Society, 11 (2), 697-714, 2023
P-ISSN: 2338-6932 | E-ISSN: 2597-4874
https://society.fisip.ubb.ac.id

Alternative Strategies for Economic Sustainability and Increased Environmental Protection in Indonesia Incorporate the Green Growth Framework and Financial Deepening

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ARTICLE INFO

Publication Info:
Research Article

How to cite:
Diartho, H. (2023). Alternative Strategies for Economic Sustainability and Increased Environmental Protection in Indonesia Incorporate the Green Growth Framework and Financial Deepening. Society, 11(2), 697-714.

DOI: *10.33019/society.v11i2.566*

Received: June 6, 2023;
Accepted: December 30, 2023;
Published: December 31, 2023;

ABSTRACT

The Indonesian government strives to achieve environmental sustainability and economic growth as integral components of its development strategy. Two perspectives are applied to evaluate whether Indonesia's economic growth adversely impacts environmental preservation: the Business as Usual approach and the Green Growth framework. This study examines Indonesia's financial commitment to green growth, which is being implemented nationwide. Employing a quantitative research approach, this study analyzes the Green Growth Framework (GGF) concerning Financial Deepening and its impact on Sustainable Development Goals from 1973 to 2014. Methodologies include the Error Correction Model (ECM) and Vector Auto Regression (VAR). The research explores the dynamics between Indonesia's economic growth and the implementation of the GGF, highlighting how various indicators within the GGF demonstrate both immediate and long-term relationships with the framework. The analysis provides insights into the extent of Indonesia's progress in integrating green growth principles within its financial and economic systems. The ECM and VAR methodologies reveal the short-term fluctuations and long-term trends, respectively, offering a comprehensive understanding of the interplay between economic policies and environmental sustainability. Results indicate that implementing the GGF significantly impacts financial deepening, influencing sustainable development outcomes. The findings suggest that while there is a strong connection between economic growth and environmental preservation initiatives, continuous efforts and policy adjustments are necessary to ensure the long-term success of green growth strategies. This study contributes to

the broader discourse on sustainable development by presenting empirical evidence from Indonesia, serving as a potential model for other developing nations aiming to balance economic expansion with environmental stewardship. The research underscores the importance of adopting a green growth framework to achieve sustainable development goals, providing valuable implications for policymakers and stakeholders.

Keywords: *Development Strategy; Financial Deepening; Green Growth Framework; Sustainable Development Goal*

1. Introduction

The concept of sustainable development has gained a lot of support as one that can be expected to help solve the issues associated with environmental crises like global warming and climate change, even though at first it was questioned as a concept that had more to do with politics. Acknowledging that environmental protection becomes a priority in Sustainable Development Goals (Rizki & Hartanti, 2021). Its creation solely responds to the ongoing environmental discussion (Cole, 2000; De Bruyn, 2012). Environmental protection has been included in every economic strategy to date. The four pillars of Indonesia's development policy since the Susilo Bambang Yudhoyono administration are pro-growth, pro-jobs, and pro-environment. The Indonesian government strives for environmental sustainability and economic growth as part of this development strategy (Saepudin et al., 2022). Kuznets developed a parallel between income disparity and the economy's relationship to environmental and economic degradation in 1955 (Özokcu & Özdemir, 2017; Roy Chowdhury & Moran, 2012; Stern, 2017).

Economic growth is the main indicator to assess economic development's efficacy in the neoclassical economic theory school. Economic growth is the method to expand production capacity in a frame of increasing national income/wage (Runtunuwu & Kotib, 2021). Pursuing economic growth necessitates exploiting natural resources and aims to achieve the anticipated growth targets. The Green Economy, which is anticipated to be a new economic paradigm, is one strategy that can be employed to accomplish economic growth while also paying attention to protecting natural resources (Djajadiningrat et al., 2012). If Indonesia's growing economy is accompanied by a rise in energy consumption, particularly energy derived from fossil fuels, this suggests that economic growth has accelerated environmental degradation. A study revealed that using fossil fuels for energy causes environmental deterioration in Indonesia (Diartho & Fardian, 2022).

Two perspectives—Business as Usual and the framework for green growth—can be used to examine whether Indonesia's economic expansion has a detrimental impact on environmental preservation. These two paradigms view economic growth differently; in the "business as usual" paradigm, economic growth is seen from the perspective of "business as it should be following market mechanisms." Meanwhile, in the "green growth" paradigm, economic growth is viewed from the perspective of "people-centered, equitable, sustainable economic growth that includes social and environmental resilience, healthy/solid environments, the capacity to deliver environmental services, and the ability to reduce greenhouse gas emissions" (Global Green Growth Institute, 2015).

