

The Impact of Green Accounting on Material Flow Cost Accounting in Improving Business Sustainability and Palm Oil Company Value in Indonesia in 2021-2023

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Abstract: - This study aims to examine the impact of green accounting on material flow cost accounting in improving business sustainability and firm value. The sample in this study were palm oil companies listed on the Indonesia Stock Exchange (IDX) during the period 2021-2023. The total sample amounted to 33 from 11 companies using purposive sampling technique. The data analysis method uses multiple regression and mediation tests using the Sobel-test. Multiple linear regression analysis for the hypothesis of green accounting on business sustainability and firm value (through MFCA). The result showed that green accounting negatively affects MFCA, business sustainability and firm value. While the results of the MFCA test as a mediating variable show that MFCA is not able to mediate the effect of green accounting on business sustainability and firm value in a positive direction.

Key-Words: - Green accounting; Material flow cost accounting; Business sustainability; Firm value; Cost Accounting.

Received: March 04, 2025. **Revised:** March 15, 2025. **Accepted:** April 27, 2020. **Published:** April 30, 2025

1 Introduction

The rapid development of oil palm has resulted in the company receiving criticism from various parties to pay attention to environmental sustainability (Selpiyanti & Fakhroni, 2020). In addition, its rapid development has a negative impact on environmental health, such as air pollution, water, and forest burning and produces several types of waste such as gas waste, solid waste, and liquid waste. Based on the Katadata.co.id statistical data report (Katadata, 2019), the expansion of oil palm plantations has caused various problems ranging from agrarian conflicts to environmental pollution and endangering the ecosystem. Based on these impacts, it can affect environmental quality as an effect of economic growth activities. According to M. Angelina and E. Nursasi (2022) managing the environment is a form of corporate concern. Abdullah & Amiruddin (2020) state that ignoring the interests of stakeholders can damage the company's image in the eyes of the public, where it will have a negative effect on the company's financial performance. Therefore, companies need a tool that can support the company's commitment to the environment and social, such as green accounting that can help record and analyze the impact of activities on the environment. In addition, companies also need tools to manage waste more effectively, such as material flow cost accounting (MFCA).

Green accounting is a process in accounting that includes recognizing, measuring, recording, summarizing, and reporting information related to the economic, social, and environmental impacts of company activities. This process aims to present integrated information so that it can be used by various stakeholders in assessing company performance and supporting more informed decision making (Lako, 2018). Material flow cost accounting (MFCA) is a management tool that serves to facilitate organizations in mastering the environmental impacts and financial consequences of material and energy use. Through MFCA, companies can evaluate their operational practices and make

improvements to increase efficiency (Abdullah & Amiruddin, 2020). Sustainable development requires simultaneous adaptation of environmental, economic and equality principles. Based on these conditions, this study analyzes the impact of green accounting on MFCA in increasing business sustainability and the value of palm oil companies in Indonesia in 2021-2023. In accordance with the description in the research background, the researcher formulates problems which include: (1) how does green accounting affect the implementation of MFCA in palm oil companies in Indonesia, (2) how does green accounting affect the sustainability of palm oil businesses through MFCA implementation, (3) how does green accounting affect palm oil company value through MFCA implementation. This study aims to provide empirical evidence to answer these three research questions.

2 Theoretical Framework and Hypothesis Development

2.1 Green Accounting

Referring to the view of Nurafika & Sari (2019) green accounting is an approach that integrates aspects of environmental management and conservation into the financial reporting system, including in the analysis of costs and benefits. Green accounting is a concept of financial recording that not only pays attention to transactions that generate profits, but also considers aspects of environmental sustainability. This concept emphasizes the company's involvement in sustainable efforts, starting from the selection of raw materials, the use of energy in the production process, to financial recording and recognition of expenses related to environmental impacts (Fitria et al., 2022). Referring to Lako (2018), green accounting aims to integrate financial, social and environmental information in a comprehensive accounting report. This report serves as a basis for stakeholders in assessing and making investment, economic, and managerial decisions. Meanwhile, according to Le & Nguyen (2019) green accounting has the aim of minimizing the environmental impacts and risks that companies must undergo, developing operational efficiency levels, and emphasizing the budget spent on environmental protection around the company.

