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Dynamic Environmental Accounting: Linking Carbon Disclosure Quality, Cost of Capital, And Firm Value in Indonesia

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Abstract

This study develops a comprehensive dynamic environmental accounting framework to investigate the intricate relationships among carbon disclosure quality, cost of capital, and firm value within the context of companies listed on the Indonesia Stock Exchange (IDX). Employing a longitudinal research design spanning the period from 2020 to 2023, the research synthesizes Environmental Management Accounting (EMA) principles with contemporary capital market theory to construct an integrated analytical model. Carbon disclosure quality is operationalized through a multidimensional index encompassing the transparency, completeness, and comprehensiveness of corporate carbon footprint reporting practices. The cost of capital is measured using the Weighted Average Cost of Capital (WACC) methodology, while firm value is assessed through market-based valuation indicators including Tobin's Q. Purposive sampling techniques yielded a final sample of 156 firm-year observations from companies demonstrating consistent carbon-related information disclosure throughout the study period. Utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM) through SmartPLS 4.0 software, the empirical findings reveal that superior carbon disclosure quality exerts a statistically significant negative influence on the cost of capital and a positive effect on firm value. Furthermore, the analysis demonstrates that cost of capital serves as a significant mediating mechanism in the relationship between carbon disclosure quality and firm value. These findings illuminate the strategic importance of transparent environmental reporting in enhancing corporate market performance and provide valuable insights for policymakers, corporate managers, and investors regarding the financial implications of environmental disclosure practices.

Keywords: *Dynamic Environmental Accounting; Carbon Disclosure Quality; Cost of Capital; Firm Value; Indonesia Stock Exchange; Environmental Management Accounting*

Introduction

The escalating urgency of climate change has fundamentally transformed the global business landscape, compelling corporations worldwide to reconsider their environmental responsibilities and disclosure practices. Indonesia, as the world's largest archipelagic nation and a significant contributor to global greenhouse gas emissions, faces mounting pressure from international stakeholders to enhance corporate environmental transparency. The Indonesian government's commitment to the Paris Agreement, targeting a 29% reduction in greenhouse gas emissions by 2030, has catalyzed regulatory initiatives mandating improved environmental disclosure among publicly listed companies. Within this context, the concept of dynamic environmental accounting has emerged as a critical framework for understanding how environmental performance indicators, particularly carbon disclosure quality, influence corporate financial outcomes.

The relationship between environmental disclosure and corporate financial performance has garnered substantial scholarly attention over the past two decades. However, the mechanisms through which environmental disclosure affects firm value remain inadequately understood, particularly in emerging market contexts. Traditional signaling theory suggests that high-quality environmental disclosure reduces information asymmetry between corporate insiders and external stakeholders, thereby lowering the cost of capital and enhancing firm value. Nevertheless, the empirical evidence supporting these theoretical predictions has been mixed, with some studies reporting positive associations while others find null or negative relationships. This inconsistency may be attributed to variations in institutional environments, measurement approaches, and analytical methodologies employed across different studies.

The Indonesian context presents unique characteristics that warrant dedicated investigation. As an emerging economy with rapidly developing capital markets, Indonesia exhibits distinctive institutional features that may moderate the relationship between environmental disclosure and financial outcomes. The establishment of the Indonesia Stock Exchange (IDX) sustainability reporting requirements, coupled with the implementation of Financial Services Authority (OJK) Regulation No. 51/POJK.03/2017 concerning sustainable finance, has created a regulatory environment increasingly conducive to environmental transparency. Furthermore, the growing participation of socially responsible investors in Indonesian capital markets suggests that environmental disclosure may have become a more salient determinant of corporate valuation in recent years.

Despite the growing importance of environmental disclosure in Indonesia, empirical research examining the financial implications of carbon-specific disclosure remains scarce. Previous studies have predominantly focused on broader sustainability disclosure measures, overlooking the unique characteristics of carbon-related information. Carbon disclosure differs from general environmental disclosure in several important respects: it typically involves quantitative metrics that are more easily verified, it directly relates to regulatory compliance and potential carbon pricing mechanisms, and it signals corporate preparedness for the transition to a low-carbon economy. These distinctive features suggest that carbon disclosure may have different financial implications compared to more general environmental reporting practices.