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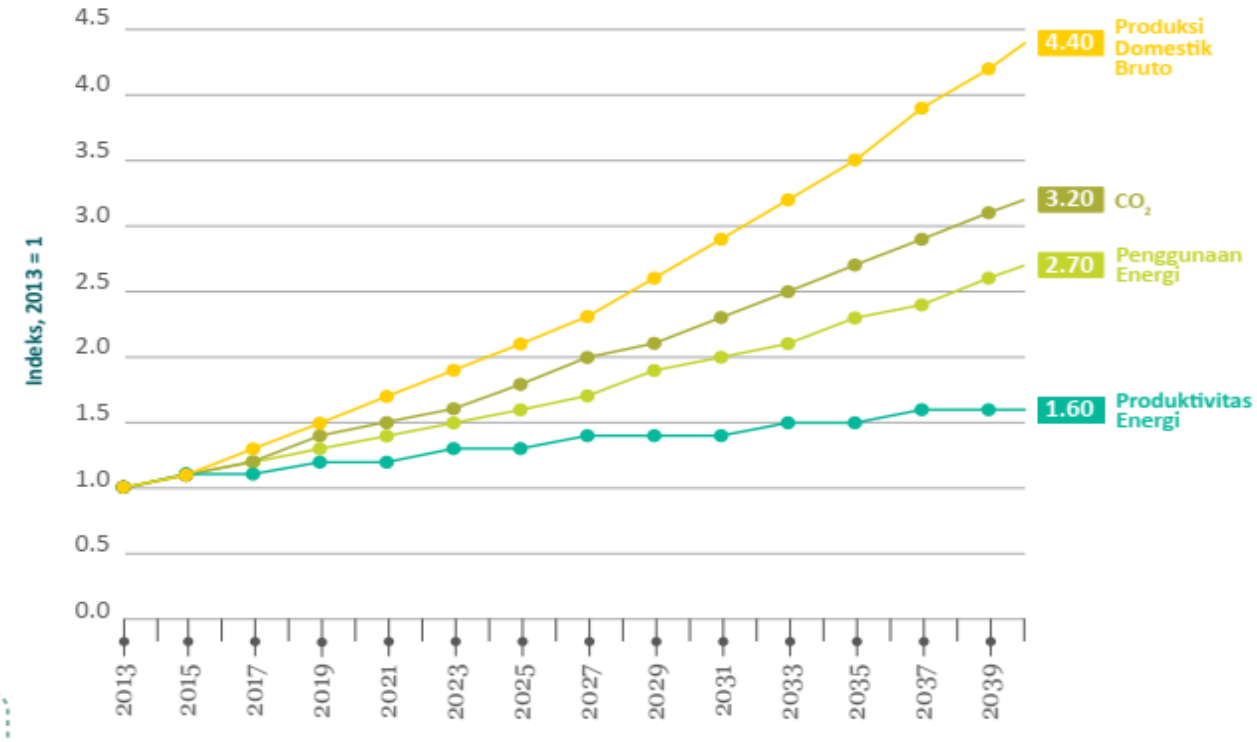

Figure 1. Business as Usual Flow
Source: (Global Green Growth Institute, 2015)

Suppose the Business as Usual flow shows an increase in economic growth of 4.40% in 2039. In that case, it will be accompanied by an increase in carbon emissions by 3.20%, energy use by 2.70%, and energy productivity by 1.60%.

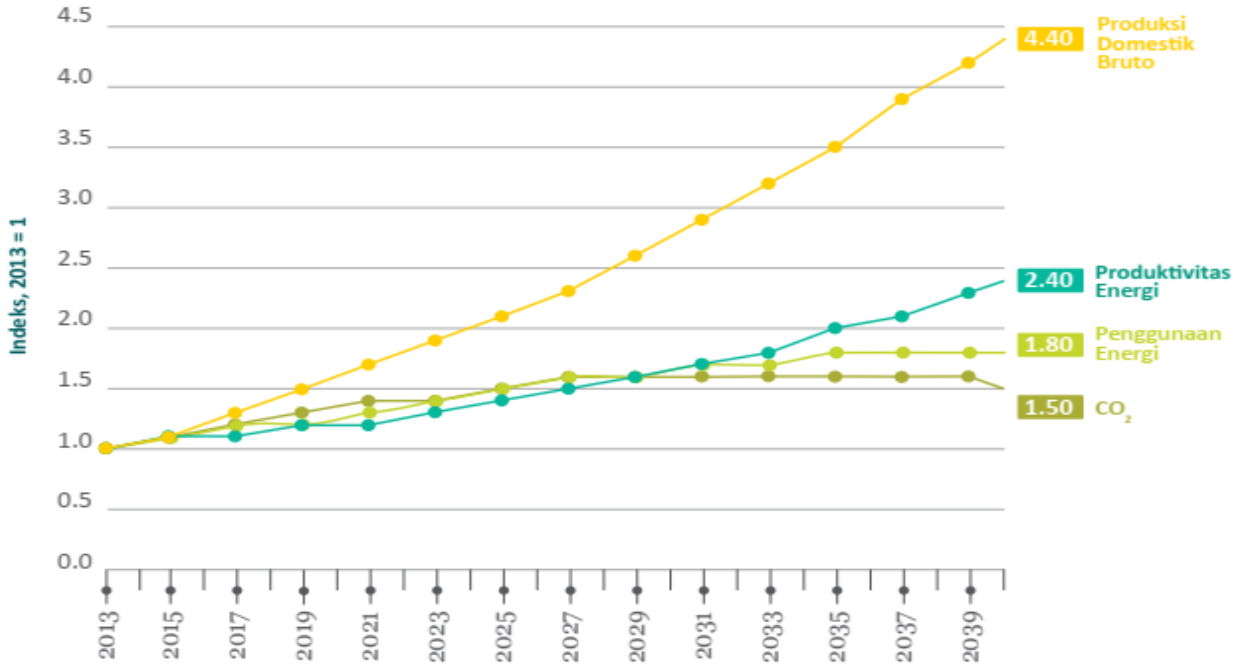

Figure 2. Green Growth Framework Flow
Source: (Global Green Growth Institute, 2015)

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Meanwhile, if using the Green Growth Framework flow, economic growth of 4.40% in 2039 will be accompanied by a reduction in carbon emissions by 2.40%, energy use by 1.80%, and energy productivity by 1.50%. In addition to the scenario above, some things need to be considered because economic growth will also be related to other sectors, including the financial sector, especially to support economic growth. In carrying out its intermediary function, the financial sector often faces financial deepening and shallow finance (Fry, 1994). This means that a well-developed financial sector will be able to encourage economic activity and vice versa; a poorly developed financial sector will cause the economy to face liquidity difficulties in achieving high economic growth targets (Levine, 1997). Financial deepening occurs when the ratio between money in circulation (M2) and gross domestic product is greater. Conversely, if the ratio between money in circulation (M2) and gross domestic product is smaller, it is considered shallow finance (Lynch, 1996).

This study examines the financial deepening of green growth in Indonesia, which has not yet happened in Indonesia. The consideration conducted by Tamazian et al. has determined that the financial sector development can increase economic growth, accompanied by pollution and environmental degradation (Tamazian et al., 2009). This study aims to see whether or not there is a short-term and long-term relationship and response of the Green Growth Framework to financial deepening. The indicator used in this study in financial deepening is M2, while the variables used to represent the concept of green economy are carbon emissions, energy consumption, energy intensity, and green GDP.

