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Riset Akuntansi dan Keuangan Indonesia
URL : http://journals.ums.ac.id/index.php/reaksi/index

Sustainability Reporting in Value Creation: The Critical Mediation of Environmental Management Accounting

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Keywords:
sustainability report disclosure, environmental management accounting, firm value

ABSTRACT
This study examines the essential function of Environmental Management Accounting (EMA) as a mediating variable in the correlation between sustainability report disclosures and firm value. The study highlights the beneficial effects of Environmental Management Accounting (EMA) on value creation by aligning business strategy with sustainable practices, as viewed through the framework of stakeholder theory. Multiple regression and path analyses were performed on a sample of Indonesian manufacturing businesses listed on the Indonesian Stock Exchange (IDX) from 2020 to 2023 to evaluate the assumptions. The findings indicate that EMA substantially increases business value by fostering operational efficiency, transparency, and stakeholder confidence. The Sobel test further substantiates EMA's mediation impact, indicating that organizations with strong EMA procedures get superior financial success and sustainability results. This study highlights the significance of incorporating EMA into sustainability reporting frameworks to improve business value and promote sustainable development.

p-ISSN:1411-6510
e-ISSN :2541-6111

INTRODUCTION

Sustainability reporting has acquired considerable prominence as firms increasingly acknowledge the necessity of incorporating environmental, social, and governance (ESG) considerations into their business plans. This transition is primarily influenced by increased stakeholder expectations, regulatory demands, and therisingacknowledgmentthatsustainablepractices may augment long-term wealth development. Sustainability reporting is an essential mechanism for businesses to convey their sustainability performance and strategies to stakeholders, promoting openness and accountability (Rezaee et al., 2023).

In this context, environmental management accounting (EMA) serves as a crucial element that facilitates the connection between sustainability reporting and value development. EMA equips firms with essential frameworks and tools to assess, evaluate, and report environmental costs and performance, facilitating informed decision-making that fits with sustainability objectives (AlShara, 2022; Sekerez, 2017). The incorporation of EMA into sustainability reporting practices improves the quality and credibility of reports while enabling the identification of opportunities for resource efficiency and cost savings, thereby enhancing organizational performance (Ardiana, 2021; Auliani et al., 2023).

Furthermore, the alignment of sustainability reporting with the Sustainable Development Goals (SDGs) has emphasized the importance of Environmental Management Accounting (EMA) in facilitating value generation. Organizations that implement SDG reporting frameworks are more inclined to undertake comprehensive sustainability practices and pursue external verification of their reports, hence augmenting stakeholder trust and bolstering their reputational capital (Rezaee et al., 2023; Rosati & Faria, 2019). As companies manage the intricacies of sustainability reporting, the pivotal role of EMA is crucial in guaranteeing that the disclosed information is both precise and indicative of the organization's dedication to sustainable development (Asiaei et al., 2021).

Despite the expanding research on sustainability reporting and its influence on company value, notable gaps still about the precise function of EMA as a mediating component in this connection. Although research has demonstrated a favorable association between sustainability reporting and business value, the processes by which Environmental Management Accounting (EMA) affects this relationship remain poorly understood. Current studies, such those by Brozović et al. (2020), highlight the significance of value co-creation in sustainability initiatives but fail to sufficiently explore how Environmental Management Accounting (EMA) might support this process.

The contextual elements that may affect the efficacy of EMA in moderating the link between sustainability reporting and business value remain insufficiently examined. Lacoste (2016) examines the sustainable value co-creation process but neglects to address how varying sector features or regulatory frameworks could influence the function of EMA. This offers a chance for additional study to examine how contextual elements influence the efficacy of EMA in augmenting the value obtained from sustainability reporting.

Moreover, although the incorporation of EMA into sustainability reporting methods is acknowledged as advantageous, empirical data assessing its effect on business value is limited. Research conducted by Harymawan et al. (2020) emphasize the significance of external assurance in sustainability reporting, although they do not explicitly investigate the mediating function of EMA. This gap signifies a necessity for empirical research that assesses the direct and indirect impacts of EMA on financial performance results within the framework of sustainability reporting.

