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DOES CARBON DISCLOSURE MODERATE THE RELATIONSHIP OF WOMEN DIRECTORS AND CORPORATE GOVERNANCE TOWARD FIRM VALUE?

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Abstrak

Penelitian ini menguji hubungan antara direksi wanita dan tata kelola perusahaan terhadap nilai perusahaan dengan pengungkapan karbon sebagai variable moderasi. Dalam penelitian ini memiliki jumlah sampel 106 perusahaan energi dan manufaktur pada periode 2019-2022 yang terdaftar di Bursa Efek Indonesia yang dianalisis dengan regresi linier berganda. Dalam penelitian ini menggunakan *random sampling* sebagai teknik pengambilan sampel. Hasil penelitian menunjukkan adanya pengaruh positif signifikan antara direksi wanita dan nilai perusahaan, begitu pula pengaruh antara tata kelola perusahaan dan nilai perusahaan. Sementara itu, pengungkapan emisi karbon tidak dapat memoderasi hubungan antara direksi wanita dan tata kelola perusahaan terhadap nilai perusahaan. Hal ini dapat dijelaskan oleh adanya prinsip-prinsip tata kelola perusahaan yang tidak sepenuhnya diterapkan dan direksi wanita lebih memiliki fokus pada kinerja dan pengelolaan perusahaan dibandingkan mengelola lingkungan dan mengungkapkan informasi lingkungan. Studi ini memberikan wawasan yang mendorong perusahaan untuk menjaga hubungan dengan pemangku kepentingan dengan menerapkan kesadaran lingkungan dan mengungkapkan laporan keberlanjutan.

Kata Kunci: direksi wanita, pengungkapan karbon, nilai perusahaan, tata kelola.

JEL Code: M40, M41, M48

Abstract

This study examines the relationship between women directors and corporate governance on firm value, where carbon disclosure is discussed as a moderating variable. This study has a total sample of 106 energy and manufacturing companies listed in the Indonesia Stock Exchange in 2019–2022, which are analyzed using moderate regression. In this study, we used random sampling as a sampling technique. The results showed a significant positive influence on both women directors and corporate governance on firm value. Meanwhile, disclosure of carbon emissions is unable to moderate those relationships. Arguably, corporate governance principles are not fully implemented, and women on board focus more on corporate performance and management than managing the environment and disclosing environmental information. Therefore, the carbon disclosure has no significant role. This study provides evidence for motivating companies to maintain stakeholder relationships by implementing environmental awareness and disclosing sustainability reports.

Keywords: women director, carbon disclosure, firm value, corporate governance.
JEL Code: M41, M40, M48

INTRODUCTION

Climate change related to global warming has become a significant topic of discussion in various sectors. Recently, climate change has become more extreme. The world community has begun to take serious action to address climate change because it plays a significant role in macro regulation. According to Battiston et al. 2021, over the past few years, climate change is also considered to be an emerging risk in the financial system. According to Our World in Data-Grapery, when the atmosphere contains too much CO2, it absorbs infrared radiation, which causes the planet's surface to radiate sunlight. This causes the planet's temperature to rise, giving rise to "global warming." Global warming and climate change are the most challenging and complicated issues. By 2022, carbon emissions from energy combustion and global industrial activity will increase. This increase of 36.8 gigatons is a record high for 1900-2022. The cause of the increase in carbon emissions in 2022 will come from burning coal and petroleum. In this case, companies are the key to carbon emissions.

Lately, businesses have also been considered by the world community only to want to get and maximize high profits. Companies should make high profits and be responsible for the damage and risks that affect the environment. One of the main strategies that companies must carry out is managing carbon emissions (Hardiyansah et al., 2021). The form of awareness to reduce carbon emissions and the company's contribution to protecting natural ecosystems and living systems on earth is by disclosing carbon emissions through a sustainability report (Monica et al., 2021). Currently, carbon emission disclosure is still voluntary, so many companies still do not issue sustainability reports and disclose carbon use. Companies that disclose carbon emissions usually participate in carbon disclosure projects (Toukabri & Jilani, 2022). According to Kurnia et al. (2020), Carbon emissions are optional, and many companies do not publish reports on carbon emissions because not many businesses choose to use carbon accounting. After all, it is expensive and can reduce profits. This carbon information strengthens the company and allows it to maintain its future.

The government is making efforts and inviting business people to assist in addressing the problem of climate change and rising greenhouse emissions year after year (Hollindale et al., 2019). Given the numerous effects of climate change, businesses and individuals must also abide by the current rules. As a result, rules and regulations are in place. As in Presidential Regulation No. 98 of 2021 concerning the Use of Carbon Economic Value to Achieve National Contribution Targets and Control of Greenhouse Gas Emissions in National Development and Presidential Regulation No. 61 of 2011 regarding the National Law Regarding Greenhouse Gas Emission Reduction Plans (Monica et al., 2021).

The Kyoto Protocol was developed in 1997 and came into effect in 2005 with the intention of the international community to significantly reduce greenhouse gas emissions to attain a stable global climate. The Kyoto Protocol extends the UNFCCC (United Nations Framework Convention on Climate Change). The Kyoto Protocol is an international agreement with the force of law regulating industrialized countries' commitment to reducing greenhouse gas emissions by 5.2% from emission levels in 1990. In this case, Indonesia is one of the countries that ratified the Kyoto Protocol, which automatically requires Indonesia to participate in reducing global emissions. Participation in the Kyoto Protocol, which gave rise to carbon accounting—the obligatory obligation of a business to identify, quantify, record, present, and disclose its greenhouse gas emissions. (Irwhantoko & Basuki, 2016). Following the expiration of the Kyoto Protocol, the Paris Agreement was established at the UN Climate Change Conference in 2015. The Paris Agreement is different from the 1997 Kyoto Protocol because it applies to everyone and ensures established countries stay dedicated to decreasing emissions until 2030 so that no more than 2 degrees Celsius and maintaining a global warming rate of less than two °C To that end, Law No. 16 about Ratification of the Paris Agreement to the UN Framework Convention on Climate Change 2016 stipulates (Presiden Republik Indonesia, 2016).