2. Research Methodology

The data utilized in secondary data study/research within the shape of time series of data/information between 1973 and 2014. Data collection began in 1973 because, at that time, there was an oil crisis caused by the war in Israel and Arab countries as oil suppliers. This resulted in Indonesia also feeling the impact. All data were obtained from the World Bank. This type of research is quantitative, which is used to analyze the Green Growth Framework (GGF) on Financial deepening towards the Sustainable Development Goal, a quantitative method using the Error Correction Model (ECM) and Vector Auto Regression (VAR) methods in 1973-2014. The Error Correction Model (ECM) method is used to see whether there is a short-term and long-term relationship. At the same time, Vector Auto Regression (VAR) is utilized to know the relationship between variables and the contribution of each variable to other variables.

In general, the Error Corection Model (ECM) model can be written as follows:

$$\Delta M2t = \alpha_0 + \alpha_1 \Delta Xt + \alpha_2 \Delta Xt + \alpha_3 \Delta Xt + \alpha_1 Ect + e_t$$

$$EC_t = (Y_{t-1} - \beta_0 - \beta X_{1t-1}) + Z_{t-1} , \Delta X_t = X - X_{tt-1}$$

Information α_1, α_2, and α_3 are short-term coefficients, α_4 is the equilibrium correction coefficient, and α_1 is the long-term coefficient. The ECM model can divided into a short-term ECM model and a long-term ECM model. Using the ECM model can help researchers solve the issue of spurious regression/relapse and non-stationary time series data/information (Gujarati, 2003; Thomas, 1997).

2.1. Short-term ECM Model

$$\Delta M2_t = \alpha_0 + \alpha_1 \Delta ECN_t + \alpha_2 \Delta CE_t + \alpha_3 \Delta INE_t + \alpha_4 \Delta GDP_t + \alpha_5 EC_t + e_t$$

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Description where α_1 is the short-term coefficient of energy utilization, α_2 is the short-term coefficient of carbon emissions, α_3 is the short-term coefficient of energy/vitality intensity, α_4 is the short-term coefficient of green GDP, and α_5 is the correction coefficient.

2.2. Long-run Engle-Granger ECM Model

$$\Delta M2_t = \beta_0 + \beta_1 \Delta ECN_t + \beta_2 \Delta CE_t + \beta_3 \Delta INE_t + \beta_4 \Delta GDP_t + e_t$$

Note that β1 is the long-run coefficient of energy utilization, β2 is the long-run coefficient of carbon emissions, β3 is the long-run coefficient of energy/vitality intensity, and 4 is the long-run coefficient of green GDP. ECM testing is done through several stages, such as stationarity testing and cointegration testing. The first step is to form the Error Correction Term (ECT) as a new variable. This must be done because ECT will be the basis for measuring long-term variables. Therefore, a good and valid ECM model must have a significant ECT (Insukindro, 1999).

2.3. Vector Auto Regression (VAR) Model Specification

$$Yt = \alpha + \sum_i^p A_1 \, Y_{t-1} + \varepsilon_t$$

The Vector Auto Regression Equation Model can be written with the equation:

$$M2_{1,t} = \alpha_{1,0} + \sum_{i=1} \alpha_{1,i} \, ECN_{t-1} + \sum_{i-1} INE_{t-1} + \sum_{d_{1,i}} GDP_{t-1} + \mu_{1,t}$$

$$ECN_{2,t} = \alpha_{2,0} + \sum_{i=1}^{k} \alpha_{2,i} M2_{t-1} + \sum_{i=}^{k} b_{2,i} CE_{t-1} + \sum_{i=1}^{k} c_{2,i} INE_{t-1} + \sum_{i=1}^{k} GDP_{t-1} + \mu_{2,t}$$

$$CE_{3,t} = \alpha_{3,0} + \sum_{i=1}^{k} \alpha_{3,i} ECN_{t-1} + \sum_{i=}^{k} b_{3,i} M2_{t-1} + \sum_{i=1}^{k} c_{3,i} INE_{t-1} + \sum_{i=1}^{k} d_3 GDP_{t-1} + \mu_{3t}$$

$$INE_{4,t} = = \alpha_{4,0} + \sum_{i=1}^{k} \alpha_{4,i} ECN_{t-1} + \sum_{i=}^{k} b_{4,i} CE_{t-1} + \sum_{i=1}^{k} c_{4,i} M2_{t-1} + \sum_{i=1}^{k} d_4 GDP_{t-1} + \mu_{3t}$$

$$GDP_{5,t} = = \alpha_{5,0} + \sum_{i=1}^{k} \alpha_{5,i} ECN_{t-1} + \sum_{i=}^{k} b_{5,i} CE_{t-1} + \sum_{i=1}^{k} c_{5,i} INE_{t-1} + \sum_{i=1}^{k} d_5 M2_{t-1} + \mu_{3t}$$

Description:
M2 : money supply/broad money
ECN : energy consumption
CE : carbon emissions
INE : energy intensity
GDP : Gross Domestic Product Green

3. Results

3.1. Error Correction Model Testing

3.1.1. Stationarity Test

Based on the results of the Augmented/Expanded Dickey-Fuller test stationarity test, there is no variable data that is stationary at the level stage at either the 1% or 5% significance level, so then it must be tested at the First difference stage; there is a variable, namely Money Supply (M2), which is also still not stationary in testing the degree of integration of the first difference because it has a probability value of 0.9985 > 0.05. Then, if the second difference

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integration degree test continues, all variables will be stationary at the 1% and 5% significance levels. So, it can be concluded that the variable data has passed the root test at the second difference level.