The influence of stakeholder involvement on the interplay between sustainability reporting, environmental management accounting, and business value is mostly unexamined. Investigation conducted by Xu et al. (2023) examines the ramifications of sustainability reporting but fails to explore the impact of stakeholder expectations on the efficacy of EMA as a mediating variable. Comprehending these relationships may yield significant insights into how companies may more effectively connect their sustainability reporting processes with stakeholder interests to augment company value.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The theoretical framework of the research is shown in figure 1. The interactions among corporate social responsibility (CSR), environmental management accounting (EMA), and firm value can be analyzed through stakeholder theory, which asserts that firms should account for the interests of all stakeholders, rather than solely those of shareholders, in their decision-making processes. Deegan (2004) argues that stakeholder theory highlights organizational accountability that extends much beyond just financial or economic success. This idea asserts that firms would willingly reveal information on their environmental, social, and intellectual performance beyond required criteria to fulfill the real or perceived expectations of stakeholders.

Figure 1. Research design

Sustainability Report Disclosure and Environmental Management Accounting

EMA functions as an essential instrument for organizations to assess, regulate, and communicate their environmental performance. It offers essential frameworks and metrics to evaluate the costs and benefits of environmental projects, thereby enabling informed decision-making (Jang et al., 2019). Jang et al. (2019) contend that competent Environmental Management Accounting (EMA) may amplify the efficacy of Corporate Social Responsibility (CSR) initiatives by offering insights on resource distribution and operational efficiency. The incorporation of EMA into CSR plans enables companies to more effectively match their environmental aims with overarching business goals, resulting in enhanced financial success.

The link between CSR and EMA is reciprocal, with CSR activities promoting the implementation of EMA techniques, while efficient EMA improves the efficacy of CSR efforts. Kun-Hsiang (2020) asserts that firms that emphasize CSR are more inclined to use EMA within their sustainability strategy. Novitasari et al. (2022) confirm this assertion, indicating that corporate social responsibility favorably impacts green supply chain management, which is intricately linked to environmental management accounting methods. The results indicate that companies that actively participate in CSR are more adept at utilizing EMA to enhance environmental performance and operational efficiency.

Studies demonstrate that the combination of Corporate Social Responsibility (CSR) and Environmental Management Accounting (EMA) can result in improved organizational performance. Zhang (2024) emphasizes that meeting CSR responsibilities is not only an expense but an investment that may provide financial rewards. Research indicates that companies implementing robust CSR policies, bolstered by efficient EMA, generally have enhanced financial performance and competitive advantage (Hasan et al., 2016). Hasan et al. (2016) discovered that corporate social responsibility (CSR) positively influences financial performance, with productivity acting as a mediating variable. This highlights the significance of EMA in converting CSR activities into quantifiable financial results.

The literature emphasizes the vital connection between corporate social responsibility and environmental management accounting. Corporate Social Responsibility activities promote the use of Environmental Management Accounting practices, hence augmenting the efficacy of these efforts and leading to enhanced organizational performance. As firms increasingly acknowledge the significance of sustainability, combining the elements of CSR and EMA will become essential for attaining long-term value development.

H1: Sustainability report disclosure has positive significant effect with EMA

Sustainability Report Disclosure and Firm Value

The correlation between corporate social responsibility (CSR) and company value has been a significant area of research in recent years, underscoring the increasing relevance of ethical business practices in improving corporate performance. Multiple studies have demonstrated a positive association between corporate social responsibility (CSR) activities and business value, indicating that socially responsible actions can enhance financial performance for organizations. For example, Chung et al. (2018) emphasize that

p-ISSN:1411-6510
e-ISSN :2541-6111

CSR initiatives may mitigate business risk and are frequently included into significant corporate plans, hence augmenting total firm value. This corresponds with the findings of Arafat et al. (2012) who say that enhanced CSR performance correlates with increased company value, hence strengthening the idea that CSR activities may serve as a strategic asset for companies.

Furthermore, the mediating influence of many elements in the link between CSR and business value has been thoroughly examined. Novitasari et al. (2022) illustrate that green supply chain management acts as a mediating variable, favorably affecting business performance via CSR activities. This indicates that the advantages of CSR transcend straight financial indicators, influencing operational efficiency and stakeholder relations. In a comparable manner, Nguyen et al. (2015) present empirical data from Vietnam demonstrating that CSR disclosures can enhance company value in succeeding periods, highlighting a temporal aspect to the CSR-firm value link wherein prior CSR initiatives affect future financial performance. The influence of profitability and ownership structure on the link between CSR and business value has been examined. Hermawan et al. (2023) investigate the relationship between profitability and the impact of CSR on business value, suggesting that a firm's financial health may enhance the beneficial benefits of CSR activities. Nafasati & Hilal (2021) reported conflicting findings about the moderating function of CSR, indicating that although CSR can affect profitability, its direct influence on business value may differ depending on contextual circumstances.

