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Managerial Ability and Carbon Emission Disclosure: Do CEOs Care About This Matter in Indonesia?

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ABSTRACT

This study examines the relationship between entity managerial capability and carbon emission disclosure of publicly listed companies on the Indonesian Stock Exchange, covering the years 2019–2023. Managerial capability is measured using data envelopment analysis (DEA) at the firm level as a decision-making unit using the Demerjian et al. (2012) model, while carbon emission disclosure uses a score for carbon emission disclosure. A final set of 301 firm-year observations was obtained by using a purposive sampling method and the available carbon emission disclosure data. Data analysis using multiple linear regression found evidence contradicting the study's hypothesis, where CEO managerial capability is negatively related to carbon emission disclosure for publicly listed companies in Indonesia. This study's findings imply that carbon emission disclosure, which is part of the global temperature reduction efforts outlined in the 2015 Paris Agreement and part of the Environment, Social, and Governance (ESG) program promoted by regulators, is still not a priority for publicly listed companies in Indonesia.

Keywords **–** Carbon Emission Disclosure, ESG, Firm Efficiency, Climate Change, Indonesia, Managerial Ability

I. INTRODUCTION

We are already experiencing climate change as a result of global warming. Reducing carbon emissions is one way to address this global environmental challenge. Greenhouse gas emissions from industrialization and the massive exploitation of non-renewable energy sources have led to an increase in global temperatures and environmental damage, such as reduced biodiversity, forest fires, and sea level rise (Lobus et al., 2023; Yang et al., 2022).

Following the industrial era, atmospheric carbon dioxide (CO_2) levels have increased significantly compared to the pre-industrial period, from 285 ppm to 420 ppm (Cheng et al., 2021). This increase has contributed to a global average temperature increase of up to 1.21°C. Without controlling carbon emissions, this surge could cause sea surface and land temperatures to continue to rise. In 2015, at COP21, the United Nations Framework Convention on Climate Change adopted the Paris Agreement, which aims to limit the global temperature increase to well below 2°C and strives to restrict it to 1.5°C above pre-industrial levels while achieving a 43% reduction in carbon emissions by 2030 (Kuh, 2017; Zhang et al., 2023).

Carbon emission disclosure is a company's contribution to reducing global warming by including carbon emissions data in its annual report. This data allows stakeholders to assess the company's ability to responsibly disclose information on environmental performance. High carbon emissions are associated with lower company value, so this data can be a factor for investors in assessing a company's carbon profile and overall ability to manage climate change (Jiang et al., 2021; Wahyuningrum et al., 2024).

Voluntary carbon emission disclosure demonstrates a company's commitment to addressing climate change issues. The Carbon Disclosure Project (CDP), established in 2000 by 35 European financial institutions, collects carbon emissions data from major companies worldwide. The primary objective of this data collection is to identify potential risks that could lead to climate change and provide investors with information to take appropriate mitigation measures (Lee et al., 2023).

Indonesia is committed to supporting international agreements on climate change by ratifying the Paris Agreement, as outlined in Law Number 16 of 2016 concerning the Ratification of the Paris Agreement to the United Nations Framework Convention on Climate Change.

Managers play a role in establishing corporate environmental policies to improve the company's environmental performance, which is a determining factor in the company's decision-making process. Managers, as the primary decision-makers, are responsible for environmental policies, resource allocation, and determining the company's operational priorities (Lee et al., 2023; Swalih et al., 2024). Managerial decisions impact a company's environmental performance by being responsible for formulating environmental policies that align with the company's values and objectives. Managers' personal characteristics, which reflect their values and beliefs about sustainability, influence how resources are allocated to support environmental initiatives, including investment in environmentally friendly technologies. Furthermore, managers' strategic decisions influence the company's long-term strategy in tackling environmental challenges. Managers are also responsible for monitoring and reporting environmental performance to stakeholders. This study indicates that managerial ability significantly influences a company's environmental performance (Ezhilarasi, 2023; Lee et al., 2023).

