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## **Environmental Pollution to Green Growth in Vietnam**

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### **ABSTRACT**

The study has clearly shown the role and importance of green growth and provided a way to measure green growth consistent with reality in Vietnam, as well as other hypotheses and research articles on the impact of the environment on growth. green growth. Positively contribute to the process of building a socio-economic green growth strategy. The authors have identified environmental factors that impact green growth including: total natural resource rent, natural resource depletion, forest area, and solid waste. Besides, it also points out the indirect impact from economic growth to the environment and then to green growth. In which: Total natural resource rent has a negative impact on green growth in Vietnam; Depletion of natural resources has a negative impact on green growth in Vietnam; Forest area has a positive impact on green growth in Vietnam; Solid waste has a negative impact on green growth in Vietnam; Economic growth has a positive impact on green growth in Vietnam.

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### **1. Introduction**

The model of exploiting natural resources on an unsustainable scale causes many negative impacts on the environment, biodiversity loss, environmental pollution, global climate change... and also leads to many problems. other complex social issues as well as affecting economic opportunities for future generations. However, according to Samuelson & Nordhaus (2014) the GDP index was never intended to be a proxy for total human well-being. Therefore, to solve this problem, a new concept, the green GDP index, was born, demonstrating that green economic growth is becoming an inevitable choice and a goal that every country is aiming for. This is a new approach to economic growth, aiming at harmonious socio-economic development with restoration and conservation of natural ecosystems. Internationally, green growth is central to achieving the United Nations' 17 Sustainable Development Goals (SDGs) by 2030. This is also the focus of many countries' national development policies. around the world including Vietnam. The national policy on green economic growth is a major and important policy of the Party and State of Vietnam to green the economy, ensuring fast, effective and sustainable economic development. With the trend of sustainable development on all three pillars of economy, society and environment. Shifting the economy to green growth is the goal Vietnam needs to aim for in the coming development period, to continue the momentum of innovation and promote the growth model in depth, quality and efficiency. This is the main content presented and discussed by the speakers at the National Scientific Conference with the theme: "Promoting green growth towards sustainable development: Connecting national vision with local action." methods and businesses" organized by the Journal of Economics and Forecasting, Ministry of Planning and Investment.

Furthermore, the world has just gone through years covered by the Covid-19 pandemic, causing the economy to decline. Therefore, the trend of the world after Covid-19 will be green growth, reducing natural resource exploitation, and restoring natural ecosystems. In the current context, green growth can be a potential solution to Vietnam's problems, as well as contribute to recovery after Covid-19 and help Vietnam move towards sustainable development. Promoting green growth in Vietnam is not only consistent with the current economic integration process, but more importantly, stems from the need to transform the growth model of the internal economy. However, during the implementation process, the green growth policy also reveals limitations such as the government has not yet given a specific and clear viewpoint, and the way to measure and synthesize data still has many difficulties and obstacles. problems, there needs to be perfect solutions in the near future.

So, what is the way to measure the impact of this issue? Does it seem that there is a negative impact of environmental pollution on green growth? From there, an urgent question arises: How does environmental pollution impact Vietnam's green growth in various fields? What are the consequences? What solutions and orientations are needed to help our country achieve the set green economic growth goal? From the above reasons, our group of authors would like to choose the topic "Research on the impact of environmental pollution on green growth in Vietnam".

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### **2. Content**

#### *2.1. Overview of environmental pollution*

Reality shows that environmental pollution directly affects the ability and productivity of workers by causing damage to their health in the long term. Guillermo Montt's (2018) study relied on 20 years of air pollution and employment data from Santiago, Chile to evaluate the relationship between air

pollution and labor supply. The results show that air pollution at levels commonly seen in Santiago, Chile, does not reduce overall labor supply. However, in the long term, this trend masks a negative impact on gender inequality. Women in general, and women with children in particular, will tend to reduce their working hours during weeks with high pollution levels. And it turns out that this reduction in working hours will often be compensated for by men, so the aggregate impact is nil. These gender impacts stem from inequalities in the distribution of care obligations within the family and perpetuate gender inequalities in the labor market.