Consider that many businesses continue to not release sustainability and carbon emission reports. According to Hollindale et al. (2019), Carbon and sustainability performance and disclosure reports are significant for internal and external stakeholders and investors. Investors use sustainability reports to determine their investment choices. Most investors will also consider and choose companies that disclose carbon and publish their sustainability reports because they are deemed to have a responsibility and a directed future, especially with concern for the environment (Kelvin, 2019). The board of directors is usually responsible for making all decisions, especially concerning carbon disclosure and performance. A study by Hollindale et al. (2019) also revealed that a company's decision to take action depends on top management. Diversity of genders in the board of directors is still a conflict because it impacts decision-making in a company. Fairuzi & Tjahjadi (2022) state that in the professional world, women still experience social inequality and obstacles to reaching top positions. Especially on the board of directors or management, women are still being debated about improving financial performance, decision-making, and reporting. The increasing number of women in board positions impacts carbon emissions disclosure. According to Tingbani et al. (2020), female board members must be able to make decisions by considering risks and delivering high-quality performance and disclosures because they have a big influence on the company's worth.

The most significant factor in a business is its worth, which gauges the enterprise's prosperity. Good corporate value is not only described by high corporate profitability but must also be balanced with performance and concern for the environment, social responsibility, and sustainability. Companies that care about sustainability or environmental sustainability will receive greater attention from investors. According to Gabrielle and Toly (2019), good disclosure will increase firm value.

Corporate governance also contributes to good corporate value (Kurnia et al., 2020). Corporate governance is also a reference for investors when investing in companies. Investors will not choose companies with poor corporate governance because they think they will lose money if they invest in those companies, which will lower their worth. Consistently using sound corporate governance will strengthen the company's competitive position and allow it to maximize corporate value, improve resource and risk management, and ultimately increase stakeholder and shareholder trust, enabling the company to operate and develop sustainably (Mukhtaruddin et al., 2019).

Environmental and climate change problems are currently of great concern, of course, in the economic and business fields. Therefore, this research contributes to carbon disclosure research for several reasons. First, specifically, the study that was carried out by Hollindale et al. (2019) with the divulgence of greenhouse gases as a dependent variable and women on board as an independent variable by analyzing greenhouse gases and women on board in Australia, which, of course, uses a sample of companies in Australia. This research found that companies with more female leaders produce high-quality disclosure reports on greenhouse gas emissions. This research will replicate and develop previous research by taking a sample of companies in Indonesia.

This research will use the energy and manufacturing sectors. Data from the Republic of Indonesia's Ministry of Energy and Mineral Resources indicate that the energy sector, in particular, is the one that provides the most carbon dioxide and that this contribution rises annually. According to the latest data in 2022, the energy sector contributes 43.83%, followed by other sectors, namely the manufacturing sector at 21.46% and several other sectors (Sekretaris Jenderal KESDM, 2020). Accordingly, samples from Indonesian businesses in both the manufacturing and energy sectors that were listed on the Indonesian Stock Exchange between 2018 and 2022 will be used in this study. Besides that, current studies by Monica et al. (2021) declared that carbon disclosure plays a role in mediating women on board on firm value. However, women on board are not significant on firm value and require further investigation using other measurements. Therefore, this research wants to test again using a sample of companies in Indonesia with updated data, considering the moderating variable carbon disclosure along with the dependent variables firm value and independent variable corporate governance. Although most of the existing literature documents that carbon disclosure mediates the relationship between women on board and firm value, carbon disclosure is less explored as a moderator variable determining firm value. In this research, we want to explore the mechanisms women use on boards and corporate governance that influence firm value through their moderating effect on carbon disclosure.

Based on previous research, this research also wants to prove whether females on the board of directors and corporate governance can increase firm value by adding moderating variables to carbon disclosure. Corporate governance variables are added because corporate governance is essential in handling climate change through transparent environmental disclosure to increase firm value (Blesia et al., 2023). Sound corporate governance can also improve company performance, which benefits stakeholders (Halimah et al., 2020). Previous research examining Australian companies also found that companies with good governance will increase the number of voluntary carbon emission reports (Choi et al., 2013; Rankin et al., 2011). This has become a focus point for researchers to conduct further research on whether corporate governance has a relationship with and can be a mechanism for increasing firm value. Hence, carbon disclosure reduces the association between corporate governance, business value, and women on board directors.

LITERATURE REVIEW

Legitimacy Theory

Legitimacy is a form of public recognition for a policy made by the leadership. Legitimacy theory was first coined by Dowling (1975), which describes a company's interaction with the community and the surrounding environment. This legitimacy theory also relates to the "social contract" (Choi et al., 2013). According to Dowling (1975), legitimacy describes an organization that builds social values and norms related to its activities that are acceptable to the social system. Suppose there is a discrepancy between the organization and the community regarding existing values. In that case, there will also be threats in the form of laws, sanctions, or, the most severe, that the community will revoke the social contract that is adhered to because there is no benefit or satisfaction in the activities carried out by the organization. This is called the legitimacy gap. In carrying out their business activities, it is essential for companies or organizations to continuously monitor the company's values so that they are in line with the surrounding environment and agreements so that they can recognize opportunities for legitimacy gaps to occur (Pratama & Deviyanti, 2022). Therefore, before an organization can become legitimate, it must analyze organizational behavior about the environment. Investors are very concerned about how companies fight for legitimacy, especially investors who wish to invest in the long term (Mardini & Elleuch Lahyani, 2021).

