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DO REDUCING CARBON EMISSIONS LEAD TO SIGNIFICANT IMPACT? GREEN ECONOMY VS ECONOMIC GROWTH

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A B S T R A K

Sejak diperkenalkannya kebijakan inovasi ramah lingkungan, pertumbuhan ekonomi diharapkan selaras dengan lingkungan hijau. Pengurangan emisi karbon menjadi cara yang dianggap mampu memenuhi harapan tersebut. Penelitian ini bertujuan untuk memastikan bahwa pengurangan emisi karbon dapat berdampak secara signifikan terhadap ekonomi hijau dan pertumbuhan ekonomi, dengan menggunakan anlisis regresi linear berganda. Dari hasil penelitian ditemukan bahwa pengurangan emisi karbon tidak memberikan dampak yang signifikan terhadap ekonomi hijau. Untuk penelitian mengenai pengurangan emisi karbon terhadap pertumbuhan ekonomi, ditemukan bahwa pengurangan emisi karbon tidak memberikan dampak terhadap pertumbuhan ekonomi. Hasil pengujian kemampuan pengurangan emisi karbon untuk meningkatkan ekonomi hijau dan pertumbuhan ekonomi dalam penelitian ini belum sesuai dengan hasil yang diharapkan, bahwa pengurangan emisi karbon memberikan dampak yang signifikan terhadap ekonomi hijau dan pertumbuhan ekonomi. Saran untuk berinvestasi lebih banyak pada produk ekonomi yang melindungi lingkungan dari degradasi.

A B S T R A C T

Since the introduction of green innovation policies, economic growth has been expected to align with a green environment. Reducing carbon emissions become a method considered capable of meeting this expectations. The research purpose to ensures that reducing carbon emissions can have an significant impact to green economy and economic growth, using multiple linear regression analysis. From the research results, it was found that reducing carbon emissions have no significant impact to lead green economy. For examines reducing carbon emissions to economic growth, it was found that reducing carbon emissions have no impact to ecocnomic growth. The result of examine the ability of reducing carbon emissions to lead green economy and economic growth in this research not match the expected result, that there has significant impact between reducing carbon emissions to lead green economy and economic growth. Reccomendation to invest more in economy products that protect the environment from degradation.

Introduction

Currently, one of the most severe global problems is climate change and its significant negative consequences for the environment. Extreme climate change in recent decades has been triggered by one of the main factors being the high level of energy consumption. Climate change as an environmental problem is a main issue in relation to economic growth. The aim of government to improving public welfare that must be achieved, while maintaining environmental sustainability, which is also crucial. Therefore, a mechanism is needed to address these issues. Reducing carbon emissions has become a leading issue as the awareness the significance of an economic growth related to the provision financial services aimed at activities that revitalize the environment and optimize resource utilization. This includes support for sustainable energy, safe and clean energy, eco-emollient conveyance and also green building project (Shan *et al.*, 2018). The purpose is to reduce pollution, conserve natural resources, and promote sustainable development. Economies has achieved remarkable progress, and rapid growth which is usually driven by a large amount of fossil energy consumption, and the excessive consumption of coal and oil often which produce massive amounts of carbon emissions. According to Hao *et al.*, (2021), green growth is a conceptual framework of sustainable economic growth, with the purpose to achieving coordinated socio-economic development, improving people's welfare, increasing

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employment, and effectively solving the problems of resource allocation and environmental degradation by changing consumption and production patterns.

Reducing carbon emissions is important for developing economies, because it can helps in address environmental and also development issues. Green economy will help countries in addressing the economic problems related to climate change. Data shows that country experience significant losses due to climate changes. Green economy would help governments in addressing climate changes issues which leading to improved performance for economy in developing countries. Countries that have adopted green economy have successfully reduced operating costs during climate changes. To achieve climate resilience and sustainable green environmental objectives, governments must strategically use green economy to enhance macro-economic stability. Integration of green economy may transform investment plans, and alleviate financial constraints on green innovation projects. Green economy may inhibit the financing activities of for economic products that are detrimental to the environment, thus positively impacting a sustainable economic growth. Therefore, prioritizing the reallocation of renewable energy resources is essential to shift existing energy consumption patterns reliant on fossil.