The managerial ability of the CEO and team, based on upper echelons theory, plays a crucial role in corporate strategy. Managers' personal characteristics, reflecting their cognitive structure, values, and beliefs, can influence decision-making and the formation of corporate strategy. Managerial capability cannot be measured solely based on demographic characteristics; it requires an assessment of the efficiency between inputs and outputs within an industry (Abatecola & Cristofaro, 2020). Research shows that managers with high managerial capability significantly impact corporate decisions. More capable managers are also more willing to take risks and invest in research and development, which contributes to increased firm value (Lee et al., 2023).

Lee et al. (2023) discovered a positive correlation between managerial capability and the voluntary disclosure of corporate carbon emissions in Korea. The results of this study indicate that managers with high capability tend to be more proactive in disclosing environmental information related to carbon emissions, especially in highly competitive industrial sectors. Furthermore, this research is supported by da Silva (2023) and Swalih et al. (2024), who stated that managerial capability significantly contributes to corporate decision-making, including disclosure of carbon emissions as part of a commitment to environmental sustainability. Highly skilled managers are more effective in designing strategies that consider the company's environmental impact and employ environmentally friendly technologies, which enhances transparency and enhances the company's reputation among investors (Demerjian et al., 2012; Kabange et al., 2023).

Against this backdrop, this study aims to examine the relationship between top-level managerial capability (CEO) and carbon emission disclosure in Indonesian companies. The results are expected to assess the commitment of Indonesian companies and contribute to environmental sustainability, including the Indonesian government's target to reduce carbon emissions by 29-41% by 2030 as part of its national efforts to mitigate climate change. The next discussion in this study includes a literature review and hypothesis development, research methods, results and discussions, as well as conclusions and suggestions.

II. HYPOTHESIS DEVELOPMENT

2.1 Managerial Ability and Carbon Emission Disclosure

Managerial ability is the skill possessed by a manager to manage a company effectively and efficiently. This ability includes the manager's expertise in managing resources, from the input stage to producing high-value outputs (Demerjian & Lev, 2021). Managers with superior managerial ability tend to be better able to understand technological developments and industry trends, project market demand, invest in high-value projects, manage the workforce effectively, and identify and capitalize on existing investment opportunities. An efficient management team can help a company improve operational performance, provide accurate information, and produce higher-quality financial reports. Good financial reporting is an indicator of a company's strong managerial capabilities (Demerjian et al., 2012; Faidah & Bandi, 2022; Luo et al., 2017).

Carbon emission disclosure (CED) is the practice of reporting and disclosing information related to carbon dioxide (CO_2) and other greenhouse gas emissions produced by an organization or company. This reporting aims to provide transparency to stakeholders—investors, consumers, and the general public—about the environmental impact of a company's operations. Understanding and accurately reporting emissions is crucial for companies seeking to reduce their carbon footprint, comply with regulatory requirements, and meet stakeholder expectations regarding sustainability and corporate social responsibility (CSR).

The practice of reporting information related to greenhouse gas emissions is grouped into three areas: direct emissions from company operations; indirect emissions from purchased energy consumption—electricity, heating, and cooling; and other indirect emissions occurring within the company's value chain—emissions from suppliers and product use. Carbon emission disclosure also includes measuring emissions from various sources, such as fossil fuel combustion, electricity use, and industrial processes. The information disclosed can include the amount of emissions, the calculation method used, and the steps taken to reduce them (Choi et al., 2013; Jiang et al., 2021; Xia et al., 2024).

Previous research has found that high managerial capability tends to have a positive effect on carbon emission disclosure (CED) in various companies. Lee et al. (2023), for example, showed that highly capable managers are more active in disclosing information related to carbon emissions, especially in highly competitive industries. Similar results were also found by Choi et al. (2013), who revealed that companies with high visibility tend to be more comprehensive in their carbon emissions disclosures.

