric stream fetched bookkeeping too have a noteworthy affect on natural yield

The method In this study, several linear regression analyses were used to determine whether independent variables are affected by dependent variables, and the orientation of the relationships between these variables is that the independent variables in this study are green intellectual capital, green accounting, and material river accounting, and the dependent variable is the result of multiple linear outcomes - analytical analysis follows :

Table 1 Multiple linear regression analysis

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.139	.042		74.151	.000
	Green Intellectual Capital	.824	.099	.607	8.309	.000
	Green Accounting	.138	.055	.099	2.500	.015
	Material Flow Cost Accounting	.197	.045	.320	4.422	.000
a. Dependent Variable: Environmental Performance						

Source: Data processed using SPSS 26 (2024)

Based on the above table, the constant value (α) is 3,139, but the regression coefficient (β) for variable x1 0824 is the regression coefficient (β) for variable x2 0138 and the regression SKO efficiency (β) for variable x3 is 0197 Therefore, the regression equation is written as follows:

Y = 3,139 + 0,824X1+0,138X2+ 0,197X3 + *e*

The t-test assesses the impact of each independent variable on the dependent variable.

H1 : Green intellectual capital has a positive and significant effect on the company's environmental performance Statistical findings for the Green Intellectual Capital variables show a significant value of 0,000 with positive regression coefficients of 005 (0000 <005) and 0824 The results of this study show that improving environmental performance is positively and heavily influenced by green intellectual capital, determined by the disclosure of green human, structural and relationship capital The theory is approved It would be better to improve an organization with a high level of green intellectual capital, as they are more equipped for adaptation and implementation of greener business strategies This is because companies that recognize how critical the environment is for long-term livelihoods will become more aware of actions that can negatively affect the environment This shows that the company's environmental output has brought good results from the Ministry of the Environment Green intellectual capital's (GIC) components promote businesses to use natural resources more efficiently, cut emissions, and limit adverse environmental effects, which is another reason why GIC has a Positive effect on environmental performance. Employees are more likely to adopt eco-friendly practices when they possess a high degree of environmental awareness, or green human capital. In the meantime, the constant application of green methods is reinforced by the backing of organizational structures and stakeholder relationships (green relational capital and green structural capital). The findings of this study are consistent with the legitimacy theory, which highlights that businesses always work to operate within socially accepted bounds and standards in order to be more sensitive to the ethical (moral) environment in their operations. Green intellectual capital development is one way to accomplish this. Research by (Sidik et al., 2019; Yadiati et al., 2019; Yusliza et al., 2019) supports the findings of this study by showing that green intellectual capital which includes green human capital, green structural capital, and green relational capital has a positive impact on enhancing environmental performance. According to (Yusliza et al., 2019), one of the most important aspects of tackling environmental concerns is green intellectual capital..

H2: Green accounting has a positive and significant effect on the company's environmental performance. The statistical findings for the green accounting variable indicate a significance value of 0.015,

which is less than 0.05 (0.015 < 0.05), and a regression coefficient of 0.138, which is positive. The premise is supported by the study's findings, which demonstrate that green accounting significantly and favorably improves environmental performance as assessed by environmental performance metrics. This positive significance suggests that businesses will see an improvement in their environmental performance if they disclose green accounting in a clear and quantifiable manner, as determined by environmental performance based on GRI (Global Reporting Initiative). Businesses can increase resource efficiency and effectiveness while also supporting environmental preservation by putting green accounting into practice. By reporting operational operations that promote environmental conservation, like waste management, energy efficiency, and emission reductions, green accounting is a type of corporate responsibility. This action helps the organization attain its

PROPER grade by supporting the Ministry of Environment's evaluation of environmental performance. Companies can comply with government regulations to achieve good environmental performance, show transparency in accounting information pertaining to the management of sustainable resources and green business activities, and assist stakeholders in evaluating and making decisions about environmental policies by disclosing green accounting.