Based on this definition, it can be said that green accounting is a tool used to measure, identify and present the company's production and environmental costs in an effort to provide efficiency and effectiveness in the continuous use of resources so as to balance the company's development with environmental functions in a healthy and clean condition free of air pollution and provide benefits to society and living things around it. The purpose of green accounting is to develop the level of efficiency and effectiveness in environmental management from the point of view of costs and benefits. The measurement of green accounting in this study uses the PROPER assessment with a score according to the color of its acquisition, namely; gold: 5, green: 4, blue: 3, red: 2, black: 1 (Melawati & Rahmawati, 2022).

2.2 Material Flow Cost Accounting

Marota et al. (2015) stated that MFCA is a recording method used to identify and measure specific waste. MFCA provides information from both financial and non-financial aspects, making it easier for managers to make more effective decisions in waste reduction efforts. Selpiyanti & Fakhroni (2020) added that MFCA functions as a management instrument that supports the use of raw materials more efficiently, thereby minimizing and reducing waste emissions. Selpiyanti & Fakhroni (2020) the application of MFCA aims to evaluate the cost of losses incurred due to the material production process, so that companies can make more optimal decisions in managing their waste. Meanwhile, Alfian et al. (2020) explained that MFCA plays a role in increasing transparency regarding material flows, energy usage, costs and environmental impacts. In addition, MFCA also supports company decision-making by providing more accurate and systematic information. The application of MFCA is based on four main principles, namely understanding material flow and energy consumption, linking physical information with monetary aspects, ensuring accuracy, completeness, and comparability of physical data, and estimating and determining the cost of material losses.

Referring to this definition, it can be concluded that MFCA is a tool used to deal with the environmental and financial consequences of reducing waste emissions for the sake of profit and business continuity. MFCA is designed to promote ecological efficiency in the organism by focusing on reducing material use and improving the economic performance of the company. MFCA aims to assess

the cost of losses incurred in the production process, increasing transparency in material flow, energy utilization, and environmental impact. Thus, companies can make more optimized decisions in waste management and support business sustainability. Masrurroh et al. (2023) MFCA is used in management of material, energy, and environmental data. Measurement variable material flow cost accounting use formula as following:

$$\text{MFCA} = \text{Total output generated} / \text{Total Cost} \times 100\%$$

2.3 Business Sustainability

Hassan (2021) reveals that the notion of corporate sustainability performance refers to the application of long-term business orientation by companies to resolve the demands of stakeholders both now and in the future, while maintaining a focus on aspects of economic growth, environmental protection, and social justice. According to Tyastuty et al. (2023) to achieve corporate sustainability, companies need to identify and incorporate environmental and social issues into their strategic planning. Therefore, tools are needed that can support the company's commitment to the environment and social aspects in an effort to achieve sustainability. Measurement variable business sustainability use formula as following:

$$\text{Business Sustainability} = \text{Economic} + \text{Social} + \text{Environmental} + \text{Technology} \text{ (Marota, 2017).}$$

2.4 Company Value

According to Naufal & Suwaidi (2021), firm value describes investors' views on the size of the company's success in managing its resources, both internally and externally. Companies that consider environmental impacts in each of their operational activities can affect the overall value of the company. Meanwhile, Yuliani & Prijanto (2022) stated that environmental cost disclosure is a form of corporate responsibility for the positive or negative impacts caused to the environment. In addition, this disclosure also serves as a strategy to maintain company legitimacy. Measurement variable company value use formula as following: Tobins`Q = $\frac{(MVE+D)}{\text{Total Asset}}$ (Melawati & Rahmawati, 2022).

The Relationship Between Green Accounting and Material Flow Cost Accounting

Green accounting and MFCA have a relationship in supporting business sustainability. Hindriani et al. (2024) green accounting leads to the measurement and reporting of environmental impacts caused by business or corporate activities, while MFCA emphasizes the management of material costs and resource efficiency in minimizing environmental damage. By applying these two approaches, companies can identify areas where the company can minimize waste and improve efficiency, with the aim of the company's own sustainability (Rakesa & Werastuti, 2022). Rahmania Santi et al. (2022) the role of green accounting in supporting MFCA can also be seen from its function in increasing transparency and accountability in the company's financial statements. Disclosing relevant information related to the environmental impact of material costs, companies can more easily identify opportunities for mitigation (Sari & Rakhmawati, 2023). This not only helps companies meet environmental regulations, but also develops the company's image in the eyes of stakeholders.