Moreover, empirical research across many locations and sectors substantiate the impact of CSR in augmenting corporate value. Kim et al. (2018) present data from Korea indicating that corporate social responsibility (CSR) is positively correlated with business value, especially when ownership arrangements are taken into account. This underscores the significance of contextual elements in comprehending the interplay between CSR and business value. Likewise, the results of Ooi et al. (2021) assert that modifications in corporate governance can affect the link between CSR and business value, indicating that legislative frameworks and governance practices are essential in influencing this interaction.

The research demonstrates a strong and complex link between CSR and business value, marked by positive correlations and the impact of many mediating and moderating factors. As companies progressively acknowledge the strategic significance of CSR, comprehending these dynamics is crucial for using CSR as a mechanism to augment company worth.

H2: Sustainability report disclosure has positive significance effect with firm value.

Environmental Management Accounting and Firm Value

The EMA enhances corporate value primarily by optimizing operational efficiency and minimizing expenses related to environmental management. For example, Yadav et al. (2015) emphasize that companies implementing comprehensive environmental performance metrics, such as EMA, can increase their market value through proficient management of their environmental obligations. Lannelongue et al. (2013) assert that the productivity enhancements resulting from environmental management strategies are directly linked to increased company performance. By methodically monitoring and controlling environmental expenditures, companies may pinpoint opportunities for cost reduction and efficiency enhancements, so strengthening their financial position.

Furthermore, EMA plays a pivotal role in augmenting a company's reputation and stakeholder interactions, which are essential elements of corporate value. Somjai et al. (2020) assert that environmental accounting is essential for assessing a firm's ecological effect and promoting honest disclosures. This transparency enhances stakeholder confidence and positions the organization advantageously with socially aware investors. This is especially pertinent in the current market, as investors are progressively factoring in environmental, social, and governance (ESG) criteria in their investment choices (Limkriangkrai et al., 2016). The affirmative association between robust environmental performance and corporate value is further substantiated by the findings of Appiah et al. (2020), who observe that senior management's dedication to environmental initiatives, mediated by Environmental Management Accounting (EMA), substantially impacts business performance.

The intermediary function of EMA in the correlation between environmental strategies and corporate value has been examined. Mulyadi & Maulana (2022) illustrate that EMA favorably impacts business value by moderating the benefits of green innovation. This indicates that companies that proficiently adopt EMA procedures are more likely to leverage innovations that improve their environmental performance, thereby elevating their market worth. Wicaksono & Tarisa (2022) similarly demonstrate that Environmental Management Accounting (EMA) may enhance the beneficial effect of sustainability performance on company value, underscoring its essential function within the larger framework of corporate sustainability.

The research demonstrates a robust and complex link between environmental management accounting and corporate value. Environmental Management Accounting (EMA) promotes environmental performance and operational efficiency, while also improving stakeholder relationships and business reputation, ultimately leading to better financial results. As companies persist in addressing the intricacies of sustainability, the incorporation of Environmental Management Accounting (EMA) into their accounting procedures will be essential for realizing long-term value development.

H3: EMA has positive significant effect with firm value.

The Role of EMA in Supporting CSR Initiatives

EMA functions as an essential instrument for organizations to assess, regulate, and communicate their environmental performance. Gunarathne et al. (2020) assert that EMA serves as the nexus between environmental management methods and corporate accounting, facilitating enterprises in improving both economic and environmental performance. EMA facilitates decision-making processes that correspond with CSR objectives by supplying pertinent financial and physical environmental information. Latan et al. (2018) contend that EMA is essential for strengthening corporate environmental performance by enabling the execution of environmental plans and bolstering senior management's dedication to sustainability.

The incorporation of EMA into CSR programs can markedly improve the efficacy of these initiatives in augmenting business value. Li & Xie (2020) discovered that participation in corporate environmental responsibility positively influences company value, with corporate innovation acting as a mediating variable. This indicates that organizations implementing CSR practices and incorporating EMA are more effectively positioned to innovate and generate value. Mulyadi & Maulana (2022) illustrate that EMA positively impacts company value and can mitigate the relationship between green innovation and firm performance. This underscores the significance of EMA in converting CSR initiatives into quantifiable financial results.

