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The Antecedents of Carbon Emission Disclosure With Carbon Knowledge as Moderation

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Abstract: Climate change is one of the main problems faced by humans in this decade. Several environmental research institutions state that climate change in the next ten years is considered the most threatening long-term risk. Developed countries contribute 65-70% while poor and developing countries contribute the remaining 30%-35%. One of Indonesia's commitments as a country that is a member of the United Nations Framework Convention on Climate Change. The UNFCCC CoP (Climate Change Conference) is an annual world climate conference, where governments meet to discuss plans to address the climate crisis. This will be the 26th meeting. Where this convention is attended by 195 countries that are members of the United Nations (UN). This study aims to analyze the factors that influence the level of carbon emission disclosure, namely to test and analyze: The Influence of Corporate Environmental Awareness, Corporate Carbon Strategy, Green Corporate Business Strategy and Green Supply Chain on Carbon Emission Disclosure. In addition, this study also tests and analyzes the Role of Carbon Knowledge as a moderating variable for the influence of Corporate Environmental Awareness, Corporate Carbon Strategy and Green Supply Chain on Carbon Emission Disclosure. The analytical method used in this study is path analysis with the pattern of relationships between independent variables in this study being correlative and causal. Based on the results of this study, it shows that Environmental Performance has a significant effect on carbon emission disclosure. Carbon management strategy does not have an effect on carbon emission disclosure. Competitive Business Strategy has a significant effect on carbon emission disclosure. And green supply chain management has an effect on carbon emission disclosure. Carbon Knowledge does not strengthen the effect of environmental performance on carbon emission disclosure, Carbon Knowledge does not strengthen the effect of Carbon Management Strategy on carbon emission disclosure. Carbon Knowledge strengthens the effect of Corporate Business Strategy on carbon emission disclosure. Carbon Knowledge strengthens the effect of Green Supply Chain Management on carbon emission disclosure

Keyword: Carbon Emission Disclosure, Corporate Environmental Awareness, Corporate Carbon Strategy, Green Competitive Business Strategy, Carbon Knowledge

INTRODUCTION

Climate change is one of the main problems faced by humans in this decade. Several environmental research institutions state that climate change in the next ten years is considered the most threatening long-term risk. Developed countries contribute 65-70% while poor and developing countries contribute the remaining 30%-35%. One of Indonesia's commitments as a country that is a member of the United Nations Framework Convention on Climate Change. The UNFCCC CoP (Climate Change Conference) is an annual world climate conference, where governments meet to discuss plans to address the climate crisis. This will be the 26th meeting. Where this convention is attended by 195 countries that are members of the United Nations (UN).

The factor that influences the disclosure of carbon emissions is Environmental Awareness. Disclosure of environmental information such as carbon emissions by companies is a form of responsibility, compliance, and awareness of government regulations, as well as the community due to the environmental impacts caused. In addition, disclosure of carbon emissions will provide benefits to the company, including avoiding reduced operating costs, reputational risks, legal processes, fines, and becoming a way to gain legitimacy (Irwhantoko, 2016). Then the green strategy facilitates transformational decisions and initiatives that improve the environment. Establishing a clear vision and strategy ultimately allows society to make better decisions and align with the company's priorities in providing goods and services in the global market. In this case, companies need to implement green strategies. innovation to reduce the impact of the production process on the environment.

