



# Integration of Material Flow Cost Accounting and Resource Efficiency into Green Accounting: A Strategy for Company Sustainability

Darwis Said<sup>1†</sup>, Eko Ganis Sukoharsono<sup>2</sup>, Darmawati Darmawati<sup>1</sup>, Muhammad Reza Pahlevi Juanda<sup>1</sup>, Alia Rezki Amalia<sup>3</sup>, Afdal Madein<sup>1</sup>

<sup>1</sup> Department of Accounting, Universitas Hasanuddin, Makassar, Indonesia

<sup>2</sup> Department of Accounting, Universitas Brawijaya, Malang, Indonesia

<sup>3</sup> Department of Accounting, Universitas Negeri Makassar, Makassar, Indonesia

## Submission Info

Communicated by Chuan Zhang

Received 20 September 2024

Accepted 5 August 2025

Available online 1 April 2026

## Keywords

Green accounting

Material flow cost accounting

Resource efficiency

Corporate sustainability

## Abstract

This research aims to explore the impact of green accounting on corporate sustainability by incorporating the MFCA approach and assessing resource efficiency. The samples for this study comprise 23 manufacturing companies listed on the Indonesian Stock Exchange (IDX) from 2020 to 2022. Data collection involved reviewing the selected companies' annual and sustainability reports. The data analysis was conducted using path analysis with the assistance of SmartPLS 4 software. The hypothesis testing results indicate that green accounting and MFCA positively affects corporate sustainability. Green accounting positively affects MFCA but negatively affects resource efficiency. MFCA mediates the relationship between green accounting and corporate sustainability. However, resource efficiency has not effectively mediated the relationship between green accounting and corporate sustainability. This pioneering research is the first to combine green accounting with MFCA within the context of manufacturing companies in Indonesia. It provides a fresh perspective on MFCA's role as a mediator between green accounting and corporate sustainability. This research underscores the importance of integrating green accounting and MFCA in the management strategies of manufacturing companies to improve long-term sustainability while seeking solutions to overcome the negative influence of green accounting on resource efficiency. This research emphasizes the importance of adopting green accounting and MFCA practices to reduce manufacturing activities' negative environmental impacts, positively contribute to society through reduced waste and emissions, and improve resource use efficiency.

©2026 L&H Scientific Publishing, LLC. All rights reserved.

## 1 Introduction

Corporations need large resources (such as energy, water, labor, etc.) to carry out the corporation's operational activities. In addition to providing benefits, corporate activities also have a negative impact, both those that have

<sup>†</sup>Corresponding author.

Email address: [darwissaid@fe.unhas.ac.id](mailto:darwissaid@fe.unhas.ac.id)

been taken into account and those that we have not considered before. If the corporate only focuses on increasing profitability without caring about the sustainability of the environment and surrounding resources, it can cause environmental damage. Increasing profitability is one of the main motives for resource exploitation. In this regard, more and more research is voicing ecological aspects in accounting [1–3]. This environmental problem has become an important agenda for all stakeholders in recent decades, including corporations and governments. The concept of environmental accounting or green accounting then comes to see that accounting does not only focus on financial problems but needs to look at the environmental impact caused by organizational activities to maintain the sustainability of the earth and the corporate in the long term [4, 5].

Furthermore, Lako [3] proposes reforming the conceptual framework and reconstructing traditional accounting into green accounting, especially in Indonesia. According to Lako [3], over the past few decades, traditional accounting has contributed to the increasing escalation of environmental damage and ecological crises. Financial statements that are the output of the corporation's accounting stage only present financial information reports, while environmental information is ignored. The desire of economic actors and the government to increase economic growth and maximize profits is one of the causes of the emergence of the ecological crisis. Furthermore, the presence of green accounting is an approach based on the value and principle of love for fellow human beings and the environment in the accounting process, which is increasingly needed. Especially the implementation of green accounting in developing countries such as Indonesia is still in the early stages of development [4, 6, 7]. Various criticisms are also directed at traditional accounting, which often does not provide enough information to stakeholders, especially regarding environmental impacts. Thus, it indicates that a more holistic approach is needed in accounting that includes environmental aspects [8]. Hence, this study's fundamental motivation is to examine the impact of green accounting on the sustainability of companies, especially in Indonesia, and to fill the gap or answer the call to consider environmental aspects in accounting.

Green accounting integrates environmental costs into a corporation's financial statements. The environmental cost describes the corporation's costs for the economic benefits it obtains. Reporting that considers environmental elements can effectively reduce information asymmetry between stakeholders. Stakeholders can access more precise information based on the corporation's green accounting report content, and the right investment and financing decisions significantly impact corporate sustainability. Several previous studies [9–12] concluded that the implementation of green accounting has a positive effect on sustainability. However, green accounting is not enough to achieve sustainability goals. Several supporting approaches are needed to achieve sustainability, such as implementing material flow cost accounting (MFCA) and resource efficiency.

Many manufacturing corporations are inefficient in producing goods and services, so they produce much waste. Industrial waste comes from using raw materials, energy, water, and materials that are easily lost. Environmental impacts must be expressed in monetary units, such as revenue from net production or fines for violating environmental regulations [13, 14]. Environmental problems are increasingly crucial for corporations because they relate to their economic and production processes [15]. Cost calculations and energy efficiency are necessary to ensure that the activities carried out by the corporation are safe for the environment. Therefore, the corporation must have proper management practices to address environmental protection and management issues such as MFCA and resource efficiency.

MFCA is an approach that helps corporations identify, measure, and manage the flow of materials and energy in their production processes [16]. By reducing material losses and improving efficiency, MFCA provides economic benefits to corporations and reduces negative environmental impacts, such as carbon emissions and waste. In addition, MFCA provides clear cost information related to material losses, which can assist managers in making better decisions regarding investments, product design, and changes in raw materials. Therefore, corporations can achieve economic goals while maintaining sustainability [17, 18].

On the other hand, resource efficiency refers to the ability of a corporation to produce a product or service by utilizing a smaller amount of resources [19]. Resource efficiency aims to harmonize economic growth and resource use. The alignment of the two contributes to sustainable economic growth and, at the same time, helps conserve resources and keep the climate conducive. Resources can be divided into two forms, namely physical

and non-physical. So, there are several ways to calculate the efficiency of a corporation's resources. One of them is the activity ratio. The activity ratio provides a clear picture of a corporation's economic performance. Corporations can evaluate and assess how well the corporation manages and streamlines its resources to achieve optimal results [20].

Regarding sustainability, resource efficiency helps corporations reduce the environmental impact of their business activities and extend the lifespan of limited resources. Corporations can monitor resource efficiency and find ways to increase efficiency. By improving resource efficiency, corporations can reduce operational costs. The ultimate goal is the sustainability of resources and the sustainability of the corporation itself [21].

By combining green accounting practices that consider environmental aspects in financial statements and increased efficiency, corporations can optimize the use of their resources. Reduce environmental impacts, including emissions and waste, and bring economic benefits through reduced production costs and more efficient management [22]. Combining green accounting and resource efficiency creates a strong synergy to increase the corporation's contribution to sustainability goals. For that reason, researchers are motivated to examine the role of green accounting on the sustainability of the corporation and the role of MFCA and energy efficiency in mediating green accounting on corporate sustainability. This research also develops the research of Marrone et al [22]. The findings of Marrone et al [22] indicate that more specific research topics, such as the shift to a low-carbon economy and sustainable development goals, are increasingly needed. Based on the best of the author's knowledge, this study is the first study in Indonesia that uses two mediating variables, namely MFCA and energy efficiency, to see the contribution of green accounting to corporate sustainability.

The results of this study are expected to be a reference for policymakers to require corporations to implement green accounting, not limited to qualitative reports on the positive environment. MFCA plays an important role in corporations reducing waste and minimizing the use of energy and less efficient materials. Furthermore, although resource efficiency does not mediate the influence of green accounting on corporate sustainability, this is a special concern for companies. The benefits obtained from implementing green innovation cannot immediately increase total assets turnover (TATO) but require a more extended period.