H₁: Green accounting has a positive effect on MFCA

The Relationship Between Green Accounting and Material Flow Cost Accounting on Business Sustainability

According to Marota (2017), a sustainability system needs to complement three main aspects, namely environmental, economic, and social. This system can be applied to various sectors, such as companies, government, agriculture, and health. One of the management instruments that can develop material efficiency while reducing the impact of production waste is MFCA, which has been proven to have a positive impact on business sustainability. Research conducted by Selpiyanti & Fakhroni (2020) and Marota (2017) shows that MFCA has a significant influence on company sustainability. However, the research findings of Abdullah & Amiruddin (2020) show that the application of MFCA in the factory area has no influence on corporate sustainability. In addition, the moderating variable of green accounting does not strengthen the relationship between MFCA (in the context of production costs and factory area) and business sustainability.

H₂: Green accounting has a positive effect on business sustainability (through MFCA)

The Relationship Between Green Accounting and Material Flow Cost Accounting on Company Value

Amira & Siswanto (2022) said that environmental accounting is seen as the most effective solution to solve the problem of environmental damage. If implemented over a long period of time, the concept of environmental accounting provides an opportunity for depreciation of production costs, thereby emphasizing the amount of the company's operational expenses. Noviany Rahmatika et al. (2023), green accounting has a constructive impact on variables that represent company performance in terms of sustainability and businesses that use environmentally friendly accounting practices in their operations will see an increase in the value of their performance in terms of corporate sustainability. Fitria et al. (2022) revealed that the application of green accounting in a company can develop the selling value of products, which in turn contributes to increased profits. This shows that the implementation of the green accounting system in the company is in accordance with existing provisions. Then in accordance with, according to Loen (2018), the application of green accounting also functions as a source of information regarding how far an organization or company has a positive or negative impact on the quality of human life and the environment.

H₃: Green accounting has a positive effect on company value (through MFCA)

This study involves four main variables, namely green accounting (independent variable), MFCA (mediating/intervening variable), and business sustainability and firm value (dependent variable). The purpose of this study is to analyze how far the application of green accounting affects MFCA in developing business sustainability and the value of palm oil companies in Indonesia. In accordance with this explanation, the conceptual framework of this research can be explained in Figure 1.

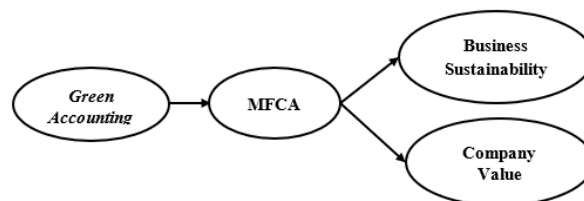


Figure 1. Conceptual Framework

3 Research Method

This research utilizes quantitative research methods. Referring to Jaya (2020), quantitative research is a type of research that aims to find new outputs through statistical procedures or other quantification methods. The approach used in this research is a descriptive approach, which focuses on analyzing problems based on facts that occur in a population today. The purpose of this approach is to answer hypotheses related to the actual conditions of the object under study. The population used in this study are palm oil companies listed on the IDX that have implemented green accounting principles or have sustainability reports in the 2021-2023 period, with a total of 30 palm oil companies with a research period of three (3) years. Sample determination using purposive sampling method is a sampling technique based on considerations or criteria consisting of: (1) palm oil companies listed on the IDX during the observation year, namely 2021-2023, (2) providing annual reports or sustainability reports consecutively during 2021-2023, (3) companies that participated in PROPER from 2021-2023, (4) companies publish complete data related to green accounting, MFCA, business sustainability indicators and company value during the 2021-2023 period. The documentation method is a method used in data collection in this study, namely by searching for data from published documents. The steps taken are through searching for the required data or documents from the company's publication report for the 2021-2023 period. This data is obtained from the official IDX website and the company.