Research paper by Houjian Li and colleagues (2022) with the topic "Research on the impact of environmental pollution on agricultural land abandonment". This study uses China labor force survey data in 2016, based on 8116 samples from 104 cities, constructing a Tobit model and IV Tobit model to quantitatively analyze land abandonment from a global perspective. environmental contamination. The results show that environmental pollution can significantly increase the probability and area of abandoned land, and there is regional heterogeneity in the impact of environmental pollution on land abandonment. Besides, the impact of environmental pollution on land abandonment is

The effects of air pollution on the world community are well established. Through the research of Sharnil Pandya and colleagues (2022), we can see the significant effects of air pollution on food crop productivity as well as their nutritional quality and safety - necessary conditions in ensuring food security. In developing countries like India, air pollution has halved national wheat and rice production. Currently, pollution levels are increasing globally and especially in India. It has spread to rural areas - where key agricultural activities take place - and has a negative impact on crop productivity and longevity and, more broadly, on the entire agricultural sector.

There is also research by a group of students from Phenikaa University, University of Economics, Hanoi National University and Vietkap group (2022) showing that air pollution has been and is a problem. This problem has a serious impact on the health of people living in urban areas of developing countries in general and Vietnam in particular. And to solve this problem, people consider migrating to another place as an option, which can lead to the loss of skilled and experienced labor. This phenomenon is also known as brain drain. The research used the Bayesian thinking framework (BMF) on the responses of 475 people living in Hanoi, Vietnam - one of the most polluted capitals in the world. Research results show that people with higher education levels are more likely to intend to migrate due to the impact of air pollution.

## **2.2. Overview of green growth**

Bowen, Alex. (2012) with the research article "'Green' Growth, 'Green' Jobs and Labor Markets" pointed out the weakness of previous models of labor markets in developed countries: green policies have a negative impact. negative impact on energy sector productivity. The researcher used a graph to show the relationship between carbon and methane emission intensity and energy intensity on per capita income. Developing countries have relatively high carbon and methane emissions and energy use per unit of GDP. The ILO/CEDEFOP (2011) study on green growth and skills shows that the lack of skills among workers is a factor hindering the transition to green economic growth.

The new point of John M. Reilly (2012) in the research article on "The relationship between green growth and the efficiency of natural resource use" is that the researcher uses the NNP index to measure green growth because if used Measuring GDP would leave out important environmental goods and services. The author is very skillful in using the character Robinson to analyze resource allocation.

Nosheen, Misbah & Iqbal, Javed & Abbasi, Muhammad Ali. (2021) has a research paper on the hypothesis of whether technological innovation promotes green growth in the European Union? In the study, the authors used the STIRPAT (stochastic regression of variables on population, affluence and technology) and IPAT (impact of people, population, affluence and technology) models. with the objective to solve the problem of cross-sectional dependence and cross-sectional heterogeneity in the model by using the combined Westerlund and ordinary least squares (FMOLS) approaches. The results received are: with the STRIPAT model, increasing budget resources to protect the environment creates favorable conditions for green growth. With the IPAT model, energy technology contributes to promoting green growth. Besides, traffic and production factors cause climate change, which has a negative impact on green growth. Those are factors that strongly influence green growth in Europe. The research team emphasizes the role of using renewable energy, suggesting that there should be policies that prioritize environmentally friendly technologies. At the same time, it is also necessary to supplement research and development (R&D) activities.

Research on green growth has positive effects on the development process of countries. However, there are still potential limitations, so it is necessary to have specific research articles on green growth suitable to the situation of each country.

Research paper by Dr. Mercy Tembon, World Bank Country Director for Bangladesh and Bhutan (2021) on the topic "Addressing plastic pollution for green growth in Bangladesh". The study mentioned the negative effects of plastic pollution leading to blockage of sewers and causing floods, providing a breeding ground for mosquito-borne diseases, furthermore decomposing plastic waste releases Microplastic particles affect human health and the daily life of Bangladeshi people. In addition, plastic waste also causes a series of incidents involving damaged dolphins, turtles, whales, and birds, seriously affecting the ecological environment, polluting water sources and soil sources, causing damage. to production

### 2.3. RESEARCH MODEL ON THE IMPACT OF ENVIRONMENTAL POLLUTION ON GREEN GROWTH IN VIETNAM

#### 2.2.1 Model description

To accurately reflect the impact of environmental pollution on green growth in Vietnam, the research team used a linear regression model to analyze and evaluate the impact of environmental pollution on growth. green in Vietnam in the period 1993 - 2021. The model includes the following important variables:

##### 2.2.1.1 Dependent variable

Green GDP: The group decided to choose the green growth index calculation method based on the formula of Saša Stjepanović, Daniel Tomić, Marinko Škare (2017) to use in this research paper according to the following formula:

$$\text{Green GDP} = \text{GDP} - (\text{KtCO}_2 * \text{PCDM}) - (\text{Twaste} * 74\text{KWH} * \text{Pelect}) - ((\text{GNI}/100) * \% \text{NRD}) \quad (2.1)$$

In there:

- GDP: Gross domestic product
- KtCO<sub>2</sub>: Carbon dioxide emissions in kilotons
- PCDM: Volume weighted average carbon price (in PPP)
- Twaste: Total waste (commercial and industrial) (in tons)
- Pelect: The price for 1 kilowatt hour is calculated based on the average commercial and industrial prices for each country.
- NRD: Natural resource depletion rate as a percentage of GNI.
- GNI: Gross national income.

Green growth is the increase in Green GDP over a certain period of time. Specifically, in the group's research paper, Green growth will be calculated over a period of 1 year:

$$\text{Green growth}_{it} = \frac{\text{GDP green}_t - \text{GDP green}_{t-1}}{\text{GDP green}_{t-1}} * 100 \quad (2.2)$$

In there:

[[Green growth]]\_it: Green growth rate in 1 year

[[Green GDP]]\_t: Green growth index in year t

[[Green GDP]]\_(t-1): Green growth index in year t-1

Green growth is the main dependent variable in the model the team chose to evaluate the impact of environmental pollution on green growth in Vietnam.

##### 2.2.1.2 Independent variable

#### Statistics and description of indicators affecting green growth

No.	Variable name	Symbol (Unit)	How to calculate	Source
1	CO2 emissions	CO2 (kt)	CO2 emissions data includes gases from fossil fuel combustion and cement production. These include CO2 produced during the consumption of solid, liquid, gas and gas fuels.	World bank
2	Co2	Fossil (Twh)	Includes total output of coal, oil, gas (Excluding cross-border electricity supply)	Our world in data
3	Total natural resource rent	TR (%GDP)	Includes the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents and forest rents.	World bank

4	Depletion of natural resources	NRD	Includes the sum of net forest depletion, energy depletion, and mineral depletion.	World bank
5	Forest area (% land area)	Forest (% land area)	Total forest area/ Total land area	World bank
6	Amount of solid waste	Waste	The total amount of solid waste that can be recycled and regenerated into energy	Mendeley
7	Developing technology related to the environment	TECH(%)	Environmental technology / all technology	OECD.stat
8	Per capita GDP Gross domestic product/average population	GDPper (US\$)	Gross domestic product/average population	World Bank
9	Population growth rate	POP (%)	An increase in the number of people in a population	World Bank
10	Foreign Direct Investment	FDI (US\$)	Net capital flows as a percentage of GDP	World Bank
11	Trade openness	OPENNESS (% GDP)	Total exports and imports of goods and services are measured as a percentage of GDP	World Bank

Source: Compiled by the authors

### 2.2.2 Model for studying the impact of environmental pollution on green growth in Vietnam.

According to the research model of Vincent Tawiah and Abdulrasheed Zakari & Festus Fatai Adedoyin (2021) research on "Determinants of green growth in developed and developing countries"

$$:Green\ Growth = \alpha + \beta_1(Determinants)_{it} + \beta_2(Control\ variables)_{it}^{(2,2)}$$

In there

□ Determinants-determining factors include:

- economic determinants: Economic Development-economic development, Economic growth-economic growth).
- internationalization factor: Trade openness - trade openness, FDI - foreign direct investment.
- institutional quality factor: Institutional quality.
- Energy determinants: Energy consumption, CO2 emissions.

□ Control variables include:

- Population.
- Population growth.
- Resource rent - resource rent.