Green economy is the extension of energy conservation to reduce carbon emission. It represent an inevitable choice for achieving energy conservation and environmental protect. Besides considering benefits and risk factors in the decision-making process, it also entirely considers environmental issues. In recent years, most developing countries have focused solely on economic growth, while neglecting environmental sustainability. Consequently, various environmental issues occur, such as air pollution, climate change, land loss, biodiversity loss, deforestation, environmental degradation. Recently, governments in developing countries have raised awareness about environmental conservation, action against climate change. Effective implementation of a green economy is a significant impact for economic growth and environmental sustainability in developing countries. Therefore, to ensure sustainable and equitable economy, awareness of environmental issues must be essential and to achieve target net-zero carbon emission in 2060, it is critical that government more involved in green innovation. Thus, it is important to investigate that green economy policies is working to promote green innovation.

To exploring the linkage between economic growth and reducing carbon emissions has major implications in green economy. Recognize that 70% of carbon emissions are generated by the use of fossil energy, implementation of green economy has practical significance in achieving the net-zero carbon targets. More importantly any mechanism that can reduces reliance on fossil fuels will support the ecological and environmental sustainability. The research on the impact of reducing carbon emissions to green economy can be traced to the discussion of the causal relationship between economic growth and carbon emissions, some research confirm that rapid economic growth has a significant impact on carbon emissions, such as the results of research by Acheampong (2018) and Wang *et al.* (2018).

Literatur Review

Carbon Emissions

Carbon emissions refer to the release of carbon dioxide (CO2) and other greenhouse gases into the atmosphere, primarily from the burning of fossil fuels like coal, oil, and natural gas. These emissions contribute to climate change by trapping heat and warming the planet, leading to various environmental and societal impacts. Based on previous research found that the increasing consciousness of carbon reduction, can elucidate the factors contributing to carbon emissions. Over the last decade, firms has faced heightened carbon emissions, inadequate governmental restrictions, and escalating fossil fuel consumption rates, which have become main challenge for government in maintaining sustainable

development and stability of economy growth. Examining the differences in elasticities reducing carbon emissions with implementing green economy may provide insights into the link between sustainability performance and environmental change. It will revealed the government ability to increase carbon emissions reductions which will have an impact to improving the green economy and economic growth.

The high level of risk and uncertainty caused by the impact factors of climate change and huge financing, makes it difficult to maintain green economy products in the long term, but through the apropriate implementation of a green economy can expand the green innovation financing to address climate change issues and promote green economic innovations to reduce carbon emissions. Liu *et al.* (2020) believe that energy consumption structures can be optimized through investments in a green economy, thereby reducing carbon emissions. Since fossil fuels such as coal and oil produce more carbon dioxide than clean energy and fossil fuels. Ran *et al.* (2023) argue that the upgrading of industrial structures is an important channels for achieving green economy through its carbon emission reduction effect. Green products can limit the approval of projects and industrial capital acquisitions that can damage and endanger the environment, and force industries to undertake green transformation, resulting in more technology-intensive and knowledge-intensive industries.

The impact of reducing carbon emissions to improve the development of green economy and economic grwoth deserves in-depth evaluation; this is particularly useful for identifying and assessing the effective reducing carbon emissions. In addition, with the rapid climate change, exploring the role of reducing the carbon emissions to improving green economy and economic growth is crucial for seeking for the specific influence reducing carbon emission on the impact of green economic growth.

Green Economy

Green economy is a development that seeks to linkage economic growth and ensuring environmental sustainability by making resources more efficient, cleaner, and resilient. It focuses on decoupling economic progress from negative environmental impacts, such as resource depletion, pollution, and climate change, by fostering innovation and investment in areas that support both economic and ecological well-being. Green economy have a purpose to create a linkage model of economic prosperity and green environment hand in hand, recognizing that a healthy environment is a fundamental component of sustainable economic prosperity and green enviromental and ecological success.