Hypothesis testing in this study was carried out through multiple linear regression analysis obtained from a certain calculation process. In order to assess whether the regression equation obtained has a good ability to estimate the value of the dependent variable, a series of hypothesis tests are carried

out. This test aims to ensure the accuracy and suitability of the regression model in describing the correlation between the independent variables and the dependent variable under study:

Model 1: Testing the effect of green accounting on MFCA

$$M = \alpha + \beta_0 + \beta_1 X + e \dots \dots \dots (1)$$

Model 2: Testing the effect of green accounting and MFCA on business sustainability

$$Y_1 = \alpha + \beta_0 + \beta_1 X + \beta_2 M + e \dots \dots \dots (2)$$

Model 3: Testing the effect of green accounting and MFCA on firm value

$$Y_2 = \alpha + \beta_0 + \beta_1 X + \beta_2 M + e \dots \dots \dots (3)$$

Description:

- M : Material flow cost accounting
- X : Green accounting
- Y₁ : Business sustainability
- Y₂ : Company value
- α : Constant
- β₀, β₁, β₂ : Regression coefficient
- e : Error term

Linear regression is used to analyze the influence of independent variables on the dependent variable in a research model. This test is carried out with a sig level of 5% (α = 0.05) to determine whether the independent variables simultaneously or partially have a significant influence on the dependent variable. The results of this analysis will show the extent of the correlation between the variables and whether the effect is positive and significant.

Mediation is an extension of simple linear by adding one or more variables to the regression equation and the mediating variable describes the way an intervention delivers an outcome (Soleman & Tiffanie Victoria, 2021). The mediation test was conducted to analyze the role of MFCA in mediating the relationship between Green Accounting with business sustainability and firm value, to determine whether MFCA strengthens or weakens the influence exerted by green accounting in the context of sustainability of palm oil companies.

Formula:

$$z = \frac{a \times b}{\sqrt{(b^2 \times SE_a^2) + (a^2 \times SE_b^2)}}$$

Description:

- a : Regression coefficient between Green Accounting → MFCA
- b : Regression coefficient between MFCA → KU/NP
- SE_a : Standard error of a
- SE_b : Standard error of b

If z > 1.96 or p < 0.05, then MFCA mediates the relationship between Green Accounting with business sustainability variables and firm value.

4 Results and Discussions

4.1 Results

Table 1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
<i>Green Accounting</i>	33	2	5	3.12	.650
MFCA	33	.00	.71	.1964	.19904
Business Sustainability	33	925004	148153622	1265496767.03	3561945962.415
Company Value	33	.55	2.29	1.0909	.41560
Valid N (listwise)	33				

Through the acquisition of descriptive statistical tests in table 1, presented with 33 samples of palm oil companies, it shows that green accounting has a mean of 3.12 with a standard deviation of 0.650. This shows that the practice of green accounting in palm oil companies that are the research sample has a fairly good level of implementation with not too large variations between companies. Material flow cost accounting (MFCA) has a mean of 0.1964 with a standard deviation of 0.19904. This value indicates that the efficiency of material use in the production process is still quite varied, with some companies having a very low level of efficiency. Business sustainability shows an average of 1,265,496,767.03, with a standard deviation of 356,194,596.24. The large standard deviation value indicates that there is a significant inequality in the level of business sustainability between companies, which can be caused by various factors such as business strategies, environmental policies, and the scale of company operations. Firm value has a mean of 1.0909 with a standard deviation of 0.41560. This value reflects the relatively stable condition of the market value of palm oil companies in this study, although there are variations between companies.

Table 2. Kolmogorov-Smirnov (K-S)
One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual	Unstandardized Residual
N		33	33
Normal Parameters ^{a,b}	Mean	.0000000	.0000000
	Std. Deviation	2.19732874	.24730131
	Absolute	.151	.165
Most Extreme Differences	Positive	.151	.165
	Negative	-.098	-.119
Test Statistic		.151	.165
Asymp. Sig. (2-tailed) ^c		.200 ^d	.138

The results of the normality test conducted using K-S in Table 2 show that the business sustainability variable has a value of 0.151 with a sig value of 0.200, while the company value variable has a value of 0.165 with a level of 0.138. Because both variables have a significance level above 0.05, it can be concluded that the residual data conforms to the assumption of normality or has a normal distribution. This finding is reinforced by the results of the distribution graph analysis, which also shows that the data has a normal distribution pattern.

