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How Does Big Data Analytics Moderate Water Accounting Disclosure in Indonesia?

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ABSTRAK

Penelitian ini bertujuan untuk meneliti pengaruh keberadaan komite keberlanjutan dan kepemilikan institusi terhadap pengungkapan akuntansi air, dengan Big Data Analytics (BDA) sebagai variabel moderasi. Populasi dalam studi ini mencakup perusahaan yang terdaftar di IDX untuk periode 2023–2025. Dengan menggunakan teknik *purposive sampling*, ditemukan 116 perusahaan diperoleh sebagai sampel. Hasil temuan menunjukkan bahwa keberadaan komite keberlanjutan meningkatkan pengungkapan akuntansi air. Sebaliknya, kepemilikan institusional cenderung mengurangi pengungkapan akuntansi air perusahaan. Sementara itu, BDA tidak secara signifikan memoderasi hubungan antara komite keberlanjutan atau kepemilikan institusional terhadap pengungkapan akuntansi air.

Kata Kunci : Komite, Kepemilikan; Big Data Analytics; Pengungkapan.

The study aimed to examine the influence of the existence of sustainability committees and institutional ownership on water accounting disclosures, with Big Data Analytics (BDA) as the moderation variable. The population in this study includes companies listed on the IDX for the 2023–2025 period. Using purposive sampling, a total of 116 companies were obtained as samples. The findings of the data analysis show that the existence of a sustainability committee increases water accounting disclosures. In contrast, institutional ownership tends to reduce the disclosure of a company's water accounting. Meanwhile, the BDA does not significantly moderate the relationship between sustainability committees or institutional ownership to water accounting disclosures

Keyword: Committee; Ownership; Big Data Analytics, Disclosure.

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INTRODUCTION

The phenomenon of ecological crisis continues to grow, crossing national, ethnic, ideological, cultural and religious boundaries. Various discourses related to environmental crises began to emerge in the 1960s, environmentalists argue that the main factors of the ecological crisis occurred due to *careless technology,* the explosion of world population growth and the consumption of non-renewable resources (Quddus, 2020). The water crisis itself has consistently been included in the five most impactful global risks since 2012 (Bunclark & Scott, 2020).

In Indonesia, based on findings documented by the Ministry of National Development Planning (BAPPENAS) 2020, it is stated that the proportion of water shortages areas is projected to rise from 6% in 2000 reaching 9.6% by 2045. It covers several provinces including, but not limited to South Sumatra, West Nusa Tenggara, and South Sulawesi. Meanwhile, in Java and Bali, the supply of potable water will experience scarcity reaching critical levels across most areas (Yasmine, 2022).

The company is also responsible for the sustainability and availability of water in the future due to its operational activities (Adhariani, 2021). This is a reflection of the global agreement on *Sustainable Development Goal* point 6 (SDG 6), designed to guarantee universal availability of clean water alongside sustainable sanitation services management universally. Thus many companies are starting to focus on the water accounting disclosures contained in sustainability reports (Weber & Saunders-Hogberg, 2018). In its preparation, sustainability reports have complexity because they are driven by the ever-increasing demands of regulation and the information contained in them is a mixture of qualitative and quantitative data and information, monetary and non-monetary, past data and future projections (Naveed *et al.,* 2025).

Internal governance mechanisms can encourage companies to optimally carry out environmental sustainability practices. In line with this, companies can voluntarily form a sustainability *committee as* a tool of accountability to stakeholders. Additionally, it can effectively integrate sustainability strategies with better costs and benefits (Albitar et al., 2023). This board-level committee has responsibilities including oversight of the company's policies, strategies, programs and sustainability reporting (Wen *et al.*, 2022). Lopez-Arceiz *et al.* (2021) further highlighted how corporate sustainability initiatives constitute a vital component in managing organizational sustainability, so the formation of such a dedicated sustainability committee can be regarded as an integral part within an overarching corporate governance structure in implementing the strategy.

Several previous studies have been conducted to assess the influence of sustainability committees on sustainability disclosure, including by Alwadani, (2023); Hanan and Setiawan, (2023); Cai *et al.* (2023); Velte, (2023); Kateb and Youssef, (2025); Albitar *et al.* (2023) demonstrated that

sustainability disclosure by corporate entities can be shaped by the presence of sustainability committees that show social responsibility to society.