This study addresses these research gaps by developing and empirically testing a dynamic environmental accounting framework that explicitly examines the relationships among carbon disclosure quality, cost of capital, and firm value. The framework integrates insights from Environmental Management Accounting (EMA), signaling theory, and capital market theory to propose a mediation model wherein cost of capital serves as the mechanism through which carbon disclosure quality affects firm value. By focusing specifically on carbon disclosure rather than broader environmental reporting, this research provides more precise insights into the financial implications of climate-related corporate transparency.

The contributions of this study are threefold. First, we develop a comprehensive carbon disclosure quality index specifically tailored to the Indonesian regulatory and business context, incorporating dimensions of transparency, completeness, and comparability. Second, we provide empirical evidence on the mediating role of cost of capital in the carbon disclosure-firm value relationship, thereby illuminating the mechanism through which environmental transparency creates shareholder value. Third, we contribute to the growing literature on environmental accounting in emerging markets by providing rigorous evidence from Indonesia, a major developing economy with significant environmental challenges and evolving disclosure requirements.

Literature review

Dynamic Environmental Accounting Framework

The concept of dynamic environmental accounting represents an evolution from traditional static environmental reporting approaches toward a more comprehensive framework that captures the temporal dynamics and strategic implications of environmental information. Unlike conventional environmental accounting, which focuses primarily on historical environmental costs and liabilities, dynamic environmental accounting encompasses forward-looking elements including carbon risk assessment, transition planning, and adaptive management strategies. This framework recognizes that environmental performance and disclosure are not merely compliance exercises but strategic activities that influence stakeholder perceptions and corporate value creation over time.

Environmental Management Accounting (EMA) provides the theoretical foundation for understanding how environmental information can be integrated into corporate decision-making and external reporting processes. EMA encompasses both monetary and physical information about environmental impacts, enabling organizations to identify, evaluate, and manage environmental costs and opportunities systematically. The integration of EMA principles with capital market theory suggests that high-quality environmental disclosure

should reduce information asymmetry, enhance stakeholder confidence, and ultimately influence corporate valuation through multiple channels including risk perception, cost of capital, and growth expectations.

The dynamic nature of environmental accounting is particularly relevant in the context of climate change, where corporate carbon performance and disclosure evolve in response to changing regulatory requirements, technological developments, and stakeholder expectations. Companies that proactively enhance their carbon disclosure quality may signal superior environmental management capabilities and better preparedness for future regulatory and market changes. This dynamic perspective suggests that the relationship between carbon disclosure and financial outcomes may strengthen over time as stakeholders become more sophisticated in their use of environmental information for investment decision-making.

Carbon Disclosure Quality and Theoretical Foundations

Carbon disclosure quality refers to the extent to which corporate reporting on greenhouse gas emissions and climate-related activities meets the information needs of various stakeholders. High-quality carbon disclosure is characterized by transparency, completeness, accuracy, comparability, and relevance. Transparency involves clear communication of carbon-related policies, targets, and performance metrics. Completeness requires disclosure across all material emission sources and organizational boundaries. Accuracy demands reliable measurement and verification of reported emissions. Comparability enables stakeholders to assess corporate carbon performance relative to industry peers and over time. Relevance ensures that disclosed information is useful for stakeholder decision-making.

Signaling theory provides a compelling theoretical lens for understanding the financial implications of carbon disclosure quality. According to this perspective, corporate disclosure serves as a signal to external stakeholders about underlying firm characteristics that are not directly observable. High-quality carbon disclosure signals superior environmental management capabilities, reduced exposure to climate-related risks, and greater organizational commitment to sustainability. In an information-asymmetric environment, such signals can differentiate firms with genuine environmental commitment from those engaging in superficial greenwashing, thereby enabling capital markets to more accurately price environmental performance.

Legitimacy theory offers a complementary perspective on the motivations and implications of carbon disclosure. Organizations operate within a broader social context and must maintain legitimacy by conforming to societal expectations regarding environmental responsibility. Carbon disclosure serves as a mechanism for demonstrating environmental accountability and maintaining social license to operate. Companies that fail to meet stakeholder expectations regarding environmental transparency may face reputational damage, regulatory sanctions, and ultimately diminished financial performance. Conversely, those that exceed disclosure expectations may enhance their legitimacy and associated benefits including stakeholder trust and market valuation.