Table 1. ECM Stationarity Test Results

	Prob. M2	Prob. GDP	Prob. CE	Prob. ECN	Prob. INE
Level	1.0000	0.9998	0.2220	0.9203	0.6660
1st Difference	0.9985	0.0048*	0.0000*	0.000*	0.0000*
2nd Difference	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*

*significant α=1%, **significant α=5%, ***significant α=10%

3.1.2. Cointegration Test

The next step is cointegration testing, which determines whether there's a long-run relationship between variables. In this research study utilizing the Johansen Cointegration Test strategy, and by the following results were obtained:

Table 2. Cointegration Test

α Level	Critical Value	Trace Statistic	Description
1%	77.81884	190.8856	Cointegrated
5%	69.81889	190.8856	Cointegrated
10%	65.81970	190.8856	Cointegrated

Based on the test above, it is obtained that all variables, both at the 1%, 5%, and 10% significance levels, experience cointegration, which means that there's a long-term relationship between variables. The quantitative method of estimating the error correction model (ECM) is an analytical method used to process data on research model variables to decide the description of the behavior of the autonomous variable and the subordinate variable in the short and long-term periods.

3.1.3. Short-term ECM Estimation Results

Based on the ECM estimation test, the following results are obtained:

Table 3. Short-term ECM Estimation Results

Variable	Coefficient	t-statistic	Probability
C	1.12E+13	6.979781	0.0000
CE	-2.11E+11	-0.311819	0.7574
ECN	1.96E+08	0.002877	0.9977
GDP	6.917605	0.175407	0.8620
INE	-2.27E+13	-2.442752	0.0209*
CE (-1)	4.93E+11	0.735249	0.4681
ECN (-1)	1.14E+11	1.650264	0.1097
GDP (-1)	1.746260	3.231338	0.0031*
INE (-1)	-2.08E+12	-0.265089	0.7928
ET	0.919434	19.25545	0.0000
Adjusted R-Square		0.949793	
Prob, F-statistic		0.000000	

*significant α=1%, **significant α=5%, ***significant α=10%

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The ECM method can be utilized to determine the behavior of variables in the short and long term. The variables are each cointegrated so that the Error Correction Model can be known and used to determine short-term changes. The estimation results of the ECM method can be determined by comparing the t-statistic and t-table values associated with the coefficient of each independent variable in the research model with the dependent variable. In addition, the estimation results can also be known and interpreted by using the R-squared correction, F-statistic probability, and ECT (Error Correction Term) value.

3.1.4. Long-term ECM Estimation Results

The ECM estimation results lead to establishing a dynamic model that allows the magnitude and standard deviation of the regression coefficients to be obtained in the long run. The results of this long-run assessment provide insight into the period required to adapt to the changes taking place fully.

Table 4. Long-term ECM Estimation Results

Variable	Coefficient	t-statistic	Probability
C	1.10E+13	1.940774	0.0604***
CE	-4.08E+12	-2.353721	0.0243**
ECN	5.25E+11	-2.829289	0.0077*
GDP	2.264428	-1.925790	0.0623***
INE	3.33E+13	-1.702518	0.0975***
Adjusted R-squared		0.731488	
Prob. F-statistic		0.000000	

*significant α=1%, **significant α=5%, ***significant α=10%

The long-term ECM test results show that carbon dioxide emissions, energy utilization, vitality intensity, and green of GDP are independent variables that significantly affect financial deepening. The carbon emission variable affects Y. The non-carbon variable has a negative impact on y or economic deepening with a significant p-value = 5% level. This result suggests that partly, in the long run, the carbon emission variable affects economic deepening. Every 1% change in carbon emissions is expected to reduce financial deepening by 4.08%.

Meanwhile, energy consumption also affects the Y variable based on the probability value of 0.0077 < 0.01 or 0.05. Thus, every 1% change in energy consumption will increase financial deepening by 5.25%. The Green GDP variable also significantly influences financial deepening for a significance level of 10%. This means that every 1% change in green GDP will increase financial deepening by 2.264%.

The Energy Intensity (INE) variable also significantly influences at a 10% significance level on financial deepening because the probability value is 0.0975 <0.1. Every 1% change in Energy Intensity (INE) will increase financial deepening by 3.33%. The behavior of the autonomous variables on the subordinate variable that is not partially unidirectional is a general description that shows that all independent variables have a relationship that explains their influence on the dependent variable. The ability of the autonomous variables to declare the subordinate variable is strongly supported by the F-statistic value of 0.000000, which shows that the dependent variable can be declared together with the independent variables. Meanwhile, the R-squared value of 0.73188 indicates that considering the degrees of freedom, all the autonomous variables in the model can explain 73% of the subordinate variable, and other variables outside the research model can explain the remaining 27%.

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3.2. Vector Auto Regression Testing

3.2.1. Vector Auto Regression (VAR) Stationarity Test

In the stationary test utilizing the Augmented Dickey-Fuller test, none of the variables are stationary at the level stage at the 1%, 5%, or 10% significance levels. These results indicate that the degree of integration must be tested to determine the extent to which the variables/factors are stationary. The results of testing the degree of integration show the existence of the first and second differences. The M2 variable/factor is not stationary/static in the first difference because the probability value is 0.9985. While the other variables are stationary, it must be continued at the second difference stage, where all variables/factors are stationary.

Table 5. VAR Stationarity Test Results

	Prob. M2	Prob. GDP	Prob. CE	Prob. ECN	Prob. INE
Level	1.0000	0.9998	0.2220	0.9203	0.6660
1st Difference	0.9985	0.0048*	0.0000*	0.000*	0.0000*
2nd Difference	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*

Based on the results of the unit root stationarity test carried out on the data of each variable, it is known that the data passes the unit root test at the second difference level. In other words, the data used in this research variable is ready to be used to test the ECM method. The cointegration test utilized in this study/research uses the Johansen Cointegration Test method with the following results:

Table 6. Cointegration Test Results

α Level	Critical Value	Trace Statistic	Description
1%	77.81884	190.8856	Cointegrated
5%	69.81889	190.8856	Cointegrated
10%	65.81970	190.8856	Cointegrated

Table 6 shows the cointegration test results, showing an overall cointegration relationship of 1%, 5%, or 10%. The existence of cointegration in the results of this cointegration test indicates a long-term relationship between the factors used in this study. The cointegration test results using the Johansen Cointegration Test method show that all detected variables have a cointegration relationship. This means the VECM (Vector Error Correction Model) model will be chosen for the next testing phase. One of the requirements for VECM estimation is the existence of a cointegration relationship. VECM estimation is canceled if there is no cointegration relationship. The VAR (Vector Autoregressive) model should be used.