Based on the above research article, the authors used the dependent variable Green Growth (%) to represent green growth according to the linear regression model. And to increase the model's suitability for Vietnam, the team chose to propose a research model for the project as follows:

$$GG_{it} = \beta_0 + \beta_1(CO2)_{it} + \beta_2(Fossil)_{it} + \beta_3(TR)_{it} + \beta_4(NRD)_{it} + \beta_5(Forest)_{it} + \beta_6(Waste)_{it} + \beta_7(TECH)_{it} + \beta_8(GDPper)_{it} + \beta_9(POP)_{it} + \beta_{10}(FDI)_{it} + \beta_{11}(OPENNESS)_{it} + \varepsilon_{it}$$

### 2.3. Research results and discussion

Presenting environmental pollution factors that impact green growth

Variable	Obs	Mean	Std. Dev.	Min	Max
Year	29	2005	8.514693	1991	2019
GG	29	6.942744	1.179625	4.635235	9.514122
GDPper	29	6.941326	1.193397	4.773587	9.54048
FDI	29	5.652767	2.254014	3.390404	11.93948
OPENNESS	29	119.4908	29.69493	66.21227	164.7042
POP	29	1.236662	.3715358	.9044912	2.138311
TR	29	7.897833	2.881616	3.365045	14.18748
NRD	29	3.410391	1.750727	.78667	7.062875
CO2	29	10.5439	6.625629	-.2885151	23.93144
FOSSI	29	351.6193	259.2341	59.83488	1013.852
FOREST	29	39.36015	5.304191	29.54553	46.5
WASTE	29	1.61e+07	901139.4	1.42e+07	1.79e+07
TECH	29	11.75	8.936942	0	40

Source: Statistical research team using Stata software

According to Vietnam's statistical table data in the period from 1993 to 2021, 29 observed variables were obtained. After differentiating to make the data stationary, 27 observed variables were obtained. Accordingly, all variables have large differences between min and max values. In particular, variables representing environmental pollution such as CO2 emissions and fossil energy have clear differences and an increasing trend over the years. Besides, the green growth index also has a difference, when the min is 4.64% and the max is 9.51%. Direct investment from abroad shows us that Vietnam has increasingly expanded its relationship with the world, trade openness tends to increase. The population growth rate shows that Vietnam's birth rate has remained stable over the years. Along with population growth, the amount of solid waste in our country is quite high. The environmental technology development index is also showing good changes. However, the environment also shows not very positive signs.

Present the impact of environmental pollution on green growth

Variable	Model	Variable	Model
D(GDP)	0.992032***	D(FOSSI)	-0.000464
D(FDI)	-0.025460*	D(FOREST)	0.125840*
D(OPENNESS)	0.007524**	D(WASTE)	-1.85E-07**
POP	-0.148180*	TECH	6.50E-05
D(D(TR))	-0.083653***	D(CO2)	0.002274
D(NRD)	-0.067645**		

The symbols \*\*\*, \*\*, \* correspond to p-value values of 1%, 5% and 10%.

Source: Results obtained from Eviews.

Firstly, the results obtained show that economic growth factors related to the environment have a positive influence on green growth at the 1% significance level.

The more GDP per capita increases, the more green growth index increases. Green growth is an important way to achieve sustainable development, towards a long-term carbon neutral economy, and people are especially considered the center of green growth. Economic growth has a positive relationship with green growth because it helps promote the development of green industries and green products, promoting an environmentally friendly industry, helping Environmental conditions become better. Economic growth also helps increase the ability to invest in green development projects, helping to promote the development of green technologies. In 2022, the year with the highest growth rate in the 2011-2022 period, the GDP growth rate will reach 8.02%. Of which the agriculture, forestry and fisheries sector increased by 3.36%, contributing 5.11%; The industrial and construction sector increased by 7.7%, contributing 38.24%; The service sector was restored and grew strongly with an increase rate of 9.99%, contributing 56.65% to the overall growth of our country's economy. Economic growth creates conditions for creating jobs and is a driving force to create more stable and sustainable jobs for workers. Employed workers aged 15 and older in 2022 will be 50.6 million people, an increase of 1.5 million people compared to 2021. Of which, the number of employed workers in urban areas increased by 877.3 thousand people, Labor in rural areas increased by 627.2 thousand people. The number of workers in the service sector has increased sharply and reached 19.7 million (accounting for 38.9%), an increase of 1.1 million people compared to 2021. In addition, economic growth also makes the People's income increases, social welfare and people's quality of life improve. According to CEOWORLD's 2022 report, Vietnam's "quality of life" index reached 78.49 points, ranked 62/165 countries on the rankings, up 39 places compared to 2021. This is a signal It is encouraging to see that Vietnam is taking steps to improve the quality of life, creating a premise to promote green growth when people are considered the center of the transition to a green economy.

