

Enhancing Firm Value Through Carbon Management Accounting System and Environmental Disclosure: A Systematic Review and Conceptual Framework on Climate Change Mitigation

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ABSTRACT

The current development of climate change conditions, which are worrying, encourages companies to be more responsible for their emissions and prioritize mitigation strategies to prevent climate change. This article proposes a carbon management accounting system (CMAS) model, which can be the basis for carbon emission disclosure (CED) and effectively increase firm value. This study extensively reviewed previous research and developed a new model by conducting a systematic literature review so that a conceptual framework for the relationship between CMAS, CED, and firm value could be developed. This research produces a new model finding that can contribute to environmental accounting theory. It proposes a framework that company managers can apply to take steps to mitigate climate change through managing carbon emissions. This study provides a foundation for future research to examine both models as an integrated approach to enhancing CED and overall firm value in the Indonesian industry.

Keywords: Firm Value; Carbon Management Accounting System; Carbon Emission Disclosure; Climate Change

ABSTRAK

Perkembangan kondisi perubahan iklim saat ini yang semakin mengkhawatirkan mendorong perusahaan untuk lebih bertanggung jawab terhadap emisi yang dihasilkan serta memprioritaskan strategi mitigasi guna mencegah perubahan iklim. Artikel ini mengusulkan model *carbon management accounting system* (CMAS) yang dapat menjadi dasar bagi *carbon emission disclosure* (CED) serta secara efektif meningkatkan nilai perusahaan. Penelitian ini melakukan tinjauan komprehensif terhadap studi-studi sebelumnya dan mengembangkan model baru melalui *systematic literature review*, sehingga dapat disusun suatu kerangka konseptual mengenai hubungan antara CMAS, CED, dan nilai perusahaan. Penelitian ini menghasilkan temuan model baru yang berkontribusi terhadap pengembangan teori akuntansi lingkungan. Selain itu, penelitian ini mengusulkan suatu kerangka yang dapat diterapkan oleh manajer perusahaan dalam mengambil langkah-langkah mitigasi perubahan iklim melalui pengelolaan emisi karbon. Studi ini juga memberikan landasan bagi penelitian selanjutnya untuk menguji kedua model tersebut sebagai suatu pendekatan terintegrasi dalam meningkatkan CED dan nilai perusahaan secara keseluruhan di industri Indonesia.

Kata kunci: Nilai Perusahaan; Sistem Akuntansi Manajemen Karbon; Pengungkapan Emisi Karbon; Perubahan Iklim

1. Introduction

Climate change is a major worldwide issue that needs significant attention this decade. Since 2011, climate change has emerged as an essential topic of discussion at the United Nations. According to research organizations and environmental observation groups, climate change will pose hazardous threats to humanity in the coming ten years. Indonesia also contributed to this situation. According to the Republic of Indonesia's Ministry of Environment and Forestry, greenhouse gas emissions in Indonesia have significantly increased (Anugrah, 2024). This rise was 157%. Indonesia also contributes 2.3% to global emissions. This figure exceeds Japan's contribution as the highest emitter (IEEC, 2024). This circumstance is highly concerning, so it is essential to analyze the variables contributing to the advent of climate change.

Industrial activity is the main contributor to greenhouse gases that cause climate change (Ambarwati et al, 2020). The problem of environmental pollution caused by industrial waste is still significant in Indonesia because many companies still do not manage their waste correctly. Especially companies with high environmental risk or a substantial dependence on the environment, such as companies in the energy sector. This is by the Ministry of Energy and Mineral Resources (2017) statement, which released the amount of emissions produced by the energy-producing sector industry in 2016 of 247,422 Gg CO₂e. Emissions in this sector have increased by an average of 7.73% per year. Other evidence presented by the Ministry of the Environment (LHK) is that around 59% of the 564 rivers in Indonesia are heavily polluted by rubbish. Companies with significant environmental risks and other industrial sectors contribute to the increasing risk of climate change if they are not wise in managing the emissions they create. Management of energy use, residual water waste, and other mitigation steps is no less important to pay attention to.