One way for companies to convince people about social values and norms is that the activities they carry out are by the social contract, namely by disclosing carbon performance through annual reports, sustainability reports, and other media. Therefore, the ability to meet stakeholder, social, and environmental expectations by disclosing carbon emission performance is a valid instrument. As a result, the business will be successful because of its positive public image. Therefore, according to legitimacy theory, social and environmental disclosures are legitimate tools companies use to increase societal legitimacy (Mardini & Elleuch Lahyani, 2021).

This theory strongly emphasizes that companies disclose social and environmental impacts to maintain their legitimacy towards the surrounding community and convey that they are ethically scrutinized for ecological and social transparency. (Deegan et al., 2002; Donovan, 2002)The company's ability to defend itself depends on how well it allocates its economic resources to society, decreasing the effects of environmental harm on its commercial operations and ameliorating social inequalities (Hardiyansah et al., 2021).

Stakeholders Theory

According to Freeman (1994), stakeholders are groups or individuals who have the power to influence and can also be influenced by an organization. Stakeholders are not only internal parties but can also be external parties (Worokinasih *et al*., 2020). According to Schaltegger et al. (2019), the basis of the stakeholder theory is that significant stakeholders only support the business and provide solutions that focus on sustainability and uphold the company's interests. Stakeholder theory explains that an established company is not only concerned with its interests but also provides benefits and fulfills the interests of stakeholders, investors, and the public (Hardiyansah *et al*., 2021).

There are important issues regarding climate change that arise in society. Society encourages companies to always convey information about the environment. In stakeholder theory, board independence correlates positively with sustainability reports because shareholders pressure internal directors (Kuzey, 2019). The submission of environmental information is a communication medium between companies, stakeholders, and the public regarding their business activities. Investors also continue to evaluate related disclosures about a company's environment. A company's environmental information generates good ideas for stakeholders, and investors are also very interested in social information related to environmental activities in the company's annual report. (Epstein, 1994; Kurnia *et al*., 2020). Thus, to accomplish a company's objectives, information regarding its operations and the surrounding environment must be shared with stakeholders (Worokinasih *et al*., 2020).

Disclosures about the environment or carbon emissions help the company get stakeholders' support and significantly impact its worth. In addition, legitimacy theory and stakeholders have a relationship. According to Gray et al. (1995) explain how legitimacy theory can help facilitate the interaction between corporate interests and the interests of its stakeholders. According to stakeholder theory, high-risk companies may get intense pressure from stakeholders, forcing them to routinely provide more information about environmentally responsible activities. As a result, companies operating in environmentally conscious industries are more likely to disclose risks related to climate change and carbon emission regulations than companies working in low-carbon industries such as the financial industry. Therefore, this stakeholder theory is widely used. Previous research regarding sustainability and environmental accounting is based on the practice of an entity disclosing environmental information that is intertwined with stakeholders.

Firm Value

According to research by Hardiyansah et al. (2021), the price that must be paid when buying or replacing the control of a company's organization is known as the company's value. A high firm value reflects higher investment returns and profits and has an increasingly good company profitability value. Stakeholders can also evaluate if a company's value is worthwhile or not. To achieve high corporate value, a company must have good economic performance, be concerned for social justice, and be responsible for sustainability or the surrounding environment (Monica *et al*., 2021). A company's operational value can be measured by its disclosures about beneficial environmental or economic practices, as this will show which sustainable management practices increase firm value. Investors can also determine whether a firm is well managed by looking at its worth. Factors that influence the good or bad of a company's value are profitability, environmental performance on disclosure, and company size (Hardiyansah *et al*., 2021). In this case, investors prefer to take measurements using Tobin's Q to significantly increase firm value (Behl *et al*., 2022).

Corporate Governance

The relationship between stakeholders and the company for a company's performance is usually called *good corporate governance* (Widyansyah *et al*., 2021). The role of corporate governance is to control a company and carry out a responsibility to stakeholders. The essence of corporate governance is a guiding principle that provides corporate responsibility in managing its performance for its shareholders and stakeholders. Effective corporate governance can increase shareholder confidence in their anticipated return on investment, strengthen competition between businesses, increase corporate value, and ultimately create trust from stakeholders and shareholders that will enable the company to grow sustainably. Managers will use *good corporate governance* as a guide in managing the company very well. Whenever a firm practices effective corporate governance, stakeholders pressure managers to decide in the best interests of stakeholders (Mukhtaruddin *et al*., 2019). On the other hand, if the business does not adopt sound corporate governance, stakeholders will stop supporting it. Therefore, effective corporate governance can also help dispel the concerns of stakeholders about the uncertainty caused by information risk. In this study, corporate governance acts as an Independent variable.

Women on Board

A director's responsibility is to make prudent judgments and use the company's resources wisely to develop the business strategy. Therefore, it is the responsibility of both boards to ensure that stakeholders are properly informed (Toukabri & Jilani, 2022). According to Toukabri and Mohamed Youssef (2023), various genders on the board of directors cause increased social and cultural disparities and impact social and environmental actions. The problem of gender inequality experienced by women also appeared on the board of directors.

