

# Disclosure of Carbon Emissions, Covid-19, Green Innovations, Financial Performance, and Firm Value

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## ABSTRACT

The purpose of this study is to investigate the effect of the publication of carbon emissions, COVID-19, and green innovation on financial overall performance and their impact on firm value. The population utilized here are Indonesian companies registered at the Indonesia Stock Exchange from 2015 to 2021 acquired from forty-eight organizations as a sample using purposive sampling. Path analysis is used as the analysis method. This study found that the publication of carbon emissions had no enormous impact on financial performance, while COVID-19 had a full-size negative impact on financial overall performance and green innovation had a substantial-higher-quality impact on financial performance. Meanwhile, COVID-19 has an extensive negative impact on firm value, financial performance has a substantial effect on firm value, and disclosure of carbon emissions and green innovation has no massive effect on firm value. Similarly, financial performance cannot seriously mediate the effect of carbon emission disclosure on firm value. However, financial performance was capable of noticeably mediating the bad effect of COVID-19 on firm value and the big high effect of green innovation on firm value.

**Keywords:** Disclosure of carbon emissions; COVID-19; green innovation; financial performance; firm value; path analysis.

## INTRODUCTION

Challenges related to long-term excessive pollution, ranging from environmental destruction, natural resource use, and harmful carbon elements, are driving new strategies not only by governments but also by economic players. This policy has led to the implementation of sustainable development as a key principle for implementing specific activities at macro- and micro-levels. For example, one of the United Nations Sustainable Development Goals is to reduce greenhouse fuel emissions by 45% in 2030, while the European Union's goal is to reduce greenhouse fuel emissions by 55% in 2030. This target demonstrates the importance of reducing greenhouse gas emissions [57]. Climate change is threatening global life expectancy in both developing and developed countries.

A low carbon footprint indicates a high capacity to be environmentally responsible. more importantly, this option not best contributes to a greener environment but also enhances an organization's competitive advantage [53]. Disclosure of carbon emissions is a form of corporate responsibility for the carbon emissions it causes. Carbon emissions publication consists of disclosure of overall power utilization and quantification of renewable power

utilization. This offers vast blessings for environmental and ecological sustainability and guarantees the survival of contemporary and future generations. Companies that reveal carbon emissions assist stakeholders to make selections about the fame of carbon emissions, expand techniques to reduce carbon emissions, and make a contribution to the public debate on weather protection regulations and policies [24].

Firms that are unable or unwilling to disclose their carbon emissions can affect public confidence. Disclosure of carbon emissions advantages companies as investors choose to put money into corporates that consider exact business ethics, proper worker practices, environmental effect, and social obligation to stakeholders. Carbon disclosure can help mitigate the inherent risks arising from conflict within the business community as it can help in building trust with business stakeholders. Building stakeholder trust helps improve a firm's reputation and affects its value [15].

On the other hand, [34] stated that in carbon-intensive industries, the publication of corporate emissions may improve financial performance for the quarter was low, but the increase was small and failed the significance test. This suggests that improving the grade of carbon disclosures by carbon-

concentrated corporate would have relatively little influence on financial results. The market has not responded sufficiently to high-quality carbon disclosures, and despite the public reputation for carbon management, the impact of carbon disclosures on financial performance is currently limited.

Despite massive efforts to address climate change, the planet has experienced an increase in total energy-related CO<sub>2</sub> emissions over the last 30 years, except during the 2009 financial crisis when emissions were cut by 1.3% [26]. In early 2020, the sudden coronavirus disease (COVID-19) pandemic swept the world. Due to the fact this COVID-19 outbreak in Wuhan, China, in December 2019, the virus has spread around the world, with the number one infection in Europe being stated in Italy on January 21, 2020. Most nations have responded to the spread of COVID-19 with strict containment measures, specifically social distancing, shortened business enterprise hours, and lockdowns of social existences main to a crumble of economic activity, mobility, and power intake.

The economic impact of the restrictions due to COVID-19 was felt to be greater, in the first few months of 2020, there was a sudden financial crisis in all markets in response to the emergence of the global health crisis, where the effects tended to be almost the same as the Great Depression of 1929-1933 compared to 2009 global financial crisis. Soon after the restrictions have been carried out, China's stock exchanges had been for the Lunar New Year festival. The market reopened on February 3, and the CSI300 plunged from 5,200 points to 4,800 points. Then the market recovered quickly and fluctuated around 5,000 points in late February. By March, COVID-19 had officially become a pandemic which resulted in global markets falling sharply and the CSI300 falling to another 4,600 points [11].

According to research by [51], the outbreak of COVID-19 had an enormous terrible effect on the overall performance of listed Chinese firms, lowering funding levels and reducing overall returns. According to [25] regulations on mobility and financial activity are a challenging mixture of supply and demand shocks, especially because of supply chain breaks and demand contractions. BPS statistics in 2020 prove that Indonesia's economic growth contracted from Q4-2019 to Q1-2020. According to [8], household expenditure consumption in Quarter IV-2019 was 2.71% but in Quarter I-2020 it was only 1.56%.

In the face of a pandemic like the current COVID-19, [65] revealed that firms that have environmental concerns such as green innovation and green finance, and therefore have a high level of "social capital", are more resilient in crisis because they can mitigate risks well, as [48] that firms that

pay attention to the environment can be more assured of their sustainability through established organizations and systems. Firms or types of businesses that pay attention to the environment, especially green innovation and green finance, show their strength from a macroeconomic point of view. Several governments in the world have enacted environmental policies to promote environmental innovation and decrease pollutant emissions to shield the environment [32].

