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Evaluating the Component Index to Reduce Environmental Pollution and Negative Impacts of Climate Change in the Red River Delta Provinces

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Abstract
In the context of increasing natural disaster and climate change risks and the growing economic sector in Vietnam, the responsibility of local governments has become increasingly greater in recent years because they are expected to solve infrastructure needs, support businesses in preparing, responding, and minimizing the growing impact of climate change on production and business activities. Minimizing environmental pollution and negative impacts of climate change is one of four components of the provincial green index. This component index measures basic infrastructure and public services provided by the provincial government to minimize risks caused by natural disasters and climate change to business operations. This article aims to evaluate the environmental pollution reduction index and negative impacts of climate change of provinces in the Red River Delta region in 2022, thereby examining the causes leading to the results. differences between provinces, and learn about policies to help provinces achieve sustainable development goals through improving the index of reducing environmental pollution and negative impacts of climate change.

Keywords: Provincial Green Index, Environmental Pollution, Climate Change

1. Introduction
Climate change is one of the biggest challenges facing humanity in the 21st century. Climate change will seriously impact production, life and the environment worldwide. Rising temperatures and rising sea levels cause flooding, salinity of water sources, affecting agriculture, posing great risks to industry and socio-economic systems in the future. Vietnam is considered one of the countries most severely affected by climate change. Over the past 50 years, the average temperature has increased about 0.5 - 0.7 ^{0}C, and sea level has risen about 20 cm. From 1994 to 2013, according to long-term risk statistics due to climate change, Vietnam ranked 7th globally with an average of 392 deaths per year and a loss of more than 1% of GDP due to disasters related to climate change. On average, each year in Vietnam, 392 people die and more than 1% of GDP is lost due to disasters related to climate change. In the context of increasing natural disaster and climate change risks and the growing private economic sector in Vietnam, the responsibility of local governments has become increasingly greater in recent years because they are expected to solve infrastructure needs, support businesses in preparing, responding, and minimizing the growing impacts of climate change (floods, rising sea levels, droughts, etc.) for production and business activities.
Therefore, the goal of this article is to evaluate the environmental pollution reduction index and negative impacts of climate change of provinces and cities in the Red River Delta region in 2022, thereby considering the reasons for different results between provinces, and learn about policies to help provinces achieve sustainable development goals through improving the index of reducing environmental pollution and negative impacts of climate change.

2. Theoretical basis
The provincial green index is a set of indicators that evaluate and rank the quality of local environmental governance from the perspective of business practices such as the level of application of environmentally friendly technology by businesses, and the level of governance and environmental behavior of businesses, the level of concern and willingness to invest in environmental issues of local governments and many other important environmental issues. The provincial green index includes 4 component indices made up of 44 indicators measuring the quality of environmental governance in provinces and cities in the direction of linking environmental protection with economic development. The methodology of the provincial green index is built with the

same steps as the provincial competitiveness index and Infrastructure index, often called the 3-step process by the research team. Data collection is the collection of data to calculate indicators from two main sources, "soft" data collected from the annual the provincial competitiveness index survey for domestic private enterprises and FDI enterprises and "hard" data collected through published official sources. Building component indices means implementing techniques to adjust the value of each evaluation criterion on a 10-point scale. After standardizing the indicators, the research team builds component indices that are related to each other theoretically related to reflect important aspects of environmental governance. Determining the overall Provincial Green Index is the step of assigning weights to each component index according to their importance relative to important outcome/performance variables.

Minimizing environmental pollution and negative impacts of climate change is one of four components of the provincial green index. This component index measures basic infrastructure and public services provided by the provincial government to minimize risks caused by natural disasters and climate change to business operations. Providing infrastructure and public services can be considered the most basic responsibility of provincial governments, even included in central planning. In the context of increasing natural disaster and climate change risks and the growing private economic sector in Vietnam, the responsibility of local governments has become increasingly greater in recent years because they are expected to solve infrastructure needs, support businesses in preparing, responding, and minimizing the growing impacts of climate change (floods, rising sea levels, droughts, etc.) for production and business activities. Component index 1 includes the following indicators: Overall environmental quality in the province is good or very good (% of enterprises); The environment in the province is not polluted or slightly polluted (% of businesses agree); Business activities of enterprises are not affected by pollution levels (% of enterprises agree); The situation of enterprises polluting the environment is common in the province (% of enterprises agree); Relocating investment to localities with less natural disaster risk (% of enterprises); Natural disasters and climate change cause difficulties for business operations (% of businesses); Data from the Ministry of Natural Resources and Environment: Number of air quality monitoring stations in urban areas of type IV or higher per 10,000 urban residents.

