Editor's Comment:

My editorial decision is to publish as is with minor corrections.

I suggest revised title: "Economic Growth and Environmental Degradation in ASEAN-10 Countries: Econometric Descriptive Analysis."

The article is well-written, most interesting and important. The author's main conclusions make good common sense to me.

This finding indicates that the economic activities in this nation have a strong impact on environmental quality, thereby creating an urgent need for sustainable strategies that are integrated into its plans for development. Such a study points out significant variations in how different countries in varying stages of development approach the growth-environment nexus. For example, high-growth economies like Singapore and Malaysia display relatively better capacity to mitigate CO2 emissions while sustaining economic growth. Such countries have invested heavily in renewable energy and energy-efficient technologies and have, therefore, seen the benefits of balancing their economic and environmental priorities.

Abstract. The linkage between GDP growth and CO2 emissions is studied in this research among the ASEAN-10 countries, as for the gradual economic growth received by the ASEAN economy; we need to analyze the complex and nonlinear relationship between the environmental indicator CO2 and economic growth. In recent decades, ASEAN countries have passed through a period of rapid economic development associated with industrialization, urbanization, and increasing foreign direct investment. But this growth has entailed a heavy environmental cost --- soaring carbon emissions, deforestation, and pollution. By using econometric methods, such as Granger causality and Johansen cointegration tests, this study investigates the short-term and long-term relationship between Economic Growth and Environmental Degradation across ASEAN 10 countries from 1990 to 2023.The results show notable country-specific economic-environmental relationships. Countries such as Cambodia and the Philippines, on the other hand, demonstrate this strong causality where GDP growth causes emissions to increase, which implies the presence of energy-intensive industries and weak regulatory frameworks. In contrast, we see severe growth in countries such as Singapore, which has invested in renewable energy and tough environmental policies.

Keywords: Maybe add: Environmental Kuznets Curve (EKC).

Introduction. The ASEAN policymakers have always valued economic development as the focus and goal [1]. However, a lot of negative impacts have been placed on the environment due to this fast rate of economic development and the area of focus is having several problems within the environmental department, such as deforestation, loss of biodiversity, and contamination of air and water. The ASEAN nations have experienced remarkable economic growth rates for the past few decades; during the 1990s, the Gross Domestic Product has grown at a rate higher than 5\% per annum [2]. This economic expansion results from many factors such as; urbanization, industrialization, and increased FDI flows. Still, economic growth has been made at the cost of the environment which is necessary to improve standards of living and fight poverty. Several countries have had the probability between carbon emissions and economic growth analyzed. Because CO2 emissions per capita are the largest source of pollution, they are used most frequently as the pollutant, with the main parameter being GDP per capita. One of the greenhouse gases, carbon dioxide, has risen due to the region's power-hungry manufacturing, fast growing urbanization, and expanding transportation sector.

A more elaborate regional approach was used in the study, Towards a Low Carbon ASEAN, which assessed how the ASEAN countries could cut emissions synergistically using the MRIO model. Using the parameters from the MRIO model, the authors found that emission reductions depend on the level of economic development and technical progress; they also proposed further development of the MRIO model to achieve a better balance in GDP growth and emissions [8]. In the same similar way, Lean and Smyth [9] estimated the co-integration and long-run causality nexus of CO2 emissions, electricity consumption and output in ASEAN. Their empirical evidence was in line with the Environmental Kuznets Curve (EKC) hypothesis that social environmental quality is inversely related to economic growth in the early stages and directly related later. Further, the study suggested the analysis of the relationship energy-economy-environment on the sectoral level for a better understanding. While analysing the impact of tourism, trade openness, FDI and renewable energy consumption on CO2 emissions in the six ASEAN countries under the Kaya's Identity of Energy (EKC) hypothesis, it was found that income level had a moderating influence while trade openness factor showed a direct relationship with emissions while tourism and foreign direct investment showed a positive relationship with emissions. Some suggestions for better use of renewables and less dependence on fossils were developed after it was found out that despite the renewable energy reducing emission in the short run, this had no similar effect in long run especially in economies that rely on tourism [10]. A related idea surfaced in the study of Economic Growth and CO2 Emission in ASEAN: Panel-ARDL model approach, which found out that there is a long run and short run relationship between GDP and CO2 emissions.

Objectives. Methodology and Data Source. Granger Causality Test is a statistical hypothesis test to check if there is a directional relationship of GDP with CO2 emissions. This test, which was proposed by Eagle and Granger (1989), analyses whether economic growth leads to environment degradation or vice versa [3],[4]. Johansen Cointegration Test implements the long-run cointegrating relationships between the model variables, GDP and CO2 emissions. The Trace and Maximum Eigenvalue statistics are used to establish the number of cointegrating equations [19]. The analysis focuses on ten ASEAN countries: Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam.

Data Source and Variables: All data is collected from well-established source such as the World Bank Development Indicators (WDI) and comprises time-series data collected yearly from 1990 to 2023 for ASEAN-10 countries.

Table 1: Result of Granger Causality test for ASEAN 10 countries. It has been concluded that in such countries as Myanmar, Cambodia, and the Philippines, GDP Granger-causes CO2 emissions, which means that growth in such states is highly dependent on industrial development and fossil fuel consumption. This implies rapid urbanization and industrial development, which have caused deterioration in the environment, leading to a lack of sustainable methods. Contrarily, Singapore and Vietnam have no evident causality between GDP and CO2 emissions, which shows that these economies could have decoupled their economic growth from environmental damage.

Table 2: Result of Cointegration test for ASEAN 10 countries. The trace statistics show that for most of the countries in ASEAN, for example, Brunei Darussalam and Indonesia, there is a weak or, in some cases, non-existent long-run relationship, and short-term economic variables appear to dominate concerns with sustainability issues. Cambodia, however, shows evidence of a long-run relationship connecting the nation's GDP and CO2 emissions.

Conclusion. There is evidence however that in the case of ASEAN nations, a common approach may not be appropriate given their varying degrees of development. Instead, specific weaknesses of every country both economically and environmentally will be the defining criterion for corrective measures. This

transformation involves promoting clean energy technologies, setting stricter regulatory frameworks, and advancing innovation for a stronger ASEAN economy. This paper adds new dimensions to existing practices by focusing on the factors where development does not only depend on focus for GDP but rather how fair, how inclusive and how sustainable the future outlook is for coming generations.

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