In general, green innovation is needed to develop and implement corrective measures to reduce environmental damage. Its function in tackling environmental issues together with electricity safety, industrial pollution, weather exchange, and waste recycling in brand new relatively aggressive surroundings is turning into an increasing number of important for business and society. Corporations that incorporate green innovation into the strategic schedule will beautify organizational and environmental performance. However, many firms show disinterest in green innovation, even though firms are perceived to be promoting sustainability. This is due to the various side effects that characterize green innovation. First, when a company introduces a new green technology or product to the market, the relative lack of intellectual property prevents the company from winning innovation awards, undermining the motivation for further innovation. Second, there are side effects due to contaminant intrusion. This is due to an unsound marketplace-based pricing system, wherein businesses frequently overpay for pollution and waste disposal charges. Green innovation techniques are frequently costly and volatile. In other words, companies implement green innovations less than other innovations [27].

This study aims to investigate the effect of disclosure of carbon emissions, COVID-19, and green innovation on financial performance and company value. This research is a development of research [9], [12], and [13] because these three studies are very relevant to the objectives of this study, but these three studies only examine the effect of the independent variables on the dependent variable directly, there are no mediating variables. Meanwhile, the novelty of this research is to combine the variables of disclosure of carbon emissions, COVID-19, and green innovation in a single observation. This research provides three contributions. First, this contributes to adding more literature that affects environmental, financial, and firm value by disclosing carbon emissions and green innovation. This presents new insights into studies variations of opinion on the effect of environmental performance on economic overall performance. Second, this observation provides to the COVID-19 literature as an independent variable on economic performance

and firm fees, where until now COVID-19 has affected the activities of everyone around the world. Third, this research can pick out crucial issues in disclosing carbon emissions, COVID-19, and green innovation to companies that assist to reap top consequences even as maintaining the surroundings.

### **Disclosure of Carbon Emissions on Financial Performance**

With the increasing importance of environmental troubles, firms inside the international are involved with the book of environmental information, especially information on carbon emissions. Firms disclose carbon emission information because it may diminish the asymmetry of information between management and outside investors so that available resources can be allocated more efficiently. Firms that disclose accurate information about their carbon footprint can pass on non-financial information to potential investors in the future. If a firm does not disclose information about its carbon footprint, investors will see this as a negative signal that can harm the firm [30].

Furthermore, research conducted by [58], [43], and [5] revealed the same thing that disclosure of carbon emissions affects financial performance and is strengthened by the results of research by [52] which states that the effect of disclosing carbon emissions does not only exist in the short term but also the long term. From the explanation above, the first hypothesis to be tested is as follows:

H1: Disclosure of carbon emissions has a positive impact on financial performance

### **Coronavirus Disease of 19 (COVID-19) on Financial Performance**

The financial performance of the industrial sector will also be affected by the economic crisis. However, the firm's management must still strive to pay attention to the interests of stakeholders by disclosing their financial condition. According to [17], the current economic crisis will undoubtedly lead to lower sales in the industrial sector due to lower purchasing power. If income in the industrial sector decline for the duration of the economic crisis due to the COVID-19 pandemic, it will undoubtedly affect the overall financial situation of the company. During the currency crisis, the decline in people's purchasing power and the rise in interest costs led to a significant drop in net income, thus greatly reducing the company's profitability. When people's purchasing power declines, it will certainly affect sales for the company as a whole. As a company's sales decline, so does its profits if the associated operating costs cannot be minimized. This is following the research conducted by [28] which provides information that firm ROA is negatively

related to cumulative cases of COVID-19. Meanwhile, [51], [42], and [3] stated that COVID-19 had a negative effect on the firm's financial performance. [39] their research revealed that COVID-19 is detrimental to financial performance which is supported by the results of research by [16] and [21] who said that COVID-19 substantially affected financial overall performance due to the fact there's a sizable difference in financial overall performance between before and after COVID-19 took place. From the explanation above, the second hypothesis to be tested is as follows:

H2: COVID-19 has a negative influence on financial performance

### **Green Innovation on Financial Performance**

The application of green innovation tends to be carried out internally because it is one of the strategies carried out for the benefit of the firm. Green innovation methods may be a solution or can be incorporated into the manufacturing manner through enter substitution, production optimization, or output. Green innovation has a superb effect on the company's competitive advantage and sustainability. [61] said that green innovation improves current manufacturing methods or adds new methods to reduce detrimental environmental effects, thereby growing the company's environmental compliance and bringing earnings to the firm. In addition, clean technology which is an important aspect of green innovation is positively associated with financial performance.

According to [35], green innovation can affect a company's economic performance via the following approaches: (1) decreasing expenses. With the aid of converting product designs and the usage of recycled substances, raw material fees can be decreased. through growing green tactics, the price of controlling pollution at a later degree in the organization may be reduced. (2) boom revenue. Corporations can get entry to extra markets by using growing environmentally friendly products. The application of green technology can enhance the firm's image, growth the firm's beauty inside the capital marketplace, and increase company financing. That is in step with the outcomes of studies carried out through [59] and [64] stated that green innovation is undoubtedly correlated to economic performance. Furthermore, [63] and [1] discovered that green innovation has a high-quality influence on financial performance. In the meantime, [33] and [46] stated that the implementation of green innovation methods impacts competitiveness, corporate profits, and firm viability. From the explanation above, the third hypothesis to be tested is as follows:

H3: Green innovation has a positive impact on financial performance

### **Disclosure of Carbon Emissions on Firm Value**

[31] said that environmental responsibility helps firms to have a competitive advantage and attract investors. Corporations with the right company governance can use carbon emissions disclosure to feature the cost of the firm because investors take into account environmental troubles, especially carbon emissions. Investors are more attracted to environmentally responsible firms, especially in conditions of potential climate change. [40]'s research stated that the publication of carbon emissions has a high-quality impact on corporate value. [4] revealed that the positive results also indicated that the market would react in line with the transparency efforts made by the firm's management. This is also directly proportional to signal theory and legitimacy theory which explains that information can be utilized as good news so that legitimacy is obtained not only from the surrounding community but also from the market. This also supports the narrative that the agent (management) will provide relevant information to the owners (shareholders) and the general public through their annual evaluations which will reduce the prevalence of records asymmetry related to the business enterprise's sustainability. [14] revealed that the carbon emissions publication has an advantageous effect on company prices. [36] also stated that there may be a nice impact of the publication of carbon emissions on company value. From the explanation above, the fourth hypothesis to be examined is as follows:

H4: Disclosure of carbon emissions has a positive impact on firm value

### **Coronavirus Disease of 19 (COVID-19) on Firm Value**

According to [16] the pandemic disrupted the Indonesian economy until the end of the first quarter of 2020. The economic downturn caused by the pandemic will be one of the factors in the economy experiencing a recession. [55] stated that inflation recorded in 2020 fell to 1.68%, the lowest in the last seven years. This shows that there may be no money to move because of the uncertainty as a result of the pandemic. This reinforces the stigma that people choose to save cash in the bank in place of spending it, resulting in demand and supply shocks and causing a lower inflation rate. Gross Domestic Product (GDP) decreased by 2.07% in 2020, whereas in 2019 GDP was at 5.02%. In 2016, 2017, and 2018, there continued to be an increase of 5.03%, 5.07%, and 5.17%. The decline in cost indicates that the economy is growing negatively.

The research of [19] offers evidence that huge terrible health shocks could have a considerable effect on companies and their outcomes range across levels. The stock market responded substantially negatively to domestic and distant places' sickness outbreaks. [9] have performed studies on the connection between the effect of COVID-19 and adjustments in firm value. By utilizing information from 4,278 corporations from 47 international locations, it concluded that firms globally have experienced a serious decline in company prices due to the COVID-19 pandemic. From the reason above, the fifth hypothesis to be examined is as follows:

H5: COVID-19 has a negative influence on the firm value

### **Green Innovation on Firm Value**

[66] stated that green innovation has helped pave the way forward and has strong political support. However, since the ultimate goal of corporations is to maximize economic profit, it is whether macro- and micro-strategies can be coordinated that makes corporations important supporters of individuals in macroeconomic development. Undoubtedly, green development can benefit the environment, but whether it can bring economic benefits to business has always been a hot debate in academia. Firms can improve their capabilities and become more competitive. While this may increase costs in the short term, this oversight will result in better business performance and boost economic development in the long term.

Meanwhile, according to [62] green innovation is a key intangible asset that influences corporate value and facilitates groups to turn their environmental sustainability goals into worthwhile funding possibilities. Financial markets assign a value to the number of a firm's assets as the prevailing discounted price of all future cash flows generated through the assets. If an intangible is predicted to affect future cash flows, its value ought to be reflected in the positioned market price of the entity. In step with this concept, if a green innovation is anticipated to affect the future cash flow of an organization's production, operations, advertising and marketing, reputation, and many others., it's going to influence economic markets while assessing its value. [18], [47] and [13] also stated that green innovation has a positive effect on firm value. From the explanation above, the sixth hypothesis to be tested is as follows:

H6: Green innovation has a positive impact on firm value

### **Financial Performance on Firm Value**

Performance is one of the elements that investors do not forget when shopping for stocks. Enhancing financial performance is critical for

groups to remain attractive to investors. The level of financial performance depends on the company's asset management, which reflects the company's operational efficiency. The better your financial performance, the more efficient your company will run. A company's profitable value gives investors and creditors a positive signal that the company is in a favorable position, inviting investors to own shares in the company. Goodwill is high because high demand for stocks causes investors to estimate the value of the stocks higher than the value reported in the goodwill. [41]'s studies indicate that economic performance has a wonderful and sizeable effect on company price. The same thing was also expressed by [45], [50], [46], and [60]. From the explanation above, the seventh hypothesis to be tested is as follows:

H7: Financial performance has a positive impact on firm value

### **Disclosure of Carbon Emissions on Firm Value Through Financial Performance**

According to [38] environmental damage around the firm can occur if the firm only prioritizes the interests of the owners of capital. Therefore, the firm's awareness and concern for the surrounding environment are needed through the carbon emissions publication. The firm through the publication of carbon emissions which is part of the firm's responsibility will be oriented to all interested parties, not only to the owners of capital, namely investors and creditors but also to employees, consumers, the community and. The image of the firm will increase with the increasing number of forms of corporate responsibility towards the environment. A good corporate image in the community will make investors more interested in investing and loyalty from consumers will be higher so that in the future the firm's sales will improve and the firm's profitability will also increase [38]. With improved profitability, the firm's overall performance might be higher which in turn will increase the value of the enterprise.