In addition, Shareholders dominated by institutional investors can actively degrade deviant behavior by irresponsible management (Hu et al., 2024). Thus, institutional shareholders exercise a crucial function within firms to supervise and encourage information disclosure (Wicaksono et al., 2024). Several previous studies have been conducted to assess how significantly the existence and extent of *institutional ownership* influences the transparency of corporate sustainability reporting. However, it is still very limited, among them Wicaksono *et al.* (2024); Nurleni *et al.* (2018) which showed that corporate environmental disclosures by companies can be encouraged by significant shares held by institutional investors who are professional and have integrity.

Today, companies are starting to embed sustainability principles into their strategic planning. The application of *big data analytics* offers substantially contextually relevant and trustworthy insights (Sánchez-Flores *et al.,* 2020). Thus, Abdullah *et al.* (2022) said that through the application of *big data analytics*, companies are able to maximize profits while building the company's sustainability performance.

Although still limited, research related to *big data analytics* on corporate environmental sustainability efforts has been conducted by Abdelhalim, (2023); Adiguzel *et al.* (2025); Najjar *et al.* (2023) found that the increasing performance of sustainability disclosure by companies, driven by *big data analytics* capabilities that make it easier for companies to determine strategic steps that add value for companies Thus, the objective of this research is to address following research questions, namely:

RQ1: Can the sustainability committee affect water accounting disclosures in companies?

RQ2: Can institutional ownership affect water accounting disclosures in companies

RQ3: Can the use of *big data analytics* moderate the relationship between sustainability committees and institutional ownership of water accounting disclosures?

This research is important to be carried out for two main reasons. First, the central objective of this study is to enrich scholarly perspectives on matters pertaining to water sustainability disclosure, where most previous research tends to discuss environmental sustainability in general through topics such as *environmental disclosure* (Wicaksono *et al.,* 2024; Driss *et al.,* 2024; Acar *et al.,* 2021; Li *et al.,* 2022), ESG *disclosure* (Tahat & Hassanein, 2024; Naveed *et al.,* 2025). As well as *Corporate Social Responsibility* (CSR) *disclosure* (Nurleni *et al.,* 2018; Aljabri, 2024; Garanina & Aray, 2021).

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Therefore, academic literature regarding the reporting of water accounting specifically remains still relatively limited in the literature. Second, this study elaborated with *big data analytics* as a moderation variable to analyze its role in moderating the relationship between sustainability committees and institutional ownership to water accounting disclosure, a subject matter that remains still infrequently discussed within the corporate water accounting disclosure scholarly domain.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Agency Theory

Agency theory describes a distinct correlation involving principal and agent entities, in terms pertaining to the execution of a task or service. Where the principal gives authority and authority to the agent to conduct management and decision-making (Jensen & Meckling, 1976). This theory serves as a valuable mechanism enabling executives to analyze and separate their diverse relational portfolios, as well as understand and reduce behavioral uncertainty (Partyka, 2022). However, agents and principals do not always have aligned interests, so seringa creates agency problems. This problem can be overcome by separating supervisory and executing positions at various levels within the firm, thereby ensuring corporate objectives are fulfilled and balanced between the two parties. (Fama & Jensen, 1998; Alwadani, 2023).

Dynamic Capabilities View (DCV)

Dynamic capabilities view (DCV) functions as an emerging and prospectively new lens for evaluating modern determinants of competitive edge. Teece *et al.,* (1997) define DCV as an approach that allows organizations to combine and integrate internal and external competencies to survive in achieving a competitive advantage in an ever-changing environment. Where organizations with high dynamic capabilities have the advantage of adapting to changing environments and optimizing opportunities that arise in the midst of market competition (Kay *et al.,* 2018).

