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Article

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Corporate Governance Mechanism for Carbon Emission Disclosure: Evidence from State-Owned Enterprises in Indonesia

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ABSTRACT

Purpose: The purpose of this study is to explore how governance-related determinants affect carbon emission disclosure; if yes, whether government ownership, board diversity, and firm size mediates the relation between these determinants and carbon emission disclosure. We test ownership structure and firm-specific characteristics (board diversity, audit reputation, firm size, audit quality, leverage, and return on asset) towards carbon emission disclosure.

Design/methodology/approach: Panel data analysis is used on a final sample of 120 firm-year observations of state-owned enterprises, having published sustainability reports with CED within the last 10 years (2012 - 2021). The direct and mediating effects were tested based on two econometric models and Sobel-Goodman test was conducted to check for the robustness.

Findings: Results find that government ownership and board diversity can be employed as a corporate governance mechanism to facilitate public, institutional ownership and audit reputation respectively, towards improved accountability and transparency of CED. Smaller firms with lower financial performance tend to be more motivated to participate in CED in order to attract investment.

Research limitations/implications: Several implications arise for various stakeholders including policymakers, and regulatory bodies interested in enhancing sustainability disclosure of firms through good CG mechanism, especially for firms with high government ownership. The findings of this research have wide implications in formulating an efficient CG mechanism for developing countries as SOEs are still prevalent.

Originality/value: This study proposes the role of government ownership and board diversity as a CG mechanism and contributes to the voluntary literature, in particular, the link between CG determinants and practices underlying CED.

Keywords: Corporate governance, ownership structure, firm-specific characteristics, carbon emission disclosure (CED), state-owned enterprise (SOE), Indonesia

I. Introduction

The business landscape is currently at a stage where transition to green accounting through carbon emission

disclosure (CED) is more than just a legitimacy issue but of a business continuity (Brooks & Schopohl, 2021). The fund market for Environmental, Social, and Governance (ESG) investing is projected to grow over \$40 trillion in assets by the end of 2022 (Henze & Boyd, 2022) accelerated by growing concerns about climate change and other societal issues. This phenomenon provides a solid motivation for firms

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to actively engage in CED to gain competitive advantage over other firms.

Being exposed to direct impacts of climate change such as sea-level rise, Indonesia has ratified the Paris agreement via Presidential Regulation No. 98 of the Republic of Indonesia in 2021 and is committed to reducing greenhouse gas (GHG) emissions by 29% by 2030 (Asian Development Bank, 2021). Ranked the 10th highest in GHG emissions and 19th highest in terms of carbon emissions per capital, this goal can realistically only be achieved upon active participation of all stakeholders including the industrial sector.

While ESG comprises of various components, the aspect of climate change, in particular the firm's carbon-related risks often call for most attention (Matos, 2020). Due to its major role in climate change, various efforts to reduce quantitative emissions of carbon (Maroušek et al., 2018) and a mechanism for better measurement by firms have become more prevalent over the years (Maroušek et al., 2019). As part of a corporate social responsibility (CSR) report, CED comprises of firm's carbon-related performance, strategies, and outlooks and mostly voluntary (Depoers et al., 2016). Increased relevance of CED has called for several research on uncovering its practical applications, determinants, and financial consequences in the firm-specific level (Velte et al., 2020).

Given that sustainability reporting (SR) is voluntary in Indonesia only 10 percent of the firms listed in Indonesia Stock Exchange (IDX) were found to have disclosed SR by the end of 2019 (OJK, 2019). In terms of SR quality, the level of disclosure has just passed 50 percent, much lower than Malaysia (64.5%) and Singapore (61.7%) (Loh et al., 2018). Due to the rising concern of climate change (Staupoulou & Sardanou, 2019).

Indonesian State-Owned Enterprises (SOEs) which together own \$600 billion in assets, or roughly more than half of annual GDP, plays a critical role in the country's economy (Asian Development Bank, 2021). Within the last 10 years, SOEs generated \$4.013 trillion for the Indonesian state, consisting of 53 percent in the form of taxes, 37 percent in

the form of non-tax revenues, and 10 percent dividends (BUMN, 2021). Aside from its economic significance, the oversized and therefore primary role of SOEs in key sectors for carbon reduction such as energy, logistics and infrastructure highlight the importance of SOEs in meeting the sustainability goals. To the best of our knowledge, this study is the first to provide empirical evidence of governance-related determinants in the context of SOEs.