## **2 Literature review and hypothesis development**

### **2.1 Literature review**

#### **2.1.1 Legitimacy theory**

The theory of legitimacy is derived from corporate legitimacy, first proposed by Dowling & Pfeffer [24]. This idea shows that legitimacy is a state or status that exists when the value structure of a harmonious element is aligned with the broader value structure of the society in which the identity is located. The legitimacy approach in green accounting to corporate sustainability is to pay attention to the environmental impact of the corporation's business activities and report on the environmental and social performance of the community in a transparent and accountable manner.

In addition, Marina et al [25] explained that a broader design for the implementation of green accounting is needed, not only for the purchase of corporation operational materials and waste management but also for investment and marketing decisions or, in other words, as a tool for environmental management and communication with the community [25, 26]. Integrating social and environmental accounting information urgently needs to be incorporated into the traditional accounting system. The desire of the government and economic actors to increase profitability triggers an ecological and social crisis because there is exploitation of natural resources [27]. Therefore, the presence of green accounting is significant to maintain corporate sustainability, especially nature's sustainability.

### **2.1.2 Material flow cost accounting**

Material flow cost accounting (MFCA) is an accounting system that measures the flow and stock of a corporation's materials both in physical and monetary form [28]. MFCA helps corporations identify and manage costs associated with material use, including raw materials, system costs, shipping, and disposal. Implementing MFCA allows corporations to create material flow graphs and cost flow matrices that clearly describe how materials are used and whether waste occurs [8].

In addition to identifying waste, MFCA is the basis for better managerial decision-making for capital investment and resource management. The corporation has a qualified understanding of the cost of waste and emissions. Therefore, implementing MFCA helps corporations manage costs and contributes to sustainability and efficiency [17].

### **2.1.3 Resource efficiency**

Resource efficiency is optimizing the use of materials and energy in the production process. In other words, resource efficiency means using the earth's limited resources sustainably while minimizing environmental impact [19]. Resource efficiency creates more value (economy) with less resource use. It reduces the environmental impact associated with resource use to sever the link between economic growth and the use of nature [22]. Resource efficiency aims to minimize the consumption of raw materials and energy and maximize the productivity and quality of the products produced [29]. This concept is fundamental in the industry because it helps corporations achieve economic benefits and the environment. Resource efficiency means creating more value (economic) with less resource use and reducing the environmental impact associated with resource use to sever the link between economic growth and natural use [30].

Resources are divided into two, namely physical and non-physical resources. So, resource efficiency can also be measured using the activity ratio that measures total asset turnover (TATO). This ratio measures the effectiveness of a corporation in using its operational resources and assesses its ability to carry out daily activities. A corporation's operational efficiency level, reflected in the ratio of activities, such as the asset turnover ratio, has powerful implications for corporate sustainability. The asset turnover ratio, which measures how efficiently a corporation uses its assets to generate sales, indicates sustainable business practices.

The higher the activity ratio, the more efficient the corporation will use its operational resources. A high ratio indicates energy and resource management efficiency, reflecting the corporation's commitment to sustainable supply chain practices. In addition, a good asset turnover can also reflect innovation and waste reduction efforts as corporations look for ways to improve production efficiency without compromising sustainability. Therefore, corporations can use the activity ratio to measure their resource use efficiency [31].

In the context of sustainability, the efficient use of resources can assist corporations in reducing the environmental impact of their business activities and extending the lifespan of limited resources. A corporation's sustainability disclosure can include information about investments in green technology, corporate social responsibility, and other specific sustainability initiatives. Therefore, the activity ratio is an important element in the sustainability narrative, providing a broader picture of how a corporation manages its assets and contributes to sustainability principles. By using activity ratios, corporations can measure how efficiently they use their operational resources, such as inventory and assets, and look for ways to improve their efficiency [20].

### **2.1.4 Corporate sustainability**

Corporate sustainability is seen as a corporate management paradigm that continues to grow. The term paradigm is used because corporate sustainability is an alternative to the traditional growth model and maximizing profits. Meanwhile, corporate sustainability recognizes that corporate growth and profitability are important and that corporations must pursue social and environmental goals. Corporate sustainability is an approach that creates long-term value by considering how the corporation operates within the ecological (environmental), social, and economic spheres [10]. This approach aims to ensure that the corporation's operational activities are not only financially profitable but also responsible for its impact on society and the environment.

## 2.2 Hypothesis development

### 2.2.1 Green accounting on corporate sustainability

The presence of green accounting is an effort to protect the environment. Green accounting is an approach that incorporates environmental considerations into the financial reporting process and business performance measurement [32, 33]. Green accounting was developed to help corporations understand and manage the trade-offs between environmental goals and traditional economic goals. However, in developing countries, such as Indonesia, corporations still ignore information related to environmental cost reporting [34]. In addition, green accounting also creates transparency, builds stakeholder trust, and helps identify environmental risks and opportunities. Corporations create sustainable decisions and shape more environmentally friendly business policies with the information generated. Thus, the understanding and development of green accounting is an urgency to promote a sustainable future for corporations.

Green accounting is also closely related to the theory of legitimacy, which states that the government seeks to ensure that it operates within the limits and norms that are acceptable to society. Through environmental impact measurement and reporting, green accounting provides the transparency needed to meet the expectations of the community and stakeholders. Corporations that look indifferent to the environment can lose the trust and support of consumers, investors, and regulators. Thus, green accounting helps corporations comply with environmental regulations but also helps to build a good reputation and public trust, which is a key element of legitimacy.

Several previous studies [35–37] supported this idea, concluding that implementing green accounting positively improves corporate sustainability. Furthermore, Dhar et al [36] stated that implementing green accounting positively affects the sustainability development of corporations with high pollution levels. The research of Endiana & Dicriyani [10] also aligns with this: implementing green accounting for manufacturing corporations in Indonesia increases corporate sustainability. Additionally, integrating green accounting and corporate sustainability systems allows corporations to grow more, especially to create long-term value for stakeholders [8]. Hence, this research proposes the following hypothesis:

H1. Green accounting positively affects corporate sustainability

### 2.2.2 Green accounting on material flow cost accounting

Green accounting provides a framework for measuring and reporting the environmental impact of a corporation's activities. Implementing green accounting helps MFCA measure and analyze costs related to resource consumption and environmental impact. Faieq & Cek [39] emphasizes that companies can increase stakeholder accountability by identifying and recording waste-related environmental costs. Accordingly, the result provides a more comprehensive picture of resource efficiency [18].

Furthermore, Tu [18] stated that green accounting and MFCA help corporations strengthen their position as responsible and sustainable entities. In addition, implementing green accounting also helps corporations stay abreast of applicable environmental regulations by providing the data needed for environmental reports and audits. This reduces the risk of fines and witnesses and improves the corporation's reputation in the eyes of stakeholders and the public. Therefore, the corporation's social legitimacy, public trust, and long-term sustainability are also strengthening [38].

Green accounting stimulates corporations to innovate in production and product development by focusing on environmental impact. The implementation of green accounting can be in the form of developing more environmentally friendly products and processes with minimal waste. The presence of green accounting can help MFCA by considering costs related to resource consumption and the environment during the production process. Based on the description above, the research hypothesis is as follows:

H2. Green accounting positively affects material flow cost accounting

### 2.2.3 Material flow cost accounting on corporate sustainability

MFCA plays an essential role in supporting the achievement of corporate sustainability. MFCA is a cost calculation method focusing on cost efficiency and waste management. If traditional accounting methods only focus

on the product's final cost, MFCA also considers all material inputs wasted during the production process. Thus, the MFCA provides a comprehensive overview of operational efficiency and sustainability [40].

In line with the legitimacy theory, implementing MFCA shows the corporation's commitment to sustainability practices and environmental responsibility. As such, MFCA supports efficiency and profitability, strengthens corporate social legitimacy, increases public trust, and supports long-term sustainability [17].

Specifically, Kokubu et al [17] state that MFCA helps organizations identify, measure, and reduce excessive material and energy use during production. This result is then reinforced by findings [40], which conclude that MFCA can affect production costs and waste management. In line with that Huang et al [42] concluded that MFCA analysis based on ISO 14051 is a valuable management tool that positively affects sustainable development. Hence, this research proposes the following hypothesis:

H3. Material flow cost accounting positively affects corporate sustainability

#### **2.2.4 Green accounting on resource efficiency**

Green accounting motivates corporations to adopt more sustainable business strategies such as waste reduction, use of renewable resources, and energy efficiency. These changes can positively impact financial ratios, such as reduced operational costs [43] and [10]. Adopting a more sustainable business strategy allows organizations to gain legitimacy from the communities and environments in which they operate. In the same boat, Rahman & Islam [43] also concluded that green accounting positively affects resource efficiency. Green accounting provides a framework for measuring and reporting on the use of resources more efficiently. Integrating economic and environmental information gives corporations a better understanding of how resources are used and their environmental impact. Consequently, corporations are authorized to identify areas where resource efficiency is improved.