Sustainability Committee

Sustainability committees hold the capacity to perform a diverse variety of functions, can act as an advisor by conveying insights through informal discussions and formal reports, and encourages the board as a whole to identify opportunities and take steps that support value creation, increase corporate transparency, and protect value for shareholders (Burke *et al.,* 2019; Driss *et al.,* 2024; Kateb & Youssef, 2025). This dedicated sustainability committee is a specialized part of the board that is formed with adequate qualifications, so as to carefully understand the benefits and costs of implementing sustainability (Martínez-Ferrero et al., 2021; Burke *et al.,*

2019). In an effort to reduce agency issues, this committee should consist of non-executive and independent directors (Lee, 2020).

Empirically, research by Li *et al.* (2022)); Hanan and Setiawan, (2023); Naveed *et al.* (2025); Driss *et al.* (2024); Tahat and Hassanein, (2024); Alwadani, (2023) shows that the expansion of corporate sustainability disclosure by companies corresponds directly with the existence of sustainability committees in companies. Hence, the proposed research hypotheses are as follows:

H1: Sustainability Committee has a positive impact on water accounting disclosures

Institutional Ownership

Institutional ownership refers to entities encompassing foundations, banking organizations, insurance firms and other forms of institutions with a share proportion of more than 5%. In two or more of the same industries (Ma et al., 2024; Nurleni et al., 2018). According to Tan and Keeper (2008), institutional investors are more as market supervisors and stabilizers than as the main decision-makers in companies. However, this important role is reflected in active supervision of investments and efforts to provide protection so that management does not take decisions that are detrimental to shareholder value.

One of the efforts to reduce agency conflicts is to increase the portion of institutional ownership so that management can be supervised more effectively. That way, supervision of management will become more harmonious. This means that a large proportion of shareholding by institutions will reduce the tendency of unethical behavior by management (Jensen & Meckling, 1976; Nurleni *et al.,* 2018). Empirically, prior literature by Nurleni *et al.* (2018); Wicaksono *et al.* (2024); Yu Hu *et al.* (2024); Ma *et al.* (2024) shows that the increase in sustainability disclosure by companies is due to the large proportion of institutional shareholding, both domestic and foreign. Hence, the proposed research hypotheses are as follows:

H2: Institutional ownership has a positive effect on water accounting disclosure

Big Data Analytic (BDA)

BDA serves as an organizational capability that refers to those unique and non-replicable advantages that companies have in effectively utilizing big data to generate strategic insights (Ciampi *et al.,* 2021: Mikalef *et al.,* 2019). DCV theory is an appropriate analytical lens to comprehensively evaluates the strategic use of business analytics, especially BDA in companies. This is because DCV views *big data* as a valuable source that must be continuously adjusted so that its knowledge can be spread and used optimally in organizational operations and strategies (Ferraris *et al.,* 2019). Empirically,

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research by Abdelhalim, (2023); Adiguzel *et al.* (2025); Najjar *et al.* (2023) found that significantly BDA is essential for devising value-generating strategic initiatives, especially corporate sustainability outcomes because such practices represent a pivotal stakeholder priority. Hence, the proposed research hypotheses are as follows:

H3: *Big Data Analytics* moderates the relationship between sustainability committees on water accounting disclosures

H4: Big Data Analytics moderates the relationship between institutional ownership to water accounting disclosures

RESEARCH METHOD

Population and Research Sample

This research employs a quantitative methodology examining the target demographic comprising all publicly traded firms on the Indonesia Stock Exchange (IDX) across the time frame of 2023–2025. This timeframe was chosen due to its relevance to contemporary current practice surrounding sustainability disclosure in Indonesia. The empirical sample was established through purposive sampling techniques, which are focused on companies in sectors with high water use intensity (Wicaksono & Setiawan, 2022), which report water accounting disclosures in accordance with the GRI 303 standard, so that it can represent more capable water resource management and reporting practices (Arif *et al.,* 2021).