Meanwhile, [15] stated that carbon emissions have a terrible effect on company value, but not significantly. The more CO<sub>2</sub> emissions disclosed, the less valuable a company is, but the impact is not strong. The company's carbon footprint disclosure demonstrates the company's commitment to reducing global carbon emissions, with companies disclosing a range of activities to reduce carbon emissions generated. But since it takes a long term to repair the earth in this state, the company also incurs huge costs to fund the company's operational activities to reduce its carbon footprint. As a result, investors are reluctant to allocate capital to companies that disclose high carbon emissions, affecting equity

value and reducing corporate value. From the explanation above, the eighth hypothesis to be examined is as follows:

H8: Disclosure of carbon emissions has a positive impact on firm value through financial performance

### **COVID-19 on Firm Values Through Financial Performance**

Social events have become one of the main concerns for firms. It is intended to meet stakeholder expectations [37]. According to [10] the occurrence of COVID-19 can affect finances, stock market performance, and other aspects of a firm's business operations. Firms in many industries experience sudden and significant sales declines. Consequently, it makes experience to evaluate the effect of the pandemic on economic performance. However the financial effect of the regulations due to COVID-19 changed into felt even extra, in the first few months of 2020, there was a sudden financial crisis across the markets in response to the emergence of the global health crisis. According to [25] regulations on mobility and financial activity are a challenging mixture of supply and demand shocks, especially because of supply chain breaks and demand contractions. BPS statistics in 2020 confirms that Indonesia's economic growth contracted from Q4-2019 to Q1-2020. According to [8] household expenditure intake in Quarter IV-2019 was 2.71% but in Quarter I-2020 it was only 1.56%. Even though hypothesis 7 states that financial performance has a positive impact on firm value, in fact the negative impact generated by COVID-19 is far greater. This is in accordance with [51] which shows that the performance of companies experiencing financial difficulties was not significantly affected by the pandemic. Given that so many companies are already in terrible financial straits, it is not surprising that the social and economic restrictions imposed during the COVID-19 pandemic have been minimal. It can be concluded that the performance of companies experiencing financial difficulties is solely due to inadequate business practices, not due to the COVID-19 pandemic. From the explanation above, the ninth hypothesis to be tested is as follows:

H9: COVID-19 negatively affects firm value through financial performance

### **Green Innovation on Corporate Values Through Financial Performance**

[44] stated that the exercise of green innovation in organization mechanisms is a superb signal for investors. Organizations that can innovate in environmentally friendly ways can improve their

financial performance. Improving financial performance affects improving corporate value. This superior corporate value encourages investors to invest in the organization with the expectation of dividends. Financial performance, which can mediate the effect of environmental overall performance and corporate price, is pushed by using businesses with high environmental overall performance and high efficiency, which could reduce charges and increase organization profitability [44]. Companies that gain great environmental overall performance are also especially rated by the stakeholders. Firms that have terrific recognition and the right financial function will be responded to by using investors and ability buyers to increase the price of the firm.

In contrast, according to [20] green innovation does not significantly affect financial performance. Developed countries have strong institutional incentives to motivate businesses to seek certification in implementing green innovations, but the context of providing information for decision-making is ineffective corporate governance, severe information asymmetry, and weak or inadequate identifiable regulatory frameworks and law. From the explanation above, the tenth hypothesis to be tested is as follows: H10: Green innovation positively affects firm value through financial performance.

### RESEARCH METHOD

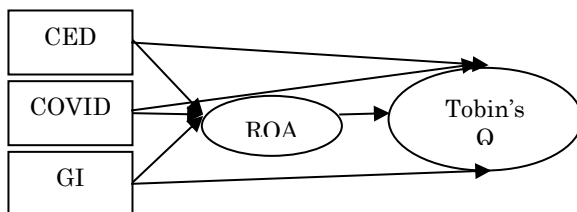


Figure 1. Research Model

This study uses a quantitative descriptive technique to try out the predetermined hypothesis. The population used in this study are non-financial sector firms listed on the IDX. The selection of non-financial firms as the population in this study is because non-financial sector firms have more direct contact and have an effect on the environment as a result of their operational activities than financial sector firms. Thus, this study decided on using a purposive sampling approach with the following criteria in Table 1.

Of the 697 firms as a population, as many as seventy-nine enterprises no longer put up annual reports and/or sustainability reports from 2015 to 2021 and as many as 570 firms did not get a gold, green, or blue rating and were not even included in the PROPER award nominations of the Ministry of

Environment and Forestry. Therefore, as many as 48 firms were selected as research samples or as many as 336 in the number of company years.

Table 1. Sampling result

Sample Criterion	Amount
Non-financial sector firms that have been listed on the IDX at least starting in 2015	697
Did not publish a complete financial/annual/sustainability report from 2015 to 2021	(79)
Did not get a gold, green, or blue rating from the Ministry of Environment and Forestry PROPER award	(570)
Total Sample Selected	48

Source: IDX (treated)

Firm value as the dependent variable in this examination has measured the usage of Tobin's Q. According to [23] through Tobin's Q, the firm is said to have succeeded in developing value if the return on investment is more than the investment cost. On the other hand, a firm is said to have failed to achieve its goal of maximizing value if the value of Tobin's Q is less than 1. Tobin's Q is used as a degree of firm cost in this look as it has the advantage of a ratio that takes into consideration all elements of debt and share capital within the firm, including all firm assets [54]. The method used to calculate Tobin's Q according to [54] is:

$$Tobin's Q = \frac{\text{market value} + \text{total debt}}{\text{total assets}}$$