The Company's motivation to create maximum profits often results in misorientation. Usually, companies only focus on increasing earnings without considering other factors, such as environmental factors. This could disrupt the socio-economic balance, hurt the Company's image, and cause much more significant losses. The resulting ecological problems will also cause many losses to stakeholders. This is what underlies the pressure from stakeholders on the Company so that the Company can be more responsible towards the environment and contribute to reducing emissions caused by the Company's operational activities (Damas et al, 2021; Meiryani & Novianti, 2024). In this case, the government responded by issuing the Financial Services Authority Regulation (POJK) No. 51/POJK.03/2017 requires issuers and public

companies to publish sustainability reporting to increase transparency regarding social, environmental, and corporate governance impacts, and Law Number 32 of 2009 concerning Environmental Protection and Management.

There is pressure from stakeholders and the government demanding that the company improve its operational management system, especially the management of carbon emissions and environmental impacts. In this case, the Carbon Management Accounting System (CMAS) is vital in systematically measuring, analyzing, and reporting an organization's carbon emissions and related costs. Companies can track their carbon footprint and its impact on climate change by measuring, analyzing, and reporting carbon emissions. This can also be used as a basis for making strategic decisions that can provide opportunities for companies to reduce emissions, optimize operations, and create a sustainable company (Hakki et al, 2024). By carrying out CMAS well, the Company has taken steps to mitigate climate change.

To ensure that the Company has carried out CMAS properly, the company needs to disclose this through Carbon Emission Disclosure (CED). This disclosure is one of the essential points in CMAS. Carbon Emission Disclosure (CED) is a company activity to record, acknowledge, disclose, measure, and present information related to the amount of carbon emissions produced by the Company (Damas et al., 2021). This can also be one of the Company's efforts to maintain its sustainability because, in the disclosure process, the Company not only reveals how much emissions it produces but also reveals the Company's practical plans for reducing carbon emissions.

A CED that all stakeholders can access can prove the Company's responsibility towards the environment. How the Company manages the emissions it produces, and the Company's commitment to reducing emissions, can be the basis for the public's and investors' assessment of the Company. Currently, a modern business organization that is considered reasonable is a business that can operate without abandoning its responsibility to ensure a balance between competitive advantages, sustainability, social development, and environmental development, and, at the same time, continues to increase benefits for its stakeholders (Kytsak, 2024). The more environmentally responsible a company is, the more its image will improve. Although the benefits of CED often cannot be felt in a short time and the reciprocity is not always in material form, this is to the Company's long-term goals, namely creating sustainable development and enhancing the Company's brand value and reputation (Das, 2019). These long-term benefits can be formed through increased public trust in the Company, increased use of the Company's services, and becoming an additional selling point for the Company in the eyes of investors and

potential investors. Thus, CED can be considered an investment rather than an expense (Shah, 2017). Increasing the Company's image can increase investor interest in investing in the Company; this can increase the Company's firm value.

Implementing CMAS and CED requires a lot of effort from the Company. From the calculation process to disclosure, this requires significantly high costs, and expert parties are involved. CED is still voluntary, so its existence is not yet binding, and few companies implement it. Therefore, implementing CMAS and CED still requires a more in-depth study regarding the significance of their benefits.

Legitimacy theory serves as a crucial theoretical framework in this study, elucidating the motivations of corporations to implement carbon management accounting systems (CMAS) and enhance environmental transparency. This idea posits that firms function to pursue economic profit and adhere to a "social contract" with society and stakeholders. Business sustainability is contingent upon the degree to which stakeholders perceive firms as legitimate about social and environmental concerns, especially climate change. In this instance, CMAS is an internal instrument for quantifying and regulating carbon emissions. In contrast, environmental disclosure is an external means to exhibit transparency and a company's dedication to sustainable practices. By employing these two techniques, corporations aim to fulfill public expectations, mitigate criticism, and enhance their reputation, potentially augmenting corporate worth. Legitimacy theory posits that corporations that neglect their environmental duties jeopardize social support, encounter governmental penalties, or suffer a decrease in investor trust. This study underscores that the adoption of CMAS and environmental disclosure serves not merely as compliance, but as a strategic initiative to uphold legitimacy and secure competitive advantage in the transition to a low-carbon economy.