Table 3. Multicollinearity Test
Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
MFCA	(Constant)	.643	.155		4.153	<,001		
	<i>Green Accounting</i>	-.143	.049	-.468	-2.945	.006	1.000	1.000
Business Sustainability	(Constant)	18.525	2.648		6.996	<,001		
	<i>Green Accounting</i>	.219	.754	.052	.291	.773	.781	1.280
	MFCA	-6.511	2.461	-.473	-2.646	.013	.781	1.280
Company Value	(Constant)	2.499	.371		6.727	<,001		
	<i>Green Accounting</i>	-.376	.106	-.587	-3.552	.001	.781	1.280

	MFCA	1.200	.345	-.574	3.475	.002	.781	1.280
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a. Dependent Variable: MFCA, Business Sustainability, Company Value

Source: SPSS Data Processing 30 2025

Referring to the multicollinearity test results displayed in Table 3, in the first model, namely the effect of green accounting on MFCA, the tolerance value of the green accounting variable is 1.000 which exceeds the 0.10 level limit. This shows that there is no significant correlation between the independent variables in the model. In addition, the VIF value obtained is also 1,000, which is below the tolerance limit of 10. So, it can be concluded that the regression model used in this study does not experience multicollinearity problems between independent variables.

In the second model, namely the effect of green accounting and MFCA on business sustainability, the tolerance value of green accounting and MFCA is 0.781 above 0.10. This indicates that there is no significant correlation between the independent variables in the research model. In addition, the VIF value for both variables is $1.280 < 10$. So, it can be concluded that the regression model used in this study does not experience multicollinearity problems, so that the relationship between variables can be analyzed more accurately.

In the third model, namely the effect of green accounting and MFCA on firm value, the tolerance value of green accounting and MFCA is 0.781 which is higher than the minimum limit of 0.10. it shows that there is no significant correlation between the independent variables in the research model. In addition, the results of the VIF value analysis show the number $1,280 < 10$. So, it can be concluded that the regression model used in this study does not experience multicollinearity problems, so that the analysis of the relationship between variables can be carried out more validly and reliably.

Table 4. Model Feasibility Test Results (F)

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	.277	1	.277	8.674	.006 ^b
Residual	.991	31	.032		
Total	1.268	32			

a. Dependent Variable: MFCA

b. Predictors: (Constant), Green Accounting

Source: SPSS Data Processing 30 2025

Based on the results of the F-test displayed in Table 4, the F-count value obtained is 8.674 with a sig value of 0.006. Because the significance value is below 5% ($\alpha = 0.05$) and the F-count value of 8.674 exceeds the F-table 4.16 ($df1=2-1=1$ and $df2=33-1-1=31$), the alternative hypothesis H1 is accepted. So, a conclusion can be drawn that green accounting has a positive influence on MFCA, and the research model used is declared worthy of further study.

Table 5. Partial Regression Test (t)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.643	.155		4.153	<.001
Green Accounting	-.143	.049	-.468	-2.945	.006

a. Dependent Variable: MFCA

Source: SPSS Data Processing 30 2025

The regression equation obtained
 $M = 0.643 + (-0.143) X$

Referring to the results of the partial regression test (t test) displayed in Table 5, the regression coefficient value for the green accounting variable is -0.143 with a significance value of 0.006, which is less than 5% ($\alpha = 0.05$). This result shows that green accounting has a negative and significant influence on MFCA. This finding is not linear with the initial hypothesis which shows that green accounting has a positive influence on MFCA, thus H1 in this study is not approved.

Table 6. Coefficient of Determination Test Results (R^2)

Model Summary Model 1				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.468 ^a	.219	.193	.17876

a. Predictors: (Constant), *Green Accounting*

Source: SPSS Data Processing 30 2025

Referring to the coefficient of determination test in Table 6, the R square value of 0.219 shows that the green accounting variable is able to explain the variance in material flow cost accounting (MFCA) by 21.9%, while the remaining 78.1% is explained by other factors not in the model. The adjusted R square value of 0.193 indicates that after adjusting for the number of independent variables, the contribution of green accounting to MFCA is slightly reduced. Thus, although there is an influence of green accounting on MFCA, there are still other factors that are more dominant in determining the cost efficiency of material flow in the palm oil industry.