Zorn et al [20] also concluded that green accounting has a positive effect on resource efficiency by considering the environmental costs and social impacts of the corporation's operations. By including environmental costs in financial statements, corporations get a more accurate picture of profitability and resource efficiency. Hence, this research proposes the following hypothesis:

H4. Green accounting positively affects resource efficiency

#### **2.2.5 Resource efficiency on corporate sustainability**

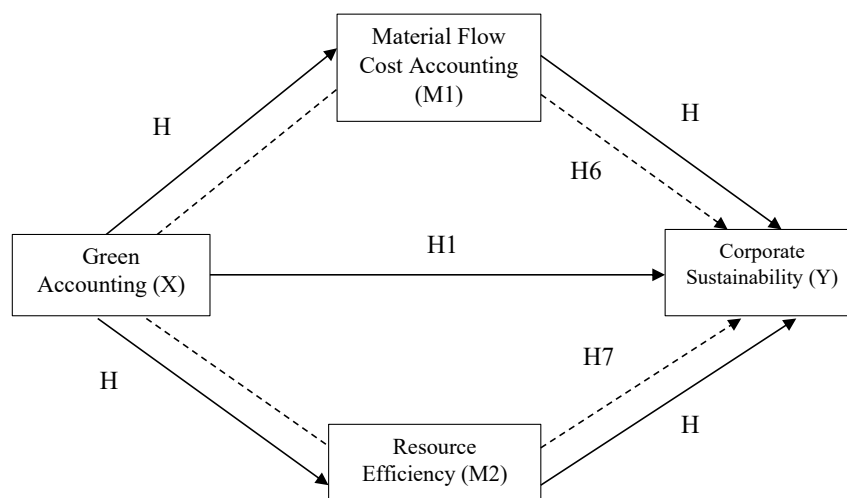
Resource efficiency is saving by using energy, water, and raw materials and maximizing product output. In other words, producing more products or services and using fewer resources reduces negative environmental impacts and improves sustainability [21]. Resource efficiency is one of the practical ways in which corporations implement sustainability principles. The corporation further adheres to social expectations to act responsibly towards the environment and demonstrates economic responsibility by reducing waste and improving efficiency, thus strengthening its legitimacy.

By increasing resource efficiency, corporations reduce production and operational costs. In addition, the corporation's stock price is becoming more competitive due to investors paying more attention to sustainability. Higher profitability supports sustainability by allocating more resources to investments in sustainable practices [20]. This is further strengthened by the findings of Liu & Wu [44], emphasizing the importance of green finance and sustainability reporting in supporting corporate financial performance and positively impacting risk management and economic development. Based on the description above, the research hypothesis is as follows:

H5. Resource efficiency positively affects corporate sustainability.

#### **2.2.6 Green accounting on corporate sustainability through MFCA**

Kokubu et al [17] stated that green accounting and MFCA positively increase a corporation's sustainability performance. Implementing MFCA helps corporations identify lost material costs and improve environmental efficiency, indirectly supporting the corporation's sustainability. Rakesa & Werastuti [46] state that green accounting positively affects corporate sustainability. They also found that MFCA positively affects corporate sustainability, and green accounting significantly affects the corporation's sustainability through MFCA. Further-



**Fig. 1** Research model.

more, research from Abdullah & Amiruddin [46] states that green accounting affects the relationship between MFCA and improving corporate sustainability.

Based on the theory of legitimacy, corporations strive to acquire or maintain social legitimacy to be accepted and recognized as legitimate members of society. In this case, practices such as green accounting and MFCA can serve as tools to gain legitimacy by demonstrating a corporation's commitment to social and environmental responsibility. Thus, through MFCA in the context of green accounting and corporate sustainability, corporations can strengthen their commitment to sustainable development by managing their environmental impact and creating long-term value for all stakeholders. Hence, this research proposes the following hypothesis:

H6. MFCA positively mediates the effect green accounting on corporate sustainability

### 2.2.7 Green accounting on corporate sustainability through resource efficiency

Green accounting focuses on environmental aspects that motivate corporations to improve energy efficiency. For example, corporations are likely to reduce energy consumption by implementing environmentally friendly technologies or more efficient processes. The better the energy efficiency, the more significant the contribution to the corporation's sustainability. The results of the study [21] and [11] reveal that resources are not always physical but non-physical. In his research, it was explained that resource efficiency can be reviewed from financial strength. Much capital is required to run a business, including research, development, and efforts to achieve resource efficiency.

In green accounting, resource efficiency acts as a mediator that connects a corporation's efforts to achieve sustainability with accurate measurements and environmental impact analysis. Green accounting allows corporations to transparently monitor and report on the efficiency of their resources, which is a critical step to reducing their ecological footprint and meeting the established sustainability standards. Furthermore, operational efficiency lowers production costs and increases competitiveness in a market increasingly concerned about sustainability.

The results of research from Gonzalez & Vines [47] show that implementing green accounting helps corporations reduce environmental impact and improve resource efficiency through better management. Then, the research conducted by Solovida & Latan [48] emphasizes the use of assets to generate income more than the efficiency of using environmental resources such as energy or water. Hence, this research proposes the following hypothesis:

H7. Resource efficiency positively mediates the effect green accounting on corporate sustainability

**Table 1** Variable operational.

| Variable                     | Measurement                                                                      |
|------------------------------|----------------------------------------------------------------------------------|
| Corporate sustainability (Y) | $EEI = \frac{\text{Net income}}{\text{Total emissions (ton CO2e)}}$              |
| Green Accounting (X)         | $GA = \text{Ln Total environmental management costs}$                            |
| MFCA (M1)                    | $\text{Material loss cost} = \text{Total input cost} + \text{Total output cost}$ |
| Resource efficiency (M2)     | $TATO = \frac{\text{Sales}}{\text{Total assets}}$                                |

**Table 2** Descriptive statistic.

| Variable                 | Mean           | Median     | Min           | Max              | Standard Deviation |
|--------------------------|----------------|------------|---------------|------------------|--------------------|
| Green accounting         | 21.502         | 21.252     | 16.993        | 26.450           | 2.219              |
| MFCA                     | 26.231         | 26.198     | 21.730        | 30.372           | 1.828              |
| Resource efficiency      | 0.747          | 0.705      | 0.305         | 1.306            | 0.291              |
| Corporate sustainability | 6798864166.137 | 771534.248 | -71100309.598 | 158967558239.862 | 31557749481.459    |

### 3 Research method

The type of research is causative research, which is to find out how much green accounting (X) has an impact on the sustainability of the corporation (Y) through the MFCA (M1) and resource efficiency (M2) approaches. This research uses secondary data obtained through annual and sustainability reports of manufacturing industry companies. As our study focuses on corporate sustainability, we have chosen manufacturing industries and firms as a sample, especially manufacturing industries in Indonesia. Investigating the corporate sustainability performance of chosen manufacturing industry firms is vital for several reasons. First, because manufacturing corporations process raw materials into finished products through a lengthy production process such as design, production, assembly, and packaging, they use many resources and generate much waste. Therefore, it is a challenge for corporations to manage the environmental impact. Moreover, manufacturing corporations are essential as a sector that contributes to widespread economic growth in Indonesia, but at the same time, they also produce hazardous and toxic waste (B3). Therefore, manufacturing corporations need considerable attention to see their role and challenges. Furthermore, the selected year range is 2020 to 2022 for manufacturing industry companies listed on the Indonesia Stock Exchange (IDX) because few corporations in Indonesia have published MFCA practices.

The total sample obtained was 23 manufacturing companies. The data analysis in this study uses Structural Equation Modeling (SEM) and data processing through the Partial Least Squares (PLS) approach, utilizing the SmartPLS 4.0 application so that it allows the processing of research problems to be effective. The measurements of each variable are presented in a table.