A green economy must avoid projects that detrimental and damage the ecosystem, and increase investment in green projects in the field of eco-friendly energy. Chen *et al.* (2016), stated that green economy can encourage the concept of green products, build investor network and encourage investors to invest more in green projects. Tabrizian (2019) argues the reasons for the slow diffusion of renewable energy technologies in emerging countries through the innovation of ecological that accounts for the socioeconomic factors that shape the capability for innovation in each country. Environmental problems cannot be solved through economic growth, and efforts to achieve green growth are depicted as being in conflict with optimizing economic growth. To encourage economic growth and a green economy, the use of ecological technology has the potential to be an effective method for reducing carbon emissions significantly (Khan & Ulucak, 2020). Therefore, the government must understand under what conditions green growth can encourage economic growth.

Green economy can contributing to public welfare by increasing the understanding of benefit of green products, public should be to pushed using green products that devoid of any substances that contribute to environmental damage. Government can find a way to grow economy and at the same time mitigate environmental damage through green economy. To achieve a net zero carbon emissions, the concept of green economy can be solutions. The green economy is the symbiotic relationship

between the socioeconomic system and the ecological improvement (Hou *et al.*, 2022). Green economy that is widely supported by the government will be able to maintain sustainable economic development. Long-term capital investment is a prerequisite to produce green product and goods (Yu *et al.*, 2021). A lack of financial resources could largely hamper investment in green technology (Andersen, 2017).

Economic Growth

Economic growth and carbon emissions have a strong and interconnected positive relationship, as economic activities such as industry, transportation, and non-renewable energy consumption generally result in increased carbon emissions, which contribute to climate change. However, this relationship is not always linear, as developed countries have demonstrated that economic growth can be achieved simultaneously with a reduced carbon footprint through clean technologies and appropriate policies. As a new method to environmental governance, green economy can decrease the risk of the economic uncertainty, maintain stable growth of the economy and linked with ecological environment and economic growth sustainability. Most research confirmed that green economy has a influence on impact of enviromental change.

Renewable energy represents an essential engine of economic growth, which directly affect people's well-being (Mendonç *et al.*, 2020). Economic activity and the rapid technology improvement give an impact the energy demand, the negative implication on people's wellfare can be managed by reducing vulnerability and promoting the right type of growth, one of the method being to reduce carbon emissions to the environment, thereby achieving the green environmental sustainability. The increase in carbon emissions is influenced by the acceleration to achieve higher economic growth and also the high consumption of non-renewable energy, this has an impact on greater environmental damage, and this has had a significant impact in the last few decades. The significant increase in energy consumption is also stimulated by changes in people's standards and lifestyle. Therefore it is very interesting to understand how the economic growth, green economy and carbon emission evolved during the last few decades and how these variables link to each other.

Increasing dependence on fossil fuel energy causes environmental pollution, and increasing carbon emissions. According to Li *et al.* (2022), energy is the backbone of an economy as it is linked to economic activities carried out by human. To achieve rapid economic growth, most emerging countries depend on non-renewable energy sources even though the source are limited in quantity and cannot be replaced once used, including fossil fuels such as oil, coal and natural gas (Hanif *et al.*, 2019). A lot of carbon emission produces from the use of non-renewable energy produces which causes the greenhouse effect, hydrocarbon and sulfur gases which are the main cause of acidification. Climate change causing many natural disasters, and threatening the lives, due to the excessive use of non-renewable energy. For those reasons, renewable energy is essential to develop, because it cannot be exhausted that also known as green energy. Green production methods and technologies must be improved to reduce and control the amount of pollutant produced during the production process. As technology advances and the economy grows, green product is also growing. The government must develop an environmentally green and clean economic concepts, as well as improve or convert any economic product that causes pollution or use too much energy. To reduce the amount of carbon emission produced, governments should consider expanding the functionality and reuse of green energy to improving the economy.