The indicator of financial performance in this research uses Return on Assets (ROA) which acts as a mediating variable. [34] stated that this measure may contemplate the firm's overall financial performance, its elevated or stunted value may straightly reflect the firm's financial situation, is not influenced by extraordinary events of the firm, is objective, has universal characteristics, and is easy to understand. In addition, ROA is one of the most important financial measures of a firm's stakeholders and is easy to compare. According to [34] the ROA formula is as follows:

$$ROA = \frac{\text{net income}}{\text{total assets}}$$

One of the independent variables used is the disclosure of carbon emissions. According to [30] disclosure of carbon emissions is measured by assigning a score to each disclosure item. The maximum rating is 18 and the minimum score is 0. The value of each point disclosed is 1. Therefore, if the firm fully discloses the points in the report, the firm's score will be 18, and the score for each factor might be introduced up then divided through the

total most rating and multiplied by one hundred percent.

$$CED = \frac{\text{Total carbon emission disclosure score}}{\text{Maximum total score}} \times 100\%$$

The next independent variable used in this study is COVID-19 using a dummy variable. Where the number 0 is used to indicate the year before the COVID-19 pandemic befell and the number 1 is used to indicate the year the COVID-19 pandemic was hit. This study uses a dummy variable as a measure of COVID-19 to detect the effect of the pandemic phase on the enterprise's financial performance.

The third independent variable used in this study is green innovation. Green innovation is new or changed manufacturing strategies and processes to reduce the impact of environmental destruction, foremost to power efficiency, pollutants discount, waste recycling, and environmentally friendly format. The higher the score obtained, the better the implementation of green innovation by a firm, with a maximum score of 12 and a minimum score of 0.

$$GI = \frac{\text{Total score of green innovation}}{\text{Maximum total score}} \times 100\%$$

The data analysis technique used in this observation is path analysis with a recursive regression model. According to [6] path analysis was developed by a geneticist named Sewall Wright which is an extension of regression analysis as a way to have a look at the direct and oblique results of impartial variables at the structured variable.

Model 1:

$$ROA_{it} = \beta_0 + \beta_1 CED_{1it} + \beta_2 COVID_{2it} + \beta_3 GI_{3it}$$

Model 2:

$$Tobin's Q_{it} = \beta_0 + \beta_1 CED_{1it} + \beta_2 COVID_{2it} + \beta_3 GI_{3it} + \beta_4 ROA_{4it}$$

This research does not use control variables because it wants to test the hypothesis directly without any other factors that will affect the research results.

## RESULTS AND DISCUSSION

**Table 2.** Descriptive Statistics

	ROA	TOBIN'S Q	CED	COVID	GI
Mean	0.070	2.349	0.259	0.286	0.147
Median	0.050	1.229	0.167	0.000	0.083
Maximum	0.921	23.286	0.833	1.000	0.667
Minimum	-0.375	0.295	0.000	0.000	0.000
Std. Dev.	0.107	3.041	0.207	0.452	0.159
Observations	336	336	336	336	336
Cross sections	48	48	48	48	48

Source: E-Views 9 (treated)

ROA has an average value of 0.076 and a median of 0.050. Meanwhile, the maximum value is 0.921 and the minimum value is -0.375. While the standard deviation value is 0.107 which is greater than the average value, this means that the data is heterogeneous due to the varying distribution of data so it has a low level of deviation.

Tobin's Q has an average value of 2,349 and a median of 1,229. Meanwhile, the maximum value is 23,286 and the minimum value is 0.295. While the standard deviation value is 3.041 which is greater than the average value, this means that the data is heterogeneous due to the varying distribution of data so that it has a low level of deviation.

CED has an average value of 0.259 and a median of 0.167. Meanwhile, the maximum value is 0.833 and the minimum value is 0.000. While the standard deviation value is 0.207 which is below the average value, this indicates that the data is homogeneous due to the less varied distribution of the data.

The GI has an average value of 0.147 and a median of 0.083, this figure indicates that each sample has almost the same contribution in terms of green innovation practices. Meanwhile, the maximum value is 0.667 and the minimum value is 0.000. While the standard deviation value is 0.159 which is below the average value, this indicates that the data is homogeneous due to the less varied distribution of the data.

**Table 3.** The estimation results of the first model

	ROA	
	β	sig
c	-0.283870	0.1981
CED	0.050739	0.0674
COVID	-0.030834	0.0000
GI	0.195834	0.0000

Source: E-Views 9 (treated)

From the table above, the CED probability value of 0.0674 is greater than the 0.05 degree of error so H1 is rejected. So it can be concluded that the CED variable does not affect ROA. The COVID probability value of 0.0000 is smaller than the 0.05 degree of error so H2 is accepted. COVID also has a coefficient value of -0.030834, which means that every 1-point increase in COVID, will result in a decrease in ROA by 0.03 points. So it can be concluded that the COVID variable has a negative influence on ROA. The GI probability value of 0.0000 is smaller than the 0.05 degree of error so H3 is accepted. The GI also has a coefficient value of 0.195834, which means that every 1-point increase in GI will have an impact on an increase in ROA of 0.2 points. So it can be concluded that the GI variable has a positive effect on ROA.

**Table 4.** The estimation results of the second model

	Tobin's Q		
	$\beta$	S.E.	sig
c	-3.2425	4.745	0.4949
CED	0.2810	0.653	0.6671
COVID	-0.4554	0.157	0.0040
GI	1.5414	0.981	0.1173
ROA	8.6419	1.239	0.0000

Source: E-Views 9 (treated)

From the table and figure above, the ROA probability value of 0.0000 is smaller than the 0.05 degree of error so H7 is accepted. ROA also has a coefficient value of 8.641853, which means that every 1-point increase in ROA will have an impact on increasing Tobin's Q by 8.64 points. It can be concluded that the ROA variable has a positive effect on Tobin's Q. The probability value of CED is 0.6671, which is greater than the 0.05 degree of error, so H4 is rejected. It can be concluded that the CED variable does not affect Tobin's Q. The COVID probability value of 0.0040 is smaller than the 0.05 degree of error so H5 is accepted. COVID also has a coefficient value of -0.455361, which means that every 1-point increase in COVID will have an impact on Tobin's Q decrease by 0.46 points. So it can be concluded that the COVID variable has a negative influence on Tobin's Q. The GI probability value of 0.1173 is greater than the 0.05 degree of error so H6 is rejected. So it can be concluded that the GI variable does not affect Tobin's Q.