Table 7. Model Feasibility Test Results (F)

ANOVA Model 2						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	59.914	2	29.957	4.994	.013 ^b
	Residual	179.967	30	5.999		
	Total	239.881	32			

a. Dependent Variable: Business Sustainability

b. Predictors: (Constant), MFCA, *Green Accounting*

Source: SPSS Data Processing 30 2025

Based on the test results in table 7, the F-count value of 4.994 is obtained with a significance value of $0.013 < 0.05$, indicating that the regression model involving green accounting and MFCA as independent variables on business sustainability is significant and $F\text{-count } 4.994 > 3.315$ F-table ($df_1 = 3-1 = 2$ and $df_2 = 33-2-1 = 30$) which means H2 is accepted. This indicates that the hypothesis model is feasible to use.

Table 8. Partial Regression Test (t)
Coefficients Model 2

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	18.525	2.648		6.996	<.001
	<i>Green Accounting</i>	.219	.754	.052	.291	.773
	MFCA	-6.511	2.461	-.473	-2.646	.013

a. Dependent Variable: Business Sustainability

Source: SPSS Data Processing 30 2025

The regression equation obtained
 $Y_1 = 18.525 + 0.219X + (-6.511) M$

Referring to the test results in table 8, green accounting has a significance value of 0.773, indicating that it has no significant effect on business sustainability. In contrast, MFCA has a significance value of 0.013, which means it has a negative and significant influence on business sustainability with a regression coefficient value of -6.511. Thus, H2 is rejected, as there is no significant effect of green accounting, and MFCA has a negative effect on business sustainability.

Table 9. Coefficient of Determination Test Results

Model Summary Model 2				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	.500 ^a	.250	.200	2.44927

a. Predictors: (Constant), MFCA, *Green Accounting*

Source: SPSS Data Processing 30 2025

The results of the Model Summary test in Table 9, show that green accounting and MFCA both have an influence on business sustainability with an R Square value of 0.250 or 25%, indicating that this model is able to explain 25% of the variance in business sustainability, while 75% is influenced by other variables not in the model.

Table 10. Model Feasibility Test (f)

ANOVA Model 3					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.986	2	.993	8.415	.001 ^b
1 Residual	3.541	30	.118		
Total	5.527	32			

a. Dependent Variable: Company Value

a. Predictors: (Constant), MFCA, *Green Accounting*

Source: SPSS Data Processing 30 2025

Table 10, is the result of the Green Accounting and MFCA influence test. The hail shows the F-count value of 8.415 with a significance value of 0.001, which means that the significance level is below 0.05 and the F-count of 8.415 exceeds the F-table of 3.315 (df1 = 3-1 = 2 and df2 = 33-2-1 = 30), which means that H3 is accepted, thus a conclusion can be drawn that the hypothesis model is feasible to use.

Table 11. Partial Regression Coefficient Test (t)

Coefficients Model 3					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.499	.371		6.727	<.001
1 <i>Green accounting</i>	-.376	.106	-.587	-3.552	.001
MFCA	-1.200	.342	-.574	-3.475	.002

a. Dependent Variable: Company Value

Source: SPSS Data Processing 30 2025

The regression equation obtained
 $Y_2 = 2.499 + (-0.376) X + (-1.200) M$

Referring to the results of the t test on H3, it is found that the green accounting variable has a regression coefficient of -0.376 with a sig value of 0.001, which is less than the significant level of 5% ($\alpha = 0.05$). This shows that green accounting has a significant effect on firm value. Then, the MFCA variable has a regression coefficient of -1.200 with a significance value of 0.002, which is also below

0.05, thus a conclusion can be drawn that MFCA has a significant influence on firm value. Thus, either green accounting or MFCA has a negative and significant influence on firm value. These findings are not linear to the initial hypothesis H3, which reveals that green accounting has a positive influence on firm value through MFCA so that the hypothesis is rejected.

Table 12. Determination Coefficient Test Results
Model Summary Model 3

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
3	.599 ^a	.359	.317	.34355

a. Predictors: (Constant), MFCA, Green Accounting

Source: SPSS Data Processing 30 2025

According to table 12, the R Square value is 0.359, which indicates that green accounting and MFCA can explain 35.9% of the variation in firm value, while the rest is influenced by other factors that are not in the model.