Several drivers that contribute to a higher quality of carbon emission disclosure (CED) have been identified. Policy measures delivered through regulations and government directives, stakeholder pressure from investors and others (Guenther et al., 2016; Liesen et al., 2015), and shifting market trends depending on technological innovation, firm size, type of ownership and industry (Luo et al., 2013) have all served as drivers of CED (Borghei, 2021). Extant literature has put much emphasis on technological efficiency mitigation (Mehmood et al., 2023), management accounting implications (Stechemesser & Guenther, 2012), general perspective on CED (Ascuí, 2014) and relationship between carbon performance and CED (Hahn et al., 2015). In the systematic literature review, highlights the lack of research on governance-related determinants of CED, in particular, their role as moderators and mediators in the CED mechanism.

The role of firm leaders and investors in implementing meaningful carbon disclosure procedures as a risk management is crucial which in this context, refers to effective corporate governance mechanism in regulating higher quality of CED (Eriqat & Al-Khazaleh, 2023). With emphasis on the critical role of SOEs in carbon reduction, this study focuses on CED of Indonesian SOEs during 2012 to 2021. This study validates the findings (Luo et al., 2022) in that the government ownership plays a strategic role in facilitating firms to provide higher quality of CED. Firm-specific CG factors such as ownership structure, board composition, stakeholder pressure and audit aspects are some of the least studied determinants of CED (Velte & Stawinoga, 2017) and provides a research gap to be addressed in this study.

II. Literature Review and Hypothesis Development

A. Literature Review

Several theories have been employed to understand the motivations for disclosure behavior, including CED (Hahn et al., 2015). Although there is no universal theory applicable to the voluntary disclosure literature, legitimacy, stakeholder, agency, resource dependence and signaling have been prevalent theories in the voluntary literature. Given that each theory has limitations in fully explaining the various motivations of CSR disclosures, (Ntim & Soobaroyen, 2013) adopts a multi-theoretical framework encompassing four theories (agency, resource dependence, legitimacy, stakeholder) to analyze corporate governance determinants of social disclosure.

Originally introduced as a theory on organizational behavior, legitimacy theory has been a prevailing theory on CED (Ascui, 2014; Velte et al., 2020). It states that companies seek to align themselves in congruence with the norms and acceptable behavior of the society in which they are a part of (Dowling & Pfeffer, 1975). Legitimacy, summed up as societal expectation for the firm's behavior, is threatened when the company is perceived as unsustainable (Ameer et al., 2012).

Derived from the stakeholder approach, stakeholder theory goes beyond the shareholders and considers the interest of all those that can be directly or indirectly affected by the company. Oftentimes the expectations of stakeholders may contradict each other, in which case the manager should make decisions to best address all stakeholders' concerns (Baalouch et al., 2019).

Building on both legitimacy and stakeholder theories, environmental legitimacy pressures are conditions that rely on public evaluations of environmental performance and reporting, which causes businesses to engage in environmental management. (DiMaggio & Powell, 1983) state that if stakeholders do not approve of an organization's conduct, the organization will face legitimacy

constraints. (Ali & Rizwan, 2013) introduce an institutional theoretical perspective for CED literature which classifies three levels of stakeholder pressure: coercive, mimetic and normative. The stakeholder's power to influence firms to adopt certain institutional practices (eg. CED), is the core argument of institutional theory and encompasses various stakeholders according to their types of pressures (Ali & Rizwan, 2013).

Agency theory posits that a voluntary disclosure serves as a governance mechanism that reduces agency costs (Ntim & Soobaroyen, 2013). In relation to the stakeholder theory, a company with a more distributed ownership structure increases public accountability (Khan et al., 2013) and place greater pressure on the company (Chiu & Wang, 2015). However, if the ownership is concentrated to only a few, the company incurs less agency cost and therefore decreased effort towards CED (Siagian et al., 2013). Resource dependence and signaling theory suggests that companies that are perceived to be sustainable by the stakeholders can expect tangible (investments, talent) and intangible (image and reputation, expertise) benefits (Ntim & Soobaroyen, 2013).

B. Hypothesis Development

1. Model 1: Testing ownership structure on carbon emission disclosure

SOEs can be defined as enterprises whose equity is owned by the state either in majority or entirety (Law No. 19 on SOEs, 2003). Legitimacy theory and stakeholder theory posits high government ownership in firm ownership structure is more prone to be sensitive to CSR performance to maintain legitimacy and address normative pressures (Khan et al., 2019). As a form of institutional pressure, government ownership will compel corporations who make low-carbon disclosures to comply with laws and regulations, namely by participating in CED.