**Second, the level of natural resource depletion has an inverse relationship with green growth at the 5% significance level.** That is, when natural resources are increasingly depleted or the amount of resource depletion increases, green growth will decline. This is quite understandable because green economic growth is sustainable economic development based on combining economic growth and environmental protection. Meanwhile, the depletion of natural resources goes against both of the above factors. Natural resources play a very important role in economic development because they not only provide raw materials for production but also directly serve human daily life. Therefore, the depletion of resources will be accompanied by negative impacts on the ecological environment and the decline of the economy as proven through many case studies such as the research of MA Nawaz, A Azam, MA Bhatti (2019) with 25 years of data from Southeast Asian countries, using the CIPS research framework and Konya Granger causality tests, found that resource depletion and mineral depletion are the causes. hinders the economic growth of many countries.

**Third, total resource rent has a negative impact on green growth at the 1% significance level.** That is, if total natural resource rent decreases, green growth will increase. Total natural resource rent is the total rent for minerals such as oil, natural gas, coal, and forest rent. In fact, increasing natural resource rent will reduce the demand for resource rent and have a positive impact on the environment. This is explained through a study by author Sadia Safdar and her colleagues (2022) showing that good management of natural resource rents can reduce greenhouse gas emissions, thereby bringing about negative impacts. positive impact on the environment. On the other hand, the relationship between natural resource rents and economic growth has always been a controversial issue over the past decades. Research by Ousama Ben-Salha and colleagues (2021) suggests that there exists an interactive cause-and-effect relationship between resource rents and economic growth. The results of the method show that economic growth has a positive impact on resource rents

**Fourth, the results obtained from the research process show that forest area has a positive effect on green growth at the 1% significance level.** This result is quite consistent with the results of previous studies. Yu Hao, Yalin Xu, Jingjing Zhang, Xinlei Hu, Junbing Huang, Chun-Ping Chang, Yaqi Guo (2019) showed the relationship between forest resources and economic growth based on data of 30 Chinese cities period 2002 - 2015. Research results according to the U-shaped model have shown that in the early years when the economy grew, forest resources were heavily exploited for production. After a period of time, as the economy develops towards balance, the rate of forest coverage will be proportional to the growth rate of the economy. The research paper R. Afonso, Daniel C. Miller (2021) showed that the expansion of afforestation areas in urban areas in the state of Minas Gerais, Brazil led to a reduction in poverty

rates and an increase in per capita income of people over time.**Fifth, the amount of solid waste has negative impacts on green growth at the 5% significance level.** Magazzino C, Mele M, Schneider N. (2020) pointed out that solid waste causes environmental impacts: in the solid state it pollutes the soil environment, when burned, it pollutes the air environment. gas. They also proved that waste recovery from recycling and composting will reduce the amount of waste, thereby reducing greenhouse gas emissions and limiting environmental pollution. That is the driving force to promote green growth.

**Sixth, foreign direct investment has a negative impact on green growth at the 10% significance level.** That is, foreign investment will hinder green growth. This result seems to be suitable for Vietnam - one of the developing countries, according to research by Rafaela Vital Caetano and colleagues (2022) when studying "How does FDI stimulate green growth?" The mediating and regulatory role of the energy transition". Your research results show that FDI is the driving force of green growth, however, for developing countries, greater efforts are required to achieve green growth through the energy transition process. quantity.

**Seventh, the model results obtained show that trade openness is positively related to green growth at the 5% significance level.** That is, the more trade openness increases, the more green growth increases. The group's result is a combination of two hypotheses: "the pollution halo hypothesis" (Birdsall and Wheeler 1993) and "The pollution haven hypothesis" (Walter and Ugelow 1979). Accordingly, FDI has a negative impact and trade openness has a positive impact on Vietnam's green growth, exactly as the study by Shahbaz et al. (2019) argues that allowing free transactions within and Foreign investment can improve environmental quality, but an increase in foreign investment will be detrimental to a greener environment.