The lag length is determined to perform causality tests and VAR tests. The VAR model approach is very sensitive to the number of data lags used. Therefore, it is essential to decide the ideal slack length. The determination of lag length is utilized to decide the length of the period of impact of the previous variable on other variables/factors and other endogenous variables/factors.

Table 7. Optimum Lag Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2460.991	NA	5.34e+51	133.2968	133.5145	133.3736
1	-2414.550	77.82007	1.70e+51	132.1378	133.4440*	132.5983*

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Lag	LogL	LR	FPE	AIC	SC	HQ
2	-2383.433	43.73233*	1.32e+51*	131.6814*	134.2018	132.6514
3	-2356.106	31.01996	1.44e+51	131.8072	135.1645	132.9093

Table 7 above shows that the optimal lag is at the 2nd lag. Several approaches can be used to determine the lag, including the likelihood ratio (LR), Final Prediction Error (FPE), Akaike Information Criteria (AIC), and Schwars Information Criteria (SC). This study uses Akaike Information Criteria (AIC) to determine the lag because it can provide additional variable intervals to explain the degrees of freedom. The optimal lag test results in Table 7 show that the minimum Akaike Information Criteria (AIC) value in this research model is at lag 2, namely 131.681.

Another analysis related to the VECM model is to find the causal relationship or causality test between the endogenous variables of the VECM model. Economic variables not only have a one-way relationship but also have a two-way relationship called causality. Causality can be tested using the Granger causality test.

3.3. VECM Model Stability Test

Table 8. VECM Model Stability Test Results

Root	Modulus
0.039491 – 0.846930i	0.847850
0.039491 + 0.846930i	0.847850
-0.476679 – 0.525356i	0.709382
-0.476679 + 0.525356i	0.709382
-0.332802 – 0.531006i	0.626677
-0.332802 + 0.531006i	0.626677
-0.435684 – 0.334265i	0.549139
-0.435684 + 0.334265i	0.549139
-0.032489 – 0.168686i	0.171787

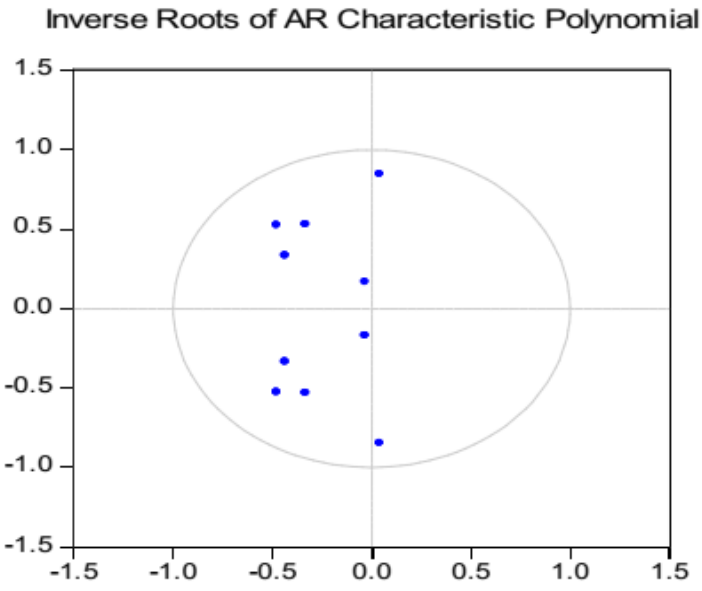

Figure 3. VECM Model Stability Test Results

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From the results of the VECM stability test above, the roots of 1 are shown in the table or figure above where the table has a coefficient of less than 1, which is also supported by the figure, which is above the figure of the inverse roots of AR Characteristic polynomial points that all variables are in a circle which indicates that the VECM model created is stable and has been stationary.

3.4. Granger Causality Test

Another analysis related to the VECM model is to look for relationships, Causality, or causality tests between endogenous variables in the VECM model. Economic variables not only have a one-way relationship but also a two-way relationship called a causal relationship. Causation can be tested with the Granger causality test.

Table 9. Granger Causality Test Results

H0	Lag 2	
	F-statistic	Probability
CE is not a granger-cause M2	0.31070	0.8175
M2 is not a granger-cause CE	0.80090	0.5032
ECN is not a granger-cause M2	2.56805	0.0729
M2 is not a granger-cause ECN	1.29382	0.2946
GDP is not a granger-cause M2	1.38865	0.2653
M2 is not a granger-cause GDP	1.07398	0.3749
INE is not a granger-cause M2	0.65706	0.5849
M2 is not a granger-cause INE	3.56448	0.0256
ECN is not a granger-cause DCE	1.36710	0.2717
DCE is not a granger-cause ECN	0.46691	0.7075
GDP is not a granger-cause CE	2.97762	0.0472
CE is not a granger-cause GDP	0.27859	0.8404
INE is not a granger-cause CE	1.21798	0.3202
CE is not a granger-cause INE	1.07739	0.3735
GDP is not a granger-cause ECN	0.15283	0.9270
ECN is not a granger-cause GDP	0.51089	0.6778
INE is not a granger-cause ECN	0.88283	0.4611
ECN is not a granger-cause INE	1.91441	0.1485
INE is not a granger-cause GDP	0.35550	0.7855
GDP is not a granger-cause INE	5.99969	0.0025

The causality relationship in the model is indicated by a probability value smaller than 0.1. Based on **Table 9**, the causal relationship in the model is represented by a lower probability value of 0.1. **Table 9** shows that the carbon emission variable does not significantly affect M2 because the probability shows 0.8175> 0.1, so H0 is accepted, and H1 is rejected, or in other words/terms, there's no causal relationship between carbon emissions and M2. The same is shown by the effect/impact of M2 on carbon dioxide emissions, where the amount of M2 does not affect the amount of carbon emissions statistically with a probability of 0.503 > 0.1, which is H0 is accepted, and H1 is rejected, or in other words/terms, there's no causal relationship between M2 and carbon dioxide emissions. From this, there is no causal relationship between the carbon emission variable and M2 and vice versa.