Cost of Capital and Environmental Disclosure

The cost of capital represents the minimum return required by investors to compensate for the time value of money and the risk associated with their investment. It comprises the cost of equity capital and the cost of debt capital, weighted according to the firm's capital structure. From a theoretical perspective, environmental disclosure may influence both components of the cost of capital through several mechanisms. First, enhanced disclosure reduces information asymmetry between corporate insiders and external investors, thereby lowering the information risk premium demanded by investors. Second, environmental disclosure may signal reduced exposure to environmental risks, leading investors to perceive lower systematic and idiosyncratic risks associated with the firm's cash flows.

The relationship between environmental disclosure and the cost of equity has received substantial empirical attention. Studies employing various methodologies including the Capital Asset Pricing Model (CAPM), Fama-

French factor models, and implied cost of capital estimates have generally found negative associations between environmental performance and disclosure quality and the cost of equity capital. However, the magnitude of this relationship varies considerably across studies, with some researchers finding economically significant effects while others report more modest impacts. These variations may reflect differences in sample characteristics, measurement approaches, and institutional contexts.

The cost of debt capital may also be influenced by carbon disclosure quality. Creditors face similar information asymmetry challenges as equity investors and may incorporate environmental risk assessments into their lending decisions. Companies with superior carbon disclosure may benefit from improved credit terms due to reduced perceived default risk associated with environmental liabilities. Furthermore, the growing emphasis on sustainable finance and green bond markets suggests that environmental transparency may provide access to preferential financing terms for companies demonstrating strong environmental credentials.

Firm Value and Environmental Performance

Firm value represents the market's assessment of the present value of expected future cash flows discounted at the appropriate risk-adjusted rate. From a theoretical standpoint, environmental disclosure may enhance firm value through multiple channels. First, as discussed above, improved disclosure may reduce the cost of capital, thereby increasing the present value of expected future cash flows. Second, environmental disclosure may positively influence stakeholder perceptions, leading to improved relationships with customers, employees, suppliers, and communities that translate into enhanced operational performance. Third, transparent environmental reporting may signal superior management quality and strategic orientation, influencing investor expectations regarding future growth and profitability.

The empirical literature on the environmental disclosure-firm value relationship has produced mixed results. Some studies find positive associations between environmental performance and disclosure and various measures of firm value including market-to-book ratios, Tobin's Q, and stock returns. Others report insignificant or even negative relationships, suggesting that the financial benefits of environmental disclosure may be contingent on various contextual factors. Recent meta-analyses attempting to synthesize this literature have generally concluded that a positive relationship exists on average, but with substantial heterogeneity across different contexts and measurement approaches.

Hypothesis Development

Building upon the theoretical foundations and empirical evidence reviewed above, this study develops three hypotheses regarding the relationships among carbon disclosure quality, cost of capital, and firm value in the Indonesian context.

The first hypothesis addresses the direct relationship between carbon disclosure quality and cost of capital. Based on signaling theory and information asymmetry arguments, we expect that higher quality carbon disclosure will reduce uncertainty regarding firms' environmental risk exposure and future cash flows, thereby lowering the risk premium demanded by investors. Furthermore, enhanced carbon disclosure may improve firms' access to sustainable finance opportunities characterized by preferential terms. Accordingly, we hypothesize:

H1: Carbon disclosure quality has a significant negative effect on the cost of capital.

The second hypothesis concerns the direct relationship between carbon disclosure quality and firm value. Drawing on stakeholder theory and legitimacy theory, we expect that superior carbon disclosure will enhance stakeholder relationships, improve corporate reputation, and signal effective environmental management, all of which should positively influence market valuation. Therefore, we hypothesize:

H2: Carbon disclosure quality has a significant positive effect on firm value.

The third hypothesis addresses the mediating role of cost of capital in the relationship between carbon disclosure quality and firm value. We propose that carbon disclosure quality influences firm value partly through its effect on the cost of capital. Specifically, higher quality carbon disclosure reduces the cost of capital, which in turn increases the present value of expected future cash flows and thus enhances firm value. This mediation mechanism is consistent with the theoretical arguments linking environmental transparency to shareholder value creation. Hence, we hypothesize:

H3: Cost of capital mediates the relationship between carbon disclosure quality and firm value.