**Eighth, the results show that population growth rate has a negative effect on green growth at the 10% significance level.** Population growth has had a major impact on natural resources and the environment due to overexploitation of resources to serve human needs. Population growth increases the need for land use, leading to deforestation to build houses and produce food. Deforestation causes a decline in vegetation in the basin; The ability to obstruct flow during floods is reduced, causing the movement speed of floods to become faster, causing more serious rains and floods. Furthermore, because there are not many trees that can absorb emitted CO<sub>2</sub>, deforestation also increases the greenhouse effect. According to the General Statistics Office of Vietnam, in the fourth quarter of 2022, the damaged forest area was 234 hectares, down 6.7% over the same period last year, of which mainly forests were cut down and destroyed with 217.2 hectares. hectares, increased by 2.5%; The area of arid forests is 16.8 hectares, a decrease of 56.8%. For the whole year 2022, the whole country has more than 1.1 million hectares of damaged forests, a decrease of 56.9% compared to the previous year, of which the burned forest area is 41.4 hectares, a decrease of 97.3%. Cut and destroyed forests were 1,080.5 hectares, a decrease of only 0.8%.

**Ninth, the model results show that the CO<sub>2</sub> variable has a similar but insignificant impact on green growth in Vietnam.** This is quite reasonable because GDP has a positive relationship with green growth, which in fact shows that CO<sub>2</sub> will increase when economic growth (expressed through GDP) increases. This has been proven through World Bank data statistics with more than 150 countries during the period from 1960-2008, researchers have discovered that when gross domestic product (GDP) increases by 1%, Correspondingly, CO<sub>2</sub> emissions will also increase by about 0.73%. Meanwhile, for every 1% decrease in GDP, the rate of decrease in CO<sub>2</sub> is only about 0.43%.

**Tenth, the results show that fossil fuels do not have a significant impact on green growth in Vietnam.** We can see that fossil fuels have an inverse relationship with green growth. Fossil fuels are our country's valuable resources and important raw materials in our country's industry

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## CONCLUDE

With the initial goals set, the research team has solved problems, including: (i) Building a green growth measurement framework suitable to Vietnamese practice, (ii) Identifying a model Assess the factors of environmental pollution that determine green growth, (iii) Based on the results of the research model, the group has made recommendations and some solutions to overcome environmental pollution towards growth. Green in Vietnam. From the results received from the research project, the following conclusions can be drawn:

Factors directly related to environmental pollution such as: Total natural resources, natural resource depletion, forest ratio, solid waste have an impact on green growth, specifically:

First, total natural resources and depletion of natural resources have a negative relationship with green growth.

Second, the proportion of forests has a positive relationship with green growth. The more green the forest is, the healthier the environment will be and the milder climate will create favorable conditions for green growth.

Third, solid waste has a negative impact on green growth. The problem of solid waste pollution is extremely painful in Vietnam, the State is in the process of finding a solution to this problem.

Factors indirectly related to environmental pollution such as: economic growth rate, foreign investment capital, trade openness, population growth rate have an impact on environmental pollution, thereby affecting environmental pollution. impact on green growth, specifically:

First, economic growth measured by GDP per capita has a positive relationship with green growth. As analyzed above, economic growth reaching a period of prosperity will help improve environmental pollution, contributing to green growth.

Second, foreign investment capital has a negative impact on green growth. Due to the fact that our country's legal regulations are still lax; Unclear policies and mechanisms cause foreign investment projects to cause environmental pollution, affecting the green growth process in Vietnam.

Third, population growth rate has a negative impact on green growth, while in Vietnam the more the population increases, the higher the level of environmental pollution, affecting the green growth process.

Fourth, trade openness has a positive relationship with green growth. Increasing international trade will create more opportunities for our country to cooperate in transferring modern technology, environmentally friendly technology, and promoting the export of goods for economic development, which is the basis for our country to achieve green growth goals.