Positive role of government ownership in enforcing CED is supported by previous research (Alshirah

et al., 2021; Bani-Khalid & Al-Own, 2020; Qian & Chen, 2021). Furthermore, (Luo et al., 2022) finds that the disclosure of environmental activities by Chinese companies is intended not only to comply with government regulations or reduce information asymmetry with stakeholders, but also to seek political and economic rents through officials stationed in these companies with certain political goals. Rent seeking, according to (Bui & Fowler, 2019) allows businesses to voluntarily share information that is congruent with government aims such as preserving stability and supporting policy execution. A recent study on 53 environmentally sensitive Indian companies reveals government ownership as one of the most influential factors on corporate sustainability disclosure (Kumar et al., 2022). Therefore, we propose:

H1a: Government ownership is positively related with CED.

The higher the firm's responsiveness to appease the public stakeholders by participating in CED, the higher the rise in firm value and market share (Bui & Fowler, 2019). Institutional and foreign investors are most active in voicing out their concerns against unsustainable firm practices and presents coercive pressure on firms to better comply with CED (Rustam et al., 2019). Foreign ownership tends to contribute to firms' transparency towards stakeholders (Yu et al., 2018), and increase overall sustainability disclosure (Rustam et al., 2019). Government ownership in SOEs is by definition more than 50% of the ownership structure and therefore is the biggest stakeholder with coercive pressure.

H1b: Government ownership mediates the relation between public ownership and CED.

H1c: Government ownership mediates the relation between managerial ownership and CED.

H1d: Government ownership mediates the relation between other institutional ownership and CED.

H1e: Government ownership mediates the relation between foreign ownership and CED.

2. Model 2: Testing of firm-specific characteristics on carbon emission disclosure

Study on the influence of board characteristics of a firm reveals that board diversity, in particular gender, positively influences firm's social performance and CSR disclosure (Katmon et al., 2019; Park & Byun, 2022; Wahid, 2019; Zahid et al., 2020). Composition of female members on board is often deployed to represent board diversity and considered an important dimension of CG (Liao et al., 2015). In previous studies, disclosures audited by BIG 4 auditors are perceived to be more credible and accountable and thus increases investor confidence in the firm (Aledwan, 2015). BIG 4 auditors face a higher reputational risk compared to non-BIG 4 auditors and therefore tend to enforce high-quality auditing standards, which not only enhances the quality of the reports but increases the effectiveness of CG mechanism and corporate governance.

Audit reputation, which positively enforces good corporate governance through prevention of fraud (DeFond & Zhang, 2014) serves as a dimension of good CG to enforce CED. Board diversity enhances good CG mechanism in general (Moses et al., 2020) as well as enforcing better quality and higher transparency of reporting practices (LópezPuertas-Lamy et al., 2017). This indicates that with the presence of female board members, good CG practices such as fraud prevention can be undertaken and positively affect CED.

H2a: Female on board positively influences carbon emission disclosure.

H2b: Female on board mediates the relationship between audit reputation and carbon emission disclosure.

Several empirical studies have found a positive correlation between firm size and carbon disclosure (Ben-Amar & McIlkenny, 2015; Dutta & Dutta, 2020; Faisal et al., 2018; Giannarakis et al., 2017). Based on stakeholder and legitimacy theory, larger firms face bigger legitimacy risk compared to smaller firms and is under higher level of stakeholder pressure

compared to smaller firm. It is assumed that large companies have higher flexibility in their resources to comply with stakeholder requests for a positive approach to CED (Choi et al., 2013) to avoid potential conflicts (Khairiddine et al., 2020).

However, (Siagian et al., 2013) finds that reporting quality of 125 Indonesian firms are negatively correlated with various proxies of firm size. This is in contradiction with the legitimacy theory and extant literature. An alternative explanation can be presented based on argument by (Omran & El-Galfy, 2014) which posits that firms operating in developing countries may be less subject to the impacts of stakeholder pressure and is better suited to explain the managerial motivations rather than the phenomenon itself. Instead, legitimacy theory is suggested to be most suitable in case of developed countries where disclosure is considered a primary communication tool to external stakeholders (Omran & El-Galfy, 2014). In addition, stakeholder theory and signaling theory does not apply as SOEs are mostly dominated by government ownership and lack the motivation to attract institutional and foreign investors compared to smaller firms.