Methods

Research Design

This study employs a quantitative research design utilizing secondary data from publicly listed companies on the Indonesia Stock Exchange (IDX). The research period spans from 2020 to 2023, capturing the period of significant regulatory developments in environmental disclosure requirements and the implementation of Indonesia's sustainable finance roadmap. This timeframe also encompasses the COVID-19 pandemic period, allowing for examination of environmental disclosure practices during a period of heightened uncertainty and stakeholder scrutiny.

The population for this study comprises all non-financial companies listed on the IDX that operated continuously throughout the 2020-2023 period. Financial institutions including banks, insurance companies, and securities firms are excluded due to their distinct regulatory environments and financial reporting characteristics. The purposive sampling technique was applied based on the following criteria: (1) companies must have been continuously listed on the IDX during the entire study period; (2) companies must have published annual reports and sustainability reports for all years within the study period; (3) companies must have disclosed carbon-related information in their reports, either through dedicated sustainability reports, integrated reports, or annual report sustainability sections; and (4) companies must have complete financial data required for the calculation of all research variables.

The application of these sampling criteria yielded a final sample of 39 companies providing 156 firm-year observations over the four-year study period. The sample distribution across industry sectors is presented in Table 1, demonstrating reasonable representation across major sectors including mining, manufacturing, agriculture, and services. The relatively modest sample size reflects the still-emerging nature of comprehensive carbon disclosure practices among Indonesian listed companies, particularly outside the high-emission intensity sectors.

Table 1. Sample Distribution by Industry Sector

Industry Sector	Number of Companies	Firm-Year Observations
Mining and Energy	12	48
Basic Industry and Chemicals	8	32
Consumer Goods Industry	6	24
Agriculture and Plantation	5	20
Infrastructure and Transportation	4	16
Property and Real Estate	4	16
Total	**39**	**156**

Source: Processed data, 2024

Variable Measurement

The measurement of research variables follows established methodologies in the environmental accounting and corporate finance literature, adapted to the Indonesian institutional context.

Carbon Disclosure Quality (CDQ) serves as the independent variable and is measured using a comprehensive disclosure index developed specifically for this study. The index incorporates 25 disclosure items across five dimensions: (1) Governance and Strategy (5 items) covering board oversight, management responsibility, climate risk integration, and strategic planning; (2) Risk Management (5 items) addressing identification, assessment, and mitigation of climate-related risks; (3) Metrics and Targets (5 items) encompassing emission measurement methodologies, scope coverage, and target setting; (4) Performance Disclosure (5 items) including historical emissions data, intensity metrics, and reduction achievements; and (5) Verification and Assurance (5 items) covering third-party verification, assurance standards, and data quality procedures. Each item is scored on a scale of 0 to 3, where 0 indicates no disclosure, 1 indicates minimal disclosure, 2 indicates moderate disclosure, and 3 indicates comprehensive disclosure. The CDQ score is calculated as the sum of item scores divided by the maximum possible score (75), yielding a continuous variable ranging from 0 to 1.

Cost of Capital (COC) represents the mediating variable and is measured using the Weighted Average Cost of Capital (WACC) methodology. WACC is calculated as:

$$WACC = (E/V \times Re) + (D/V \times Rd \times (1\text{-}Tc))$$

where E represents market value of equity, D represents market value of debt, V represents total firm value (E + D), Re represents cost of equity estimated using the Capital Asset Pricing Model (CAPM), Rd represents cost of debt calculated as interest expense divided by total debt, and Tc represents corporate tax rate. The risk-free rate is proxied by Indonesian government bond yields, market return is based on the IDX Composite Index, and beta coefficients are estimated using 60-month rolling regressions.

Firm Value (FV) serves as the dependent variable and is measured using Tobin's Q, a widely employed market-based valuation metric. Tobin's Q is calculated as:

$$\text{Tobin's Q} = (\text{Market Value of Equity} + \text{Book Value of Debt}) / \text{Book Value of Total Assets}$$

A Tobin's Q value greater than one indicates that the market values the firm above the replacement cost of its assets, suggesting that intangible factors including environmental reputation and sustainability practices contribute to firm value.

