A COMPARATIVE STUDY OF THE PLANETARY PRESSURES – ADJUSTED HUMAN DEVELOPMENT INDEX (PHDI) IN THE EUROPEAN UNION AND OTHER REGIONS

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Abstract

Sustainable development has emerged as a significant issue in the late 20th century. This descriptive study compares the environmental pressures of countries and regions according to the Planetary Pressures-adjusted Human Development Index (PHDI). Thus, this paper aims to evaluate sustainable development through its environmental dimension. Data from this study were taken from Human Development Reports published by United Nations Development Programme. The findings indicate that the European Union (EU) is the region with the greatest environmental pressure. EU countries must implement more environmental policies in line with sustainable development.

Keywords: Planetary Pressures-adjusted Human Development Index, Sustainability, Human Development Index, The European Union

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Introduction

Since the Industrial Revolution, the structure of production has changed and the mass production system has led to the consumption of natural resources without considering future generations, and economic growth has been prioritized without considering environmental problems. However, nowadays, high levels of waste, climate change, ozone layer depletion, pollution or destruction of water resources, loss of natural habitat characteristics, and extinction of some species have led to a reconsideration of economic development (Ay, 2017, p. 89-90). Human-induced changes have made it difficult to protect the environment and living resources on a global scale. As a result of the emergence of serious threats to human survival, our place in the ecosystem has been reassessed and efforts have been made to find a new path that combines development with long-term survival (Shi et al, 2019, p. 1). Sustainable development is a relatively new concept that has gained prominence as a result of these efforts. Although development is generally associated with developing countries, emerging environmental

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problems affect the whole world. Therefore, the new approach also assigns various responsibilities to developed countries. The study has three main parts.

This study aims to assess sustainable development with its environmental dimension using data from the United Nations Development Programme's (UNDP) Planetary Pressures Adjusted Human Development Index (PHDI). The reports published by the UNDP contain data on a country-by-country basis and developing regions. However, there are no regional data for the EU, which includes developed countries. The purpose of the calculations in this study is to compare the pressures on the environment in the EU and in the developing regions. The first part explains the concept of sustainable development and the main stages in its historical development. In the following section, the PHDI and the method used to calculate it will be analyzed. Finally, the third section compares data for selected countries and regions.

Sustainable Development

It can be said that sustainability is a natural interest of economics since it is based on the recognition of the availability of scarce resources. However, it was not until the Club of Rome published its report Limits to Growth (1972) that the concept received significant attention. The report argued that the resources needed to sustain life would be exhausted within a few generations (Kuhlman and Farrington, 2010, p. 3437). Although definitions vary, sustainability generally refers to the ability to continue an activity or process indefinitely. Reasons for different definitions include the fact that the concept relates to economic, social, or environmental activities and has different meanings in different disciplines (Markulev and Long, 2013, p. 1).

Development, another term with a positive connotation, encompasses a range of measures to ensure economic growth and improve the quality of life. The process of development can be defined as a social process that improves the quality of life of underdeveloped societies through economic growth as well as socio-cultural and political transformation. From the Second World War until the 1970s, the primary focus of development was on economic growth. Nevertheless, it has since been acknowledged that the planet's finite resources will not support the current economic growth rates indefinitely (Rabie, 2016, p. 7 – 8). The concept of sustainable development, which represents a synthesis of these two concepts, emerged in this context.

In light of the growing population, the concept of sustainable development assumes greater significance, particularly given the dearth of resources to meet the needs and demands of a rapidly expanding global population. There is no consensus on a definition of this relatively recent concept, as it can be approached from different disciplinary perspectives. However, in essence, it can be defined as a form of development that can be sustained for an indefinite or a specified period. On the other hand, it can be defined as a development approach that aims to enhance living standards while ensuring the preservation of ecosystems and the avoidance of environmental issues such as climate change and species extinction (Mensah, 2019, p. 5-6). Since the final quarter of the

20th century, several significant historical events have contributed to the adoption of this approach.

The year 1972 saw the publication of the report Limits to Growth, which was followed by the convening of the Conference on the Human Environment, the inaugural international conference dedicated to environmental issues. While the conference did not significantly influence the trajectory of development plans, the establishment of the United Nations Environmental Programme (UNEP) was a noteworthy outcome. The organization's mission is threefold: to disseminate information and inspire nations; to enhance future generations' quality of life without endangering them; and to promote partnership through environmental leadership (Bac, 2008, p. 577). Another significant milestone at this point was the publication of the United Nations report entitled Our Common Future (1987), which followed the work of the World Commission on Environment and Development. The report asserted that humanity can achieve sustainable development in a manner that meets the needs of the present without compromising the ability of future generations to meet their needs (United Nations, 1987, p. 15).