Different things are shown by the energy consumption variable that significantly affects M2 with a probability of 0.0729 < 0.1, so H0 is rejected, and H1 is accepted, or in other

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words/terms, there is a causal relationship between energy consumption and M2. Furthermore, the green GDP variable does not significantly affect M2 with a probability of 0.2653 > 0.1, so H0 is accepted, and H1 is rejected, or in other words/terms, there's no causal relationship between green GDP and M2. The insignificant effect of the green GDP variable on M2 indicates that green GDP cannot be a leading indicator for M2. The same is shown by the effect of M2 on green GDP, where statistically, the M2 variable does not significantly affect the green GDP variable with a probability of 0.3749 > 0.1, which means that H0 is accepted and H1 is rejected or in other words/terms, there's no causal relationship between green GDP and M2. Then, the energy consumption variable significantly does not affect carbon emissions with a probability of 0.2717 > 0.1, so H0 is accepted, and H1 is rejected, or in other words/terms, there's no causal relationship between energy consumption and carbon emissions.

Furthermore, the green GDP variable significantly affects carbon emissions with a probability of 0.00472 < 0.1, so H0 is rejected, and H1 is accepted, or in other words/terms, there's a cause-and-effect relationship between green GDP and carbon emissions. The significant effect of the green GDP variable on carbon emission indicates that green GDP can be a leading indicator of carbon emission. Similarly, the carbon intensity variable does not significantly affect carbon emissions with a probability of 0.3202 > 0.1, so H0 is accepted, and H1 is rejected; in other words, there is no causal relationship between carbon intensity and carbon emissions. Furthermore, the green GDP variable significantly does not affect energy consumption with a probability of 0.9270 > 0.1, so H0 is accepted, and H1 is rejected; in other words, there is no causal relationship between green GDP and energy consumption. Then, the energy intensity variable significantly does not affect energy consumption with a probability of 0.4611 > 0.1, meaning that the energy intensity variable significantly does not affect green GDP with a probability of 0.7855 > 0.1, and there is no causality relationship between energy intensity and energy consumption/utilization.

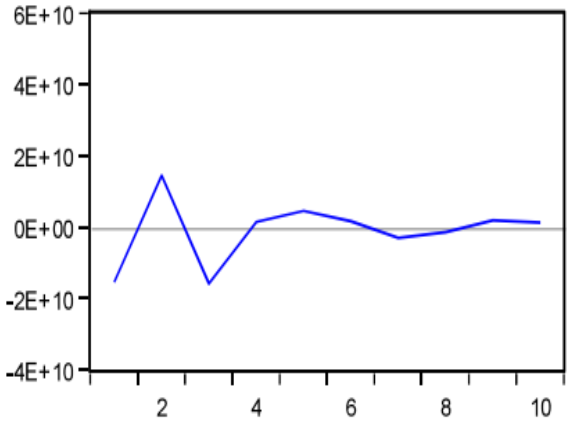

Figure 4. Green GDP Response to Financial Deepening

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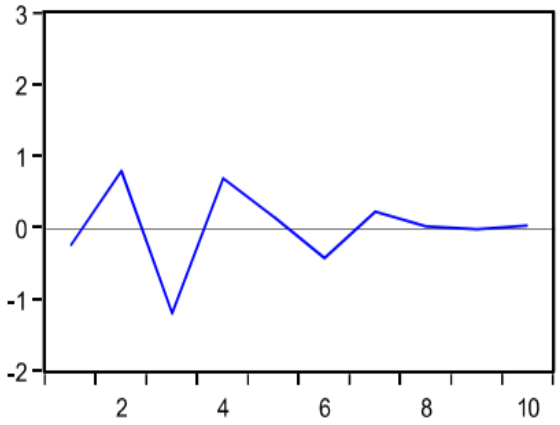

Figure 5. Carbon Emissions Response to Financial Deepening

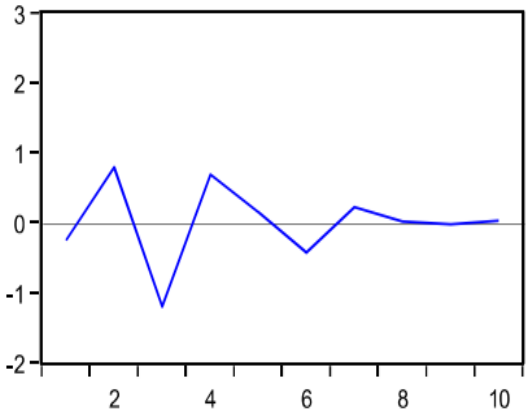

Figure 6. Energy Intensity Response to Financial Deepening

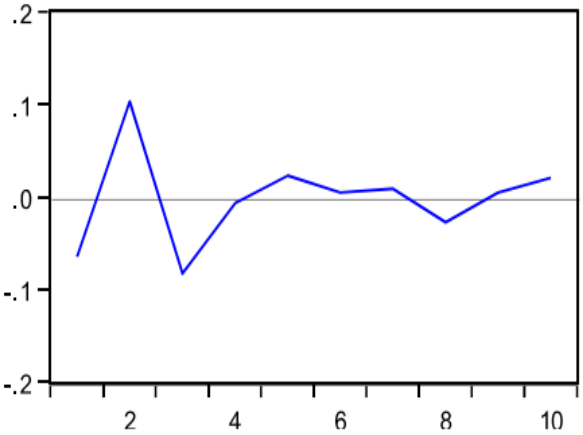

Figure 7. Energy Consumption Response to Financial Deepening

The response of green GDP to financial deepening can be seen in **Figure 4** above, which shows that at the beginning of the period, green GDP responds negatively to financial deepening, then in the second period, where green GDP still shows a positive response to financial deepening. **Figure 5** shows the response of carbon emissions to financial deepening. At the beginning of the period, carbon emissions negatively responded to deepening financial conditions. The second period shows a positive response, but the third period shows a negative response shortly afterward. Carbon emissions show a positive response to financial deepening in the fourth period. **Figure 6** above explains the response of energy intensity to financial deepening. In the initial period, energy intensity negatively responds to financial deepening.