### 4 Result and discussion

#### 4.1 Result

This study is designed to analyze the role of MFCA and resource efficiency in mediating the relationship of green accounting to corporate sustainability. It uses a manufacturing company listed on the Indonesia Stock Exchange (IDX) and the purposive sampling method for sample selection. The data used are from each related company's annual and sustainability reports.

##### 4.1.1 Descriptive statistic

Table 2 summarizes the descriptive statistics of the variables. It presents the variables' minimum, maximum, and average values and the standard deviation.



**Table 3** Outer loading value.

| Indicator                    | Outer Loading |       |
|------------------------------|---------------|-------|
| Green Accounting (X)         | 1.000         | Valid |
| MFCA (M1)                    | 1.000         | Valid |
| Resource Efficiency (M2)     | 1.000         | Valid |
| Corporate Sustainability (Y) | 1.000         | Valid |

**Table 4** Discriminant validity.

|                          | Corporate Sustainability | Green Accounting | MFCA   | Resource Efficiency |
|--------------------------|--------------------------|------------------|--------|---------------------|
| Corporate sustainability | 1.000                    |                  |        |                     |
| Green accounting         | 0.452                    | 1.000            |        |                     |
| MFCA                     | 0.377                    | 0.582            | 1.000  |                     |
| Resource efficiency      | -0.127                   | -0.162           | -0.054 | 1.000               |

### 4.1.2 Analysis of PLS

The data were analyzed employing PLS with SmartPLS. The analysis encompassed the following stages: assessing the outer or measurement models and testing the structural or inner models.

### 4.1.3 Measurement /outer model

Three criteria—convergent validity, discriminatory validity, and composite reliability—are used to assess the outer model. These are explained in more detail below.

#### (1) Convergent validity

The relationship between indicators and their constructs reflects convergent validity in reflective indicators. Indicators with a high loading factor are considered valid and reliable if they have a construction value 0.7. Based on the table below, it can be inferred that all indicators have met the validity criteria with an outer loadings value of  $> 0.5$ .

#### (2) Discriminant validity

The method used to determine the discriminant validity in this study is to compare the square root value of the AVE for each construct with the correlation between the construct and other constructs. A model is considered to have sufficient discriminatory validity if the AVE root value of each construct is greater than the correlation between the construct and the other constructs.

Table 4 shows that the root value of each construct's AVE is higher than the correlation between constructs and other constructs. From these results, it can be concluded that all the constructs evaluated in the model have met the standards of the discriminatory validity test.

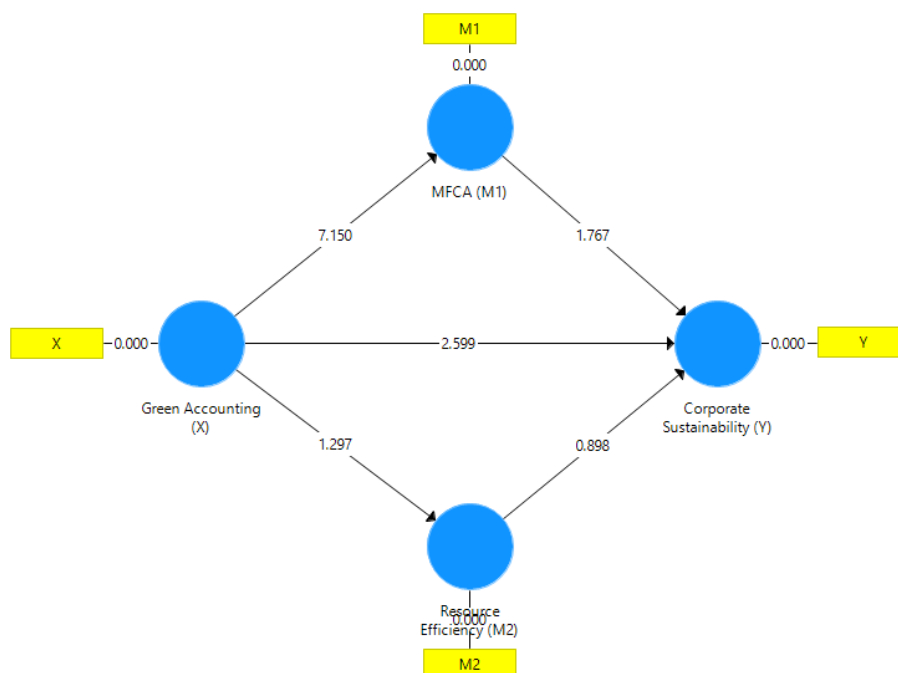
#### (3) Composite reliability

Composite reliability, which assesses a construct's reliability, can be evaluated through internal consistency and Cronbach's alpha value. The interpretation of the composite reliability value is similar to Cronbach's alpha value, where the range of values considered good is between 0.80 and 0.90 (Hair et al 2019). Table 5 summarizes Cronbach's alpha, composite reliability, and R square.

Measuring the reliability of a construct with reflexive indicators can be done in two ways: firstly, by looking at the composite reliability value and secondly, by Cronbach's alpha. All constructs are reliable if composite reliability or Cronbach's alpha is more than 0.70 (confirmatory research). However, using Cronbach's alpha to test the reliability of the construct will provide a lower value (underestimate); hence, using composite reliability is advisable. Table 5 presents the result of composite reliability in this study and shows that all constructs have a composite reliability greater than 0.70. It confirms that all of them have adequate reliability.

**Table 5** Cronbach's alpha, composite reliability, and R square.

|                          | <i>Cronbach's Alpha</i> | <i>Composite Reliability</i> | <i>R Square</i> |
|--------------------------|-------------------------|------------------------------|-----------------|
| Green accounting         | 1.000                   | 1.000                        |                 |
| Corporate sustainability | 1.000                   | 1.000                        | 0.228           |
| MFCA                     | 1.000                   | 1.000                        | 0.339           |
| Resource efficiency      | 1.000                   | 1.000                        | 0.026           |

**Fig. 2** Output bootstrapping.

#### 4.1.4 Structure/inner model

Table 5 shows the R-square of the constructs. It may be inferred from the table that 33.9% of the variation in MFCA can be explained by green accounting, whereas other variables influence the remaining 66.1%. Then, R-square resource efficiency is 2.6%, while other variables influence 97.4%. Resource efficiency does not influence explaining changes or variations on dependent variables. Moreover, green accounting, MFCA, and resource efficiency explain 22.8% of the variation in corporate sustainability, whereas other variables affect the remaining 77.2%.

#### 4.1.5 Hypothesis testing

In the hypothesis test using the bootstrapping method with the one-tailed test, the t-table value is 1.64. To accept the alternative hypothesis ( $H_a$ ) and reject the null hypothesis ( $H_o$ ), the resulting t-statistical value must be greater than 1.64, with a significance level ( $\alpha$ ) of 5%. If the t-statistic value  $> 1.64$  and the P-value  $< 0.05$ , then  $H_a$  is acceptable, and  $H_o$  is rejected. Conversely, if the t-statistic value  $< 1.64$  and the P-value  $> 0.05$ ,  $H_a$  is rejected, and  $H_o$  is accepted.

First, to examine the effect of green accounting on corporate sustainability (H1). The second is to test MFCA and resource efficiency as mediating variables (H2, H3, H4, H5, H6, and H7).

The result indicates that green accounting positively affects corporate sustainability (coefficient: 0.005 ;  $p < 0.05$ ). Therefore, H1, which states that green accounting improves corporate sustainability, is accepted (**H1 is accepted**). A greater distance analysis is carried out by establishing MFCA and resource efficiency as

**Table 6** Path coefficient test and significance of influence.

|                       | Original Sample (O) | T Statistics | P Values |
|-----------------------|---------------------|--------------|----------|
| GA CS                 | 0.340               | 2.599        | 0.005    |
| GA MFCA               | 0.582               | 7.150        | 0.000    |
| MFCA CS               | 0.176               | 1.767        | 0.039    |
| GA RE                 | -0.162              | 1.297        | 0.098    |
| RE CS                 | -0.063              | 0.898        | 0.185    |
| GA MFCA CS            | 0.102               | 1.811        | 0.035    |
| GA RE CS              | 0.010               | 0.744        | 0.229    |
| Variable control      |                     |              |          |
| FS CS                 | 0.134               | 2.307        | 0.011    |
| GA uses another proxy |                     |              |          |
| GA CS                 | 0.397               | 2.541        | 0.006    |

**Description:**

GA = green accounting

CS = corporate sustainability

MFCA = material flow cost accounting

RE = resource efficiency

FS = firm size

mediating variables. There was a positive influence between green accounting and MFCA (coefficient: 0.000;  $p < 0.05$ ), so the second hypothesis was accepted (**H2 is accepted**). MFCA also had a positive effect on corporate sustainability (coefficient: 0.039;  $p < 0.05$ ), so the third hypothesis was accepted (**H3 is accepted**).