**Table 5.** Sobel test results

	Tobin's Q
	ROA
CED	1.775
COVID	-3.953
GI	3.945

Source: E-Views 9 (treated)

From the table of Sobel test effects above, it can be visible that the financial performance variable as proxied through ROA is not able to mediate the impact of carbon emission publication represented by CED on the firm value represented by Tobin's Q. This can be proven through the z values of 1.775 each. where these values are lower than the 5% significance level, which is 2.01669. Thus, this result states that H8 is rejected.

ROA can mediate the effect of COVID-19 represented by COVID on the value of the firm represented by Tobin's Q. This can be proven by the z-value of -3.953 each, where these values are greater than the 5% significance level of 2.01669. Thus, these results indicate that H9 is accepted.

ROA can mediate the impact of green innovation represented by GI on the value of the firm

represented by Tobin's Q. This can be proven through the z-value of 3.945, respectively, where these values are greater than the 5% significance level, which is 2.01669. Thus, these results indicate that H10 is accepted.

### Interpretations

#### 1. The Impact of Disclosure of Carbon Emissions on Financial Performance

Carbon emissions disclosure has no impact on financial performance, each of which is represented by ROA as an indicator. This means that the firm's financial performance will not be affected by the intensity of carbon emissions disclosed by the firm. The consequences of this examination contradict [2] and [56] which state that carbon emissions are correlated and have a positive effect on financial performance. Furthermore, the consequences of this examination are also inconsistent with those of [43] and [5] who revealed the same thing that disclosure of carbon emissions affects financial performance and is strengthened by the results of the research of [52] which states that the effect of disclosing carbon emissions exists in the short run as well as the long run.

[34] stated that firms have not yet received an appreciation for high-grade carbon footprint publication actions, and the influence of the publication of carbon on financial performance is currently still bounded even though firms receive high evaluations from the public on their carbon management. According to [34] improving financial performance through the publication of carbon emissions has a tiny impact. This can also show that even though firms have carried out carbon emission-intensive disclosures, they no longer at once get better financial overall performance, which means that carbon-concentrated and non-carbon-concentrated corporates also need to set good goals so that they can attract stakeholders by building low-carbon consciousness. and diminish emissions of carbon.

In addition, according to [43] firms that pay attention to the environment and publish carbon footprints are failing to develop a competitive power and catch the attention of customers and different stakeholders. The shock of this reality may diminish the firm's income. Carbon footprint disclosure may not influence corporate profits due to loss of popularity amongst stakeholders about eco-friendly conditions or loss of socialization.

According to [15] disclosure of carbon emissions by firms that reveal how much emissions are



generated and indications of committees and boards of directors who are less responsible for activities related to environmental issues so that stakeholders do not respond which is good because the firm has done great damage to nature and polluted the environment without any responsibility from the firm.

## 2. The Effect of COVID-19 on Financial Performance

[51] mentioned that the pandemic had a terrible effect on the manufacturing, operations, and income of corporations, which become ultimately pondered in negative rates of return. Regionally, local firms are experiencing a much more pronounced negative impact as strict quarantine measures restrict consumption and production, sending poor indicators to their managers and stakeholders. Financial constraints can make operations even more difficult in times of COVID-19.

[42] said this caused a panic situation in the financial markets, which resulted in a sharp decline in the price of stocks and other securities, further reducing economic activity, the chain reaction also casts doubt on the future financial performance of many firms and the industry in general. Even before the effects of the pandemic became apparent, investors reacted by selling stocks and other financial securities.

Focusing on the firm's performance, there are large fluctuations in the first and second quarters of 2020. According to [51], similar to stopping and controlling the spread of the pandemic, nations must steadily provide a guide to industries most likely to be affected by the pandemic, imparting numerous subsidies and preferential guidelines to organizations within the worst-affected areas, which will enable companies to easily thru the storm of the pandemic.

## 3. The Effect of Green Innovation on Financial Performance

The results of the analysis above show that green innovation has a significant positive effect on all financial performance indicators, namely EPS, ROA, and ROE. This means that financial performance will increase which is supported by an increase in green innovation within the firm. The results of this study are in line with [33], [63], [1], [46], [59], and [64] which state that the implementation of a green innovation strategy affects competitiveness, firm profits, and firm viability.

[64] said for firms that are highly committed to reaching sustainable aggressive benefits in modern-day dynamic surroundings,

implementing green innovations can lead to the ability of green to outperform competitors, especially in terms of financial performance. Firm resources are also an important element to gain a sustainable competitive gain. The assignment of supplies for green innovation is also critical to profitability, putting ahead greater necessities for dynamic abilities than other elements of the company. Opportunities to increase sales are more open when companies are assumed to be environmentally responsible [46]. Investments in environmental remediation put additional strain on company sustainability and society in the short term while improving financial performance.