H3a: Firm size negatively influences carbon emission disclosure.

As for (Hammami & Zadeh, 2019; LópezPuertas-Lamy et al., 2017) audit quality affects the quality of reports to non-financial reports. (Hammami & Zadeh, 2019) prove this by using two proxy measures of audit quality tested with ESG. A high-quality audit report will mitigate misstatement information to make the report more credible to investors. In this regard, the company will undoubtedly try to maintain the transparency and credibility of the audit report (Hammami & Zadeh, 2019). Large companies will not risk stakeholders or investors conveying information, including environmental policy. Therefore, with all resources, larger firms will have better disclosure reports (Cucari et al., 2018; Yu et al., 2018)

H3b: Firm size mediates the relation between audit quality and carbon emission disclosure.

Return on asset (ROA) is a standard accounting measure of financial performance that represents how efficiently a firm generates profit. Firms that are larger in size and have higher ROA are deemed to have more resources available for preparing CSR statements and address stakeholder concerns on sustainability (Andrikopoulos & Krikiani, 2013). However, contradicting results exist suggesting the opposite relationship where smaller and is more motivated to attract investors and increase their market value (Siagian et al., 2013). This is in line with the signaling theory that firms tend to disclose more information to attract more investment.

H3c: Firm size mediates the relation between return on assets and carbon emission disclosure.

III. Methodology

A. Sample and Data Collection

This study examines state-owned enterprise from six industrial sectors from 2012 to 2021. Ownership structure, corporate governance, and financial performance are variables that influence carbon emission disclosures. As of May 2022, there are 48 state-owned enterprises in Indonesia, organized into 12 sectors. We collect from IDX (Indonesian Stock Exchange) manually for empirical analysis. However, some data had to be eliminated because not available for such a long period. The total number of firm-year observations used for ten years is 120. The data utilized in this study are specified in table 1 provided below:

B. Variables

1. Dependent variable

All models using carbon emission disclosure as dependent variable. To measure this variable, this study adopted a measurement that had previously

Table 1. Sample selection

Sampling	Number of Companies
Initial SOE from 12 sectors, beginning 2022	87
Less: SOE from 12 sectors, as of May 2022	39
Less: missing data	36
Final sample, 7 sectors	12
Length of study (years)	10
Total observations	120

been developed and tested in several studies (Choi et al., 2013). Unweighted disclosure index is utilized to measure the dependent variable. It is more applicable to all companies (Cooke, 1989). The score was 1 if the company disclosed the information as determined by the checklist items, and 0 otherwise.

2. Independent variable

The first model analyses the ownership structure, which includes public ownership (PUB), managerial ownership (MAN), other institutional ownership (INSTO), and foreign ownership (FOR). The percentage of public ownership is calculated by dividing the number of foreign-owned shares by the total number of outstanding shares, and those shares owned by top managers (Dakhli, 2021; Hajawiyah et al., 2020). Other institutional ownership and foreign ownership are also measured by dividing the number of shares held by non-SOE shareholders and the number of shares held by foreign investors by the total number of outstanding shares (Buerthey et al., 2020; McGuinness et al., 2017).

The second model analyses firm-specific characteristics using audit reputation (AUDIT), audit quality (using abnormal working capital accrual as a proxy - ACA) and return on assets (ROA) as independent variables. It is scored of 1 if the company has a Big 4 auditor and a score of 0 otherwise. Audit quality measured by adopting absolute discretionary accrual from DeFond and Park (2001). This proxy is frequently employed in previously research (Hammami & Zadeh, 2019) because it can reflect audit quality (DeFond & Zhang, 2014). For return

on assets is determined by net income divided by total assets (Dutta & Dutta, 2020; Jaggi et al., 2018).

3. Mediating variable

This study employs three mediating variables: government ownership (INSTG), board diversity (FEM), and firm size (SIZE). INSTG is measured by number of shares held by government divided by number of shares outstanding. To evaluate the impact of board diversity, we utilized the proportion of women on the board of directors. This variable is the ratio of the total number of female Board directors to the total number of Board members (Aribi et al., 2018; Ben-Amar et al., 2017). Firm size is measured as the natural logarithm of total assets (Jaggi et al., 2018; Kılıç & Kuzey, 2019; Salhi et al., 2019).