Table.1 Distribution Sample

Sample	Frequency	%
Sector Distribution:		
Material	23	19,83
Consumer non-cyclical	33	28,45
Energy	27	23,28
Infrastructure	19	16,38
Properties and Real Estate	14	12,07
Total	**116**	**100,00**

Source: Authors' own work (2026)

Table.2 Variable Description

Variable	Description	Measurement	References
WAD	*Water Accounting Disclosure*	Total indicators of water accounting disclosure by companies based on GRI 303	(Farooq *et al.,* 2024)
SC	*Sustainability Committee*	Companies that have a sustainability committee worth 1 are not 0	(Tahat & Hassanein, 2024)
IO	*Institutional Ownership*	The percentage of institutional ownership in the company is at least 5%	(Ma *et al.,* 2024)
BDA	*Big Data Analytics*	The frequency of the occurrence of keywords related to big data analytics that reflect the intensity of the implementation of BDA by companies	(Naveed et al., 2025)
ROE	*Return on Equity*	Net profit divided by the total equity of the owner	(Wolf *et al.,* 2016; Husna & Satria, 2019).
ROA	*Return on Asset*	Net income divided by total assets	
CR	*Current Ratio*	Total current assets divided by short-term liabilities	
SR	*Solvency Ratio*	Total liabilities divided by total equity	

Source: Authors' own work (2026)

This study developed a regression model to empirically evaluate all proposed correlations detailed in Table. 2. The specific linear regression model formulated to test the study hypotheses is specified below:

$$WAD = \beta_0 + \beta_1 SC + \beta_2 IO + \beta_3 BDA + \beta_4 (SC \times BDA) + \beta_5 (IO \times BDA) + \beta_6 ROE + \beta_7 ROA + \beta_8 CR + \beta_9 SR + \epsilon$$

RESULT

Table. 3 describing the statistical descriptive results, related to the disclosure of water accounting in the company in the sample is still at a good level. **Table. 4** shows a correlation matrix between variables, where WAD has a positive correlation with SC (r = 0.318). However, it had a negative correlation with IO (r = -0.012) and BDA (r = -0.083). Meanwhile, WAD also had a positive influence on the control variable ROE (0.048), but was negatively correlated with ROA (-0.002), CR (-0.062) and SR (-0.136). Correlation test results indicate that inter-variable correlation coefficients remain far well under 0.8. Hence, it is evident that the model suffers from no serious problem of multicollinearity (Sekaran & Bougie, 2016).

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Table. 3 Statistical Descriptive Results

Variable	Obs	Min	Max	Mean	Std. Dev
WAD	348	0	1	0.524	0.382
SC	348	0	1	0.100	0.301
IO	348	0	147.5	71.500	28.075
BDA	348	0	5	0.244	0.774
ROE	348	-237	183	15.560	32.022
ROA	348	-28.2	79.59	9.328	12.57
CR	348	0	84.53	3.016	6.909
SR	348	-83.46	99.77	53.512	24.86

Source: Authors' own work (2026)

Table. 4 Correlation Matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) WAD	1							
(2) SC	0.318***	1						
(3) IO	-0.012	0.116***	1					
(4) BDA	-0.083***	-0.043***	0.048	1				
(5) ROE	0.048	0.088**	0.051	0.039	1			
(6) ROA	-0.002	0.050	-0.030	-0.019	0.777***	1		
(7) CR	-0.062	-0.055	0.049	-0.061	-0.007	0.052	1	
(8) SR	-0.136***	-0.038	-0.018	-0.093**	0.112**	0.323***	0.347***	1
VIF		1.02	1.02	1.02	2.70	2.96	1.15	1.34

Notes: *,**,*** show significance at the 10%, 5%, and 1% levels respectively
Source: Authors' own work (2026)

The Hausman specification test was applied in order to identify the most appropriate model specification, selecting either the *Fixed Effect Model* (FEM) or the *Random Effect Model* (REM) in providing an optimal best explanation according to the characteristics of the research data (Wicaksono *et al.,* 2024). The result of Hausman's test indicates that the optimal specification for this study is the Random Effect Model (REM). Therefore, subsequent regression testing is carried out using this model. The detailed estimation results are displayed in **Table 5**.