Several control variables are included to account for firm-specific characteristics that may influence the focal relationships. These include firm size (measured as the natural logarithm of total assets), profitability (measured as return on assets), leverage (measured as total debt to total assets ratio), and growth opportunities (measured as revenue growth rate). Industry fixed effects are included to control for sector-specific factors influencing carbon disclosure practices and financial outcomes.

Data Analysis Technique

The research hypotheses are tested using Partial Least Squares Structural Equation Modeling (PLS-SEM) implemented through SmartPLS 4.0 software. PLS-SEM is selected over covariance-based SEM for several reasons. First, PLS-SEM is particularly suitable for research contexts involving mediation analysis and relatively complex structural models. Second, PLS-SEM does not require multivariate normality assumptions and is robust to departures from normality that may characterize financial data. Third, PLS-SEM performs well with smaller sample sizes, making it appropriate for the present study given the relatively limited availability of carbon disclosure data in Indonesia.

The analysis proceeds in two stages. The first stage involves assessment of the measurement model, including evaluation of indicator reliability, internal consistency reliability (Cronbach's alpha and composite reliability), convergent validity (average variance extracted), and discriminant validity (Fornell-Larcker criterion and heterotrait-monotrait ratio). For the reflective constructs in this study, indicators with loadings below 0.70 are candidates for removal, and composite reliability should exceed 0.70 while average variance extracted should exceed 0.50.

The second stage involves assessment of the structural model and hypothesis testing. Path coefficients are estimated using the PLS algorithm, and statistical significance is evaluated using bootstrapping with 5,000 subsamples to generate standard errors and confidence intervals. The coefficient of determination (R^2) is examined to assess explanatory power, with values of 0.25, 0.50, and 0.75 considered weak, moderate, and substantial, respectively. Predictive relevance is assessed using Stone-Geisser's Q^2 obtained through blindfolding procedures, where positive Q^2 values indicate predictive relevance.

Mediation analysis follows the approach recommended by Hair et al. (2017), involving assessment of the significance of indirect effects, calculation of variance accounted for (VAF), and determination of mediation type (full, partial, or no mediation). The indirect effect of carbon disclosure quality on firm value through cost of capital is calculated as the product of path coefficients, and significance is assessed using bootstrap confidence intervals.

Results and Discussion

Descriptive Statistics

Table 2 presents descriptive statistics for the research variables. The mean carbon disclosure quality score of 0.483 indicates that, on average, sample companies disclosed approximately 48% of the items in the carbon disclosure index. This moderate level of disclosure suggests room for improvement in carbon reporting practices among Indonesian listed companies. The substantial standard deviation (0.187) indicates considerable variation in disclosure quality across the sample, with scores ranging from a minimum of 0.147 to a maximum of 0.893.

Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Carbon Disclosure Quality	0.483	0.187	0.147	0.893
Cost of Capital (WACC)	0.098	0.034	0.042	0.189
Firm Value (Tobin's Q)	1.347	0.892	0.412	4.856
Firm Size (Ln Total Assets)	30.547	1.623	27.124	34.892
Profitability (ROA)	0.067	0.089	-0.156	0.312
Leverage (DER)	0.487	0.234	0.087	1.124
Growth	0.089	0.187	-0.342	0.678

Source: SmartPLS 4.0 Output, 2024; n = 156 firm-year observations

The average cost of capital (WACC) of 9.8% is consistent with typical capital costs in emerging market contexts, reflecting the higher risk premiums demanded by investors in developing economies. The mean Tobin's Q of 1.347 indicates that, on average, sample companies are valued at approximately 35% above their asset replacement costs, suggesting positive market perceptions of intangible value creation including environmental reputation. The control variables show reasonable distributions consistent with the characteristics of Indonesian listed companies.

Measurement Model Assessment

Table 3 presents the results of measurement model assessment for the carbon disclosure quality construct. All five dimensions of the disclosure index demonstrate loadings exceeding the recommended threshold of 0.70, indicating satisfactory indicator reliability. The composite reliability of 0.891 exceeds the minimum threshold of 0.70, demonstrating adequate internal consistency. The average variance extracted (AVE) of 0.621 surpasses the 0.50 threshold, confirming convergent validity. Discriminant validity is established through the Fornell-Larcker criterion, with the square root of AVE exceeding correlations with other constructs.