Input:	Test statistic:	Std. Error:	p-value:
a -0.143	Sobel test: 2.00179778	0.55084135	0.04530648
b -7.711	Aroian test: 1.94233018	0.56770626	0.05209714
s _a 0.049	Goodman test: 2.06708478	0.53344353	0.03872617
s _b 2.803	Reset all	Calculate	

Source: Data Processing Sobel-test Calculator

Figure 2. Computer Calculator Results for Mediation

Z-score Formula

$$Z = \frac{(-0.143) \times (-6.511 + (-1.200))}{\sqrt{(-6.511 + (-1.200))^2 \times 0.049^2 + (-0.143^2 \times ((2.461 + 0.342)^2))}}$$

$$Z = \frac{1.1027}{\sqrt{0.1428 + 0.1606}}$$

$$Z = \frac{1.1027}{0.5508} = 2.002$$

Based on the mediation test results using the Sobel Test and Z-score calculation, the Z value is 2.002 > 1.96 with a p-value of 0.04 < 0.05. This shows that MFCA significantly mediates the relationship between Green Accounting and business sustainability and firm value. Thus, in the context of palm oil companies in Indonesia, MFCA has a strong enough role in strengthening or weakening the influence of Green Accounting on business sustainability and firm value.

4.2 Discussions

The first hypothesis test results state that if green accounting does not have a positive influence on MFCA then H1 is rejected. The regression test results show that green accounting has a negative influence on MFCA with a regression coefficient value of -0.143 and a significance level of 0.006 (p < 0.05). Although this effect is significant, the negative direction of the coefficient indicates that the implementation of green accounting does not necessarily increase the effectiveness of MFCA. The negative coefficient value indicates that the implementation of green accounting actually tends to reduce the effectiveness of MFCA. This can be caused by several contextual factors such as limited technical understanding, inadequate information infrastructure, and resistance to change in the traditional accounting system of palm oil companies. These findings are reinforced by the results of research by Suhartini et al. (2024), suggested that the implementation of green accounting in the industry on resources often faces obstacles in recording accurate environmental costs. These obstacles can be caused by the lack of integration of adequate environmental information systems within the company. In addition, the complexity in measuring environmental costs can reduce the effectiveness of MFCA in analyzing material and resource efficiency. The implications of these findings

suggest the need to re-evaluate the implementation mechanism of green accounting so that it can be effectively integrated with the MFCA framework in the context of the Indonesian palm oil industry.

The second hypothesis (H2) in this study reveals that green accounting does not have a significant influence on business sustainability through MFCA, thus H2 is not accepted. The regression test shows that green accounting has a positive regression coefficient of 0.219 on business sustainability with a sig level of $0.773 > 0.05$, which shows an insignificant effect. Meanwhile, MFCA has a negative influence on business sustainability with a regression coefficient of -6.51 and a significance level of $0.013 < 0.05$. The findings of this study indicate that the implementation of green accounting through MFCA has not directly contributed positively to business sustainability. In addition, MFCA also cannot function as a mediating variable that strengthens the correlation between green accounting and business sustainability. This finding is linear with research conducted by May et al. (2023) and Loen (2019), which revealed that green accounting has no significant effect on business sustainability, and MFCA does not contribute positively to company sustainability. One of the factors that could lead to this is the different characteristics of waste and waste generated by each company, where not all waste can be safely managed or reused in the production process.

The results of the third hypothesis test (H3) in this study reveal that green accounting has no positive influence on firm value through MFCA. In accordance with the regression test, it shows that green accounting has a negative influence on firm value with a regression coefficient of -0.376 and a significance level of 0.001. Meanwhile, material flow cost accounting (MFCA) shows that it has a significant negative influence on firm value, with a regression coefficient of -1.200 and a significance level of 0.002. This finding indicates that neither green accounting nor MFCA has been able to contribute positively in increasing firm value. In addition, MFCA also cannot function as an effective mediating variable in the correlation between green accounting and firm value. The findings of this study are consistent with the study conducted by Agatha & Widoretno (2023), which revealed that green accounting and MFCA have no positive influence on firm value. One of the contributing factors is that companies have not fully realized environmental costs in their financial statements during the study period. This finding is also linear with Loen (2019) is research, which shows that MFCA has no influence on firm value because environmental costs have not been implemented in the company's financial statements optimally.