The next factor is carbon management strategy. Given the increasing public concern about global warming and climate change, the issue of climate change has become a concern for companies and stakeholders expect companies to disclose relevant GHG (greenhouse gas) emissions (Depoers, et. al., 2016). it is very important for companies to articulate an effective carbon management strategy (CMS) and communicate the level of emissions in their organization's emission disclosures. In this particular research area, our paper aims to analyze the effectiveness of CMS on carbon emission disclosure. Green Supply Chain Management is a practice that encourages transparent disclosure of emissions from both upstream and downstream in the supply chain, thereby reducing uncertainty in environmental decision-making (Blanco et al., 2017; Dahlmann and Roehrich, 2019; Wu & Pagell, 2011). the level and type of involvement may vary depending on the company's actions and practices. Based on this study, the researcher examines the factors that influence carbon emission disclosure focused on company activities, including those factors that can be seen in the Corporate Environmental Awareness and Green Competitive Business Strategy variables, which are the company's environmental awareness that will be measured from various dimensions in Corporate Carbon Management Strategy, Green Supply Chain Management, Corporate Environmental Awareness, Green Corporate Business Strategy, and Carbon Knowledge. Another novelty of this study is by adding the Carbon Knowledge variable as a moderating variable for the Corporate Environmental Awareness, Corporate Carbon Strategy, Green Corporate Business Strategy and Green Supply Chain variables on Carbon Emission Disclosure. We believe that this study will enrich the existing theory on the relationship between carbon management strategies and organizational performance, offering insights and understanding that have been sought by researchers and corporate practitioners.

METHOD

Subjects, time and place of research, instruments, procedures, and research techniques, as well as other matters relating to the method of research. This section can be divided into several sub-chapters, but no numbering is necessary.

Research Object

Table 1. Research Object

Variable	Dimention	Indicator	Scale
Y Carbon Emission Disclosure	1. Mandatory Disclosure 2. Voluntary Disclosure 3. Financial Disclosure	1. Disclosure of the amount of carbon produced by the Company 2. The Company has experienced an increase in carbon emissions 3. Calculation of energy produced from renewable resources 4. Details of plans or strategies to reduce carbon emissions	Ordinale (with Scale Likert 1-6)
X1 Corporate Environmental Performance (Sudibyo & Sutanto 2020)	1. Knowledge 2. Environmental Monitoring EcoDesign Product	1. Does the Company explain environmental awareness in the Company's vision 2. Does the Company explain environmental awareness in the Company's mission 3. The Company implements a total quality environment 4. The Company implements an environmental compliance and audit program 5. The Company implements an environmental management system 6. The Company implements green distribution and packaging 7. Product design to reduce material consumption	Ordinale (with Scale Likert 1-6)
X2 Corporate Carbon Management Strategy (Tan. Et al, 2022)	1. Process System 2. Technology System	1. The company has a formal department responsible for environmental affairs 2. The company has a formal system of environmental improvement in operations 3. The company formally tracks and reports environmental performance within the company 4. The company regularly tracks, monitors, and shares environmental information and monitors environmental issues	Ordinale (with Scale Likert 1-6)
X3 Green Corporate Business Strategy (Sudibyo, 2019)	1. Human Capital 2. Relantionship Capital	1. Environmental protection products and services provided by the Company's employees are better than its main competitors 2. Employee productivity and contribution to environmental protection in the Company are better 3. Managers in the Company can fully support employees to achieve environmental protection goals	Ordinale (with Scale Likert 1-6)

X4 Green Supply Chain Management	1. Green Purchasing 2. Green Colaboration	1. Designing products that reduce the use of hazardous materials/components in the manufacturing process. 2. Enforcing specifications on the requirements of purchased components/materials and their impact on the environment to partners/suppliers. 3. Implementing recycling practices for production waste 4. Creating a website related to the promotion of environmentally friendly products 5. Providing information related to the benefits of using environmentally friendly products	Ordinale (with Scale Likert 1-6)
X4 (Moderation) Carbon Knowlege	1. Carbon Understanding 2. Carbon Concern	1. Carbon understanding for all staff 2. Understanding the impact of carbon pollution 3. Understanding carbon literacy and the greenhouse gas effect The carbon tax that has been enacted is complied with by the Company	Ordinale (with Scale Likert 1-6)

Data Analysis Methods

Normality Test

According to Ghozali (2020), the normality test is used to determine whether the data used is normally distributed. One way to see normality is to use a histogram by comparing observations with a distribution that approaches a normal distribution. If the data distribution is normal, the line that describes the data will follow its diagonal line. Normality testing in research is carried out using the Kolmogorov-Smirnov statistical test.