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There is a positive response in the second period, but not long before, the response shows negative in the third. In the third period, the positive response lasts until the seventh period. **Figure 7** above explains the response of energy consumption to financial deepening. At the beginning of the period, energy consumption negatively responds to financial deepening. In the second period, the increase in positive response continues to be shown by energy consumption and financial deepening until the third period. However, a negative response soon emerges in the fourth period, and a stable positive response starts in the fifth period and continues until the final period.

Table 10. Variance Decomposition of M2

Period	S.E.	M2	CE	ECN	GDP	INE
1	4.58E+13	100.0000	0.000000	0.000000	0.000000	0.000000
2	5.14E+13	86.97897	1.884959	2.311128	8.388371	0.436573
3	5.28E+13	86.07618	1.805316	2.470597	7.956519	1.691389
4	5.32E+13	85.14080	1.809631	2.666106	8.376547	2.006913
5	5.34E+13	84.83496	1.870118	2.803230	8.351284	2.140404
6	5.36E+13	84.48271	1.924822	2.906524	8.295877	2.390067
7	5.38E+13	83.77672	1.927522	3.151860	8.773293	2.370601
8	5.39E+13	83.59307	2.059545	3.157094	8.808970	2.381320
9	5.40E+13	83.23742	2.056328	3.275549	9.056726	2.373976
10	5.40E+13	83.15063	2.096695	3.272318	9.107924	2.372429

From the table above, which shows the variance decomposition of M2, it can be seen that the variation in the M2 variable is mostly affected by the variable/factor itself, namely M2, both in the long and short term. In the first period, it can be seen that the variation in the M2 variable is 100% influenced by the variable itself, after which it gradually decreases until the period ended so that at the period ended, the variation in the M2 variable becomes 83% influenced by the variable itself.

Table 11. Green GDP Variance Decomposition

Period	S.E.	M2	CE	ECN	GDP	INE
1	4.98E+10	9.821638	0.018421	2.980835	87.17911	0.000000
2	5.85E+10	13.27891	0.835209	3.000324	79.97145	2.914104
3	6.41E+10	17.21153	0.894004	3.711861	70.67615	7.506446
4	6.46E+10	16.99110	0.934351	4.759646	69.81758	7.497325
5	6.61E+10	16.70475	0.991808	5.113495	68.44531	8.744635
6	6.67E+10	16.44048	1.043635	5.794316	67.82969	8.891876
7	6.81E+10	16.00892	1.404484	5.753645	68.12056	8.712395
8	6.85E+10	15.83505	1.773768	6.397557	67.38553	8.608093
9	6.93E+10	15.56707	1.803489	6.484319	67.64921	8.495911
10	6.95+10	15.51250	2.011897	6.708424	67.31262	8.454562

From the above table showing the variance decomposition of green GDP, it can be seen that the variation of the green GDP variable depends more on the variable itself, i.e., green GDP. H. Green GDP. In the first period, it can be seen that the variable itself influences 87% of the fluctuation in the green GDP variable. This influence gradually decreases until the end of the

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period, leaving the fluctuation in the green GDP variable at 67% by the period's end, still influenced by the variable itself.

Table 12. Variance Decomposition of Energy Intensity

Period	S.E.	M2	CE	ECN	GDP	INE
1	0.153571	17.62850	4.104169	9.194808	3.671165	65.40136
2	0.260396	21.72396	2.490489	13.36637	36.83382	25.58537
3	0.330813	19.78854	9.482796	8.91 1731	45.29289	16.52405
4	0.362945	16.47309	10.17866	18.37735	41.22994	13.74097
5	0.384609	15.02298	9.907414	17.43543	45.12701	12.50717
6	0.392575	14.43423	10.69716	18.67228	43.95435	12.24198
7	0.398346	14.06302	10.40472	18.55770	44.65749	12.31 707
8	0.401563	14.32415	10.30099	18.52896	44.64810	12.19781
9	0.403644	14.19086	10.28626	18.34359	44.85644	12.32285
10	0.406358	14.25855	10.15759	18.44166	44.96767	12.17453

In the table above, which shows the variance decomposition of energy intensity, it can be seen that the variation of the energy intensity variable is more dominantly influenced by the GDP variable, namely green GDP. In the short term, energy intensity affects 65%. However, the influence of both the long-term and the short-term is influenced by the green GDP variable by 36%, which increases little by little until the end of the period, so that at the end of the period, it is 44%.

Table 13. Variance Decomposition of Energy Consumption

Period	S.E.	M2	CE	ECN	GDP	INE
1	2.631057	0.965788	99.03421	0.000000	0.000000	0.000000
2	3.502280	5.558131	84.2 1886	3.392372	6.572189	0.258444
3	3.775292	15.04053	72.981 17	5.106615	6.153673	0.7180 10
4	3.899235	17.16544	69.07976	5.430545	7.451232	0.873028
5	3.926907	17.05527	68.36655	5.627469	8.035531	0.915 181
6	3.951915	17.99084	67.32204	5.539934	7.931091	1.216094
7	3.970212	18.16527	66.90834	5.796055	7.883487	1.246854
8	3.975150	18.12038	66.78066	5.885255	7.9331 12	1.280593
9	3.977102	18.10792	66.73037	5.908812	7.958530	1.294359
10	3.980548	18.07862	66.62923	5.925424	8.071801	1.294924

From the first period until the end of the period, it can be seen that the variation of the energy consumption variable is affected by the carbon emission variable by 99%. It decreases little by little until the end of the sixth period, so in the sixth period, the variation of the energy consumption variable is impacted by the carbon emission variable by 66%.