The plays role of the government as a regulator of capital the policy in green economy growth policies, and become the effective driving of energy transition and environmental improvement. According to Tran (2021), the goverment has responsibility to provide protection for ecosystem, as a basic policy for preserving the environment, considers potential environmental effects in the investment

and financing process for economic projects or products, and actively provides financial services related to clean energy, green buildings, and green transportation. Furthermore, green economy pays attention to the protecting of ecological environment, and reducing its impact by shifting limited resources of economy and society from high polluting areas to low-energy area.

Conceptual Framework

In accordance with the research title of this article, the conceptual framework that is the basis for examining the variables used in the research, as follows

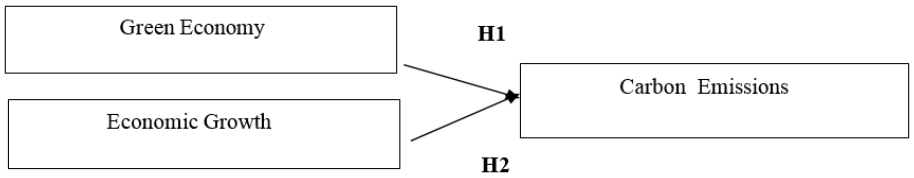

Figure 1. Conceptual Framework
Sources: Author's Document.

Hypothesis Development

Accelerating Reducing Carbon Emission Can Impact Green Economy

The transformation process of to build a green economy aims to ensure sustainable development and improves people's living standards, while reducing greenhouse gas emissions and enhancing the ability to adapt to climate change (Aneja *et al.*, 2023). The green economy serves as a drive for green environment, encouraging eco-friendly products and goods, and reducing pollution by substituting high-energy machinery with energy-efficient alternatives. Reducing carbon emissions will have an impact to improving the green economy.

H_1: Accelerating reducing carbon emission can impact green economy.

Accelerating Reducing Carbon Emissions Can Help Increase Economic Growth

Carbon releases significantly impact contemporary global environmental challenges. Consequently, it is essential to explore innovative strategies for enhancing energy efficacy to mitigate environmental harm while concurrently facilitating instant economic expansion (Wang *et al.*, 2019). Ferrat *et al.* (2022), assert that the quality of environment improves due to advancements in energy technology. Government need to contemplate augmenting expenditure, particularly in the energy sector, to stimulate technological innovation and subsequently reduce carbon emissions. Some of the research find that increasing of economic growth has no impact on the reducing carbon emissions. To accurately understand the relationship between carbon emissions and economic growth, an indicator is required that reflects the relationship.

H_2: Accelerating reducing carbon emission can help increase economic growth.

Method

The concept of green economy is a concept of comprehensive coordination and sustainable development between economy, society, ecological environment, and natural resources. Xu *et al.* (2021), assert that to accelerate the development of the economic growth and environment, governments will issue relevant policies and regulations regarding carbon emission reduction and green economic innovation to create a environmental sustainability for green growth, meanwhile Dong *et al.* (2021), stated that government will allocate funds to protect enviroment by developing research and development of green economy innovation, creating a base for technological expansion and innovation.

On the other hand, the government will actively effort to the purpose of achieving carbon neutrality by eliminating outdated capacities and accelerating corporate transformation and technological innovation. These measures play a essential role in reducing the green-house effect to create a green economic environment.

To examine the impact of carbon emissions to green economy and economy growth, this research uses a multiple regression linear, with carbon emissions as the independent variables, meanwhile green economy and economic growth as the dependent variable, which increases the accuracy of assessing the relationship between carbon emissions and green economy, also between carbon emissions and economy growth. The specific estimated model is presented in the following equation:

$GEI = \alpha + \beta 1\ CO21 + e$

$EG = \alpha + \beta 1 CO21 + e$

CO2 = Carbon Emissions
GEI = Green Economy Index
EG = Economic Growth
α = constant
β1 = coefficient regression
e = error term

The data used in this research were obtained from the various data from 2017-2020, based on the variables that used as an research sampled. The reason for using data of the year of 2017- 2020, because the data used as variables for this research was complete during that time period.