Table 3. Measurement Model Assessment

CDQ Dimension	Loading	CR	AVE
Governance and Strategy	0.812		
Risk Management	0.786		
Metrics and Targets	0.823	0.891	0.621
Performance Disclosure	0.759		
Verification and Assurance	0.734		

Note: CR = Composite Reliability; AVE = Average Variance Extracted

Structural Model Assessment and Hypothesis Testing

Table 4 presents the results of structural model assessment and hypothesis testing. The coefficient of determination (R^2) values indicate that the model explains 23.4% of the variance in cost of capital and 41.7% of the variance in firm value, representing moderate explanatory power. The predictive relevance (Q^2) values of 0.187 and 0.298 for cost of capital and firm value, respectively, exceed zero, confirming the model's predictive validity.

Table 4. Hypothesis Testing Results

Hypothesis / Path	Coefficient	T-Statistic	P-Value	Decision
H1: CDQ → COC	-0.387	4.892	0.000	Supported
H2: CDQ → FV	0.312	3.567	0.000	Supported
COC → FV	-0.423	5.234	0.000	-
H3: CDQ → COC → FV (Indirect)	0.164	3.124	0.002	Supported

Note: CDQ = Carbon Disclosure Quality; COC = Cost of Capital; FV = Firm Value

The results provide strong support for all three hypotheses. Hypothesis 1, predicting a negative relationship between carbon disclosure quality and cost of capital, is supported with a path coefficient of -0.387 ($t = 4.892$, $p < 0.001$). This finding indicates that a one-standard-deviation increase in carbon disclosure quality is associated with a 0.387 standard deviation decrease in the cost of capital, representing an economically meaningful effect. The negative coefficient confirms that enhanced carbon transparency reduces the risk premium demanded by investors.

Hypothesis 2, predicting a positive relationship between carbon disclosure quality and firm value, is also supported with a path coefficient of 0.312 ($t = 3.567$, $p < 0.001$). This result demonstrates that superior carbon disclosure practices are positively associated with market valuation, consistent with the theoretical predictions

of signaling theory and legitimacy theory. Companies that provide comprehensive carbon disclosure are rewarded by the market with higher valuations.

Hypothesis 3 examines the mediating role of cost of capital in the carbon disclosure-firm value relationship. The indirect effect of carbon disclosure quality on firm value through cost of capital is 0.164 (calculated as -0.387 × -0.423), with a t-statistic of 3.124 (p = 0.002) indicating statistical significance. The variance accounted for (VAF) is 34.4%, calculated as the indirect effect (0.164) divided by the total effect (0.476 = 0.312 + 0.164). This VAF value indicates partial mediation, suggesting that cost of capital serves as an important but not exclusive mechanism through which carbon disclosure quality influences firm value.

Discussion

The empirical findings of this study contribute to the growing body of literature on environmental disclosure and corporate financial outcomes by providing evidence from the Indonesian context. The significant negative relationship between carbon disclosure quality and cost of capital supports the theoretical arguments derived from signaling theory and information asymmetry perspectives. High-quality carbon disclosure reduces uncertainty regarding firms' environmental risk exposure and future cash flow implications, thereby lowering the risk premium required by investors. This finding is consistent with prior studies conducted in developed market contexts and extends the generalizability of these relationships to emerging market settings.

The positive association between carbon disclosure quality and firm value aligns with stakeholder theory predictions that transparent environmental reporting enhances relationships with diverse stakeholder groups including investors, customers, employees, and communities. The market appears to value the information content of carbon disclosure, interpreting comprehensive reporting as a signal of effective environmental management and reduced exposure to climate-related risks. This finding has important practical implications for corporate managers considering investments in environmental reporting infrastructure and capabilities.

The mediation analysis reveals that cost of capital serves as a significant pathway through which carbon disclosure quality affects firm value. The partial mediation result (VAF = 34.4%) indicates that approximately one-third of the total effect of carbon disclosure on firm value operates through the cost of capital mechanism. The remaining effect may be attributed to other channels including direct stakeholder perception effects, operational performance improvements associated with environmental management, and signaling effects independent of financing considerations.