Recent studies offer empirical data that substantiates the favorable correlation among CSR, EMA, and corporate value. Novitasari et al. (2022) assert that the integration of CSR with proficient EMA techniques can result in improved business performance. Their findings indicate that CSR programs foster environmental improvement that enhances corporate performance, underscoring the importance of EMA in achieving the financial advantages of CSR. Wicaksono & Tarisa (2022) discovered that EMA enhances the favorable impact of sustainability performance on firm value, signifying its mediation function in this connection.

The literature demonstrates a strong correlation between corporate social responsibility, environmental management accounting, and business value. Corporate Social Responsibility programs promote the implementation of Environmental Management Accounting procedures, which subsequently augment the efficacy of these efforts and lead to enhanced organizational performance. As firms increasingly acknowledge the significance of incorporating CSR and EMA into their business strategy, the beneficial effect on firm value is expected to become more evident.

H4: The relationship between sustainability reporting and firm value is influenced by environmental management accounting (EMA) practices.

RESEARCH METHODS

The whole population examined in this research comprises companies listed on the Indonesian Stock Exchange (ISE). This study's sample is confined to manufacturing enterprises

p-ISSN:1411-6510
e-ISSN :2541-6111

listed on the Indonesian Stock Exchange (ISE) for the years 2020 and 2023 only. This research is based on secondary data obtained from www.idx.co.id. A purposive sampling method is employed under the specified conditions: (i) A comprehensive list of all manufacturing firms listed on the Indonesia Stock Exchange (IDX) from 2020 to 2023; (ii) A detailed account of all companies that did not provide complete data necessary for this study; and (iii) A summary of all companies lacking any information related to sustainability reports or annual reports during the research period. The outcomes of the sample selection are presented in Table 1.

Table 1. Results of Sample Selection

Criteria	Company	Observation
A comprehensive list of all manufacturing firms listed on the Indonesia Stock Exchange (IDX) from 2020 to 2023	85	340
A detailed account of all companies that did not provide complete data necessary for this study	(3)	12
A summary of all companies lacking any information related to sustainability reports or annual reports during the research period*	(3)	12
Outlier data		50
Total Research Sample	79	266

*Including companies with unavailable/unreadable financial statements

The initial three hypotheses are examined by two distinct multiple regression models in multiple regression analyses. To start the testing of hypothesis 1, we construct a multiple regression model using EMA as the dependent variable and CSR as the independent variables. In the second multiple regression model employed to evaluate hypotheses 2 and 3, the dependent variable is firm value (FV), while the independent variables are CSR and EMA. Defond (2016) presents the subsequent regression models:

$EMAi, t = \alpha0 + \alpha1CSRi, t{+}\alpha2GICi, t + \varepsilon$............ (1)
$FVi,t = \alpha0{+}\alpha1\ CSRi,t{+}\alpha2GICi,t{+}\alpha3EMAi,t{+}\varepsilon$... (2)

Path analysis was employed to evaluate hypothesis 4. Baron and Kenny (1986) were the pioneers in introducing path analysis as a method for examining interdependencies among independent, dependent, and mediating variables. This research use path analysis using a structural equation model to elucidate the influence of sustainability report disclosure variable on firm value. We ascertain the connection between the two variables and next decompose it into its constituent components—the direct pathways and the indirect paths through mediating factors (Defond, 2016). Baron and Kenny (1986) propose that the dependent variable can follow two potential pathways—direct and indirect effects—within three-variable systems. Baron and Kenny (1986) stipulate that a variable must comply with three criteria to be designated as a mediator:

1. Variations in the independent variable significantly influence the variable hypothesized to be the mediator variable (path a).
2. The mediator variable exerts a strong influence on the dependent variable (path b).
3. When pathways a and b are regulated, the formerly substantial link between the independent and dependent variables becomes unimportant (path c). The absence of path c signifies total mediation, whereas a reduction in path c that does not culminate in zero denotes partial mediation.
4. Three regression equations are necessary for a variable to qualify as a mediator in testing the mediation hypothesis:
   a. $M = \beta_0 + \beta_1 X$
   b. $Y = \beta_0 + \beta_1 X$
   c. $Y = \beta_0 + \beta_1 X + \beta_2 M$