Although the research team has tried to research resources as completely as possible, the research topic still has the following limitations:

First, the study points out environmental pollution factors such as total natural resources, natural resource depletion, forest ratio, solid waste, CO2 emissions, fossil fuels, and technological development. related to the environment. In particular, the variables CO2 emissions, fossil fuels, and technology development related to the environment do not have a significant relationship with green growth, while these variables clearly show environmental pollution. in Viet Nam. It may be because the group's research period is quite short and has not updated the data of recent years, so it is necessary to increase the number of samples to expand the scope of research and other related reasons.

Second, the research topic on environmental pollution factors includes 11 variables and there are still other factors related to environmental pollution such as the rate of renewable energy, political institutions and other variables. different, so it is necessary to increase new independent variables that affect environmental pollution.

## REFERENCES

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1. Vincent Tawiah, Abdulrasheed Zakari, Festus Fatai Adedoyin (2021), *Determinants of green growth in developed and developing countries*.
2. Saša Stjepanović, Daniel Tomic, Marinko Skare (2017), *A new approach to measuring green GDP: a cross-country analysis*.
3. Anupam Prakash, Kaustav K Sarkar, Amit Kumar (2022), *Estimation of Green GDP for India Estimation of Green GDP for India*.
4. Guizhi Wang, Xiaolin Li, Marc Humphries, Venkatesh Chinni, Khanittha Uthaiipan (2022), *Coastal Pollution*.
5. Lin-Na Hao, Muhammad Umar, Zeeshan Khan, Wajid Ali (2020), *Green growth and low carbon emission in G7 countries: How critical the network of environmental taxes, renewable energy and human capital is?*
6. Mingliang Zhao, Fangyi Liu, Yingjie Song, Jiangbo Gengg (2020), *Impact of Air Pollution Regulation and Technological Investment on Sustainable Development of Green Economy in Eastern China: Empirical Analysis with Panel Data Approach*.
7. David Popp (2012), *The Role of Technological Change in Green Growth*
8. Muhammad B, Khan S (2019), *Effect of bilateral FDI, energy consumption, CO2 emission, and capital on economic growth of Asia countries*.
9. Walter I, Ugelow JL (1979), *Environmental policies in developing countries*
10. Birdsall N, Wheeler D (1993), *Trade policy and industrial pollution in Latin America: where are the pollution havens?*

11. Ayamba EC, Haibo C, Ibn Musah A-A, Ruth A, Osei-Agyemang A (2019), *An empirical model on the impact of foreign direct investment on China's environmental pollution: analysis based on simultaneous equations.*
12. Cole MA, Elliott RJ (2003), *Determining the trade–environment composition effect: the role of capital, labour, and environmental regulations.*
13. Mihci H, Cagatay S, Koska O (2005), *The impact of environmental stringency on the foreign direct investments of the OECD countries.*
14. Khan A, Hussain J, Bano S, Chenggang Y (2020), *The repercussions of foreign direct investment, renewable energy, and health expenditure on environmental decay? An econometric analysis of B&RI countries.*
15. Shahbaz M, Gozgor G, Adom PK, Hammoudeh S (2019), *The technical decomposition of carbon emissions and the concerns about FDI and trade openness effects in the United States.*
16. Salman M, Long X, Dauda L, Mensah CN (2019), *The impact of institutional quality on economic growth and carbon emissions: evidence from Indonesia, South Korea, and Thailand.*
17. Sarkodie SA, Adams S (2018), *Renewable energy, nuclear energy, and environmental pollution: accounting for political, institutional quality in South Africa.*
18. Muhammad Tufail, Lin Song, Tomiwa Sunday Adebayo, Dervis Kirikkaleli & Suliman Khan (2021), *Do fiscal decentralization and natural resources rent curb carbon emissions? Evidence from developed countries.*
19. Rafaela Vital Caetano, António Cardoso Marques, Tiago Lopes Afonso (2022), *How Can Foreign Direct Investment Trigger Green Growth? The Mediating and Moderating Role of the Energy Transition.*
20. Jalil Khodaparast Shirazi, Vahid Mohamad Taghvaei, Mohamad Nasiri & Abbas Assari Arani (2020), *Sustainable development and openness in oil-exporting countries: green growth and brown growth.*
21. Jalil Khodaparast Shirazi, Vahid Mohamad Taghvaei, Mohamad Nasiri & Abbas Assari Arani (2020), *Sustainable development and openness in oil-exporting countries: green growth and brown growth.*