Table. 5 Regression Results

Variable	(1)	(2)	(3)
SC	0.339 (0.000)***	-0.017 (0.933)	
IO	-0.000 (0.581)	-0.000 (0.365)	
BDA		-0.040 (0.262)	
ROE	0.000 (0.801)	0.000 (0.774)	0.000 (0.688)
ROA	3.060 (0.986)	-2.620 (0.998)	0.000 (0.783)
CR	-0.000 (0.779)	-0.000 (0738)	-0.001 (0.694)
SR	-0.001 (0.199)*	-0.001 (0.164)*	-0.001 (0.266)
Year Effect	Yes	Yes	Yes
Industry Effect	Yes	Yes	Yes
R^2	0.557	0.553	0.454
F-Stat	10.549	1.261	0.400
Prob.(F.stat)	0.000***	0.262	0.808

Notes: *,**,*** show significance at the 10%, 5%, and 1% levels respectively
Source: Authors' own work (2026)

Empirical findings generated from this research found demonstrably that there was a statistically meaningful favorable impact of SC (β = 0.375, p < 0.01) on WAD. These outcomes closely mirror several previous studies conducted by (Li *et al.,* 2022; Hanan and Setiawan, 2023; Naveed *et al.,* 2025; Driss *et al.,* 2024; Tahat and Hassanein, 2024; Alwadani, 2023). Establishing a dedicated sustainability committee contributes towards fostering broader organizational disclosure pertaining to water accounting in each company, hence **H1 accepted**. Meanwhile, in the IO variable, it had a significant negative influence (β = -0.000, p > 0.10). These empirical findings align with the work of Garanina and Aray, (2021) that the existence of institutional ownership does not affect the contribution of water accounting disclosure in companies, so **H2 rejected**.

In addition, in column 2, it was found that BDA as a moderation variable had negative and significant values both at SC (β = -0.0175, p > 0.10), and IO (β = -0.000, p > 0.10). This suggests that BDA can weaken the influence of the SC but reinforces the influence of IO on water accounting disclosure. This influence can be caused by weak *human capital* in the company (Al-Khatib, 2022). So **H3 and H4 were rejected**.

ROBUSTNESS CHECK

Robustness check refers to the approach of Alwadani, (2023) by separating samples by industry sector, so as to test whether the findings remain consistent across different industries. The output is detailed and represented in columns 1 to 5 of **Table 6**. The relevance of the robustness check results showed consistency and reliability rather than regression in this study.

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Table. 6 Robustness Check

Industri	Material	Consumer non-cycle	Energy	Infrastructure	Properties dan Real Estate
Variable	(1)	(2)	(3)	(4)	(5)
SC	0.395	0.470	0.494	-0.217	0.378
	(0.013)**	(0.002)***	(0.000)***	(0.530)	(0.061)*
IO	0.003	-0.000	0.002	-0.002	-0.005
	(0.063)*	(0.720)	(0.188)	(0.144)	(0.053)*
BDA	-0.084	-0.044	0.003	-0.026	-0.035
	(0.688)	(0.461)	(0.953)	(0.428)	(0.164)
ROE	-0.003	0.001	0.001	-0.002	0.000
	(0.446)	(0.218)	(0.349)	(0.346)	(0.627)
ROA	-0.000	0.003	0.000	-0.007	-0.000
	(0.976)	(0.426)	(0.852)	(0.234)	(0.713)
CR	-0.056	-0.031	-0.033	0.033	-0.002
	(0.008)***	(0.055)*	(0.068)*	(0.128)	(0.359)
SR	-0.001	-0.001	-0.005	-0.001	0.006
	(0.461)	(0.343)	(0.006)***	(0.437)	(0.000)***
Year Effect	Yes	Yes	Yes	Yes	Yes
Industry Effect	Yes	Yes	Yes	Yes	Yes
R^2	0.554	0.551	0.562	0.561	0.528
F-Stat	2.979	2.355	5.838	1.343	7.141
Prob. (F.stat)	0.009***	0.029**	0.000***	0.250	0.000***

Notes: *,**,*** show significance at the 10%, 5%, and 1% levels respectively

Source: Authors' own work (2026)

DISCUSSION

Current research shows that sustainability committees have an influence on the openness of water accounting, these results support a prior investigation authored by Alwadani *et al.* (2024) which asserts that any improvement of company performance concerning sustainable practices is a direct result attributable to the role fulfilled by the sustainability committee. Another scholarly work by Ciampi *et al.* (2021); Naveed *et al.* (2025) demonstrates how establishing a dedicated sustainability committee serves a pivotal function in becoming an active sustainability promoter through monitoring strategies, programs, policies, and reporting, as well as ensuring quality sustainability openness, fully compliant with applicable regulatory standards, and responding to broader information demanded by stakeholders. Through the lens of agency theory, the formal existence and operation of a sustainability committee serves to mitigate divergent objectives arising among corporate owners and their executives, through conveying more transparent information (Driss et al., 2024) related to water resource management. In addition, establishing a dedicated sustainability committee

can reduce information asymmetry (Hanan & Setiawan, 2023) by increasing accountability regarding corporate sustainability risks alongside strategic opportunities.