4. Control variable

This study employed four specific factors as control variables to evaluate the accuracy of the predictions and enhance the reliability of the inference analysis; first, leverage which is measured by total debt divided by total assets in year (Jaggi et al., 2018; Tulcanaza-Prieto et al., 2020). Next, dummy type (1 for company listed in IDX otherwise 0), dummy industry of seven sector, and finally, dummy year (1 if period before COVID 19 otherwise 0).

C. Model Specification

We used two models to investigate the relation between several determinants such as ownership

structure, firm-specific characteristics towards carbon emission disclosure. We estimate the econometrical models below:

Equation of ownership structure on CED

$$\begin{aligned} CED_{i,t} = & \alpha_1 + \beta_1 INSTG_{i,t} + \beta_2 PUB_{i,t} \\ & + \beta_3 MAN_{i,t} + \beta_4 INSTO_{i,t} + \beta_5 FOR_{i,t} \\ & + \beta_6 DEBT_{i,t} + \beta_7 TYPE_{i,t} + \beta_8 dy_{i,t} \\ & + \beta_9 Dummy_{i,t} + \epsilon_{1i,t} \end{aligned} \quad (1)$$

Where:

CED	carbon emission disclosure
INSTG	government institutional ownership
PUB	public ownership
MAN	managerial ownership
INSTO	other institutional ownership
FOR	foreign ownership
FEM	% of female on board
AUDIT	auditor type (big 4=1, non=0)
ACA	abnormal working capital accruals
ROA	returns on asset
DEBT	proxy of leverage from total debt divided by total asset
TYPE	company type: go public = 1, private =0
dy	dummy year: 1 before COVID 19 and 0 after COVID 19

Dummy basic industry manufacture & surveyor including:

Df	dummy variable finance
Dis	dummy for infrastructure services
Dbm	dummy for basic materials
Dtr	dummy for transportation
Dog	dummy for oil and gas
Den	dummy for energy

Equation of board characteristics and financial performance on CED

$$\begin{aligned} CED_{i,t} = & \alpha_2 + \beta_{10} FEM_{i,t} + \beta_{11} SIZE_{i,t} \\ & + \beta_{12} AUDIT_{i,t} + \beta_{13} ACA_{i,t} + \beta_{14} ROA_{i,t} \\ & + \beta_{15} DEBT_{i,t} + \beta_{16} TYPE_{i,t} + \beta_{17} dy_{i,t} \\ & + \beta_{18} Dummy_{i,t} + \epsilon_{2i,t} \end{aligned} \quad (2)$$

IV. Empirical Finding and Discussion

A. Descriptive Statistics

Table 2 shows the descriptive statistics for the variables used in this research. The quality of carbon emission disclosure (CED) is scored up to 77.80% in accordance with the indicators (Choi et al., 2013). However, some companies do not have any related strategy for a specific time. The minimum 0 is just for short term in given period for the CED. The quality of the disclosure among the SOEs is relatively low (0.216). It implies that the rules and regulations governing the CED still need further practical and technical implementation. In terms of ownership, on average, the government institutions (INSTG) hold 70.5% of the SOEs shares. It emphasizes the dominant role of government ownership in several industries, especially the financial and the manufacturing sector. The second major ownership falls down to the public (22.5%) followed by minor ownership by other institutional and managerial investors (1.5% and 1.3%, respectively).

Concerning the company characteristics, 1 in 3 firms go public (66.7%), trading their shares in the Indonesian stock exchange. This is an important characteristic which qualifies the company's governance policy to be more transparent and expectation to comply with CED standards. On board composition, only 8% are female members. In the cultural context, despite being a relatively low rate of female participation, it indicates commitment to woman empowerment, as their influences, and leadership style can impact the general company policy. Audit quality (AUDIT and ACA) has the value of 67.5 and 15.26, respectively. The SOEs willingly make effort to maintain the standard both nationally as well as internationally. The company performance derived from asset is valued at 2.6% (ROA) and some companies show negative ROI. The SOEs are big in size and with rather high leverage ratio of 71.3% on average.