Other research, such as that by Wibowo et al. (2022), added that factors such as company size and managerial ownership also influence carbon emissions disclosure. Larger companies tend to make more extensive disclosures. Furthermore, Simamoral et al. (2022) found that the presence of a strong board of directors positively influences carbon emissions disclosure, confirming the importance of managerial roles in this regard. Based on the above explanation, it can be concluded that highly capable managers play a significant role in increasing carbon emissions disclosure as part of a company's sustainability strategy. Carbon emission disclosure (CED) plays a role in increasing transparency and attracting investors. Top-level managers with high managerial ability are expected to disclose carbon emissions information and design environmentally friendly strategies.

Therefore, we will test the following study hypothesis:

H1: Managerial ability has a positive relationship with carbon emissions disclosure (CED).

III. RESEARCH METHOD

3.1 Research Population and Sample

The study population comprised all publicly listed companies on the Indonesia Stock Exchange for the 2019-2023 period. The study's sampling method was purposive. The sample criteria included: (i) companies listed on the IDX throughout 2019-2023; (ii) companies with complete annual reports and sustainability reports during the study period; (iii) companies with carbon emissions disclosures in their reports; (iv) companies with complete data for all study variables; and (v) companies not in the financial sector. Based on the above criteria, the final number of observations in this study was 301 firm-years.

3.2 Empirical Model

To test hypothesis H1, the empirical model of this study is as follows:

$$\begin{aligned}
CED_{i,t} = \alpha_0 &+ \alpha_1 MGRABLITY_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 GROWTH_{i,t} + \alpha_5 LOSS_{i,t} \\
&+ \alpha_6 BIG4_{i,t} + \alpha_7 INHRISK_{i,t} + \alpha_8 FDISTRESS_{i,t} + \alpha_9 MTB_{i,t} + \alpha_{10} OCF_{i,t} \\
&+ \alpha_{11} ROA_{i,t} + \alpha_{12} DROA_{i,t} + \alpha_{13} AGE_{i,t} + \alpha_{14} COVID_{i,t} + \varphi YEAR + \delta INDUSTRY
\end{aligned}$$

Hypothesis H1 will be supported if the MGRABILITY coefficient is positive and statistically significant. In the empirical model above, there are control variables that influence the dependent variable, carbon emission disclosure (CED). The expectation of each control variable can be positive or negative, based on previous studies.

The dependent variable in this study is Carbon Emission Disclosure (CED). Carbon Emission Disclosure (CED) is defined as the disclosure of information related to carbon emissions by a company through its annual report or sustainability report (Choi et al., 2013). We follow Choi et al. (2013) to measure the items of carbon emission disclosure using a disclosure index. This disclosure consists of 18 items divided into five main categories: (i) Risks and opportunities related to climate change (2 items); (ii) Greenhouse gas emissions (7 items); (iii) Energy consumption (3 items); (iv) Greenhouse gas emission reduction and related costs (4 items); and (v) Carbon emission accountability (2 items). We collect the data directly using a content analysis from the annual reports or sustainability report of the listed firms. Each item is scored 0 if not disclosed and 1 if disclosed. The CED Index is then calculated using the formula: CED Index = (Number of items disclosed) / 18.

Managerial capability (MGRABILITY) is measured by evaluating the entity's efficiency as a decision-making unit (DMU) in producing maximum output (output-oriented) using specific company inputs. This measurement method for calculating managerial capability was developed by Demerjian et al. (2012) using the Data Envelopment Analysis (DEA) approach. In the first stage, company efficiency is calculated based on output in the form of sales and inputs including production costs (COGS), operating expenses (SG&A), fixed assets (PPE), operating leases, research and development (R&D), goodwill, and other intangible assets (see operational definitions of variables in Khrisnan et al., 2021).

Empirical model for stage I:

$$\theta = \frac{Sales}{COGS + SG\&A + PPE + OpsLease + RnD + Goodwill + OtherIntan}$$

After the company's efficiency value is obtained from step I, the next step (second stage) is to calculate the managerial ability score with Tobit regression, where the residual value of the regression represents the managerial ability score value. The Managerial Ability score (MGRABILITY) ranges from 0.00 to 1.00, where a score closer to 1 indicates that the entity, as a Decision-Making Unit (DMU), has a higher level of managerial ability compared to its respective industry peers (Demerjian et al., 2012).