Basically, women are considered to have different values from men in matters of social responsibility because they are more concerned with maintaining relationships, responding to the needs of others, and sensitivity. A larger view of others and consideration of the interests and perspectives of various parties A better level of supervision is owned by women in top management, which will affect decision-making and company performance. In social activities regarding the management of an environment, women on a board of directors are more capable of prioritizing giving stakeholders the finest available information. Companies driven by innovation will perceive that having women on the board can give them a competitive advantage through experience, skills, and a broader perspective (Hollindale *et al*., 2019). Therefore, companies with women's boards are also considered to have high-quality disclosures related to carbon emissions.

Carbon Disclosure

Considering that the issue of climate change is currently on the rise, people's fears have become a concern throughout the world. This change is caused by increased greenhouse gases, usually called carbon emissions because they are calculated based on the carbon dioxide used. The amount of carbon dioxide in the Earth's atmosphere has allegedly increased since the industrial revolution (Ning et al., 2019). With this problem, companies contribute to conveying information about their carbon emissions to stakeholders. Carbon disclosure is now emerging as a useful communication tool to ensure accountability and transparency. Disclosure is also a way for companies to maintain their social contract. Firms are responsible for giving relevant information about their commitment to the environment and carbon emission disclosures. Therefore, companies must plan good carbon management strategies and disclose their carbon emissions performance (Toukabri & Mohamed Youssef, 2023).

Voluntary carbon disclosure indicates to corporate authorities that companies are actively addressing potential climate concerns, especially in light of the approaching effects of climate change. Corporate authorities can see if they are successfully addressing possible climate hazards by looking at voluntary carbon disclosure in the wake of climate change. In this instance, to fulfill the investment criteria in sustainability reports, carbon disclosure and performance must be integrated to promote sustainability and social responsibility (Martínez-Ferrero & García-Meca, 2020).

Disclosure of a company's carbon emissions allows investors to see potential threats to future performance and assess plans to address those threats. Good company disclosure also shows that the company's carbon management activities and economic performance are better. Therefore, disclosing carbon emissions will encourage investors to assess company operational activities by analyzing sustainable management practices, producing better firm value (Monica et al., 2021). According to (Choi et al., 2013), the extent to which disclosure procedures related to environmental impacts and greenhouse gas emissions are included in publicly available reports can be measured using a "checklist" consisting of eighteen items, namely Climate Change, Greenhouse Gases, Consumption Energy, Cost, and Reduction, and Carbon Emission Accountability are the five areas included in the “checklist” element.

Hypothesis Development

The board of directors is one of the most important elements of company value. According to Monica et al (2021), The company's board of directors is the most influential in business decision-making. There is a variety of genders on the board of directors. In addition to men, many women hold positions on the board of directors. Women on boards tend to produce ideas and breakthroughs. Still, women are also considered very careful in making decisions, afraid of failure, and hesitant when trying new things. Thus, women are considered less able to strongly impact increasing firm value. In line with this statement, previous research by Monica et al. (2021) found that having women on board had a positive but not statistically significant effect on firm value in all non-financial organizations. The presence of female directors considerably raises the company's worth. (Orazalin & Baydauletov, 2020; Triana & Asri, 2017).

H1: Women on the board of directors have a positive effect on firm value.

Corporate governance refers to the internal controls that a corporation uses to manage its performance and fulfill its obligations to stakeholders. The value of the firm will rise with good corporate governance, and corporate governance is one of the variables that affect the value of the organization. Similarly, agency theory—a fundamental idea of sound corporate governance—convinces investors that their investment will yield a return. Therefore, based on the research of Indriastuti & Kartika (2021) Research, looking at how excellent corporate governance affects business value shows a large and beneficial connection between firm value and this type of governance. Applying good corporate governance into action is a consideration for investors to determine which companies are worthy of their investment (Worokinasih et al., 2020).

H2: Corporate governance is positively and significantly impacted by firm value

Gender inequality on the board of directors is still a problem experienced by women. It has been suggested that having a female on a board of directors can help to achieve good governance. Females on the board of directors are also considered to have a higher level of supervision, thereby influencing decision-making and the performance of the company they lead (Fairuzi & Tjahjadi, 2022). Apart from that, research by Monica et al. (2021) argues that having women on board can increase the company's value even in a tiny way. In this instance, women place a high value on business performance that advances stakeholders' interests. It can be concluded that women are smarter at carrying out social activities, such as environmental management strategies. The size of a company does not determine whether an investor will invest, but investors will consider information about carbon disclosure when investing. According to Choi et al. (2013), large companies are under pressure to disclose environmental and social responsibility issues and want to gain legitimacy. Carbon disclosure is a source of information for investors and can be a factor in increasing firm value. Therefore, it can be stated that:

H3: Carbon disclosure moderates women on board on firm value

Companies with effective corporate governance in disclosing carbon emissions performance or considering the environment will create quality disclosures, and the principle of transparency is the principle behind good corporate governance and disclosure of carbon emissions. Disclosure of carbon emissions is also one of the firm's responsibilities to its stakeholders. This transparency principle encourages companies to publish better disclosures to stakeholders. Thus, this is done to maintain and fulfill stakeholder legitimacy (Blesia et al., 2023). Based on the research findings of Astiti & Wirama (2020), It can be concluded that disclosure of carbon emissions results from effective corporate governance. The firm's value will rise due to effective corporate governance, which is one aspect that affects company value. Investors evaluate companies based on their execution of strong corporate governance when deciding which ones are worth investing in (Worokinasih et al., 2020). The research hypothesis is as follows, based on the preceding research results:

H4: Carbon disclosure moderates corporate governance on firm value

RESEARCH METHODOLOGY

The author employed a quantitative approach in this investigation. As stated by Sheard (2018), quantitative research is defined as research that analyzes all data as numerical data by applying statistics. This research also uses secondary data by collecting data from the IDX website, company website, and annual and sustainability reports of companies listed on the IDX in 2018-2022. This research focuses on several sectors of companies that provide the largest carbon in Indonesia, namely energy and manufacturing companies (Sekretaris Jenderal KESDM, 2020). The sample used in this study used simple random sampling techniques or probability sampling. According to Marradi (2022), Random sampling is a method commonly used in a study to select samples from a large population so that each individual in the study population has the same opportunity to be selected as a sample.