Table 2. Descriptive statistics

	N	SD	Mean	Min	Max	Median
CED	120	.216	0.163	0	.778	.056
INSTG	120	.196	0.705	0	1	.637
PUB	120	.179	0.225	0	.49	.244
MAN	120	.042	0.013	0	.329	0
INSTO	120	.054	0.015	0	.283	0
FOR	120	.076	0.028	0	.294	0
FEM	120	.084	0.080	0	.333	.083
AUDIT	120	.47	0.675	0	1	1
SIZE	120	1.852	18.776	13.997	21.269	18.665
ACA	120	2.461	15.258	8.837	25.989	15.373
ROA	120	.054	0.026	-.23	.249	.023
DEBT	120	.674	0.713	.071	7.601	.729
TYPE	120	.473	0.667	0	1	1
dy	120	.458	.300	0	1	0
Dfi	120	.473	0.333	0	1	0
Dis	120	.374	0.167	0	1	0
Dbm	120	.374	0.167	0	1	0
Dtr	120	.374	0.167	0	1	0
Dog	120	.278	0.083	0	1	0
Den	120	.278	0.083	0	1	0

B. Results and Discussions

1. Ownership and carbon emission disclosure

Institutional government ownership (INSTG) has positive and significant relationship influencing the firm to disclose the carbon emission (CED) as shown on Table 3. Even if the firms are SOEs, the ownership structure is diverse. However, the higher the government institutions own majority of shares, the more enthusiasts the firms disclose their policy on carbon emission. It shows a positive trend for the Indonesian government through the SOEs to implement the policy on environmental policy. (Benlemlih et al., 2023) suggests the attractiveness of institutional investor to low emission policy of the firm. This implies in practice that institutional ownership plays important role in mitigation higher CO₂ emission as they (stockholders, including government) are more engaged on environmental risk

mitigation. Furthermore, government is more aware from its policy on climate change, thus, INSTO has positive impact on CED because government aims to promote the transparency on carbon information (Nguyen et al., 2024).

The governmental institutional ownership has a long-term horizon on controlling the firm. Besides, it encompasses the quality of good governance policy. Corporate with good corporate governance policy tend to voluntarily disclose the carbon emission policy. This finding is in line with Velte et al., (2020), positing that institutional government ownership has long term influence on the firm policy regarding CED as it also relates to the firm performance.

Results from the regression shows, institutional government ownership completely mediates the relationship between public ownership (PUB) and carbon emission disclosure. Public ownership of 22.5% on average has not the legitimacy to empower the policy on carbon emission unless the government

shareholders as majority take into action. Bernauer and Koubi (2009) for instance support this idea that in the case of Indonesia with a democratic governance, it is more attentive and responsive to the public aspiration and expectations, meaning the government ownership tends to respond to the public stakeholders' aspiration on carbon emission disclosure.

Other institutions that own shares in the SOEs are found to be mediated by the government institutional ownership. These institutions are normally

large in terms of variety as some are private and public companies with different industries, the others from the government itself (SOEs) and non-SOEs. The potentiality derived from the variety with smaller shares encourage the government to disclose more.

This result is not similar to the case where the managers (MAN), and foreign (FOR) own shares in the SOEs. They own shares but relatively low and especially with less variety on the importance of stakeholder's characteristics. As SOEs, the

Table 3. Regression result - Model 1

VARIABLES	(1) CED	(2) INSTG	(3) INSTG	(4) INSTG	(5) INSTG
INSTG	0.302*** (0.114)				
PUB	0.0971 (0.191)				-0.452** (0.211)
MAN	0.0773 (0.531)	-0.0518 (0.499)			
INSTO	0.352 (0.376)		-0.928*** (0.331)		
FOR	0.140 (0.273)			-0.0465 (0.299)	
DEBT	-0.00366 (0.0227)	0.0222 (0.0200)	0.00545 (0.0221)	0.0224 (0.0200)	
TYPE	-0.0512 (0.0598)	-0.00275 (0.152)	0.0654 (0.0533)	-0.000506 (0.150)	-0.0277 (0.108)
dy	-0.0807** (0.0314)	-0.00263 (0.0264)	-0.0194 (0.0305)	-0.00233 (0.0265)	-0.00730 (0.0263)
Dfi	-0.0290 (0.114)	-0.414* (0.229)	-0.478*** (0.0753)	-0.415* (0.224)	-0.240 (0.180)
Dis	-0.0434 (0.102)	-0.319 (0.240)	-0.362*** (0.0780)	-0.322 (0.237)	-0.151 (0.185)
Dbm	-0.237** (0.0929)	-0.348* (0.201)	-0.381*** (0.0639)	-0.349* (0.198)	-0.182 (0.163)
Dtr	-0.249*** (0.0698)	-0.242 (0.201)	-0.209*** (0.0639)	-0.241 (0.198)	-0.187 (0.145)
Dog	0.236*** (0.0700)	-0.102 (0.215)	-0.101 (0.0672)	-0.102 (0.211)	-0.1000 (0.152)
o.Den	-	-	-	-	-
Constant	0.0575 (0.125)	0.990*** (0.152)	1.003*** (0.0496)	0.990*** (0.150)	1.002*** (0.108)
Observations	120	120	120	120	
Number of Firm	12	12	12	12	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