According to [59] a firm can be said to have continuous innovation and superior performance when profits in a period continue. Green innovation cannot handiest build a good green image of the enterprise and improve the recognition of the agency, but also maximize the profit of the organization, so organizations need to actively improve the performance of green innovation. Green innovations have a greater impact on financial performance than non-green innovations.

## 4. The Effect of Disclosure of Carbon Emissions on Firm Value

Based on the results of the analysis using Tobin's Q as an indicator of firm value, the publication of carbon footprints does not influence at all on firm value. This shows that the high or low intensity of the disclosure of carbon emissions can not make a significant change in the value of the firm. The results of this study are not consistent with [4], [14], and [36] which reveal that the publication of carbon footprints has a positive influence on corporate value, where the positive results also indicate that the market will react in line with the transparency efforts made by the firm's management. The difference in the results of this study with [4], [14], and [36] is largely due to the use of analytical methods and research objects. According to [12] companies are under stress from diverse stakeholders, along with traders, monetary risk managers, and the majority, to a degree, divulge, reveal and control the carbon emissions they produce. The carbon footprint has emerged as a vital issue in analyzing a company's chance profile because of capability liabilities and contingency expenses together with fines, penalties, and litigation. different capacity carbon-associated fees encompass capital fees as a consequence of environmental initiatives inclusive of the value of acquiring or developing technology and methods that reduce

carbon depth, research and improvement costs for items and offerings related to low carbon emissions, and costs of other corporate initiatives.

According to [15], the company's carbon footprint disclosure demonstrates its commitment to reducing global carbon emissions. The company publishes diverse activities to reduce its CO<sub>2</sub> emissions produced. But since it would take a long time to repair the earth in this state, the company also incurs enormous costs to fund the company's operational activities to reduce its carbon footprint. As a result, investors are reluctant to allocate capital to companies that disclose high carbon emissions, affecting equity value and reducing corporate value.

#### 5. The Effect of COVID-19 on Firm Value

Based on the results of the analysis by including ROA as a financial variable, it can be seen that COVID-19 has a negative influence on firm value. This means that the COVID-19 outbreak has reduced the value of the firm. The results of this study are following research by [7], [9], and [19] who reported that almost all industries experienced a significant decline in revenue and stock prices during the COVID-19 period. The average cumulative abnormal return value from the industry is negative and significant, indicating a significant influence of COVID-19. In addition, a large bad health shock can have a giant effect on a company, and its outcomes range throughout levels. The stock marketplace spoke back extensively negatively to domestic and remote places ailment outbreaks.

#### 6. The Effect of Green Innovation on Firm Value

From the results of the analysis by including ROA as a financial performance variable, it can be visible that green innovation has no impact on firm value. This means that no matter how good the implementation of innovation practices by a firm is, it will not mean anything to the high or low value of the firm. The consequences of this examination are not in line with [18], [47], and [13] which state that green innovation has a positive effect on firm value. The difference in the results of this study with [18], [47], and [13] is caused by the use of analytical methods, variables, and research objects. According to [27] many firms show disinterest in green innovation, even though firms are considered to be promoting sustainability. This is due to the various side effects that characterize green innovation. First, when a corporate launches a brand new green era or product, the relative lack of highbrow assets safety prevents the company from triumphing in innovation

awards and weakens its motivation to create further innovations. Second, there are side effects due to the entry of pollutants. This is due to a dangerous market-based pricing device, firms regularly pay more than budgeted for pollutant and waste disposal costs. Green innovation techniques are regularly steeply-priced and unstable, which means that firms implement green innovations less than other innovations [27].

In addition, firms in developing countries have different cultural and socio-political aspects from firms in developing countries that have a higher focus on green innovation and research on green innovation than in developing countries [22]. [20] stated that because of the dearth of sturdy environmental laws that offer little incentive to innovate environmentally, corporations that innovate do not often prioritize green innovation, as a loss of institutional help makes it tough to publicize the achievements that companies need to fill the distance among the resources and talents had to undertake powerful green innovations.

#### 7. The Effect of Financial Performance on Firm Value

ROA suggests a nice effect on firm price. this is, when ROA will increase, the value of the firm may also grow. Therefore, [49] stated that maximum resource management can increase the value of the firm which will then increase corporate profits while increasing company value and generating shareholder returns. According to [44] corporate value can typically be motivated by utilizing financial elements. These elements can imply how a business enterprise gets a price range. Financial elements can suggest how a business enterprise receives finances, how the enterprise allocates those funds, and how the company can use those funds to make a profit. Financial performance represents a company's performance achieved over a period of time. If a company's financial prospects are good, its shares will become more sought after by many investors, which could affect the sale price of the shares. [45] said that increased financial performance can prosper investors so that investors will evaluate the firm well and will invest in the firm so that the value of the firm will increase. Meanwhile, firms that have declining financial performance will not be able to attract investors to invest because the firm is considered not to be able to prosper the investors so the value of the firm will also decrease. The same thing was conveyed by [50] and [60].

8. Disclosure of carbon emissions affects firm value through financial performance

Based on the direct test that has been done previously, it can be seen that the carbon emissions publication does not influence the value of the firm. This suggests that investors do not respond to the disclosure of carbon emissions at once to the value of the company. Consistent with that, from the table of Sobel test consequences above, it can be visible that the disclosure of carbon emissions does not affect the price of the firm through financial performance. This indicates that investors do not respond to the disclosure of carbon emissions on the price of the company as visible through financial performance. Therefore, there may be no massive exchange in the value of the firm even though the company has voluntarily disclosed carbon emissions as a consequence of its operational activities. Indirectly, investors do not pay attention to firms that contribute to the increase in carbon emissions. This result is not in line with [38] which states that environmental damage around the firm can occur if the firm only prioritizes the interests of capital owners. Therefore, the firm's awareness and concern for the surrounding environment are needed through the disclosure of carbon emissions. The firm through disclosure of carbon emissions which is part of the firm's responsibility will be oriented to all interested parties, not only to the owners of capital, namely investors and creditors but also to employees, consumers, the community and. The image of the firm will increase with the increasing number of forms of corporate responsibility towards the environment. A good corporate image in the community will make investors more interested in investing and loyalty from consumers will be higher so that in the future the firm's sales will improve and the firm's profitability will also increase.