Empirical model for stage II:

$$\begin{aligned}
Firm\ efficiency \\
= \alpha + B_1 ln(Total\ Assets)_i + B_2 Market\ Share_i \\
+ B_3 Free\ Cash\ Flow\ Indicator_i + B_4 ln(Age)_i \\
+ B_5 Business\ Segment\ Concentration_i + B_6 Foreign\ Currency\ Indicator_i \\
+ Year_i + Industry_i + \varepsilon_i
\end{aligned}$$

IV. RESEARCH RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Descriptive statistics for all study variables are presented in Table 1. Table 2 shows that the CED disclosure score averages 8,395 items out of a total of 18 disclosures. This indicates that carbon emission disclosure for the study sample profile averages 0.4664, or 46.64%. The average carbon emission disclosure for the sample profile remains below 9 out of 18 items disclosed.

Meanwhile, the entity-level efficiency score for top-level managers (MGRABILITY) averages 0.438 on a scale of 1.00. Table 1 displays the mean, standard deviation, minimum, and maximum values for all control variables. A value of 0 for the AGE variable is rounded to the nearest year because the company is less than one year old.

TABLE 1
DESCRIPTIVE STATISTICS

Valrialble	Obs.	Mealn	Std. Dev.	Min	Malx
CED	301	8.395	5.199	0	18
MGRAIBILITY	301	0.438	0.210	0	1
SIZE	301	4.859	2.172	-1.208	9.285
LEVERAIGE	301	0.531	0.462	0.012	6.477
GROWTH	301	0.183	0.749	-0.691	6.812
INHRISK	301	0.273	0.202	0.002	0.809
LOSS	301	0.202	0.402	0	1
FDISTRESS	301	0.670	0.470	0	1
MTB	301	0.128	0.622	0	7.340
BIG4	301	0.983	0.128	0	1
OCF	301	0.054	0.144	-0.458	1.576
DROAl	301	-0.924	0.243	-1.443	0.229
ROAl	301	0.027	0.123	-0.443	1.229
AlGE	301	30.936	15.46	0	70

All continuous variables were winsorized at the mean ± 2 deviation standard for data outliers so that the data were spread around 95% in a normal distribution. Source: Stata 17.0 output results.

4.2 Hypothesis Test Results and Discussion

Prior to executing the H1 hypothesis test, the author performed classical assumption tests due to the utilization of the OLS estimation model. The results of the hypothesis testing are presented in Table 2. The empirical model has an F-value of 8.18, significant at the <1% level. The empirical model has R-squared and adjusted R-squared values of 40.45% and 35.515, respectively, reflecting the ability of all variables to explain the dependent variable, MGRABILITY.

In Table 2, the managerial ability coefficient (MGRABILITY) is -4.450, with a t-test value of -3.63, significant at the 1% level (prob. = 0.000). This indicates that managerial ability has a highly significant negative relationship with carbon emission disclosure (CED). This finding contradicts the statement of hypothesis H1, which expected a positive relationship with CED. This finding is also inconsistent with previous studies that found a positive relationship between managerial ability and carbon emission disclosure.

This study found that, although the managerial ability of the CEO, as a representative of top-level managers and their teams, was not associated with increased disclosures regarding carbon emissions reductions, several alternative explanations exist for this finding. First, carbon emissions disclosures in the sample profiles were still below 50%, or close to 50%, of the 18 items disclosed. This observation is suspected to have influenced the hypothesis testing results. Second, the average managerial ability score of the entities included in the study sample was below 0.50 on a scale of 0.00-1.00. This could have influenced the study results, as it indicates that the average entity, as a decision-making unit led by a top management team (CEO), had an efficiency score below the median of 0.50. Third, the study findings suggest that top-level managers may prioritize achieving short-term performance over achieving long-term performance related to business sustainability.