In this study, the total population of the energy and manufacturing sectors is 145. In this case, researchers use random sampling techniques to ensure this fairly large population can have the same opportunity to be sampled. Of the total population of 145 companies listed on the IDX in the energy and manufacturing sectors, only 106 samples were selected or could be used. In line with this, to find the minimum number of samples that can be used from the population, researchers apply the Slovin formula with the formula below:

$$\boldsymbol{n} = \frac{\mathrm{N}}{1+\mathrm{Ne}^2}$$

Where:
$\boldsymbol{n}$ = Sample Minimum
N = Sample Populasi
e = Margin of Error

From the Slovin formula, calculations are derived as follows:

$$\boldsymbol{n} = \frac{\mathrm{N}}{1+\mathrm{Ne}^2}$$

$$\boldsymbol{n} = \frac{145}{1+145 * (5\%)^2} = 106$$

The sample of 106 companies for this research was chosen using the random sampling approach from 145 organizations in the energy and manufacturing sectors based on the findings of the minimum sample calculation made using the Slovin formula.

Dependent Variable

According to Maddala (1987), Since the dependent variable can be utilized to comprehend or offer an explanation, it is the variable that the researcher is most interested in analyzing in the study. Tobin's Q will be used in this study to assess company value. In the literature on accounting, economics, and finance, the link between a company's market value and its asset replacement cost is referred to as Tobin's Q. A more trustworthy indicator of a company's performance and value is Tobin's Q, which explains both its past performance and its anticipated future growth. (Brainard & Tobin, 1968; Gompers et al., 2003; Li et al., 2020; Tobin, 1969). Therefore, Tobin's Q was chosen in this study to evaluate firm value. This measurement was also used in previous studies by Kelvin et al. (2017), Dang et al. (2020), Monica et al. (2021), and Nekhili et al. (2017).

Independent Variable

Women on Board

Researchers change Independent variables in scientific investigations to observe how they affect the outcomes of other factors, or they can be called dependent variables, either positively or adversely (Sekaran & Bougie, 2016). This study uses women on board (X) as an independent variable. Women on board are female representatives who serve on a company's or the business's board of directors. The gender diversity ratio, which shows the percentage of women on the board of members of the company and acts as a barometer of the influence of women's presence on the board, is defined as the ratio of women directors to all current directors (Fairuzi & Tjahjadi, 2022), The measurement of the women on boards on the research of Monica et al. (2021) and Hollindale et al. (2019). It is as follows:

$$\text{Women on Boards} = \frac{\text{Number of Women on Board}}{\text{Total Number of Directors}}$$

Corporate Governance

The framework for company operations and the regulations defining the rights and obligations of creditors, employees, governments, shareholders, and other internal and external stakeholders are collectively called corporate governance. Accountability, honesty, and transparency are ensured by good corporate governance. Long-term value is said to be created from the implementation of good governance by the company (Indriastuti & Kartika, 2021). Consequently, corporate governance (X) is the study's independent variable. In addition, the company's annual report's strong corporate governance principles will be used to evaluate the effectiveness of corporate governance. To achieve this, the Corporate Governance Disclosure Index (IPCG), which measures corporate governance, will be used to evaluate this variable. In this case, the assessment is also measured by 16 items of good corporate governance based on IPCG on GCG in the aspects of shareholders, boards, members of commissioners, board, and members of directors, nomination and remuneration committees, risk management committees, company secretaries, internal control, corporate risk, access to information and data, corporate ethics, social responsibility, and other important matters relating to the implementation of GCG. Each disclosure in the 16 GCG categories has reflected the GCG principles that must be adhered to by the company to realize better governance related to increasing the company's value (Blesia et al., 2023).

Carbon Disclosure

Third parties can modify the initial relationship between the independent and dependent variables. These are known as moderating variables. This variable intersects with other variables, especially the dependent and independent variables (Sekaran & Bougie, 2016). Therefore, carbon emissions disclosure can be measured by an index or checklist developed by Choi et al. (2013). The index or checklist is useful to determine how far-related voluntary disclosures, climate change, and carbon emissions are combined and available in the report for general publication. This index is a factor identified in the information request form by CDP (carbon disclosure project). The carbon emissions disclosure index consists of 18 components, and if the company fulfills the disclosure, it will receive a score of 1; if it does not, it will receive a score of 0. Then, the total points for each company will be divided by the maximum points. The result of the division will be multiplied by 100%. Thus, the formula for disclosing carbon emissions made in this study can be presented in percentage form as follows:

$$\text{CED} = \left(\frac{\sum di}{M}\right) X\ 100\%$$

Information:

CED = Carbon Emission Disclosure
$\sum \boldsymbol{di}$ = The company's overall score of one
M = Maximum of 18 components for a total score