Multicollinearity Test

The multicollinearity test is used to test whether the regression model finds a correlation between independent variables. The multicollinearity test is carried out using the tolerance value and Variance Inflation Factor (VIF) (Choiriyah and Damayanti 2020). A good regression model should not have a correlation between independent variables. The basis for making decisions based on multicollinearity is as follows:

If VIF <10 and tolerance> 0.1 then there is no multicollinearity

If VIF> 10 and tolerance <0.1 then there is multicollinearity

Multiple Linear Regression Analysis

The data analysis method used in this study is multiple linear regression. According to (Sugiyono, 2015) Multiple linear regression analysis is used by researchers, if researchers intend to predict how the condition (rise and fall) of the dependent variable (criterion), if two or more independent variables as predictor factors are manipulated. According to Imam Ghozali (2013:98) Regression analysis is used to measure the strength of the relationship between two or more variables, also shows the direction of the relationship between the dependent and independent variables. The accuracy of the sample regression function in estimating the actual value can be measured from its goodness of fit. Statistically, at least this can be measured from the coefficient of determination, F statistic value and t statistic value (Ghozali, 2013)

Hypothesis Testing

According to (Sugiyono, 2018) Hypothesis is a temporary answer to the formulation of research problems, usually arranged in the form of a question sentence. It is said to be temporary because the answers given are only based on relevant theories, not yet based on empirical facts obtained through data collection. Data analysis in this study was carried out using the Structural Equation Modeling (SEM) method using Partial Least Square (PLS) assisted by smartPLS 3.0 software. The advantage of using PLS is that PLS is a powerful analysis method because it does not assume that data must be on a certain scale and the number of samples is small (Ghozali, 2011) This analysis is used to determine the effect of several independent variables (X) on the dependent variable (Y). Multiple linear analysis was conducted using determination coefficient test, t test, and F test. The regression model in this study is as follows:

$Y = \alpha + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \varepsilon$ ……..……..……. (i)

$Y = \alpha + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \beta5X1*X5 + \beta6X2*X5 + \beta7X3*X5 + \beta8X4*X5 + \varepsilon$ …… (ii)

Description:

Y = Carbon Emission Disclosure
α = Constant
β1...β2 = Regression Coefficient
X1 = Environmental Performance
X2 = Corporate Carbon Management Strategy
X3 = Competitive Business Strategy
X4 = Green Supply Chain Management
X5 = Carbon Knowledge
ε = error term

Error tolerance (a) is set at 5% with a significance level of 95%

Partial Effect Test (t-Test)

According to (Ghozali, 2018) the t-test is used to determine whether two unrelated samples have different average values and the t-test basically shows how far the influence of one independent variable is individual in explaining the variation of the dependent variable. The t-test is done by comparing the difference with the standard error. The null hypothesis (H0) to be tested is whether a parameter (bi) is equal to zero, or H0: bi = 0, meaning whether an independent variable is not a significant explanation of the independent variable. The alternative hypothesis (Ha) of a variable parameter is not equal to zero or Ha: bi≠0.

The test is carried out using a significance level of 0.05 (α=5%). Acceptance or rejection of the hypothesis is carried out with the following criteria: Criteria for accepting the hypothesis:

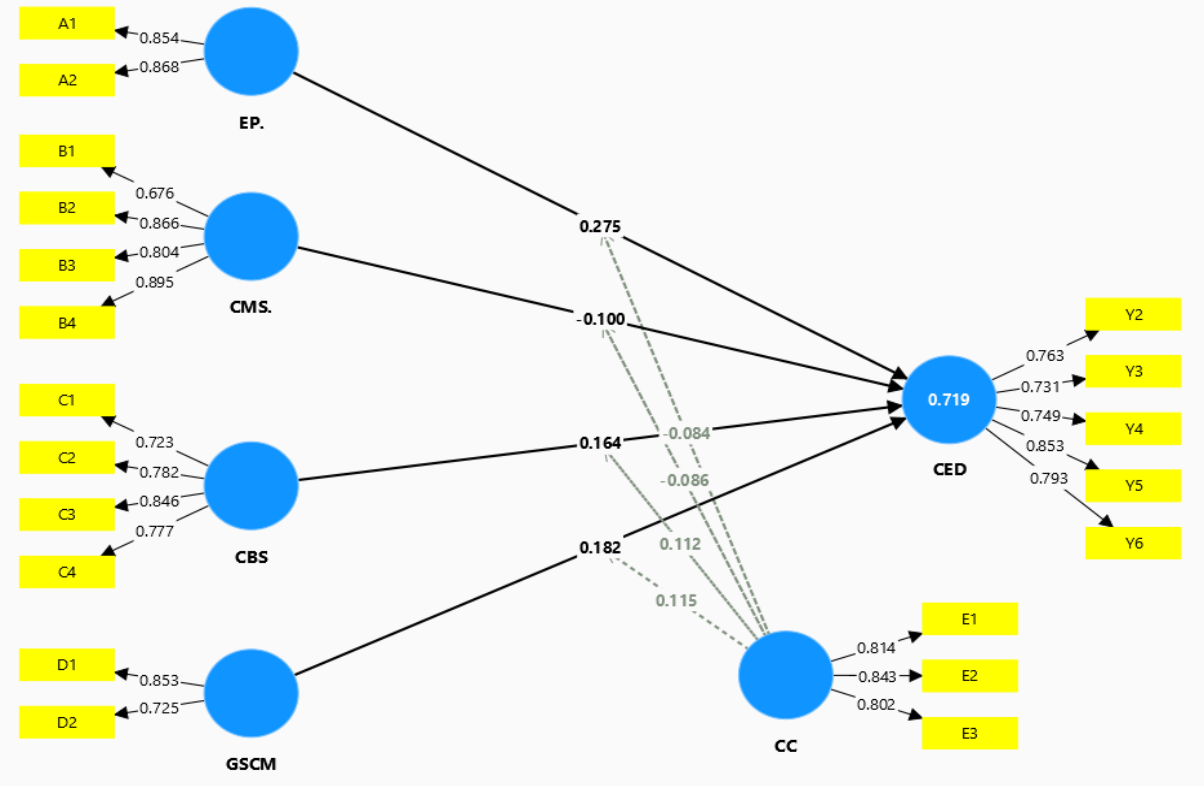
1) If the significant value is <0.05 and tcount> ttable, then H1 is accepted
2) If the significant value is> 0.05 and tcount <ttable, then H1 is rejected

Simultaneous Influence Test (F Test)

According to (Ghozali, 2018) The f statistical test basically shows whether all independent variables included in the model have a joint influence on the dependent variable. To test these two hypotheses, the F statistical test is used:

Quick look: if the F value is greater than 4 then Ho can be rejected at a 5% confidence level, in other words we accept the alternative hypothesis, which states that all independent variables simultaneously and significantly affect the dependent variable.

RESULTS AND DISCUSSION



Based on the PLS results, it shows that variables A1, B2, B4, C1, and D1 are invalid because the Loading Factor results are below 0.7 so they must be discarded.

Table 2. Construct Reliability and Validity Test

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
CBS	0.789	0.792	0.864	0.614
CC	0.756	0.758	0.860	0.672
CED	0.837	0.840	0.885	0.607
CMS.	0.826	0.838	0.887	0.664
EP.	0.750	0.751	0.851	0.741
GSCM	0.712	0.731	0.769	0.627

The results of the study indicate that the Sustainability Performance variable has a Composite Reliability value of 0.841 > 0.70 which indicates that each item that measures satisfaction is consistent/reliable in measuring Sustainability Performance. Then the Green Supply Chain Management variable has a Composite Reliability value of 0.885 > 0.70 which indicates that each item that measures satisfaction is consistent/reliable in measuring Green Supply Chain Management, then the Enterprise Resource Planning variable has a Composite Reliability value of 0.888 > 0.70 which indicates that each item that measures satisfaction is consistent/reliable in measuring Enterprise Resource Planning and Environmental Knowledge shows that the Composite Reliability value is 0.892 > 0.70 which indicates that each item that measures satisfaction is consistent/reliable in measuring Environmental Knowledge.