This component index measures three edge dimensions. Dimension 1 focuses on businesses' assessments of the provincial government's efforts to reduce environmental pollution. Dimension 2 measures the provincial government's efforts to minimize and mitigate the negative impacts of natural disasters on businesses. The third dimension uses a benchmark to evaluate these efforts from available hard data.

3. Index for reducing environmental pollution and negative impacts of climate change in the Red River Delta region in 2022

The scores of the index "Reducing environmental pollution and negative impacts of climate change" in 2022 in 11 provinces and cities in the Red River Delta region are shown in Fig 1. Survey results have shown that the number The ranking of these 11 provinces on the index "Reducing environmental pollution and negative impacts of climate change" is as follows: Bac Ninh, Quang Ninh, Hai Duong, Vinh Phuc, Hung Yen, Thai Binh, Ninh Binh, Hanoi, Nam Dinh, and Hai Phong.

Dimension 1 of the index "Reducing environmental pollution and negative impacts of climate change" focuses on businesses' assessments of the provincial government's efforts to reduce environmental pollution. The first dimension, pollution reduction, includes four indicators identified from PCI 2022 survey data for domestic private enterprises and FDI enterprises. The four indicators include: The overall environmental quality in the province is good or very good, the environment in the province is not polluted or slightly polluted, the business activities of the enterprise are not affected by the level of pollution, and enterprises causing environmental pollution are common in the province. The first indicator comes from a question in the PCI 2022 survey asking businesses to evaluate the overall environmental quality in the province. This indicator is measured by the proportion of businesses assessing the environmental quality in the province as "good" or "very good". The score results for dimension 1 "Reducing environmental pollution and negative impacts of climate change" of provinces in the Red River Delta region are shown in Fig 2. Regarding the indicator "The overall environmental quality in the province is good or very good", Thai Binh is the province with the highest evaluation rate of 85%, followed by Hai Duong (79%), the lowest is Ha Nam (57%). For the indicator "The environment in the province is not polluted or slightly polluted", Quang Ninh is rated at 48%, Hung Yen is 36%, Vinh Phuc is 14%. For the indicator "Enterprises' business activities are not affected by pollution levels", Thai Binh is rated the best (72%), Quang Ninh is rated the lowest (44%).

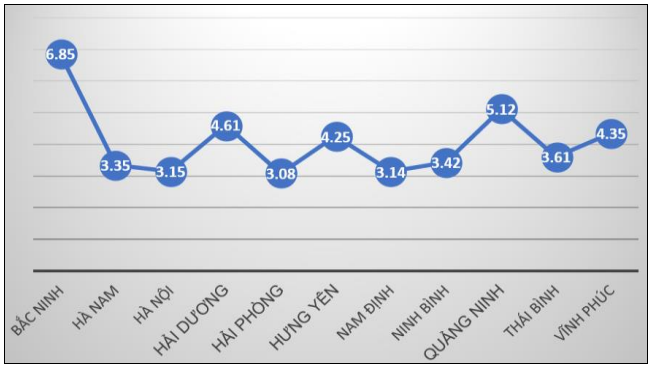

Fig 1: Index for reducing environmental pollution and negative impacts of climate change in the Red River Delta provinces

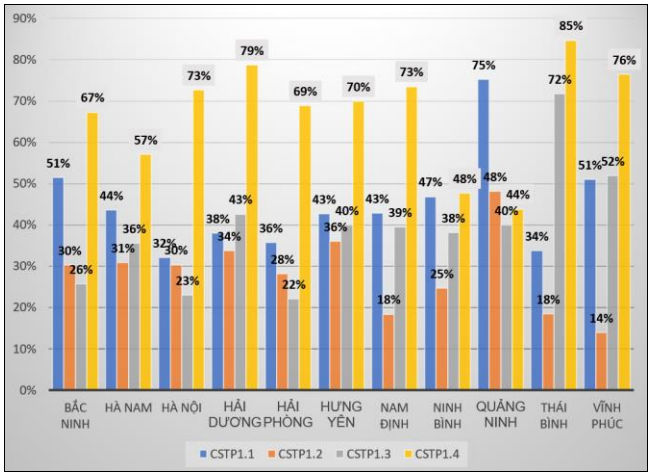

Fig 2: Score for dimension 1 of the index "Reducing environmental pollution and negative impacts of climate change"