The Indonesian government has issued several regulations regarding ESG disclosure, such as POJK No. 51/POJK.03/2017—Implementation of Sustainable Finance, the contents of which include sustainability policies, strategies, identification of risks & opportunities, and ESG performance achievements, as well as SEOJK No. 16/SEOJK.04/2021—Form and Content of Sustainability Reports, which, among other things, regulates the format and content of ESG reporting, which must include data on Greenhouse Gas (GHG) emissions, energy consumption, and waste management (environmental aspects in ESG). However, it is suspected that disclosing carbon emissions is not a priority for entities aiming to improve their performance, such as adopting a carbon-neutral strategy for their products. The Indonesian Institute of Accountants (IAI), through its Sustainability Standards Board (DSK), has issued sustainability disclosure standards (SPK) based on the International Sustainability Standards Board (ISSB) standards. These standards will become effective in January 1, 2027. These standards include PSPK 1 (General Disclosure Requirements) and PSPK 2 (Climate-Related Disclosures) on July 1, 2025 (OJK, 2025).

PSPK 1 establishes the basic principles of sustainability reporting, including report structure, governance approach, strategy, risk management, and sustainability performance measurement. Meanwhile, PSPK 2 specifically regulates disclosures on how companies address climate change-related risks and opportunities, including physical and transition risks, their impact on business strategy, and emission targets and steps towards a low-carbon transition. Various types of entities, including public companies, state-owned enterprises, non-financial companies, and other privately owned entities, can apply both standards.With this new regulation, it is hoped that companies led by top managers (CEOs) will prioritize sharing information about their carbon emissions, suggesting that better management skills may lead to more transparency in carbon emission reporting.

TABLE 2
HYPOTHESIS TESTING RESULTS

Independent Variables	Dependent variable: CED			
	Pred. sign	Coefficient	t-test	Prob.
Constant	?	6.016**	2.24	0.026
MGRABILITY	+	-4.450***	-3.63	0.000
SIZE	+	0.161	1.06	0.292
LEVERAGE	-	-0.400	-0.48	0.635
GROWTH	+	-0.165	-0.66	0.511
INHRISK	-	-0.991	-0.72	0.473
FDISTRESS	?	0.088	0.17	0.868
MTB	+	1.33***	3.71	0.000
OCF	?	-0.537	-0.22	0.827
DROA	+	0.366	0.30	0.763
ROA	-	-1.610	-0.47	0.641
BIG4	+	-1.363	-0.70	0.487
LOSS	-	-2.543***	-3.60	0.000
AGE	+	-0.006	-0.35	0.727
COVID	+	5.690***	7.33	0.000
YEAR	?		Yes	
INDUSTRY	?		Yes	
N			301	
F-value			8.18	
Prob.			0.0000	
R-squared			0.4045	
Adj. R-squared			0.3551	

*** significant at the 1% level with two-tailed tests. Source: Stata output 17.0 results

V. CONCLUSION AND SUGGESTIONS

This study discovered a negative correlation between an entity's CEO's managerial ability and its disclosure of carbon emissions. This finding contrasts with the hypothesis and previous studies, which found that higher managerial ability as a measure of CEO performance leads to lower carbon emissions disclosure (e.g., Lee et al., 2023). This suggests that highly capable top-level managers tend to focus more on operational efficiency and short-term performance rather than on long-term entity sustainability, prioritizing reduced carbon emissions disclosure as part of a strategy to enhance the company's image. Furthermore, it is suspected that carbon emissions disclosures still utilize various platforms with varying disclosure standards; thus, disclosing diversity may impact the level of public understanding of disclosures in reports.

Future research is expected to identify other factors influencing carbon emissions disclosure, such as corporate culture and entity size, and identify factors or products or services with low or high carbon emissions. This can provide a more comprehensive picture of carbon emissions disclosure levels under regulatory oversight in Indonesia. Previous studies need to compare the influence of managerial ability on carbon emission disclosure before and after the implementation of the new rules

or standards issued by the IAI on July 1, 2025, regarding sustainability disclosure, which will be effective on January 1, 2027.

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