The Indonesian context provides unique insights into the environmental disclosure-financial performance relationship. As an emerging economy with developing capital markets and evolving sustainability regulations, Indonesia represents an important test case for understanding whether relationships observed in developed markets extend to different institutional environments. The significant findings suggest that even in contexts with less developed enforcement mechanisms and investor sophistication regarding environmental issues, carbon disclosure quality influences corporate financial outcomes. This may reflect the growing integration of Indonesian capital markets with global investment flows and the increasing influence of international institutional investors with established environmental, social, and governance (ESG) investment criteria.

The study period encompassing 2020-2023 captures a period of significant transition in Indonesian environmental disclosure practices. The implementation of OJK sustainable finance regulations, combined with growing awareness of climate risks following the COVID-19 pandemic, has likely heightened stakeholder attention to corporate environmental transparency. The significant relationships observed in this study may partly reflect this increased salience of environmental issues in investment decision-making processes. Future research examining temporal trends in these relationships could provide insights into how the financial implications of environmental disclosure evolve as institutional environments develop.

Conclusion

This study developed and empirically tested a dynamic environmental accounting framework examining the relationships among carbon disclosure quality, cost of capital, and firm value in the Indonesian Stock Exchange. Using a sample of 156 firm-year observations from 39 companies over the 2020-2023 period, the research employed PLS-SEM analysis to test three hypotheses regarding direct and mediated relationships among the focal constructs.

The findings demonstrate that carbon disclosure quality exerts a statistically significant negative influence on the cost of capital, supporting the theoretical prediction that enhanced environmental transparency reduces information asymmetry and investor risk perceptions. Furthermore, carbon disclosure quality has a significant positive effect on firm value, indicating that the market rewards companies with comprehensive carbon reporting through higher valuations. Importantly, the analysis reveals that cost of capital partially mediates the relationship between carbon disclosure quality and firm value, illuminating the mechanism through which environmental transparency creates shareholder value.

Theoretical and Practical Implications

From a theoretical perspective, this study contributes to the environmental accounting literature by developing an integrated framework that connects carbon disclosure practices to financial outcomes through the cost of capital mechanism. The findings provide empirical support for the application of signaling theory and information asymmetry arguments to environmental disclosure contexts in emerging markets. The concept of dynamic environmental accounting, emphasizing the forward-looking and strategic nature of environmental reporting, offers a useful framework for understanding the evolving relationship between environmental transparency and corporate value creation.

For corporate managers, the findings underscore the financial benefits of investing in high-quality carbon disclosure. The significant reduction in cost of capital associated with enhanced disclosure suggests that environmental transparency may provide competitive advantages in capital acquisition. Managers should consider carbon disclosure not merely as a compliance exercise but as a strategic activity with implications for financing costs and market valuation. The development of robust carbon measurement systems, transparent reporting practices, and third-party verification mechanisms may yield tangible financial returns.

For policymakers and regulators, the findings support the rationale for enhanced environmental disclosure requirements. The positive association between carbon disclosure quality and firm value suggests that mandatory disclosure requirements need not impose net costs on companies but may instead facilitate value creation through improved stakeholder relationships and reduced information asymmetry. Indonesian regulators may consider strengthening carbon disclosure requirements while providing guidance on best practices to enhance the quality and comparability of reported information.

For investors, the findings highlight the informativeness of carbon disclosure for investment decision-making. The significant relationships between disclosure quality and both cost of capital and firm value suggest that carbon reporting provides value-relevant information that should be incorporated into valuation analyses. Investors seeking to identify companies with lower environmental risk exposure and better sustainability positioning may benefit from systematic assessment of carbon disclosure quality as part of their investment processes.

Limitations and Future Research Directions

Several limitations of this study warrant acknowledgment and suggest directions for future research. First, the relatively modest sample size of 156 firm-year observations, while adequate for PLS-SEM analysis, limits the generalizability of findings and precludes examination of certain moderating effects. Future research with larger

samples could explore industry-specific variations in the carbon disclosure-financial performance relationship and examine the moderating influence of firm characteristics.

Second, the carbon disclosure quality index developed for this study, while comprehensive, involves subjective judgment in scoring individual disclosure items. Future research could employ alternative measurement approaches including automated text analysis of disclosure documents or utilize established international disclosure frameworks such as the Task Force on Climate-related Financial Disclosures (TCFD) recommendations to enhance comparability with international studies.