Conversely, empirical observations show that institutional shareholding exerts no significant impact on water accounting disclosures. These findings corroborate the empirical study of Garanina and Aray, (2021); Meutia *et al.* (2017) who argue that across numerous corporate entities, institutional equity is highly widespread and fails to represent controlling shares. Therefore, they place less emphasis on the disclosure of CSR activities to external stakeholders because such entities are less actively engaged in fostering long-term strategic growth of the corporation. Thus, it can be assumed that the absence of institutional ownership influence on water accounting disclosures indicates the low role of investor supervision and control. In the perspective of agency theory, agency problems occur when a fundamental divergence gap of objectives emerges between the principal and the agent. Thus, there is no strong pressure from institutional investors on the implementation of sustainability reporting which causes the monitoring function to not run optimally (Garanina & Aray, 2021).

In addition, empirical outputs from the moderation model show that leveraging BDA can reduce the beneficial explanatory power of sustainability committee oversight regarding water accounting disclosure. Theoretically, BDA should have the ability to process information more accurately, quickly and comprehensively so that it can support the role of sustainability committees (Ciampi et al., 2021; Gupta & George, 2016). However, the empirical findings derived from the research demonstrate that deploying BDA across firms operating in Indonesia has not been fully integrated to support the increased role of sustainability committees. Al-Khatib, (2022) said that this can be caused by limited human resource competence, limited digital infrastructure, and the lack of a massive digital-based culture in the company environment. In addition, the strategic decision-making process of water accounting disclosure relies not only on quantitative information, but also on professional judgment, intuition, and a deep comprehension regarding corporate-level situation through a gradual accumulation of organizational experience and capabilities (Usman & Wirawan, 2021).

In contrast, the results of BDA moderation support the dampening negative power linked to institutional equity in water accounting disclosures. Empirical results derived from our analysis reveal that institutional investors will prioritize cost effectiveness and immediate financial returns (Meutia *et al.*, 2017). Thus, big data analytics conducted by institutional investors are utilized to examine financial performance. This will encourage management to care more about profitable financial reporting, rather than with the disclosure of environmental issues that require more investment and transparency.

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Based on the perspective of dynamic capability view (DCV), the implementation of BDA must be carried out by aligning and combining internal and external competencies to survive and cultivate sustainable market leadership within a dynamic and ever-changing environment (Kay et al., 2018). Nevertheless, this must be done in such a way to ensure an optimal balance integrating the application of BDA with organizational human resources can be strengthened.

RESEARCH CONCLUSIONS AND IMPLICATIONS

This research reveals that establishing the existence of sustainability committees has an important role in improving water accounting disclosure. However, institutional ownership is not a factor that can encourage companies to disclose water accounting because institutional investors are not fully oriented to environmental sustainability because of its cost-free nature, so the supervisory function on sustainability issues is still weak. In addition, the results of *the big data analytics moderation* provided two different findings.

First, big data analytics actually weakens the influence of sustainability committees because strategic decisions related to water accounting disclosure require not only data, but also professional considerations and experience. Second, big data analytics reinforces the negative influence of institutional ownership, as institutional investors use it more to assess financial performance than environmental issues. The implications of our empirical findings prove the critical importance inherent in strengthening the oversight capacity of sustainability committees not only as a symbol of compliance, but also as a driving force in improving the quality of water accounting disclosure.

There are several avenues that future research may pursue. Firstly, further research may be carried out concerning various governance structures that would be used to gain insight into all of the factors influencing water accounting disclosure. Examples of such governance structures include sustainability experience of the board, environmental expertise of the board, board diversity, audit committee and managerial ownership. Secondly, future research might look into different technological capabilities like artificial intelligence, the Internet of Things, blockchain technology and digital reporting systems

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