The mediation test results based on the Sobel-test stated that the statistical value was 2.001 with a p-value of $0.045 > 0.05$. Meanwhile, the Z-score calculation produces a value of $2.002 > 1.96$, both of which indicate that MFCA can mediate (strengthen or weaken) the correlation between Green Accounting and business sustainability and firm value. The results in this study provide the fact that MFCA is able to weaken the influence of Green Accounting on business sustainability and firm value. The indirect coefficient path obtained from multiplying the Green Accounting coefficient on MFCA (-0.143) with the MFCA coefficient on business sustainability (-6.511) and firm value (-1.200) produces a positive indirect effect. This result is in line with the research of Ranjan & Jha (2019) who identified complexity in the mediation path between sustainability practices and firm performance, where contextual factors such as firm size, regulatory intensity, and market orientation can affect the strength of the relationship.

5 Conclusions

This research was conducted with the aim of identifying the impact of green accounting on MFCA in increasing business sustainability and the value of palm oil companies in Indonesia for the 2021-2023 period. Based on the description of the results and discussion of the research that has been submitted, several conclusions can be drawn which include:

Green accounting has a negative and significant effect on MFCA. The regression coefficient test results show a regression coefficient value of -0.143 with a sig value of $0.006 < 0.05$, which indicates that the implementation of green accounting actually tends to have a negative direction to reduce the effectiveness of MFCA, although the effect shows a statistically significant value. This could be caused by several contextual factors such as limited technical understanding, inadequate information infrastructure, and resistance to change in the traditional accounting system of palm oil companies.

Green accounting has a negative and insignificant effect on palm oil business sustainability through MFCA implementation. The results of the analysis conducted show that green accounting has a regression coefficient of 0.219 with a significance value of $0.773 > 0.05$, while MFCA has a negative and significant effect with a regression coefficient value of -6.511 and a significance of $0.013 < 0.05$. These findings indicate that the application of green accounting through MFCA has not directly contributed positively to business sustainability. In addition, MFCA has not been able to positively mediate green accounting on business sustainability.

Green accounting has a negative and significant effect on firm value through MFCA implementation. The analysis shows that green accounting has a regression coefficient of -0.376 with a sig level of 0.001 . MFCA has a coefficient of -1.200 with a significance of 0.002 . These results indicate that neither green accounting nor MFCA has been able to have a positive influence on firm value, and MFCA is still unable to positively mediate green accounting in increasing firm value.

The mediation test results show that MFCA can mediate (strengthen/weaken) the correlation between green accounting with business sustainability and palm oil company value. The results of this study provide the fact that MFCA weakens the effect of green accounting on business sustainability and firm value. The Sobel Test statistical value is 2.001 with a p-value of $0.045 < 0.05$ and a Z-score of $2.002 > 1.96$. The indirect coefficient path obtained from multiplying the green accounting coefficient on MFCA (-0.143), MFCA on business sustainability (-6.511) and MFCA on firm value (-1.200) results in a positive indirect effect.

Overall, this study found that in the context of the Indonesian palm oil industry for the period 2021-2023, the implementation of green accounting and MFCA has not shown significant benefits to business sustainability and firm value as hypothesized. These findings highlight the need for a more contextualized and comprehensive approach in adapting sustainable accounting practices to the Indonesian palm oil industry, taking into account the specific characteristics, implementation challenges, and expectations of stakeholders in this sector.

This research still has a number of limitations that need to be reviewed to interpret the results and be taken into consideration for the development of future research: (1) Expanding the measurement instruments of green accounting variables, MFCA, business sustainability, and firm value. (2) Future researchers are advised to expand the scope of independent variables to increase the variance in the analysis. (3) Take into account mediating and contextual factors that can affect the relationship between variables.

Some of the suggestions given aim to optimize future research results to be more comprehensive and useful for interested parties: (1) For palm oil companies listed on the IDX to take a more strategic and integrated approach in implementing green accounting and MFCA. (2) Companies are advised to disclose transparently all costs related to environmental accounting in the financial statements to make it easier for stakeholders to obtain relevant information to support more effective and sustainable decision making. (3) For accounting practitioners and sustainability consultants to underline the importance of developing an adaptive green accounting and MFCA implementation approach.

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