This article intends to provide the results of a systematic literature review and conceptual framework related to the Carbon Management Accounting System (CMAS) concept, which is then disclosed through Carbon Emission Disclosure (CED). Additionally, this article will investigate the benefits of CMAS, which include benefits for external parties and directly impact the increase in firm value. This most recent study has not been extensively studied in the previous literature, especially in the conceptual model of CMAS and FV mediated by CED; see research by (Guntara and Widaningsih, 2019; Shrestha et al, 2022; Han et al, 2023; Kurnia et al, 2021; Qian et al, 2018). As a result, it offers a fresh viewpoint in environmental accounting. This article aims to provide fresh insights and solutions connected to problems that have not been answered thoroughly, clarify still vague concepts, and uncover gaps in existing

research. An in-depth review of relevant literature and theories will accomplish this. Therefore, this paper is a contribution to the academic community that has the potential to deepen our understanding of environmental accounting and serve as a foundation for more empirical research in the future.

This study seeks to empirically examine the relationship between the Carbon Management Accounting System (CMAS) and company value and between Carbon Emission Disclosure (CED) and firm value, grounded in the phenomena described and legitimacy theory. The study investigates the relationship between CMAS and CED, employing a mediation model to assess their direct and indirect effects on enhancing company value. This study assesses the direct influence of CMAS and CED on firm value. It investigates CED's function as a mediating variable that may enhance or moderate the relationship between CMAS and firm value.

2. Literature review

2.1. Legitimacy theory

The principle of legitimacy proposes that organizations should make the voluntary production of social and environmental accountability reports their primary objective (Dewi and Nazmel, 2022). This theory emphasizes the need for businesses to demonstrate that their operations are based on society's values (Alfayerds and Setiawan, 2021). Firms must disclose their environmental efforts transparently through social disclosures to get credibility (Zaneta et al, 2023). Disclosing ecological actions is necessary to preserve, restore, and accomplish this legitimacy (Banjari, 2023). Accordingly, businesses are responsible for carefully considering the environmental implications of their operations and taking appropriate action (Dama et al, 2021). Public recognition can also be obtained by publishing reports on carbon emissions or implementing actions to mitigate the effects of greenhouse gases, both of which are components of environmental management (Maharani and Sudibjo, 2023). In addition to simply reporting emissions, firms can improve their legitimacy by using more environmentally responsible accounting procedures (Rahmadina et al, 2023).

Legitimacy theory asserts that, within environmental accounting, corporations must declare their ecological consequences and incorporate sustainable practices into their internal management systems (Alfayerds and Setiawan, 2021). By implementing the Carbon Management Accounting System (CMAS), organizations can methodically quantify and regulate carbon emissions, fulfilling legal requirements and enhancing stakeholder confidence. Corporate Environmental Disclosure (CED) provides tangible evidence of a company's

commitment to addressing environmental hazards, enhancing its credibility among the public, investors, and regulators. Consequently, integrating CMAS and CED functions serves as an accountability mechanism and a strategy to sustain a long-term societal license to operate.

2.2. Carbon management accounting system (CMAS)

Carbon management accounting encompasses a range of strategies and tools that companies use to measure, monitor, and manage their carbon footprint. It provides a systematic framework for organizations to assess the carbon emissions associated with their activities and operations, including direct and indirect emissions (Manap et al, 2024). This enables organizations to develop strategies for reducing emissions and achieving sustainability goals while demonstrating environmental accountability to stakeholders (Sharaf, 2024). The primary objective of carbon management accounting is to integrate ecological costs into traditional accounting systems, enabling corporations to make decisions informed by carbon emissions and cost information (Egbunike and Emudainohwo, 2017). This approach can enhance a company's sustainable profile and improve decision-making (Manap et al, 2024).

In practice, the implementation of carbon management accounting is not only beneficial for regulatory compliance, but also becomes a competitive differentiation in the green economy era. Companies that consistently implement this system can identify energy efficiency opportunities and reduce long-term operational costs while meeting investor and consumer demand for sustainable business practices (Sharaf, 2024). Furthermore, integrating carbon data into financial reporting allows companies to communicate their environmental performance more transparently, strengthening stakeholder trust and brand positioning in the market. This shows that carbon management accounting has evolved from a reporting tool to a business strategy that creates added value for the company (Manap et al, 2024).