The fourth hypothesis test was carried out to test the influence of green accounting on resource efficiency. Based on the test results, it was shown that green accounting did not affect (coefficient: 0.098;  $p > 0.05$ ) on resource efficiency (**H4 is rejected**). Furthermore, the test results showed that resource efficiency did not affect (coefficient: 0.185;  $p > 0.05$ ) on corporate sustainability (**H5 is rejected**).

The test results for hypothesis six show that MFCA is proven to mediate (coefficient: 0.035;  $p < 0.05$ ) the influence of green accounting on corporate sustainability (**H6 is accepted**). These results confirm that MFCA is a partial mediating variable mediating the effect of green accounting on corporate sustainability. Green accounting has an indirect impact on corporate sustainability through MFCA and a direct effect on corporate sustainability.

The seventh hypothesis test was carried out to determine the influence of resource efficiency in mediating the relationship between green accounting and corporate sustainability. The test results showed that resource efficiency did not mediate (coefficient: 0.229;  $p > 0.05$ ) the effect of green accounting on corporate sustainability (**H7 is rejected**).

#### 4.1.6 Variable control and robustness test

We added firm size as a control variable. Based on previous research (Gallo & Christensen, 2011; Drempetic et al 2019; Susana, 2019; Fadilah et al 2022), it was also concluded that firm size positively affects corporate sustainability. We control for firm size, measured by the natural logarithm of total assets. The results are consistent with previous research showing that firm size positively affects corporate sustainability (coefficient: 0.011;  $p < 0.05$ ).

Furthermore, green accounting is proxied by another resilience testing measurement: the Public Disclosure Program for Environmental Compliance (PROPER) index, which the Indonesian Ministry of Environment and Forestry developed. In the PROPER assessment, the corporation will gain a reputation/image through its environmental management. Images are graded with five colors: gold, green, blue, red, and black. The best PROPER is marked with a golden color, which means the company has implemented comprehensive and sustainable envi-

**Table 7** Sub-sample analysis.

| Subset Sample   | Relationship | Path Coefficient | p-value | Significance |
|-----------------|--------------|------------------|---------|--------------|
| Lower quartile  | GA CS        | 0.290            | 0.038   | Significance |
| Middle quartile | GA CS        | -0.640           | 0.000   | Significance |
| Upper quartile  | GA CS        | 0.477            | 0.006   | Significance |

**Table 8** Analysis bootstrapping.

| Relationship | Path Coefficient | p-value | Significance     |
|--------------|------------------|---------|------------------|
| GA CS        | 0.340            | 0.008   | Significance     |
| MFCA CS      | 0.176            | 0.038   | Significance     |
| RE CS        | -0.063           | 0.178   | Not Significance |

ronmental management. Several previous studies (Damayanti & Yanti, 2023; Gustinya, 2022; Sarni et al 2023) have also used the PROPER index to measure green accounting. The test results show that green accounting using the PROPER index as a proxy is proven to have a positive effect on corporate sustainability (coefficient: 0.006;  $p < 0.05$ ).

The authors conducted a robustness test by dividing the sample into three sub-samples of analysis (Table 6). The results of the sub-sample analysis show the difference in relationship strength based on the company's size. The direct effect was strongest in the upper quartile (0.477), indicating that large corporations have a higher capacity to integrate Green Accounting into their sustainability strategies. A negative effect in the middle quartile (-0.640) may reflect constraints on medium-sized firms in sustainability implementation. The model results remain consistent despite the analysis being conducted on different sub-groups.

In addition, bootstrapping analysis or alternative econometric methods (Table 7) were also added. The bootstrapping analysis results with 10,000 subsamples showed stability. The path coefficient remains stable and significant for direct and mediation by MFCA. Resource efficiency is not significant, which is consistent with previous results.

## 4.2 Discussion

### 4.2.1 Green accounting on corporate sustainability

The results of this study prove that green accounting has a positive effect on corporate sustainability. This would mean that the application of green accounting in manufacturing companies in Indonesia increases corporate sustainability. Accordingly, it confirms that green accounting is an important part of social responsibility and long-term value creation. Specifically, green accounting helps manage environmental costs. By transparently reporting their environmental impact and adopting sustainable business practices, companies can maintain their legitimacy in the eyes of stakeholders [9].

The results of this study are in line with [9] and [10], who stated that green accounting has a positive effect on corporate sustainability. The implementation of green accounting allows corporations to understand better how to manage costs related to the environment, such as energy use. So that companies can make better decisions regarding energy use. The results of the study are further strengthened by the research of Wiredu et al [37], which also concluded that green accounting has a positive effect on corporate sustainability.

### 4.2.2 Green accounting on MFCA

The results of this study prove that green accounting has a positive effect on MFCA. It indicates that the better the implementation of green accounting improves MFCA. MFCA helps corporations identify and minimize environmental costs such as waste and energy through process efficiency and the more efficient use of raw materials. This waste reduction will be reflected in the MFCA as a reduction in material loss costs. The results of this study support the theory of legitimacy; corporations not only reduce material loss costs but also show

their commitment to environmentally responsible business practices.

In addition to improving the corporation's economic and social performance, green accounting further strengthens its legitimacy in the eyes of the public. Research by Rachmawati & Karim [11], Abdullah & Amirudin [46] and Santi et al [57] stated that green accounting positively affects MFCA and that they are in the same boat as this study.

#### **4.2.3 MFCA on corporate sustainability**

This study's results show that MFCA positively affects corporate sustainability by identifying and measuring waste in the production process, such as unused raw materials or defective products. By reducing this waste, corporations minimize production costs, including waste disposal and unused material handling costs, and increase efficiency. MFCA also helps identify areas where energy and resources are used inefficiently so that process improvements reduce energy and resource consumption.

In the context of legitimacy theory, implementing MFCA helps corporations maintain the support and confidence of stakeholders by demonstrating a commitment to managing environmental impacts transparently and effectively, strengthening their legitimacy as an environmentally responsible entity. These findings are in line with those of researchers from Rachmawati & Karim [11], Selpiyanti & Fakhroni [41], Khotimah et al [57] and Doorasamy [58] stated that MFCA is a management tool that plays an important role in ensuring corporate sustainability in the future. The results of this research are further strengthened [39], which states that MFCA implementation, such as waste reduction and recycling principles, contribute to corporate sustainability.

#### **4.2.4 Green accounting on resource efficiency**

The test results show that green accounting has no effect on resource efficiency. Total asset turnover (TATO) describes the efficiency level of corporate resource utilization. In addition, TATO is used to assess the corporate ability to increase sales generated for each asset (resource) in the company. Meanwhile, the resource efficiency in this study was proxied with TATO. Green accounting practices, such as waste management and environmental investments, include the cost of maintaining and restoring the environment. This certainly increases the corporate expenses. The benefits obtained by the corporate may not necessarily be felt in the short term. Investments in green technology also require large capital and do not directly increase revenue, leading to a decrease in the asset turnover ratio in the short term. This study's research period is relatively short, namely three years. So this can be the reason why green accounting does not affect resource efficiency.

From the legitimacy theory perspective, green accounting helps corporations maintain support and trust by meeting social and regulatory expectations. However, in the short term, it can be seen as inefficient in terms of resource efficiency. This strategy is essential to maintain the sustainability and long-term support of the corporation. This research is in line with the findings of [45] and [59], showing that while green accounting can encourage corporations to improve their environmental performance, the associated administrative and operational challenges reduce overall efficiency in the short term.