9. COVID-19 affects firm value through financial performance

Based on direct tests that have been carried out previously, it can be recognized that COVID-19 has a bad impact on company value. This indicates that investors are responding to the continued COVID-19 pandemic and its effect on company value. In line with that, from the table of Sobel test results above, it could be known that COVID-19 has a poor impact on company value via financial overall performance. This suggests that investors have responded to the pandemic that has befallen up to now, which is indicated by the aid of the decline in company value through economic performance. COVID-

19, which has swept across the world, has caused a significant shock to financial performance as a result of all forms of restrictions and led to a decline in corporate value.

These results are in line with the research of [10] who reported that the occurrence of COVID-19 can affect finances, stock market performance, and other aspects of a firm's business operations. Firms in many industries experience sudden and significant sales declines. Consequently, it makes experience to assess the effect of the pandemic on financial performance and firm value. But the economic impact of the restrictions due to COVID-19 was felt even greater, in the first few months of 2020, there was a sudden financial crisis across the markets in response to the emergence of the global health crisis. These results also show that social issues have become one of the main concerns for firms in conveying information to stakeholders [37]. [25] add that regulations on mobility and financial activity are a challenging mixture of supply and demand shocks, especially because of supply chain breaks and demand contractions. BPS statistics in 2020 prove that Indonesia's economic growth contracted from Q4-2019 to Q1-2020. According to [8] household expenditure consumption in Quarter IV-2019 was 2.71% but in Quarter I-2020 it was only 1.56%.

10. Green innovation affects firm value through financial performance

Based on the direct test that has been done previously, it could be recognized that green innovation has no impact on firm price. This suggests that investors do not respond to green innovation without delay at the value of the company. However, primarily based on the table of Sobel check effects above, it could be recognized that green innovation has a positive impact on firm value through financial overall performance. This suggests that investors respond well to environmentally pleasant improvements done via the company. The green innovation which is performed internally by way of the company can enhance financial performance and result in a boom in firm value. Indirectly, investors pay attention to firms that contribute to environmental sustainability through the firm's financial performance.

This result is in accordance with research by [44] which states that the application of green innovation in enterprise mechanisms is a great signal for investors. Companies that can innovate in environmentally friendly ways can improve their economic performance. Improving financial performance affects improving

corporate value. This advanced corporate value encourages investors to invest within the business enterprise with the expectancy of dividends. financial overall performance, which could mediate the impact of environmental performance and company price, is driven by using businesses with high environmental performance and excessive efficiency, which can reduce charges and increase enterprise profitability [44]. Companies that reap exceptional environmental overall performance are also quite rated by way of their stakeholders. An organization with an amazing reputation and economic status might be well obtained by traders and potential investors, growing the price of the business enterprise.

### CONCLUSION

This study cannot confirm that the carbon footprint publication influences financial performance, but can confirm that COVID-19 has a negative effect on financial performance and green innovation has a positive effect on financial performance. In addition, this study states that the disclosure of carbon emissions and green innovation can not affect the value of the firm. However, this study can confirm that COVID-19 has a negative effect on firm value. Furthermore, the disclosure of carbon emissions does not affect the value of the firm through financial performance. However, COVID-19 has a negative effect on firm value through financial performance and green innovation has a positive effect on firm value through financial performance.

### Implications of Research Results

Increase low carbon awareness publications. Low carbon awareness needs to be explained first because it only needs to be explained by setting up a low carbon consciousness that may take action to diminish emissions of carbon. Improving legislation on carbon disclosure and green innovation. Legal guidelines and regulations are the premises for companies to control their action. In the absence of sound legal guidelines and regulations, companies often chase short-run profits at the cost of the environment, causing weighty harm to the environment in the future. Governments should also independently disclose carbon information, meet or exceed emissions reduction targets, and increase rewards or incentives for companies that implement green information.

In terms of tackling COVID-19, the government needs to consider the sustainability performance of firms when making choices approximately

firm regulatory regulations or launching an excellent stimulus package to enhance the financial system inside the publish-pandemic length. The government can make policies to provide benefits for firms that contribute and collaborate in handling COVID-19.

### Limitations of Research Results

This research is limited to the availability of data on the disclosure of carbon emissions and green innovation because in Indonesia it is still voluntary, so there are firms that are too little in disclosure. This study also does not separate the sample for firms that disclose carbon emissions, implement green innovation, and have fairly healthy financial performance. Finally, for COVID-19 data, this study uses a dummy variable because it is to see the magnitude of the impact of the pandemic and has not used data on infections and deaths due to COVID-19.

### Suggestions for Further Researchers

Future research is expected to be able to develop a newer and broader checklist of items on carbon emission disclosure and green innovation. Further research can use other econometric-based analysis methods such as the Vector Error Correction Model (VECM) and Vector Autoregression (VAR) so that they can see the short-term, long-term, and shock effects of carbon emission disclosure, implementation of green innovation and COVID-19 on financial performance and firm value.

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