Research Model

The equation below shows the regression model used to test the hypotheses using SPSS version 29.0. Regression analysis was run to test the impact of carbon disclosure as a moderating variable and women on board and corporate governance on carbon disclosure. The regression model of this study is as follows:

$$\gamma = \alpha + \beta_1 X1 + \beta_2 X2 + \beta_3 X1Z + \beta_4 X2Z + \varepsilon$$

Information:

γ = Firm Value
α = Constanta
$\beta_1 - \beta_4$ = Regression Coefficient
X_1 = Women on Board
X_2 = Corporate Governance
Z = Carbon Disclosure
ϵ = Standard Error

RESULT

The table presents women on Board (WOB) data with a minimum and maximum range of data, namely 0–67%, with an average woman on board (WOB) of 9%. It can be interpreted that women on board (WOB) are still relatively low and small because it is less than half of the sample. A minimal value of 0 and the highest value of 1 are displayed for corporate governance (CG), meaning at least 0% and 100% of the disclosure of corporate governance principles from 101 IPCG items. The average score is 0.6866, which indicates that the average energy and industrial sector company implements 68% of good corporate governance from 101 IPCG items.

Table 1 Descriptive Statistics Results

	N	Minimum	Maximum	Mean	Std. Deviation
WOB	530	0	0,67	0,0922	0,15721
CG	530	0	1	0,6866	0,40992
FIRMVAL	530	0	3	0,7145	0,68448
CD	530	0	1	0,2391	0,31132

From the average of 106 sample companies, Mark Dynamics achieved the highest value of 3 in 2018. It can be concluded that at that time, Mark Dynamics' share price was the highest. Data results are presented by Carbon Disclosure (CD) with a minimum range of 0 and a maximum of 1, while the average carbon disclosure is 0.23, or only 23%, and is classified as low because less than half of the sample contains carbon disclosure.

Classic Assumption Test

The normality test is run to ensure that the investigation's data has been distributed correctly. This study used a single-sample Kolmogorov-Smirnov test. The normality test rules state that if a significant result of more than 0.05 is found, the data can be regarded as normally distributed and vice versa (Ghozali, 2016).

Table 2 Normality Test Results

One – Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		123
Normal Parameters[a,b]	Mean	0,0000000
	Std. Deviation	0,60131928
Most Extreme Differences	Absolute	0,076
	Positive	0,073
	Negative	-0,076
Test Statistic		0,076
Asymp. Sig. (2-tailed)[c]		0,079

The previously mentioned Kolmogorov-Smirnov test results are used to determine the Asymp Sig value. This 2-tailed c value is 0.079. Thus, this data is normally distributed.

Table 3 Muticollinearity Test Results

Model	Tolerance	VIF
WOB	0,880	1,136
CG	0,710	1,408
CD	0,794	1,259

The multicollinearity testing results in the table above indicate that every variable has a VIF value less than 10 and a tolerance value of more than 0.1. As a result, it is possible to conclude that the data-driven regression model does not exhibit multicollinearity or correlation among its independent variables.

Table 4 Heteroscedasticity Test Results

Model	Sig.	Indicates
WOB	0,954	No heteroscedasticity is detected.
CG	0,116	No heteroscedasticity is detected.
CD	0,604	No heteroscedasticity is detected.

Based on the findings, the study's heteroscedasticity test reveals that none of the independent variables, women on boards, corporate governance, and carbon disclosure, show signs of heteroscedasticity, all with significance values greater than 0.05. The autocorrelation model resulted in a DU value of 1.86361, a DW value of 1.884, and a 4-DU value of 2.136, as can be shown from the Durbin-Watson test findings in the above table. It can be interpreted that there are no symptoms of autocorrelation in this study because it is by the provisions of DU < DW < 4-DU or 1.86361 < 1.884 < 2.136.

Hypothesis Result

Moderated Regression Analysis (MRA)

The use of multiple regression analysis with moderating factors, or moderated regression analysis (MRA), was the type of regression analysis employed in this investigation. The goal of moderated regression analysis is to determine if the moderating variable will improve or worsen the relationship between both independent and dependent variables (Ghozali, 2016). In this research, Moderated Regression Analysis (MRA) can be used to ascertain the description of the effect of women on board and corporate governance on firm value and to ascertain whether the carbon disclosure variable is able to moderate the relationship between women on board and corporate governance on firm value.

Table 5 Moderated Regression Analysis Test Results

Coefficients						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	0,370	0,621		0,596	0,552
	WOB	0,497	0,188	0,114	2,642	0,008
	CG	1,016	0,058	0,608	17,614	<0,001
	WOBCD	0,122	0,497	0,014	0,245	0,806
	CGCD	-0,159	0,285	-0,051	-0,559	0,577

The coefficients for the regression model can be arranged in the following equation using the output results shown in the previous table as a guide:

FIRMVAL = $\mathbf{0,370} +$ 0,497WOB + 1,016CG + 0,122WOBCD – 0,519CGCD + ε

A constant amounting to 0.370 means that if the scores for corporate governance, women on the board, and moderation of carbon disclosure are constant or zero, then the company's value is also 0.370.

Regression Coefficient Simultaneously (F- Test)

Table 6 F Test

Model	F	Sig.	Result
Regression	3,528	0,008	Simultaneously

As can be observed, F has a significant value of 0.008, meaning that its importance is 0.008 less than that of 0.05. As a result, it is possible to say that both the independent and dependent variables are changed simultaneously. Therefore, it can be concluded that corporate governance, the proportion of women on the board, and moderating factors all impact business value simultaneously.