#### **4.2.5 Resource efficiency on corporate sustainability**

Based on the results of this study, it is concluded that resource efficiency does not affect corporate sustainability. Short-term profit focus causes resource efficiency not to affect corporate sustainability if the corporation reduces production costs, for example, by using cheaper but less environmentally friendly raw materials to produce more waste or toxic emissions, contrary to the principle of sustainability. Resource efficiency and corporate sustainability are two intertwined concepts that are often mutually reinforcing. However, corporations need to be careful not to focus too much on one aspect at the expense of another.

Dura & Suharsono [9] concluded that resource efficiency does not affect corporate sustainability because the corporate sustainability model varies with market developments and the level of orientation desired by stakeholders. Research by Dura & Suharsono [9] shows that companies focus on maximizing shareholder wealth, often ignoring aspects of sustainable development. This indicates that although resource efficiency measured using TATO is good, it is not always aligned with achieving sustainable development goals.

Overall, the theory of legitimacy highlights the importance of corporations focusing on asset efficiency and considering their operations' environmental and social impacts. By doing so, corporations maintain stakeholder support, comply with applicable regulations, and achieve long-term sustainability. This research is in line with the findings by Liu & Wu [44], Majid et al [60], Wang & Wang [61], and Zhang et al [62]. The research shows that while some organizations see positive effects on corporation value and market perception, others do not experience significant financial benefits.

#### **4.2.6 MFCA mediates the effect of green accounting on corporate sustainability**

This study concludes that MFCA could mediate the influence of green accounting on corporate sustainability. MFCA is effective in green accounting practices to identify the impact of material use on the environment in more detail than regular green accounting. The MFCA uncovers the costs associated with materials and energy wasted in production and helps corporations reduce previously identified environmental costs. By reducing wasted materials through MFCA, the corporation improves eco-efficiency and operational efficiency, an important contribution to sustainability. In sustainability, green accounting and MFCA help corporations maintain legitimacy by transparently reporting environmental costs and measuring the positive impact of waste reduction and improved material efficiency. The results of this study are consistent with the research of Rakesa & Werastuti [45] that green accounting has a positive effect on corporate sustainability.

In summary, green accounting and MFCA have a major impact on achieving sustainability goals. In addition, green accounting helps measure and report environmental impacts. MFCA focuses on revealing the cost of materials and energy wasted during production. The results of this study are on the same page as Wiredu et al [37], who stated that MFCA is proven to mediate green accounting toward corporate sustainability. MFCA is an important mediator in the influence of green accounting and sustainability. MCA helps corporations better understand and manage the environmental impact of their activities, which ultimately contributes to better sustainability performance.

#### **4.2.7 Resource efficiency mediates the effect of green accounting on corporate sustainability**

The results of this study show that resource efficiency does not mediate the influence of green accounting on corporate sustainability. Although green accounting is implemented, the direct relationship between green accounting and resource efficiency, especially in the context of asset turnover, is not always clear. TATO can be high without significant efficiency improvements, as many assets, such as financial or office property, do not contribute directly to environmental efficiency. Instead, spending on green accounting is considered an additional cost that does not directly increase sales, thereby reducing asset turnover. Based on a fairly short research period is one of the reasons why this hypothesis is rejected. The impact of green accounting and resource efficiency is not directly visible in the short term. It takes a long enough time for the benefits of corporate sustainability to be real.

To mediate a more effective relationship between green accounting and sustainability, corporations must integrate green accounting with their overall business strategy, ensure that environmental initiatives support operational and financial efficiency, and manage stakeholder perceptions transparently regarding investments and long-term ecological impacts. This research aligns with the findings of Solovida & Latan [48] and Indriastuti et al [63] and that a strong environmental strategy and applying environmental management accounting can improve a corporation's environmental performance. Still, resource efficiency does not significantly mediate the relationship.

## **5 Conclusion**

This study aims to determine whether MFCA and resource efficiency could mediate the relationship between green accounting and corporate sustainability. Based on the research findings, the following conclusions can be drawn: The direct effect of (1) Green accounting positively affects corporate sustainability. The higher the

influence of green accounting, the better the corporate sustainability will be. (2) Green accounting has a positive effect on MFCA. This means that the better the environmental costs are incurred, the better the MFCA will analyze the data to determine the cost of material loss. (3) MFCA has a positive effect on corporate sustainability. In other words, if waste management is better in MFCA, it will reduce waste and emissions, ultimately increasing sustainability. (4) Green accounting does not affect resource efficiency. Another way of saying that when environmental costs are incurred, they will add to the corporation's total assets, decreasing sales because revenue does not increase comparatively. (5) Resource efficiency does not affect corporate sustainability. A short-term profit focus means a company focuses only on one aspect and ignores other factors, such as the environment.

Furthermore, (6) MFCA can mediate the relationship between green accounting and corporate sustainability. Green accounting that is integrated with environmental costs, as well as MFCA, reveals more detailed costs related to materials and energy wasted in the production process and can improve sustainability because the information from green accounting and MFCA can help corporations reduce environmental costs, which reduce negative impacts on the environment and improve operational efficiency. Finally, (7) Resource efficiency does not mediate the effect of green accounting on corporate sustainability. This can indicate that the impact of implementing green accounting and resource efficiency is not directly visible in the short term. It takes a long enough time for the benefits of corporate sustainability to be felt.

The results of this study are expected to be a reference for policymakers to require corporations to implement green accounting, not limited to qualitative reports on the positive environment. Ultimately, green accounting and MFCA are essential tools in improving corporate sustainability. Green accounting helps companies manage environmental impacts, increase efficiency, and encourage sustainable innovation. MFCA is critical in assisting corporations in reducing waste and minimizing energy use and inefficient materials. Furthermore, MFCA effectively integrates sustainability considerations into business decision-making, enhancing a company's environmental and economic performance.

Although resource efficiency does not mediate the influence of green accounting on corporate sustainability, this is a special concern for corporations. The benefits obtained from implementing green innovation cannot immediately increase TATO but require a more extended period. In the future, further research can extend the research period with the intention that the implementation of resource efficiency is more visible. Also, additional research can explore other contexts and different industry sectors to test and validate the results of this research. Moreover, green accounting, MFCA, and resource efficiency explain 22.8% of the variation in corporate sustainability; therefore, further research can explore other variables that enhance corporate sustainability.

## Acknowledgements

This research was supported by the Faculty of Economics and Business, Universitas Hasanuddin, Makassar, under Grant 556/UN4.4/KEP/2024.

## References

- [1] Chamorro, C., Jesús, G., and Vines, P. (2022), A framework for a green accounting system: exploratory study in a developing-country context, Colombia, *Environment, Development and Sustainability*, **1**, 1-25. <https://doi.org/10.1007/s10668-022-02445-w>.
- [2] Gray, R. (2002), Of messiness, systems and sustainability: towards a more social and environmental finance and accounting, *The British Accounting Review*, **34**(4), 357-386. <https://doi.org/10.1006/bare.2002.0217>.
- [3] Lako, A. (2017), Krisis ekologi dan urgensi tatakelola bisnis dan akuntansi hijau, *Akuntansi Indonesia*, **7**, 60-64.
- [4] Chotaliya, M. (2022), Green accounting in India as a measure of attaining sustainable development goals, in *Future of Work and Business in Covid-19 Era*, 31-37. [https://doi.org/10.1007/978-981-19-0357-1\\_4](https://doi.org/10.1007/978-981-19-0357-1_4).
- [5] Araújo, R.A.de M., Kaczam, F., Lopes Lucena, W.G., Silva, W.V.da, and Veiga, C.P.da (2024), Environmental innovation and corporate sustainability: evidence-based systematic literature review, *Technological Sustainability*, **3**(2), 212-231. <https://doi.org/10.1108/TECHS-04-2023-0018>.