Table 1. Data Variable

Variable	2017	2018	2019	2020
CO_2	29.000	40,000	54,800	64,400
GEI	57.13	57.79	56.04	59.17
EG	5.07%	5.17%	5.02%	(2.07%)

Source: Statistics Indonesia (Biro Pusat Statistik), Green Growth Index

Results and Discussion

The result of the analysis using descriptive statistical to examining the entire total sample used, the results show that the average of reduction of carbon emissions for period of 2017-2020 is 47050 tons, while examining for green economy index, obtained the average result is 57.5325, and the test average results for the economy growth is 0.032975 or 3.2975% see table 2 below:

Table 2. Descriptive Statistic Test

Statistics	Mean	Std Deviation	Minimum	Maximum
CO_2	47050.0000	15669.39693	29.0000	64400.0000
GEI	57.5325	1.30860	56.0400	59.1700
EG	0.032975	0.357888	(0.020700)	0.051700

Description : CO_2 = Carbon Emissions, GEI = Green Economy Index, EG = Economic Growth.

Data seen in table 3 below, it shown that there is positive, but has no significant correlation at α = 5% between reducing carbon emissions to green economy, this is indicated by the Pearson r value of 0.362. Based on the results of the analysis using Sig (2-tailed), it can also be concluded that reducing of carbon emission has impact to improving green economy, but not significant which is indicated by Sig. (2-tailed) of 0,638, meanwhile for the correlation between reducing of carbon emissions to economy

growth, it can also be concluded that there is negative, and has no significant correlation, this is shown by the Pearson r value of -0.743 and Sig. (2-tailed) is 0.257, it is mean that reducing of carbon emissions can not lead to the significant impact on theconomy growth, and it also be conclude that reducing carbon emission not linkage with economy growth. This indicates that the reducing carbon emissions program has not an impact to economy growth.

Table. 3 Pearson Coefficient Correlation Test

	Carbon Emissions	Green Economy	Economy Growth
Carbon Emissions	1.000	0.362	-0.743
		(0.638)	(0.257)
Green Economy	0.362	1.000	-0.825
Sig. (2-tailed)	(0.638)		(0.175)
Economic Growth	-0.743	-0.825	1.000
Sig. (2-tailed)	(0.257)	(0.175)	

Significant correlation at the α = 5 % (2-*tailed*)
Number in parentheses indicates *p-value*

From the results of that conducted for the type of partial significance testing (t-test and f- test) to examines the effect of reducing carbon emission to green economy and economy growth, using linear regression contained in table 4, it can be concluded that based on the results of the t- test of CO2-GEI at α = 5%, this can be seen from the insignificant probability for reducing carbon emissions of 0.638 which is higher than 0.05 or in other words reducing carbon emissions has impact to improving the green economy, but not significant.

Meanwhile in table 5, it can be seen that for the t-test and f-test on impact of reducing carbon emissions to economy growth the same result is obtained, there has no correlation at α = 5%. This can be seen from the significance probability of the two variables is 0.257, which is higher than 0.05, in other words reducing carbon emissions does not have an impact to improving economy growth at all.

Table. 4 Carbon Emissions-Green Economy

	Expected Sign	Unstandardized Coefficient	t	Sig.
		B		
(Constant)		-202615.589	-0.446	< 0.005
CO_2	+	4339.557	0.550	0.638
Adjusted R-squared	-0.303			
F-statistic	0.302			

Carbon Emissions-Green Economy
significant at the α = 5%

Table. 5 Carbon Emissions-Ecomomic Growth

	Expected Sign	Unstandardized Coefficient	t	Sig.
		B		
(Constant)		57774.599	6.160	< 0.005
CO_2	+	-325234.238.	-1.569	0.257
Adjusted R-squared	0.328			
F-statistic	2.462			

Carbon Emissions=Economic Growth
signficant at the α = 5%

The results of this research provide the different results as some of the previous research for the relationship between reducing carbon emissions to green economy and economy growth, that reducing carbon emissions will have a significant effect in improving the green economy and also economy growth, this can be illustrated through the increasing of green economy index and also the increasing of economy growth. The result of this research show that there is positive, but not significant correlation between reducing carbon emissions in improving green economy, it can be concluded that this research not meet the expectation, that there is impact between reducing carbon emissions in improving the green economy, but not significant.