government holds the majority of shares and able to control over the management even senior managers, the result is in line with the stakeholder salience theory (Mitchell et al., 1997).

2. Board characteristics and financial performance on carbon emission disclosure

Board characteristics encompass size, independence and ownership, this research includes the firm performance while analyzing the impact on carbon

emission disclosure. Table 4 shows that female on board (FEM) has positive and significant impact on deciding the carbon emission disclosure.

Female board members tend to be more social, demonstrating deeper concern on environmental and social issues, and female CEOs actively support these practice more actively compared to their male counterparts due to altruism mechanism preference (Zhou et al., 2018). Based on Table 4, the hypothesis on gender diversity relation to carbon emission

Table 4. Regression result - Model 2

VARIABLES	(1) CED	(2) FEM	(3) SIZE	(4) SIZE
FEM	0.754*** (0.184)			
SIZE	-0.0414* (0.0242)			
AUDIT	0.0376 (0.0395)	0.0421** (0.0210)		
ACA	0.00422 (0.00810)		0.0863*** (0.0229)	
ROA	-0.235 (0.374)			-4.079*** (0.936)
DEBT	-0.0216 (0.0222)	0.0185* (0.0111)	-0.205*** (0.0663)	-0.228*** (0.0565)
TYPE	-0.135** (0.0598)	0.0736** (0.0346)	-1.015*** (0.341)	-1.195 (1.008)
dy	-0.0601* (0.0354)	-0.0103 (0.0148)	0.632*** (0.0909)	0.553*** (0.0837)
Dfi	-0.0370 (0.0809)	-0.122** (0.0527)	0.514 (0.511)	0.764 (1.512)
Dis	-0.0882 (0.0887)	-0.112** (0.0551)	-1.797*** (0.542)	-1.692 (1.594)
Dbm	-0.375*** (0.105)	-0.0732 (0.0459)	-3.577*** (0.461)	-3.518*** (1.336)
Dtr	-0.319*** (0.0911)	-0.106** (0.0459)	-2.836*** (0.451)	-2.818** (1.332)
Dog	0.158** (0.0692)	0.0293 (0.0493)	-0.337 (0.482)	-0.201 (1.425)
o.Den	-	-	-	-
Constant	1.049** (0.461)	0.0789** (0.0376)	19.32*** (0.502)	20.77*** (1.008)
Observations	120	120	120	120
Number of Firm	12	12	12	12

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

disclosure is supported. This result is in line with the legitimacy theory (Dowling & Pfeffer, 1975) regarding female on board; the more the number of females member in the top managerial positions, the more likely the firm will enforce policies on carbon emission disclosure.

Moreover, executive female of board (FEM) can mediate the relationship between the proxy of audit quality (AUDIT) and carbon emission disclosure. This proxy on audit quality tends to explain the evidence that for SOEs, only relying on the big4 performance is not as efficient as compared to when female on board has the volition to improve the environmental company disclosure including the CED. However, considering the reputation of the auditors, female CEOs will be more attentive to the suggestion, recommendation, and best practices from them. These firms also make research on environmental condition.

The result shows that the firm size has significant influence on carbon emission disclosure. Because of growth concern and business viability, smaller companies tend to disclose the CED policy more. It supports our hypothesis, as larger firms are already with good reputation to attract investors and they follow the government rules. Thus, smaller companies need to find valuable strategy to maintain and gain trust from investors. Small size companies opt to have intense carbon emission disclosure support for business sustainable growth and expansion. This is also in line with (Luo et al., 2023; Zhang & Liu, 2020) that one of the important factors disclosing the CED is because of firm performance. Management and stakeholders decide to collaborate for enhancing firm performance for this practice on good sign.

In terms of audit quality proxied by abnormal working accruals (ACA) (DeFond & Park, 2001; DeFond & Zhang, 2014; Hammami & Zadeh, 2019), it serves as powerful instrument to increase the firm value; it needs the size of the firm to bypass the policy on carbon disclosure.