Table 3. Fornell Lacker

	CBS	CC	CED	CMS.	EP.	GSCM
CBS	0.783					
CC	0.644	0.820				

CED	0.613	0.779	0.779			
CMS.	0.650	0.699	0.627	0.815		
EP.	0.584	0.722	0.753	0.636	0.861	
GSCM	0.554	0.783	0.689	0.637	0.641	0.792

The results of the Fornell Lacker table show that the AVE Root Value for Sustainability Performance is 0.779 which is greater than other variables, so the discriminant validity for the correlation variable is fulfilled, then the Green Supply Chain Management variable is 0.799 which is greater than other variables, so the discriminant validity for the correlation variable is fulfilled and the Enterprise Resource Planning variable is 0.891 which is greater than other variables, so the discriminant validity for the correlation variable is fulfilled.

Multicollinearity Test

The following are the results of the multicollinearity test.

Table 5. Multicollinearity Test

	VIF
A1	1.302
A2	1.302
B1	1.413
B2	2.572
B3	1.821
B4	2.735
C1	1.401
C2	1.660
C3	2.085
C4	1.501
D1	1.072
D2	1.072
E1	1.542
E2	1.608
E3	1.447
Y2	1.742
Y3	1.580
Y4	1.739
Y5	2.631
Y6	2.162

Source: Data processed by Researchers (2023)

In the table above, we can see that there are no independent variables that have a Tolerance value of less than 0.1 and there are no independent variables that have a Variance Inflation Factor (VIF) value of more than 10. So it can be concluded that there is no multicollinearity between independent variables in the regression model.

Hypothesis Test

Basically, statistical tests show how far the influence of one independent variable individually can explain the variation of the dependent variable (Ghozali, 2011). The basis for making decisions for this partial test is to compare the p value with α 0.05. 1. If the significance value is < 0.05 then H1 is accepted. 2. If the significance value is> 0.05 then H0 is accepted. The following are the regression results:

Table 6. Hypothesis Test

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
EP -> CED	0.048	0.050	0.092	0.527	0.028
CMS -> CED	0.146	0.152	0.090	1.609	0.328
CBS -> CED	0.739	0.731	0.078	9.503	0.000
GSCM -> CED	-0.158	-0.145	0.098	1.609	0.018
EP x CC -> CED	0.092	0.181	0.085	1.077	0.182
CMS x CC -> CED	0.448	0.250	0.091	0.527	0.128
CBS x CC -> CED	0.246	0.152	0.098	1.609	0.008
GSCM x CC-> CED	0.539	0.731	0.092	9.743	0.000

Based on the results of this study, it shows that Environmental Performance has a significant effect on carbon emission disclosure. Carbon management strategy does not have an effect on carbon emission disclosure. Competitive Business Strategy has a significant effect on carbon emission disclosure. And green supply chain management has an effect on carbon emission disclosure. Carbon Knowledge does not strengthen the effect of environmental performance on carbon emission disclosure, Carbon Knowledge does not strengthen the effect of Carbon Management Strategy on carbon emission disclosure. Carbon Knowledge strengthens the effect of Corporate Business Strategy on carbon emission disclosure. Carbon Knowledge strengthens the effect of Green Supply Chain Management on carbon emission disclosure

Coefficient Determination

Table 7. Coefficient Determination

	R-square	R-square adjusted
CED	0.719	0.690

Based on the research results, it shows that the Adjusted R-Square value is 0.690, which means that the independent variable has an effect on the dependent variable of 0.690, while the remaining 0.31 is influenced by other factors that are not explained in the independent variable.

CONCLUSION

Based on the results of this study, it shows that Environmental Performance has a significant effect on carbon emission disclosure. Carbon management strategy does not have an effect on carbon emission disclosure. Competitive Business Strategy has a significant effect on carbon emission disclosure. And green supply chain management has an effect on carbon emission disclosure. Carbon Knowledge does not strengthen the effect of environmental performance on carbon emission disclosure, Carbon Knowledge does not strengthen the effect of Carbon Management Strategy on carbon emission disclosure. Carbon Knowledge strengthens the effect of Corporate Business Strategy on carbon emission disclosure. Carbon Knowledge strengthens the effect of Green Supply Chain Management on carbon emission disclosure

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