The study's findings are consistent with the legitimacy theory (Suchman, 1995), which describes how a business and society form a social contract in which the business constantly tries to persuade the public that its operations respect the laws and boundaries of the community in which it operates. The results of this study are corroborated by research by (Aniela., 2012), which demonstrates that environmental accounting has a positive impact on environmental performance, both in the dimension of environmental validity and environmental health. The company will also disclose environmental management information in its sustainability reports and annual reports in compliance with government regulations in order to continuously legitimize its operations. Research by (Homan., 2016; Ulupui et al., 2020; Wahyuni et al., 2019) further supports this study, showing that green accounting significantly and favorably affects environmental performance.

H3 : Material Flow Cost Accounting berpengaruh positif signifikan terhadap environmental performance
According to the statistical results, the material flow cost accounting variable has a positive regression coefficient of 0.197 and a significance value of 0.000, both of which are below the 0.05 (0.000 < 0.05) threshold.The study's findings demonstrate that material flow cost accounting, as determined by production costs, significantly and favorably improves environmental performance. This positive significance suggests that businesses can improve their environmental performance by properly accounting for material flow costs. This is due to the fact that material flow cost accounting enables businesses to allocate costs appropriately while preserving profits and safeguarding the environment by increasing the efficiency and transparency of material and energy consumption. Businesses in the mining industry that employ material flow cost accounting can examine how much energy and materials are used during the manufacturing process, allowing them to maximize output without using excessive amounts of either. Mining businesses use material flow cost accounting to determine production costs, which results in savings that improve resource efficiency in terms of energy and materials. Businesses can attain operational sustainability by minimizing material losses and waste, protecting the environment from harm, and improving their performance, especially in terms of environmental performance and long-term environmental improvement. In order to achieve the environmental vision of mining companies, material flow cost accounting is also essential. This is because it analyzes the use of material and energy resources more effectively, which increases productivity and improves environmental performance on a larger scale. The study's findings are consistent with the legitimacy thesis (Suchman, 1995), which contends that businesses should always make sure their activities stay within the relevant parameters and standards. Businesses must monitor their operations till the end of the manufacturing process to make sure that specified boundaries and standards are being followed in order to preserve the validity of their operations. Businesses can maintain their public legitimacy by adhering to established standards and maintaining environmental performance. Research by (Arieftiara et al., 2021) and (Salim et al., 2017), which found that material flow cost accounting improves environmental performance, lends credence to this study. Additionally, research by (Doorasamy., 2014) shows that material flow cost accounting significantly improves environmental performance. According to this study, businesses can lower material losses (waste) by implementing material flow cost accounting. The outcome supports the findings of a study by (Arieftiara et al., 2021), which indicates that material flow cost accounting can reduce waste production and protect the environment. Businesses that recognize their environmental duties typically perform better on both an environmental and economic level, citing the study by (Salim et al., 2017).

The findings of this study can provide important contributions for companies in improving operational efficiency, encouraging innovation and competitiveness because green intellectual capital which involves the management of human, structural, and relational resources that focus on environmentally friendly innovation can produce new technologies in increasing the competitiveness of companies in global markets, reducing environmental and legal risks, improving strategic decisions, and increasing the reputation of corporate value.

V. CONCLUSION

Based on the analysis results, it can be concluded that the variables of green intellectual capital, green accounting, and material flow cost accounting have a significant positive effect on environmental performance. Green intellectual capital is considered effective in enhancing environmental performance. Awareness of the impact of business activities enables companies to evaluate the environmental consequences of their operations, allowing them to develop effective environmental strategies to support environmental performance, through the implementation of green accounting, companies can demonstrate transparency in accounting information related to sustainable resource management. This encourages companies to voluntarily comply with government regulations to achieve good environmental performance, additionally, material flow cost accounting enables

companies to save costs by improving resource efficiency, including both materials and energy. This helps companies reduce material losses or waste while protecting the environment from damage, ultimately improving company performance, particularly in terms of environmental performance. It also contributes to long-term environmental improvement, ensuring operational sustainability.

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