Contrary to legitimacy theory, firm size is found to have a negative influence on CED. An alternative explanation for this may be that smaller firms tend to be more participate in disclosing their carbon

emissions information to attract more investment and increase their firm value. On the other hand, larger firms may not be as motivated as smaller firms in pursuing further investment opportunities. The characteristics of our sample size also provides a rational background where the government ownership is dominant (avg. 70%). Despite its contrariness to legitimacy theory, its rational for smaller firms with low financial performance to be highly motivated to attract investment through non-financial performance disclosure, such as CED. Our findings align with (Siagian et al., 2013) who explains that larger firms may consider such disclosures not really relevant for firm growth and also faces bigger risk by disclosing too much information that may be unfavorable for them.

3. Robustness check

Robustness check is done using two econometrical approaches. Using OLS multiple regression approach, the result shows the same direction and significance level. The regression demonstrates the impact of the variable INSTG on CED as expected.

This table demonstrates the effectiveness of Delta, Sobel, and Monte Carlo simulations. The results confirm the OLS and GLS approaches. Nevertheless, some results are needed to strengthen by (Zhao et al., 2010). As for instance, Delta, Sobel, and Monte Carlo show insignificant value for INSTO. (Zhao et al., 2010) provide evidence on the level of mediation that INSTG play on the influence of INSTO towards CED. There is 0.320 yielded (Indirect effect / Total effect) or simply $(0.151 / 0.471) = 0.320$ showing that about 32 % of the effect of INSTO on CED is mediated by INSTG. The rests show complete mediation for the variables.

V. Conclusion

This study examined the impact of ownership

structure (government, public, managerial, institutional, and foreign ownership) and firm-specific characteristic (board diversity, audit reputation, firm size, audit quality and financial performance) determinants towards CED. Our analyses focused on a final sample of 120 firm-year observations of state-owned enterprises, having published sustainability reports with CED within the last 10 years (2012 - 2021).

Findings indicate that CED has a positive relationship with government ownership and board diversity and negative relationship with firm size. It implies that government attempts to promote the CED transparency in Indonesia in owning the SOEs through management. Furthermore, results indicate fully mediating effect of the following variables: 1) government ownership between public other institutional ownership and CED; 2) board diversity between audit reputation and CED; and 3) firm size between audit quality and financial performance. Out of 10 hypotheses proposed, 8 are accepted, except for mediating effect of government ownership between managerial and foreign ownership and CED. Government plays important role on influencing other stakeholders to contribute together in the voluntarily CED thoroughly. Besides, only audit reputation is unable to intrigues the company to disclose, but with the presence of board diversity CED is maximal. Besides, having BIG 4 as trustee institution could not work alone unless the bigger the firm is, that enables to increase its performance.

This study recommends the state-owned enterprises to consider increasing the size of its board, the number of independent directors, the number of women on the board, and the number of board meetings held annually, as these measures will improve corporate disclosure and consequently reduce information asymmetry, which not only clarifies the conflicts of interest between shareholders and management but also makes management more accountable.

By employing two econometric models, our research contributes to the carbon emission disclosure literature, in particular the role of government ownership and board diversity as an efficient CG mechanism to enhance transparency, accountability,

and effectiveness of their sustainability reporting practices. In addition, the findings of this research have wide implications in formulating an efficient CG mechanism for developing countries as SOEs are still prevalent. The contradictory findings of negative relationship of firm size towards CED contributes an alternative explanation for why legitimacy and stakeholder theories may not be relevant.

Several implications arise for various stakeholders including policymakers, and regulatory bodies interested in enhancing CG initiatives to increase corporate transparency in implementing a generally accepted framework of non-financial reporting to meet the demand for greater transparency and accountability.

There are limitations to this study that could be addressed in future research. Our sample size is relatively small and focuses on SOEs where government ownership is dominant (avg. 70.5%). Therefore, it would be interesting to expand it to a larger sample size by adopting a comparative study between SOEs and private companies. External and internal CG mechanisms may be considered, for example, other board characteristics such as ethnicity, age, tenure, and experience may be further explored. Finally, we propose investigating whether political connection and other stakeholder pressures such as media exposure facilitates the disclosure of CG, environmental, and ethical information, specifically for SOEs.

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Conflicts of Interest

All the authors declare no conflict of interest in this research.

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