2.3. Firm value

The firm's value represents the market's assessment of the total economic worth of a business entity, as indicated by its stock price in public businesses or by business valuation outcomes (Effendi, 2021). Within the framework of sustainability and climate change, firm value is influenced not solely by conventional financial performance, but also by: 1) the establishment of an efficient Carbon Management Accounting System (CMAS) for quantifying and mitigating carbon emissions; 2) the caliber of environmental disclosure reflecting a dedication to sustainable practices; and 3) the organization's capacity to navigate climate risks and capitalize on energy transition prospects. Investors and stakeholders are increasingly evaluating these factors due to their direct influence on long-term profitability, brand reputation,

and the company's adaptability to more stringent environmental legislation. Consequently, organizations that successfully incorporate sustainability principles into their business strategy generally exhibit greater market value (Rahmadina, 2023).

High stock prices can make a company valuable (Effendi, 2021). High stock values imply firm performance, which might impact investor decisions (Zaneta et al, 2023). The stock value measures a company's entire value, good or poor (Mulyai and Maulana, 2022). Company value is a key measure of investment needed to grow the business (Rahmadina, 2023). Investors will favorably see companies that receive significant investments, boosting stock prices and value (Wenni and Suhaidar, 2022). Environmental disclosure, profitability ratios, and corporate social responsibility disclosure affect a company's share price (Hariadi and Nurwanda, 2024). Every company wants to retain its reputation and benefit its members and shareholders (Rahmadina, 2023). Investors' views of management's performance determine firm value. Company theory states that maximizing value is the primary goal. High company value indicates good performance and reassures investors about the company's future (Joa et al, 2022). A company's success determines its worth to investors (Damas et al, 2021). The stock price shows the company's value; higher prices indicate higher value, and vice versa (Zaneta et al, 2023). Shareholders might get the most significant profits if the stock price keeps rising. Green accounting requires organizations to consider profit, the environment, and society (Effendi, 2021). Companies must effectively address social and environmental challenges to maintain their reputation and long-term viability with the public and investors (Hariadi and Nurwanda, 2024).

2.4. Carbon emission disclosure (CED)

Carbon emission disclosure pertains to a company's practice of revealing information regarding greenhouse gas emissions generated by its operational activities (Apriliani et al, 2024). This disclosure encompasses three primary aspects: 1) Quantitative data on carbon emissions categorized by Scope 1 (direct emissions), Scope 2 (indirect emissions from energy), and Scope 3 (supply chain emissions); 2) policies and strategies for emission reduction; and 3) accomplishments in environmental performance. This disclosure is becoming essential in the transition to a low-carbon economy, as investors and others utilize this information to evaluate a company's climate risk and sustainability commitments (Banjari, 2023). While sometimes voluntary in several developing nations, thorough carbon emission disclosure methods can enhance a company's reputation, comply with progressively rigorous regulatory standards, and draw ESG (Environmental, Social, and Governance)-focused investments. The primary

obstacles to its adoption encompass measurement methodology constraints, data verification expenses, and the absence of standardized reporting protocols globally (Hariadi and Nurwanda, 2024).

Carbon emission disclosure articulates data that quantifies a company's carbon emissions and establishes objectives to mitigate these emissions (Nashrulloh and Achyani, 2024). This disclosure is essential as stakeholders require information regarding environmental risks from the company's operations (Banjari, 2023). Carbon emission disclosure remains nascent in poorer nations, with only a few enterprises participating (Apriliani et al, 2024). In contrast to wealthy nations, enterprises in poor countries typically possess constrained financial resources for such disclosures (Hariadi, 2024). In Indonesia, carbon emission disclosure remains optional or voluntary, rather than mandated by regulations (Rahmadina et al, 2023). Stakeholders increasingly demand substantial and comprehensive disclosures regarding greenhouse gas emissions and managing associated risks (Rochmah, 2022). Such disclosures can illustrate a company's commitment to addressing environmental concerns, especially regarding carbon emissions transparency (Rahmadina et al, 2023). Nonetheless, thorough disclosures may be impeded if the data quality is subpar when evaluating the company's genuine greenhouse gas emissions strategy and performance (Joa et al, 2022).

3. Research methodology

The scope of a literature review delineates significant research streams, summarizes research findings, evaluates the knowledge base within a specific research domain, and elucidates prospective research prospects (Hristov et al, 2021). This study seeks to analyze the correlation between the Carbon Management Accounting System (CMAS) and Firm Value (FV), with Carbon Emission Disclosure (CED) serving as a mediating variable. The study will employ a Systematic material Review (SLR) methodology, identifying pertinent material from many indexed scientific databases. The research selection procedure will adhere to stringent inclusion and exclusion criteria to guarantee that only high-quality studies are evaluated. A qualitative analysis will be performed by identifying and synthesizing significant themes concerning the impact of CMAS on Firm Value and the function of CED in modulating this relationship.