- [6] Jui, C.T. and Hsieh, S.H. (2003), Green accounting in developing countries: the, *Managerial Finance*, **29**(8), 37-45.
- [7] Buric, M.N., Filipovic, A.L., and Stojanovic, A.J. (2022), Green accounting with special reference to Montenegro, in *International Conference "New Technologies, Development and Applications"*, 1017-1023. [https://doi.org/10.1007/978-3-031-05230-9\\_120](https://doi.org/10.1007/978-3-031-05230-9_120).
- [8] Onishi, Y., Kokubu, K., and Nakajima, M. (2008), Implementing material flow cost accounting in a pharmaceutical company, in S. Schaltegger, M. Bennett, R.L. Burritt, and C. Jasch (eds.), *Environmental Management Accounting for Cleaner Production*, 395-409. [https://doi.org/10.1007/978-1-4020-8913-8\\_22](https://doi.org/10.1007/978-1-4020-8913-8_22).
- [9] Dura, J. and Suharsono, R. (2022), Application green accounting to sustainable development improve financial performance study in green industry, *Jurnal Akuntansi*, **26**(2), 192-212. <https://doi.org/10.24912/ja.v26i2.893>.
- [10] Endiana, I.D.M. and Dicriyani, N.L.G.M. (2020), The effect of green accounting on corporate sustainability and financial performance, *Journal of Asian Finance, Economics, and Business*, **7**(12), 731-738. <https://doi.org/10.13106/jafeb.2020.vol7.no12.731>.
- [11] Rachmawati, W. and Karim, A. (2021), Pengaruh green accounting terhadap MFCA dalam meningkatkan keberlangsungan usaha serta resource efficiency sebagai variabel moderating (studi kasus pada perusahaan peraih penghargaan industri hijau), *Tirtayasa Ekonomika*, **16**(1), 59-82. <https://doi.org/10.35448/jte.v16i1.10205>.
- [12] Trisnangsih, T. (2024), The impact of implementing green accounting and MFCS on sustainable development, in *Proceedings of the International Conference of Economics Business and Economics Education Science (ICE-BEES-24)*, 1-9. [https://doi.org/10.2991/978-94-6463-522-5\\_51](https://doi.org/10.2991/978-94-6463-522-5_51).
- [13] Huseno, T. (2018), The environmental management accounting (EMA) perspective calculation of environmental management environment in Riau, *Journal of Applied Management (JAM)*, **16**(4), 714-721. <https://doi.org/10.21776/ub.jam>.
- [14] Sari, R.N., Pratadina, A., Anugerah, R., Kamaliah, K., and Sanusi, Z.M. (2020), Effect of environmental management accounting practices on organizational performance: role of process innovation as a mediating variable, *Business Process Management Journal*, **27**(4), 1296-1314. <https://doi.org/10.1108/BPMJ-06-2020-0264>.
- [15] Amiruddin, A. and Pagalung, G. (2016), Environmental management accounting: identifying future potentials, *Asia-Pacific Management Accounting*, **11**(1), 80-94.
- [16] Tran, T.T. and Herzig, C. (2020), Material flow cost accounting in developing countries: a systematic review, *Sustainability (Switzerland)*, **12**(13), 5413-5430. <https://doi.org/10.3390/su12135413>.
- [17] Kokubu, K., Kitada, H., Nishitani, K., and Shinohara, A. (2023), How material flow cost accounting contributes to the SDGs through improving management decision making, *Journal of Material Cycles and Waste Management*, **25**(5), 2783-2793. <https://doi.org/10.1007/s10163-023-01696-7>.
- [18] Tu, J.C. and Huang, H.S. (2019), Relationship between green design and material flow cost accounting in the context of effective resource utilization, *Sustainability (Switzerland)*, **11**(7), 1974-1988. <https://doi.org/10.3390/su11071974>.
- [19] Han, J., Forman, G.S., Elgowainy, A., Cai, H., Wang, M., and DiVita, V.B. (2015), A comparative assessment of resource efficiency in petroleum refining, *Fuel*, **157**, 292-298. <https://doi.org/10.1016/j.fuel.2015.03.038>.
- [20] Zorn, A., Esteves, M., Baur, I., and Lips, M. (2018), Financial ratios as indicators of economic sustainability: a quantitative analysis for Swiss dairy farms, *Sustainability (Switzerland)*, **10**(8). <https://doi.org/10.3390/su10082942>.
- [21] Sun, Y., Gao, P., Tian, W., and Guan, W. (2023), Green innovation for resource efficiency and sustainability: empirical analysis and policy, *Resources Policy*, **81**. <https://doi.org/10.1016/j.resourpol.2023.103369>.
- [22] Karppa, J. (2023), Resource efficiency of agricultural sectors in Finland, *Aalto University*.
- [23] Marrone, M., Linnenluecke, M.K., Richardson, G., and Smith, T. (2020), Trends in environmental accounting research within and outside of the accounting discipline, *Accounting, Auditing & Accountability Journal*, **33**(8), 2167-2193. <https://doi.org/10.1108/AAAJ-03-2020-4457>.
- [24] Dowling, J. and Pfeffer, J. (1975), Organizational legitimacy: social values and organizational behavior, *The Pacific Sociological Review*, **18**(1), 122-136.
- [25] Marina, A., Wahjono, S.I., and Desipradani, G. (2017), Akuntansi hijau berbasis etika bisnis: implementasi di RSUA Ponorogo, Jawa Timur, *BALANCE (Economic, Business, Management, and Accounting Journal)*, **14**(1), 19-28. <https://doi.org/10.30651/blc.v14i01.1560>.
- [26] Lubis, H.Z. and Diani, A. (2018), Analisis penerapan akuntansi lingkungan (green accounting) dalam pengelolaan limbah perusahaan, in *Proceedings Konferensi Nasional Asosiasi Program Pascasarjana Perguruan Tinggi Muhammadiyah Aisyiyah Ke-8*, 1-7. <http://www.appptma.org/wp-content/uploads/2019/07/39.978-623-90018-0-3.pdf>.
- [27] Lako, A. (2015), *Green Economy: Menghijaukan Ekonomi, Bisnis & Akuntansi*, 1st edn, Erlangga, 60-75.
- [28] Nishitani, K., Kokubu, K., Wu, Q., Kitada, H., Guenther, E., and Guenther, T. (2022), Material flow cost accounting (MFCA) for the circular economy: an empirical study of the triadic relationship between MFCA, environmental performance, and the economic performance of Japanese companies, *Journal of Environmental Management*, **303**. <https://doi.org/10.1016/j.jenvman.2021.114219>.
- [29] Huysman, S., Sala, S., Mancini, L., Ardente, F., Alvarenga, R.A.F., De Meester, S., Mathieux, F., and Dewulf, J. (2015), Toward a systematized framework for resource efficiency indicators, *Resources, Conservation and Recycling*, **95**, 68-76. <https://doi.org/10.1016/j.resconrec.2014.10.014>.