Third, the cross-sectional nature of the panel data analysis, while incorporating multiple years, does not fully capture the dynamic evolution of disclosure-financial performance relationships over time. Longitudinal research designs examining how these relationships evolve as companies develop their disclosure practices and as institutional environments mature could provide valuable insights into the temporal dynamics of environmental transparency effects.

Fourth, the study focuses specifically on carbon disclosure and does not examine broader sustainability reporting dimensions. Future research could investigate whether the observed relationships extend to other environmental disclosure categories such as water usage, biodiversity impacts, and waste management, or to social and governance disclosure dimensions. Comparative analysis of different disclosure types could inform corporate decisions regarding disclosure resource allocation.

Finally, the Indonesian context, while providing valuable emerging market insights, may exhibit institutional characteristics that limit generalizability to other settings. Comparative international research examining carbon disclosure-financial performance relationships across different regulatory environments, capital market developments, and cultural contexts could enhance understanding of the boundary conditions for the relationships observed in this study.

References

Barth, M. E., Cahan, S. F., Chen, L., & Venter, E. R. (2017). The economic consequences associated with integrated report quality: Capital market and real effects. Accounting, Organizations and Society, 62, 43-64.

Brammer, S., & Pavelin, S. (2008). Factors influencing the quality of corporate environmental disclosure. Business Strategy and the Environment, 17(2), 120-136.

Burritt, R. L., & Schaltegger, S. (2010). Sustainability accounting and reporting: Fad or trend? Accounting, Auditing & Accountability Journal, 23(7), 829-846.

Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. Strategic Management Journal, 35(1), 1-23.

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. Accounting, Organizations and Society, 33(4-5), 303-327.

Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting. The Accounting Review, 86(1), 59-100.

El Ghoul, S., Guedhami, O., Kwok, C. C., & Mishra, D. R. (2011). Does corporate social responsibility affect the cost of capital? Journal of Banking & Finance, 35(9), 2388-2406.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). A primer on partial least squares structural equation modeling (PLS-SEM) (2nd ed.). Sage Publications.

Hahn, R., & Kühnen, M. (2013). Determinants of sustainability reporting: A review of results, trends, theory, and opportunities in an expanding field of research. Journal of Cleaner Production, 59, 5-21.

Healy, P. M., & Palepu, K. G. (2001). Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. Journal of Accounting and Economics, 31(1-3), 405-440.

IPCC. (2021). Climate change 2021: The physical science basis. Contribution of working group I to the sixth assessment report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

Kolk, A., Levy, D., & Pinkse, J. (2008). Corporate responses in an emerging climate regime: The institutionalization and commensuration of carbon disclosure. European Accounting Review, 17(4), 719-745.

Luo, L., & Tang, Q. (2014). Does voluntary carbon disclosure reflect underlying carbon performance? Journal of Contemporary Accounting & Economics, 10(3), 191-205.

Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2014). Firm-value effects of carbon emissions and carbon disclosures. The Accounting Review, 89(2), 695-724.

OJK. (2017). Peraturan Otoritas Jasa Keuangan Nomor 51/POJK.03/2017 tentang Penerapan Keuangan Berkelanjutan bagi Lembaga Jasa Keuangan, Emiten, dan Perusahaan Publik. Otoritas Jasa Keuangan.

Plumlee, M., Brown, D., Hayes, R. M., & Marshall, R. S. (2015). Voluntary environmental disclosure quality and firm value: Further evidence. Journal of Accounting and Public Policy, 34(4), 336-361.

Richardson, A. J., & Welker, M. (2001). Social disclosure, financial disclosure and the cost of equity capital. Accounting, Organizations and Society, 26(7-8), 597-616.

Schaltegger, S., & Burritt, R. L. (2010). Sustainability accounting for companies: Catchphrase or decision support for business leaders? Journal of World Business, 45(4), 375-384.

Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. Academy of Management Review, 20(3), 571-610.

TCFD. (2017). Recommendations of the Task Force on Climate-related Financial Disclosures. Task Force on Climate-related Financial Disclosures.

Verrecchia, R. E. (2001). Essays on disclosure. Journal of Accounting and Economics, 32(1-3), 97-180.

World Bank. (2023). Indonesia country climate and development report. World Bank Group.