This study uses content analysis to deliver a quantitative evaluation of the literature examined. We establish a systematic search methodology that delineates the procedure for obtaining answers to our study inquiries. This study includes papers indexed in SINTA (Science

and Technology Index) categories 1-6, published from 2011 to 2025. This selection period is predicated on the observation that worldwide attention to climate change significantly increased following the United Nations (UN) climate change agenda agreement at a summit in South Africa in November 2011. Consequently, the chosen literature will encompass articles pertinent to CMAS, FV, and CED within the established context post that year. A total of 53 papers addressing these factors were identified through the systematic literature review (SLR).

These articles serve as a reference for developing a conceptual framework for future study or as a foundation for corporate management in defining policies about carbon emission management and enhancing company value through sustainable environmental practices. The SLR is valuable since it facilitates a comprehensive understanding of the theory by encapsulating the principal difficulties that emerge and are acknowledged. This study seeks to summarize current research findings, evaluate the existing knowledge base, and identify future research gaps, thereby contributing significantly to advancing carbon management accounting theory and practice and offering insights for subsequent research in this domain.

4. Conceptual Framework

The following is a conceptual framework that we propose here, which is based on the explanation that was given earlier:

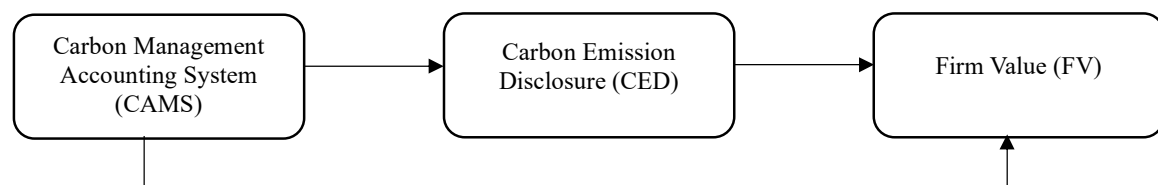


Figure 1. Conceptual Framework for Future Research

The Carbon Management Accounting System (CMAS) is a framework designed to systematically measure, monitor, and manage a company's carbon emissions with accountability. This method allows firms to identify primary sources of carbon emissions, evaluate the resulting environmental impact, and develop more effective mitigation strategies. The practical application of CMAS enables businesses to meet increasingly stringent environmental standards, boosts operational efficiency, and creates long-term value. This is undoubtedly capable of enhancing the Company's reputation in the eyes of stakeholders by adhering to sound environmental standards, conducting healthy business operations, and fulfilling the Company's responsibility function for emission disclosure. This has the potential to positively impact the company's value (Guntara and Widaningsih, 2019; Onat et al, 2025;

Shrestha et al, 2023). However, the full benefits of this system cannot be realized without transparency in disclosing information about carbon emissions.

Carbon Emissions Disclosure (CED) is a variable that links the implementation of CMAS to corporate value (Damas et al, 2021). CED refers to the organization's transparency in communicating information and policies regarding carbon emissions through sustainability reports, annual reports, or other reporting platforms (Banjari, 2023). Carbon dioxide emissions, the revelation of information concerning the carbon emissions that are created by a corporation or organization as a result of its operations, is referred to as disclosure. This involves disclosing the total quantity of greenhouse gas (GHG) emissions that have been created, as well as the origin of those emissions and the measures that have been taken to control them. The assumption, which is accompanied by clear empirical evidence regarding the unbalanced condition of the earth and the environment caused by the Company's operational activities, is what makes carbon emission transparency a significant thing in the modern era. This is especially true for companies that have a high dependence on the environment. Disclosure of carbon emissions can serve not only as a disclosure but also as a tool to legitimize the improvement of the Company's image among stakeholders. A company's transparency in disclosing carbon emissions positively correlates with investor and stakeholder trust in its commitment to environmental sustainability. Proper disclosure can reduce regulatory risk, improve the company's reputation, and send a positive signal to the market about the company's strategic response to environmental challenges.