- [30] Rieckhof, R., Bergmann, A., and Guenther, E. (2015), Interrelating material flow cost accounting with management control systems to introduce resource efficiency into strategy, *Journal of Cleaner Production*, **108**, 1262-1278. <https://doi.org/10.1016/j.jclepro.2014.10.040>.
- [31] Idris, Q.S., Kurniawan, A.W., and Anwar (2022), Analisis rasio aktivitas untuk menilai kinerja keuangan PT PLN (Persero) UP3 Makassar Selatan, *Majalah Ekonomi dan Bisnis*, **18**(22), 80-88.
- [32] Rounaghi, M.M. (2019), Economic analysis of using green accounting and environmental accounting to identify environmental costs and sustainability indicators, *International Journal of Ethics and Systems*, **35**(4), 504-512. <https://doi.org/10.1108/IJOES-03-2019-0056>.
- [33] Gonzalez, C.C. and Mendoza, K.H. (2020), Green accounting in Colombia: case study of the mining sector, *Environment, Development and Sustainability*, **23**, 6453-6465. <https://doi.org/10.1007/s10668-020-00880-1>.
- [34] Yasrawan, K.T. and Werastuti, D.N.S. (2022), Bagaimana peran dan penerapan akuntansi hijau di Indonesia? *Jurnal Akuntansi Kontemporer*, **14**(3), 151-161. <https://doi.org/10.33508/jako.v14i3.3514>.
- [35] Maama, H. and Appiah, K.O. (2019), Green accounting practices: lesson from an emerging economy, *Qualitative Research in Financial Markets*, **11**(4), 456-478. <https://doi.org/10.1108/QRFM-02-2017-0013>.
- [36] Dhar, B.K., Sarkar, S.M., and Ayittey, F.K. (2022), Impact of social responsibility disclosure between implementation of green accounting and sustainable development: a study on heavily polluting companies in Bangladesh, *Corporate Social Responsibility and Environmental Management*, **29**(1), 71-78. <https://doi.org/10.1002/csr.2174>.
- [37] Wiredu, I., Osei Agyemang, A., and Agbadzidah, S.Y. (2023), Does green accounting influence ecological sustainability? Evidence from a developing economy, *Cogent Business and Management*, **10**(2), 1-25. <https://doi.org/10.1080/23311975.2023.2240559>.
- [38] Soraya, B., Nurrochmah, A., and Hwihanus, H. (2024), Business transformation towards sustainability: the role of green accounting in sustainability management, *Journal of Environmental Economics and Sustainability*, **1**(3), 1-8. <https://doi.org/10.47134/jees.v1i3.342>.
- [39] Faieq, H.T. and Cek, K. (2024), Enhancing Kurdistan's manufacturing companies' sustainable waste management: a norm activation approach to green accounting, CSR, and environmental auditing oversight, *Heliyon*, **10**(12). <https://doi.org/10.1016/j.heliyon.2024.e32725>.
- [40] Schmidt, M. and Nakajima, M. (2013), Material flow cost accounting as an approach to improve resource efficiency in manufacturing companies, *Resources*, **2**(3), 358-369. <https://doi.org/10.3390/resources2030358>.
- [41] Selpiyanti, S. and Fakhroni, Z. (2020), Pengaruh implementasi green accounting dan material flow cost accounting terhadap sustainable development, *Jurnal ASET (Akuntansi Riset)*, 109-116. <https://ejournal.upi.edu/index.php/aset/article/view/23281>.
- [42] Huang, S.Y., Chiu, A.A., Chao, P.C., and Wang, N. (2019), The application of material flow cost accounting in waste reduction, *Sustainability (Switzerland)*, **11**(5), 1270-1296. <https://doi.org/10.3390/su11051270>.
- [43] Rahman, M.M. and Islam, M.E. (2023), The impact of green accounting on environmental performance: mediating effects of energy efficiency, *Environmental Science and Pollution Research*, **30**(26), 69431-69452. <https://doi.org/10.1007/s11356-023-27356-9>.
- [44] Liu, C. and Wu, S.S. (2023), Green finance, sustainability disclosure and economic implications, *Fulbright Review of Economics and Policy*, **3**(1), 1-24. <https://doi.org/10.1108/frep-03-2022-0021>.
- [45] Rakesa, P.R.C. and Werastuti, D.N.S. (2022), Pengaruh penerapan green accounting dan material flow cost accounting terhadap corporate sustainability, *Jurnal Ilmiah Mahasiswa Akuntansi*, **13**(4), 1141-1152. <https://doi.org/10.23887/jimat.v13i04.35926>.
- [46] Abdullah, M.W. and Amiruddin, H. (2020), Efek green accounting terhadap material flow cost accounting dalam meningkatkan keberlangsungan perusahaan, *EKUITAS (Jurnal Ekonomi dan Keuangan)*, 166-186. <https://ejournal.stiesia.ac.id/ekuitas/article/view/4145>.
- [47] Gonzalez, C.C. and Vences, J.-P. (2023), A framework for a green accounting system—exploratory study in a developing-country context, Colombia, *Environment, Development and Sustainability*, **25**, 9517-9541. <https://doi.org/10.1007/s10668-022-02445-w>.
- [48] Solovida, G.T. and Latan, H. (2017), Linking environmental strategy to environmental performance: mediation role of environmental management accounting, *Sustainability Accounting, Management and Policy Journal*, **8**, 595-619.
- [49] Gallo, P.J. and Christensen, L.J. (2011), Firm size matters: an empirical investigation of organizational size and ownership on sustainability-related behaviors, *Business & Society*, **50**(2), 315-349. <https://doi.org/10.1177/0007650311398784>.
- [50] Drempetic, S., Klein, C., and Zwergel, B. (2019), The influence of firm size on the ESG score: corporate sustainability ratings under review, *Journal of Business Ethics*, **167**(4), 333-360. <https://doi.org/10.1007/s10551-019-04164-1>.
- [51] Susana, D. (2019), Pengaruh ukuran perusahaan dan profitabilitas terhadap pengungkapan sustainability report serta dampaknya kepada nilai perusahaan, *Jurnal Studia Akuntansi dan Bisnis*, **7**(2), 173-186. <https://doi.org/10.55171/jsab.v7i3.361>.
- [52] Fadilah, F., Uzliawati, L., and Mulyasari, W. (2022), The effect of firm size and firm age on sustainability reporting and the impact on earnings management, *Jurnal Riset Akuntansi Terpadu*, **15**(1), 84-99. <https://doi.org/10.35448/>

jrak.v15i1.14510.

- [53] Damayanti, R.S. and Yanti, H.B. (2023), Pengaruh implementasi green accounting dan material flow cost accounting terhadap sustainable development, *Jurnal Ekonomi Trisakti*, **3**(1), 1257-1266. <https://doi.org/10.25105/jet.v3i1.16014>.
- [54] Gustinya, D. (2022), Pengaruh penerapan green accounting terhadap nilai perusahaan manufaktur peserta PROPER yang listing di Bursa Efek Indonesia tahun 2017-2019, *Jurnal Akuntansi dan Bisnis Krisnadwipayana*, **9**(2), 759-771. <https://doi.org/10.35137/jabk.v9i2.688>.
- [55] Sarni, B.S., Syahril, V., and Pandin, M.Y.R. (2023), Pengaruh green accounting terhadap sustainability ekonomi pada industri perkebunan yang terdaftar di Bursa Efek Indonesia (BEI), *Jurnal Riset Ekonomi dan Akuntansi*, **1**(2), 62-74. <https://doi.org/10.54066/jrea-itb.v1i2.424>.
- [56] Santi, A.R., Andi, K., Lindrianasari, L., and Oktavia, R. (2022), Pengaruh penerapan material flow cost accounting terhadap green accounting dan financial performance, *Fair Value: Jurnal Ilmiah Akuntansi dan Keuangan*, **5**(2), 723-732. <https://doi.org/10.32670/fairvalue.v5i2.2327>.
- [57] Khotimah, T.A.N., Nurlaili, N., Ekawati, E., and Sisdiyanto, E. (2022), The effect of green accounting and material flow cost accounting on corporate sustainability in Islamic economic perspective: study on manufacturing companies listed on the SRI-Kehati Index 2016-2020, in *Annual International Conference on Islamic Economics and Business*, 233-243. <https://doi.org/10.18326/aicieb.v2i1.172>.
- [58] Doorasamy, M. (2015), Theoretical developments in environmental management accounting and the role and importance of MFCA, *Foundations of Management*, **7**(1), 37-52. <https://doi.org/10.1515/fman-2015-0024>.
- [59] Gunarathne, N. and Lee, K.H. (2021), Corporate cleaner production strategy development and environmental management accounting: a contingency theory perspective, *Journal of Cleaner Production*, **308**, 127402-127411. <https://doi.org/10.1016/j.jclepro.2021.127402>.
- [60] Majid, S., Zhang, X., Khaskheli, M.B., Hong, F., King, P.J.H., and Shamsi, I.H. (2023), Eco-efficiency, environmental and sustainable innovation in recycling energy and their effect on business performance: evidence from European SMEs, *Sustainability*, **15**(12), 9465-9494. <https://doi.org/10.3390/su15129465>.
- [61] Wang, Y. and Wang, B. (2024), Can resource dependency and corporate social responsibility drive green innovation performance? *Sustainability*, **16**(11), 4848-4869. <https://doi.org/10.3390/su16114848>.
- [62] Zhang, C., Chen, P., and Hao, Y. (2022), The impact of digital transformation on corporate sustainability—new evidence from Chinese listed companies, *Frontiers in Environmental Science*, **10**, 1047418. <https://doi.org/10.3389/fenvs.2022.1047418>.
- [63] Indriastuti, M., Chariri, A., and Fuad (2022), Green accounting adoption toward sustainable performance, in *International Conference on Intelligent Networking and Collaborative Systems*, 264-273. [https://doi.org/10.1007/978-3-031-14627-5\\_26](https://doi.org/10.1007/978-3-031-14627-5_26).