4. Discussion

The effect of the Green Growth Framework's relationship with economic deepening in Indonesia shows that several variables that are indicators of the Green Growth Framework have short-term and long-term relationships with the existence of the Green Growth Framework and the position of Indonesia's economic deepening. The economic dynamics that began in 1973-

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2014 were shaped by the global oil crisis in 1973, which also affected Indonesia, the global financial crisis in 1997/1998, and the global financial crisis in 2007/2008. These crises certainly have implications from the perspective of economic fundamentals and Indonesia's energy security. The financial sector is crucial in maintaining the economy's liquidity. Financial sector shocks affect economic performance at both macro and micro levels because the financial sector can act as an intermediary in strengthening the economy through investment financing and as a provider of monetary tools for people's financial transactions. Likewise, the energy sector is strategically important in improving Indonesia's economic conditions.

The strengthening of these two important sectors, namely the financial sector and the energy sector, gave birth to a green growth framework known as the Green Growth Framework, given that the Millennium Development Goals (MDGs) ended on December 31, 2015, and turned into Sustainable Development Goals (SDGs) or sustainable development. Based on the test results in the short term, there is a significant negative relationship between the energy intensity variable and financial deepening energy intensity as measured by M2 by 2.7%. This means that if there is a 1% change in the energy intensity variable, this will have a negative effect/impact on the financial sector in Indonesia, especially financial deepening, which will decrease by 2.7%. Furthermore, green GDP in the year before the research period, namely 1972, also shows a significant positive relationship of 1.7%. This means that if there is a change in the green GDP variable in the previous year by 1%, this will have a positive effect on the financial sector in Indonesia, especially financial deepening, which will increase by 1.7%. Furthermore, the variables of carbon emissions and energy consumption still do not show a significant positive or negative relationship with financial deepening in the short term.

Unlike the test results of the Error Correction Model (ECM) method in the short term, all independent variables show positive or negative relationships in the long term and are significant at a certain level. The first is the carbon emission variable, where carbon emission has a significant negative relationship of 4.08% in the long run. This means that a 1% change in the carbon emission variable will negatively influence Indonesia's financial sector, especially financial deepening, which will decrease by 4.08%. The energy consumption variable shows a significant positive relationship of 5.25% in the long run. This means that if there is a change in the energy consumption variable by 1%, this will positively affect Indonesia's financial sector, especially financial deepening, which will increase by 5.25%. The results of this research study conform with the opinion of neoclassical economists who argue that increased energy consumption reflects an increase in the economy (Kraft & Kraft, 1978).

Like the short-term ECM test results, the green GDP variable shows a significant positive relationship of 2.2% in the long term. This means that if there is a change in the green GDP variable by 1%, this will positively affect Indonesia's financial sector, especially financial deepening, which will increase by 2.2%. The results of this research follow the theory utilized that when there's a rise in income in a country or individual, it will raise individual consumption of a good (Pindyck & Rubinfeld, 1998) so that there's an elastic relationship between the level of income in a country or individual. Therefore, there is an elastic relationship between the level of income. GDP per capita and the level of energy consumption. The energy intensity variable also shows a significant positive relationship of 3.3% in the long run. This means that if there is a 1% change in the energy intensity variable, it will positively affect the financial sector in Indonesia, especially financial deepening, which will increase by 3.3%. The results of this research study are also supported by Engel's Law, which states that increased per capita income increases the energy demand and will eventually lead to an increase in energy intensity in the long run. In the long run, the research results of the Error Correction Model

https://doi.org/10.33019/society.v11i2.566

(ECM) method show that all independent variables affect financial deepening and cannot be separated from the phenomena that occurred in Indonesia from 1973 to 2014. Green GDP, which positively influences financial deepening, occurred because the Green Growth Framework was implemented in Indonesia in 2012. Based on data from the World Bank, carbon emissions in Indonesia have decreased from 2006 to 2014. In 2006, carbon emissions showed a fairly high figure of 30.8% and then decreased slowly until the year the rate of carbon emissions became 18.4%. The negative influence of green GDP and energy intensity on financial deepening is also inseparable from applying the Green Growth Framework. Green GDP shows a figure of 6.2% and continues to decline until 1998, reaching -14.3%. This means that during the economic crisis, efforts to increase economic growth were not accompanied by efforts to preserve the environment in 1998.

5. Conclusion

Based on the results of Green Growth Framework research on financial deepening in Indonesia using Error Correction Model (ECM) and Vector Autoregressive (VAR) methods, the following conclusions can be drawn: Energy intensity variables and green GDP in the previous year as indicators of Green Growth Framework have a short-term relationship to financial deepening in Indonesia. Energy intensity shows a negative relationship with financial deepening in Indonesia, while green GDP in the previous year shows a negative relationship with financial deepening in Indonesia. The long-term ECM test concludes that all Green Growth Framework indicators have a significant long-term relationship with financial deepening in Indonesia. Carbon emissions have a negative impact on Indonesia's financial deepening. Green GDP, energy consumption, and energy intensity variables positively impact Indonesia's financial deepening. This occurs due to the implementation of the Green Growth Framework in Indonesia.

Testing the Green Growth Framework on financial deepening in Indonesia using the second research method, Vector Autoregressive (VAR), concluded that each variable included in the indicators gave different responses to financial deepening. The green carbon GDP variable gives a negative response at the beginning of the period, then shows a positive response in the third period, and stabilizes towards the equilibrium point. Carbon emissions gave a negative response at the beginning of the period, then began to show a positive response in the third period and stabilized towards equilibrium. However, it is still said that carbon emissions respond negatively to deepening financial conditions. Energy intensity and consumption give a negative response at the start of the period. Then, in the next period, they showed a positive response to financial deepening at the end of the 2014 study period.

6. Acknowledgment

The author thanks those who are willing to cooperate profusely during this research.

7. Declaration of Conflicting Interests

The author has declared no potential conflicts of interest concerning this article's research, authorship, and/or publication.

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https://doi.org/10.33019/society.v11i2.566