The influence of the independent variable on the dependent variable in the regression equation will diminish if all three criteria of the findings are met. Utilizing the subsequent formula in the Sobel test, one may ascertain if the mediation effect is statistically significant:

$$Z = \frac{ab}{\sqrt{b^2Sa^2 + a^2Sb^2 + Sa^2Sb^2}}$$

In this context, “a” represents the beta coefficient of the “a” path, whereas “b” signifies the beta coefficient of the “b” path. The standard deviation for path an is represented by Sa, whereas the standard deviation for path b is marked as Sb. Under the assumption of an abnormal sample distribution at $\alpha = 0.05$, the critical value for the z-test is ±1.96 (Carolina et al., 2004). This study employed a research test comprising three variables: firm value, environmental management accounting as a mediating variable, and sustainability report disclosure as an independent variable. The path analysis chart of this study may be described according to the prior explanation and in accordance with the theoretical frameworks proposed by Baron & Kenny (1986) and Defond (2016).

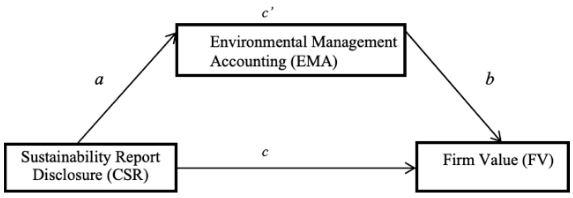

FIGURE 2. Path Analysis of Hypothesis 4

The Operational Definition of Variables

TABLE 2. An overview of the variables utilized in this research.

Variable	Operational Definition	Reference
Dependent Variables		
Firm Value	Measured by Tobin's Q	(Conyon & He, 2017)
Independent Variables		
CSR	The Sustainability Report Disclosure Index (SRDI) comprises 91 disclosure items. Each item is assigned a score of 1 if disclosed and 0 if not. The scores are then entered into the SRDI formula: SRDI = n / k, n = the number of disclosure items made by the company k = the number of items that the company is expected to disclose.	(Pradipta & Supriyadi, 2015)
Mediating Variable		
EMA	Environmental performance evaluation is carried out using an ordinal scale, where a value of 1 indicates that the company has implemented the ISO 14001 standard, a value of 2 indicates that the company has ISO 14001 certification, and a value of 0 implies that the company has not implemented or has not been ISO 14001 certified.	(Zulaikha & Prafitri, 2016)

RESULTS AND DISCUSSION

Utilizing EMA as the mediating variable, we examined hypotheses concerning the link among CSR, GIC, and corporate value. Two regression models were employed to evaluate the hypotheses. The results of the hypothesis testing for the research model are presented in Table 3.

p-ISSN:1411-6510
e-ISSN :2541-6111

Table 3. The results of hypothesis testing on the research model.

Panel A: Hypothesis Testing Model 1			
Model 1	**β**	**t**	**Sig.**
CSR	0,675	3,194	0,002**
Adj. R-square	0,101		
Dependent variable: EMA			
*** 1% significance level, **5%, *10%			
Panel B: Hypothesis Testing Model 2			
Model 2	**β**	**t**	**Sig.**
CSR	0,567	3,031	0,003**
EMA	0,219	4,093	0,000***
Dependent variable: Firm Value (FV)			
Significance level ***1%, **5%, *10%			

Path analysis and the Sobel test were used to investigate the indirect influence of CSR on company value via the proposed mediator variable, EMA. Baron and Kenny (1986) stipulate that a variable qualifies as a mediator if it satisfies three initial requirements. Table 4.9 presents a summary of the path analysis results and the Sobel test inside the study model. Table 4.9 illustrates the path analysis on the direct and indirect impacts of CSR on firm value. The findings demonstrate that both the direct path (c) and the path via the proposed mediator factors (a and b) exhibit significant values. Consequently, EMA has effectively satisfied the three primary requirements as a mediating variable. A Sobel test was performed to ascertain the significance level of the EMA variable as a mediator by evaluating the Z value of the mediator. The resultant z value is 2.039, above 1.96. The findings supports hypothesis four (H4), indicating that EMA mediates the association between CSR and firm value.