Companies in poorer nations typically engage in Carbon Emissions Disclosure (CED) due to resource availability and management's motivation to attract stakeholders with higher-quality financial reports by providing information about their carbon emissions. By raising public awareness of environmental issues, such as air pollution, businesses are encouraged to operate more transparently. At this point, stakeholders are also concerned with the corporation's environmental responsibility and overall profitability (Hardianti and Mulyani, 2023). A firm's value, reflective of its performance and the market's view of its long-term potential, is significantly influenced by environmental, social, and governance (ESG) factors. By disclosing carbon emissions through CMAS, organizations can demonstrate their commitment to managing ecological risks affecting their business sustainability. The process of compiling a good mitigation system against the worst impacts of company operations, namely climate change, will also be carried out well. Furthermore, a strong commitment is needed to maintain the sustainability of the system that has been compiled. As a result, the more effectively CMAS

is implemented, the superior the quality of a company's carbon emission disclosures. This ultimately boosts firm value through investor confidence, competitive advantage, and an enhanced corporate reputation in the market.

5. Conclusion

This article investigates the intersection of carbon management accounting systems (CMAS) and carbon emission disclosure (CED) in terms of firm value (FV). The objective is to comprehensively review the relevant literature to offer valuable insight into the intricate dynamics of environmental accounting. This research contributes substantially to the discourse on sustainable business practices and their advantages for corporate value by providing theoretical insights into carbon management accounting systems and their carbon emission disclosures. To accomplish this, a comprehensive research framework has been established, potentially affecting theoretical and managerial perspectives. This study posits that Carbon Emission Disclosure (CED) is a mediating variable connecting the Carbon Management Accounting System (CMAS) to enhanced Firm Value. The practical application of CMAS enables firms to systematically identify, quantify, and manage carbon emissions, yielding precise and accountable data. This data is subsequently revealed via CED, enhancing corporate transparency and fostering stakeholder trust in the company's environmental dedication. In this context, CED serves as a conduit that converts carbon management practices (CMAS) into enhanced value for companies, as thorough and credible disclosure can elevate market perception of the company's environmental performance, mitigate reputational and regulatory risks, and attract investors aligned with ESG (Environmental, Social, and Governance) principles. The collaboration between CMAS and CED is crucial in enhancing Firm Value, particularly when sustainability factors are progressively incorporated into the evaluation of business performance by the capital market. The conceptual framework establishes a foundation for future researchers to empirically investigate the impact of CMAS techniques on CED and Firm Value outcomes. This framework directs Indonesian companies' attention to carbon data from internal and external sources from a managerial perspective. This aids in creating strategies and initiatives designed to improve environmental performance, reduce carbon emissions, and mitigate climate change in the corporate sector.

6. Research Implications

The findings of this research underscore the necessity of adopting a Carbon Management Accounting System (CMAS) and Carbon Emission Disclosure (CED) as a strategic approach for companies, particularly in industries with high environmental risk, to enhance corporate

value. This study further substantiates the business sector's involvement in mitigating global warming. This study's findings offer a robust foundation for regulators and policymakers to formulate incentives or rewards for enterprises using CMAS and CED, such as streamlined licensing, tax benefits, or preferential treatment in government contracts. Conversely, this research is advantageous for corporations, particularly those in carbon-intensive sectors, as it demonstrates that dedication to emission governance positively influences sustainability and enhances economic value. The amalgamation of CMAS and CED is now regarded not as a compliance obligation, but as a strategic investment that fosters competitive advantage in the transition to a green economy.

7. Future Research

Future research can develop this framework with several empirical and contextual approaches. Initially, longitudinal studies may be undertaken to examine the effects of CMAS adoption on CED and Firm Value over time, particularly for Indonesian enterprises that have recently commenced carbon management strategies. Secondly, comparative research can evaluate the efficacy of CMAS and CED across carbon-intensive industrial sectors (such as mining or manufacturing) and the service sector, taking into account varying emission profiles and financial capabilities. Third, qualitative research might investigate the technical and organizational cultural obstacles in adopting CMAS, encompassing management's opinions of its costs and benefits. Moreover, additional research may examine moderating variables such as stakeholder pressure, regulatory strength, or digital technology preparedness in enhancing the link between CMAS, CED, and Firm Value. Future research can validate this conceptual framework and offer precise, practical advice for companies and governments in Indonesia by integrating quantitative and qualitative methodologies.

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