According to Solaymani (2020), emphasized that the impact of the carbon emission on green economy shows carbon emissions are increasing rapidly, but it is not moving toward the green economy situations. Urge-Vorsatz *et al.* (2016), identifies a few key challenges to the evaluation of the co-impacts of low-carbon emission on green economy, demonstrates that these are more complex for co-impacts than for the direct ones. Other research by Peng *et al.* (2023), states that the green economy's effect on carbon emissions demonstrated significant spatial differentiation. For the examines of reducing carbon emissions to economy growth, it was found that there is no relationship between reducing carbon emissions economic growtg found that reducing carbon emissions has no impact on economic growth. Abbasi *et al.* (2021), conclude in their research that carbon emissions have a positive impact to economic growth, but different result were found by Gyimah *et al.* (2023), who assert that economic growth has no relevant effect on carbon emissions. From the reasons above, examining the impact of reducing carbon emissions on the green economy and economic growth, it is concluded that the government must have the ability to increase the green economy and economic growth, in an appropriate and rapid method.

Conclusion

Conclusion of this research, it was found that reducing carbon emissions is increasing every year, but it was also found that there's no linkage the reducing carbon emissions to improving the green economy and also economic growth, because from the results of tests using quantitative methods carried out on data variables it turns out that it cannot describe the relationship between the variables researched, or it can be concluded that reducing carbon emissions has not an impact to increasing the green economy and economic growth. This is also shown from the results of statistical examining of this research which found that the reducing carbon emissions has positive correlation but, no effect on the green economy, and for economic growth, found it was no relationship.

The results of this research not match the expected results, and also have the different results with some previous researchs that used the same data variables. These discrepancy are caused by the period of the data variables used in this research not same with other research in same topic. Another cause is the existence internal or external factors that are very influential in a research which takes a topic about something that has an impact on the general public, such as the macroeconomic situation, global issues, and geopolitical problems which indirectly influence the results of this research. For these reasons, the results obtained cannot be applied generally.

The government's target to achieve a green economy index of 90.65% by 2045, and also the net-zero carbon emissions target by 2060 requires stronger efforts from the government. If you look at the results of the research and analysis by reviewing the achievement targets, it is found that the figures to be achieved are still very small and also fluctuating, such as the reduction in carbon emissions in the research year period on average was only around 54 thousand tons per year or approximately 8% of the total carbon emissions produced per year. year, and the average green economy index is 57.76%. Data

for 2023, Indonesia's green economy index is 58.36%, compared to 2020 there was a decrease of 0.81 or around 1.37%, seeing this is certainly an important note, thus the government can prioritize and focus on achieving the targets that have been determined through collaboration with foreign and domestic parties.

Following the results of this research, recommendations that can be given to the government in order to achieve equality of public welfare that aligned with a green environment, the government must pay attention to several factors, such as the huge cost that must be incurred to finance that, Especially with the current extreme climate change which makes the risk of achieving the alignment more greater. Most research indicates that the most efficient method for establishing an economy of carbon-neutral is to promote the advancement of carbon-neutral reserves. Falcone *et al*. (2021) argued that emerging economies had great potential and advantages in sustainable development and green economy, but they still needed to strengthen policy support, technological innovation, and international cooperation.

Therefore, through collaboration with various parties, it is necessary to develop a green system or technology that can detect and mitigate extreme climate changes, as well as their impact to the environment, thus more effective and efficient methods can be found to generates economic products that do not damage the environment and are eco-friendly, can also improve people's welfare, but can also reduce risk factors that may arise in each economic products that generates, thus green ecological sustainability can be achieved, as well as increasing the ability and willingness of industry and society to have global competitiveness, and encourage them to participate in environmental greening programs.

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