Table 4 Analysis and Sobel Test

	β	**Std. Error**	**Description**
Direct Pathway			
CSR, FV (c)	0,567	0,187	*Significant*
Mediating Pathway			
CSR, EMA (a)	0,675	0,211	*Significant*
EMA, FV (b)	0,219	0,053	*Significant*
Total mediation pathway (c')	0,048	0,0021	*Eligible*
Sobel test z value		2,53 (> 1.96)	*Mediator Significant*

The outcomes of hypothesis testing, path analysis, and the Sobel test, as previously detailed, are summarized below in Table 5.

Hypothesis	Hypothesis Statement	Results
H1	CSR → EMA	Supported
H2	CSR → FV	Supported
H3	EMA → FV	Supported
H4	CSR → EMA → FV	Supported

Initially, we evaluate the hypothesis asserting a positive link between Corporate Social Responsibility (CSR) and Environmental Management Accounting (EMA) (H1). At the 5% significance level, the alternative hypothesis (H1) is supported. The findings of experiment H1 indicate that CSR has a statistically significant positive impact on EMA (β = 0,675); sig. = 0.002). This research supports the findings of Jang et al. (2019 and Mardiati et al. (2022). The research indicates a favorable correlation between corporate social responsibility and environmental management accounting. CSR activities enhance the acceptance and efficacy of EMA through increased responsibility, the incorporation of environmental factors, stakeholder influence, and higher-level decision-making. As firms increasingly acknowledge the significance of incorporating CSR and EMA into their business strategy, the beneficial effects on environmental performance and sustainability are expected to become more evident.

The second hypothesis (H2) was validated by a statistical test with a 5% significance level (β = 0,567; p = 0,003). In line with (Harun et al., 2020; Hermawan et al., 2023; Kim et al., 2018; Ooi et al., 2021), effective CSR procedures cultivate robust connections with stakeholders, encompassing consumers, workers, and investors. Harun et al. (2020) assert that CSR disclosure can strengthen stakeholder trust, which is crucial for sustained corporate success. When companies exhibit a dedication to social responsibility, they are more inclined to attract and keep loyal consumers and motivated staff, both of which enhance organizational performance and value. This stakeholder involvement fosters a virtuous cycle in which excellent CSR activities enhance trust and, in turn, elevate financial success.

The 5% significance level (β=0,219; p=0,000) provided statistical evidence for the third hypothesis (H3). This findings in line with the research's results by (Javed et al., 2022; Mulyadi & Maulana, 2022). The EMA is essential for assisting companies in adhering to environmental requirements and managing related risks. Javed et al. (2022) assert that firms implementing EMA techniques are more adept at managing regulatory obligations and reducing ecological risks. By carefully controlling environmental consequences, companies may circumvent potential penalties and legal responsibilities, therefore safeguarding their financial success. The risk management component of EMA is crucial for preserving and augmenting corporate value, especially in sectors governed by rigorous environmental rules.

Furthermore, this study aims to demonstrate the mediating influence of EMA, yielding a Sobel test result that substantiates the fourth hypothesis. This research aligns with (Mulyadi & Maulana, 2022; Novitasari et al., 2022; Wicaksono & Tarisa, 2022). Novitasari et al. (2022) discovered that corporate social responsibility (CSR) significantly enhances business performance, suggesting that companies participating in CSR initiatives are prone to achieve superior financial results. Additionally, Kong et al. Kong et al. (2019) illustrate that corporate social responsibility (CSR) is positively correlated with the adoption of environmental management techniques, hence validating the idea that CSR activities facilitate the application of environmental management accounting (EMA), which subsequently increases company value.

CONCLUSION

This study establishes that Environmental Management Accounting (EMA) significantly mediates the association between sustainability report disclosure and corporate value. Regression analysis and the Sobel test revealed that EMA may augment corporate value by improving operational efficiency, transparency, and stakeholder confidence. The results demonstrate that organizations who actively include EMA into their sustainability reporting have superior financial success. This finding underscores that the integration of Corporate Social Responsibility (CSR) and Environmental Management Accounting (EMA) not only fosters environmental sustainability but also enhances the company's long-term economic worth. Consequently, it is essential for firms to perpetually enhance EMA practices as a fundamental component of their sustainability strategy to provide increased value for all stakeholders.

p-ISSN:1411-6510
e-ISSN :2541-6111

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