Regression Coefficient Partially (T-Test)

You must use the T analysis test to determine the partial impacts of every independent variable on the dependent variable (Ghozali, 2016). The hypothesis is accepted if the t-statistical value is higher than the table of t and the t-significance value is less than 0.05. If the significant value of t is more than 0.05 and the t-statistical value is less than the value shown in the t table, it is rejected in the interim.

Table 7 T Test

Models		B	t	Sig.	Result
1	(Constant)	0,370	0,596	0,552	
	WOB	0,497	2,642	0,008	Supported
	CG	1,016	17,614	<0,001	Supported

WOBCD	0,122	0,245	0,806	Not Supported
CGCD	-0,159	-0,559	0,577	Not Supported

The study's corrected R-square value, which is 0.028 or 2.8%, indicates the coefficient of determination (R2), with other factors influencing the remaining 97.2%. This demonstrates that while other factors impact 97.2% of business value, 2.8% of firm value is influenced by the ability of women on the board as well as corporate governance and moderation characteristics.

The results of this study on Hypothesis 1, namely women on board (X1), have a significant and favorable impact on firm value (Y), as indicated by the t-test findings displayed in the preceding table. Women on board (X1) had a t-statistics value of 2.642, a known t-table of 1.964, and a significance value of 0.008, according to the data in the following table. The fact that the t-statistics value is greater than the t-table value and the significance of 0.008 is less than 0.05 may help to explain the study's first hypothesis, which states that having women on board (X1) has a positive and significant effect on company value (Y).

Hypothesis 2, Firm value (Y) is positively and significantly impacted by corporate governance (X2). Corporate governance (X2) has a t-statistics value of 17.614 with a known t-table of 1.964 and a significance value of <0.001, according to the data in the above table. This can be explained by the fact that the t-statistics value is bigger than the t-table value, and the significance of <0.001 is smaller than 0.05. Thus, the study's second hypothesis is accepted: corporate governance (X2) has a positive and significant impact on company value (Y).

The third hypothesis states that the association between women on board (X1) and business value (Y) can be strengthened or moderated by carbon disclosure (Z). Based on the data in the previous table, the t-statistics value of women on board moderated by carbon disclosure is 0.245, with a known t-table of 1.964 and a significance value of 0.806. The association between women on board (X1) and company value (Y) cannot be strengthened or moderated by carbon disclosure (Z), as the significance of 0.806 is greater than 0.05, and the t-statistics value is smaller than the t-table value. As a result, hypothesis 3 in this study is rejected.

The link between corporate governance (X2) and business value (Y) can be strengthened or moderated by hypothesis 4, specifically carbon disclosure (Z). The information in the preceding table indicates that, with a known t-table of 1.964 and a significance value of 0.577, the t-statistics value of corporate governance moderated by carbon disclosure is -0.559. Given that the significance of 0.577 is greater than 0.05 and the t-statistics value is smaller than the t-table value, it can be concluded that hypothesis 4 of this study is rejected because carbon disclosure (Z) is unable to either moderate or strengthen the relationship between corporate governance (X2) and firm value (Y).

DISCUSSION

Women on board effect

Based on the statistical test results, this study reveals that women on board have a significant influence and are positively related to firm value. The first hypothesis, which holds that having women on board significantly and favorably increases firm value, is supported by this finding. The findings of this investigation match those of previous studies carried out by Triana & Asri (2017) and Orazalin & Baydauletov (2020), which conclude that having women as board members significantly and favorably affects the company's value.

In this case, it is considered that women on the board of directors can provide a competitive advantage through experience, skills, and a broader perspective that will affect company value (Hollindale et al., 2019). Women with high ethical standards are also less likely to engage in unethical behavior, such as earnings manipulation. As a result, they tend to be more cautious and strive to achieve higher work standards, which will attract investors (Martinez & Rambaud, 2019). Explained by Triana & Asri (2017)Female directors can produce better company performance because they tend to be more risk-averse and cautious in decision-making. In the area of social responsibility, female directors are more concerned about corporate social responsibility and moral issues of their business. In addition, female directors have better communication and listening skills in daily operations.

There are indications that the company's actions are commensurate with stakeholder and societal expectations. Commensurability also enhances a company's legitimacy and credibility. The theory of legitimacy, an effective framework within organization theory, holds that organizations attempt to increase their legitimacy by matching themself within the standards standards, and values of the community. The test findings support this theory in this regard. In this regard, gender equality in the workplace is viewed as a means for businesses to align themselves with social norms and expectations that are always evolving and, ultimately, contribute to their legitimacy. Legitimacy, in this context, can positively impact a company's reputation, trust, and relationships with various stakeholders.

Moreover, the findings support the Stakeholder Theory, which holds that in order to generate long-term value and sustainability, organizations should take into account the requirements and interests of all stakeholders, not just shareholders. Employee happiness and engagement can rise with a diverse board that includes women. Employee engagement aligns with the interests of labor, a key stakeholder group, and increases the likelihood that an employee will contribute to the overall performance and success of the organization. One facet of the business's broader dedication to sustainability and stakeholder interests is the representation of women on boards.

Corporate Governance and Firm Value

The findings from the tests in this study support the claim that corporate governance significantly increases firm value. In this instance, the study's second hypothesis is validated. Therefore, it can be illustrated that the better corporate governance by applying its principles, the higher the firm value (Worokinasih et al., 2020). As a result, the company actually practices excellent corporate governance ideals. Because the business has adopted the fundamentals of good corporate governance transparency, accountability, responsibility, independence, and honesty—for the benefit of stakeholders, shareholders, and society at large, the application will enhance the company's reputation. As a result, it is possible to reduce agency conflicts that arise between agents, shareholders, stakeholders, and society at large. This demonstrates that markets or investors value businesses that use good corporate governance at a greater level.