Dimension 2 measures the provincial government's efforts to minimize and mitigate the negative impacts of natural disasters on businesses. In the first indicator, the research team used the question: If there is a plan to expand investment and business to another province, which locality will the enterprise choose to invest in because the geographical location has less risk of natural disasters and more climate change. The proportion of businesses answering "intending to move their investment location" to a specific province is considered a measure of that locality's environmental safety. For the second indicator, the proportion of businesses reporting that natural disasters and climate change are a barrier to business operations is used as a measure. Provincial green index 2022 survey data shows that only 0.5% of businesses in the median province (Hung Yen) answered "yes" to their intention to move their investment location to another province. Among the 11 provinces and cities in the Red River Delta region, businesses in 6 provinces and cities have no intention of moving their investment locations to localities with less natural disaster risk, including Bac Ninh, Hai Duong, Ninh Binh, and Quang Ninh and Vinh Phuc. Hanoi, Ha Nam, Hung Yen, Nam Dinh, and Thai Binh are provinces where businesses want to move their investment locations to localities with less natural disaster risk.

For the indicator "Natural disasters and climate change cause difficulties for business operations", the highest rate is 8% (Quang Ninh) and the lowest is 2% (Quang Ninh and Thai Binh). Survey data shows that provinces in the Red River Delta region belong to the group of provinces with a moderate level of exposure to natural disasters and the effects of climate change. For this indicator, the highest score nationwide is 24%, the lowest score is 1%, and the median score is 6%. Most provinces and cities in the Red River Delta region have scores lower than the median score.

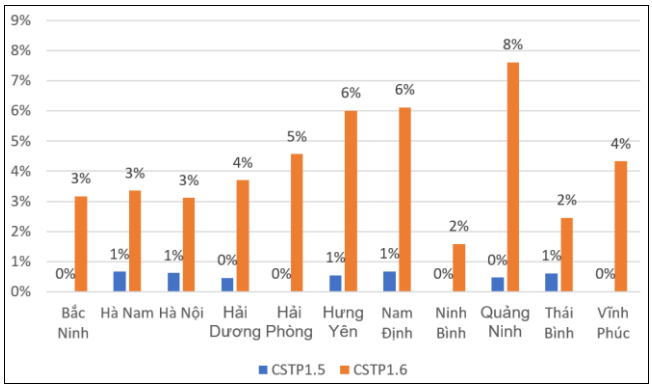

Fig 3: Score for dimension 2 of the index "Reducing environmental pollution and negative impacts of climate change"

The third dimension uses a benchmark to evaluate these efforts from available hard data. The final dimension of component index 1 uses only one hard data indicator from the Ministry of Natural Resources and Environment's PEPI 2021 survey - the number of automatic air quality monitoring stations in urban areas of type IV and above to over 10,000 urban residents. This dimension is assigned a weight of 40% in component index 1, higher than the other two dimensions with a weight of 30% respectively. Bac Ninh achieved the highest score because of the importance of the hard data indicator "number of automatic monitoring stations for air environment quality" (0.52 points). Bac Ninh has made many efforts in monitoring and minimizing the risk of environmental pollution from craft villages and the rapid development of industrial zones and clusters in the province. Provinces without air quality monitoring stations include Ha Nam, Hai Phong, Nam Dinh, and Ninh Binh.

Table 1: Number of air quality monitoring stations in urban areas of type IV or higher per 10,000 urban population

Province	Number of air quality monitoring stations in urban areas of class IV or higher with over 10,000 urban residents
Bắc Ninh	0,52
Hà Nam	0,00
Hà Nội	0,01
Hải Dương	0,20
Hải Phòng	0,00
Hưng Yên	0,14
Nam Định	0,00
Ninh Bình	0,00
Quảng Ninh	0,20
Thái Bình	0,05
Vĩnh Phúc	0,16

4. Conclusion

Minimizing environmental pollution and negative impacts of climate change is one of four components of the provincial green index in Vietnam. This is the first set of indicators surveyed in 2022. The survey results showed the scores of the component "Reducing environmental pollution and negative impacts of climate change" of 11 provinces and cities in Red River Delta area. This result measured the basic infrastructure and public services provided by the provincial government to minimize risks caused by natural disasters and climate change to business operations. Most provinces and cities in the Red River Delta region are aware of the impact of environmental pollution and climate change on the socio-economic situation in the provinces and cities. Through the survey results on the green index in general and the component "Reducing environmental pollution and negative impacts of climate change" in particular, create a basis for providing information to serve local policy planning, but also creates motivation for localities to take the right steps in socio-economic development, to minimize the negative impacts of climate change and environmental pollution on production and business activities and corporate sustainability, in accordance with the development trends of the country and the world.

Since then, the provinces have synchronously deployed solutions, focusing on planning solutions to create new development space and promote comprehensive development; restructuring the agricultural sector, shifting crops and livestock with high productivity and value; Developing organic agriculture and high-tech agriculture to adapt to climate change, limiting and eventually reducing the area of greenhouses and net houses in the province.

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