Effective decision-making can produce strategies and actions that can improve the financial performance and long-term value of the company. Another illustration would be if shareholders trust corporate governance, they are more inclined to invest in and hold the company's stock, which can raise its market value. Therefore, this study is in line with research Indriastuti & Kartika's (2021) research, which additionally found that business value is significantly positively impacted by corporate governance. The test findings in this study are believed to support the stakeholder hypothesis, which contends that implementing certain practices by companies can foster relationships with stakeholders, foster trust, and ultimately raise corporate value.

Moderating the Impact of Carbon Disclosure of Women on Boards on Firm Value

The moderating impact of the carbon disclosure test found no impact. In contrast to the hypothesis, the test results demonstrate that carbon disclosure has no moderating effect on the association between business value and corporate governance. Good corporate governance and carbon disclosure have produced a negative value that can lower business value (Blesia et al., 2023). This is in line with the findings that there is no strong corporate governance if there is a relationship between information about the environment and firm value (Pujiningsih, 2020).

In addition, corporate governance is expected to reduce the gap between management and shareholder rights, helping management obtain cognitive benefits for the benefits of their decisions. However, ineffective corporate governance procedures can affect a company's value, decision-making, and carbon emission disclosure. Carbon emission disclosure decreases credibility if the fundamentals of good corporate governance are not followed in line with established guidelines and regulations.

The hypothesis was tested, and the findings indicated that low-quality carbon disclosure can lower a company's worth and that it is also a result of corporate governance that does not follow sound guidelines. The majority of businesses just employ it as a technique to meet their obligations under government rules (Mutmainah, 2015).

This finding suggests that the legitimacy theory needs to be supported because a negative impact on carbon disclosure will imply that the company is acting immorally or environmentally harmfully, which will disappoint stakeholders and shareholders and reduce the company's perceived legitimacy in the eyes of the public. Lawsuits or other actions that damage the company's reputation may result from this, which would lower its worth. Regarding corporate governance, careless behavior regarding environmental hazards might doubt the system's efficacy.

CONCLUSION

This research also contributes to current scientific findings in various ways. Firstly, this research increases insights by investigating some factors that influence the value of environment-based companies by companies in Indonesia. Having insights into the factors affecting the value of environmentally-based firms on carbon disclosure will motivate the government, stakeholders, investors, and other parties to be more conscious in reporting their emissions disclosure. According to this study, organizations that fully implement the principles of good corporate governance can see a rise in value due to the inclusion of women on their boards of directors.

This study concluded that corporate governance and having women around the board have a favorable and significant effect on firm value. The study additionally performed empirical tests and examined associations for various business variables. Female directors can produce better company performance because women tend to be more risk-averse and cautious in decision-making. In terms of social responsibility, female directors are more concerned about corporate social responsibility and the moral issues of their business. Furthermore, female directors are more adept at listening and communicating in day-to-day operations. Furthermore, corporate governance has a positive and noteworthy impact, meaning that adhering to sound corporate governance principles contributes to the growth of the company's value.

However, carbon disclosure cannot mitigate the impact of women on boards and corporate governance on firm value in this study. This might result from the company's failure to execute sound corporate governance when it comes to revealing carbon emissions, which could lead to carbon emissions of inadequate quality and a decline in the company's value. The market's reduction of the reputation premium in firm valuation and investors' loss of confidence are most likely to blame for this finding when companies with a high percentage of female board members perform poorly in greenhouse gas disclosure (Bartov et al., 2019).

Implications were also found in the results of this study. Stakeholders and society pressure companies to be more responsible and concerned about the environment. Meanwhile, companies' initiatives to regulate and minimize carbon emissions are questionable, as most companies still depend on fossil fuels. Corporate governance principles still need to be maximally applied in the approach to the environment or in disclosing environmental information. Therefore, disclosure of carbon emission levels is a critical way to address the problem of climate change and global warming (Ben-Amar et al., 2015). This study reveals that the level of disclosure of carbon emissions is still relatively low. This study argues that companies in Indonesia need to increase their responsibility and awareness of environmental sustainability issues by disclosing more of their carbon emission levels and improving good corporate governance.

This study also provides theoretical implications by demonstrating the legitimacy and stakeholder theories, highlighting the factors influencing firm value, corporate governance, and carbon disclosure. Companies that receive pressure from stakeholders such as society, government, environmental groups, and the media legitimize their activities. They try to regulate environmental risks by publishing voluntary carbon emissions disclosures in annual and sustainability reports.

This study also provides recommendations for future researchers in line with this research. First, future research should use additional corporate governance indicators, such as the CGPI, audit committee, independent commissioner, and ESG Score, to investigate the connection between carbon emission disclosure and business value (Blesia et al., 2023). Second, future researchers are suggested to investigate carbon emission disclosure more broadly, investigating two sub-sectors and adding other sub-sectors with the largest emitters. This will give readers broader and more specific insights into the most influential factors because each sub-sector may have different carbon emission reporting factors. Third, future research is suggested to integrate other variables apart from this literature to find other possible factors that influence firm value and carbon disclosure, such as financial performance and others. Further analyze women on the board of directors in light of the institutional and cultural framework, as there is likely to be a significant correlation between firm value and gender diversity (Martínez-Ferrero & García-Meca, 2020).

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