In 1992, the United Nations Conference on Environment and Development was convened in Rio de Janeiro, resulting in significant outcomes. The program of action, Agenda 21, which sets out the conditions necessary for the establishment of a new economic and social order, was adopted (Baum, 2021, p. 17). Agenda 21 represents a global program and comprehensive guideline for sustainable development. It emphasizes international cooperation, consensus, and participation, and places responsibility on developed countries. Another significant outcome of the Conference was the Rio Declaration on Environment and Development, which comprises 27 principles of sustainable development. The document proposed that countries whose activities result in pollution should bear the associated costs. Furthermore, developed countries have been tasked with the responsibility of providing technology and financial resources (Klarin, 2018, p. 75).

Finally, in 2015, the United Nations published the report „Transforming Our World: The 2030 Agenda for Sustainable Development“. The report identifies 17 sustainable development goals that must be achieved by 2030. To protect the needs of future generations, a series of decisions have been made concerning the sustainability of natural resources, the realization of progress in harmony with nature, sustainable production and consumption, and so forth. Furthermore, it was declared that all countries would collaborate to ensure the security of our planet (United Nations, 2015, p. 3 – 4).

There is a consensus relation to sustainable development has three main dimensions: economic, social, and environmental. The economic dimension of sustainability, which includes quantitative indicators related to the economy, encompasses a production system that takes into account the needs of future generations and financially prudent decisions for sustainability. The social dimension asserts that the pursuit of development and the fight against poverty should not result in environmental degradation or economic instability. As a system of social organization that has the objective of reducing

poverty, it embodies concepts such as accessibility, participation, and equality (Mensah, 2019, p. 8 – 10).

The environmental dimension encompasses the maintenance of a stable resource base for energy. It includes the prevention of the overexploitation of renewable resource systems along with the consumption of non-renewable resources to the extent that is consistent with the investment in the development of adequate substitute energy resources. These measures are aimed at preserving biodiversity, maintaining atmospheric stability, and sustaining other ecosystem functions (Harris, 2003, p. 1). There is a significant connection between the acquisition and utilization of energy and the environmental dimension of sustainable development. Indeed, the majority of the 17 targets established in 2015 are either directly or indirectly associated with energy. Accordingly, it can be reasonably deduced that there is a correlation between the sustainability of energy and the success of the Sustainable Development Goals. At this point, sustainable energy development has emerged as a means of minimizing the environmental impact of energy consumption, while also ensuring the availability of sufficient energy for current and future generations (Jedrzejczak-Gas et al, 2024, p. 2 – 3). Energy use is a crucial element of the PHDI, which enables for evaluation of sustainable development in terms of its environmental impact.

Planetary Pressures-adjusted Human Development Index (PHDI)

In fact, the official publication of the PHDI as of 2020 represents another significant advancement in environmental awareness on the part of the UN (UNDP, 2020). The PHDI is an index that measures human development in relation to the pressures exerted on the planet. In the absence of pressure on the planet, the Human Development Index (HDI) and PHDI values are equal. According to the intensification of pressures on the planet, the PHDI value declines below the HDI value (UNDP, 2024a, p. 14). The PHDI is comprised of two indicators: carbon dioxide emissions per capita and material footprint per capita (UNDP, 2024b, p. 305). The per capita carbon dioxide emission value is calculated by dividing the total carbon dioxide emissions resulting from activities such as the use of gas, coal, oil, etc., by the average population for a given year. The source of the relevant data is the Global Carbon Project (GCP) (UNDP, 2024a, p. 14).

On the other hand, the material footprint per capita encompasses biomass, fossil fuels, metal ores, and non-metal ores. The index in question is designed to calculate the final domestic demand of a country. Firstly, the import value and the quantity of raw materials extracted domestically are aggregated, and then the export value is deducted. The source of data used in the calculation is UNEP. The arithmetic mean of the two aforementioned indicators is used in the calculation of the adjustment factor for planetary pressures. A low value indicates that greater pressure is exerted on the planet (UNDP, 2024a, p. 14).

The calculation of the PHDI value is performed in three stages. Firstly, the carbon dioxide emission index and material footprint index are converted into a value between

0 and 1 using the measured minimum and maximum values. Aforementioned both indicators are represented by the letter „j“ and are calculated using the same formula (UNDP, 2024a, p. 15):

„A_j Index= ($Maximum_j$-Observed $Value_j$) / ($Maximum_j$-$Minimum_j$)“ (1)

In the calculation, the minimum values are set at zero, while the upper limit corresponds to the maximum value observed at the global level since 1990. The observed approach of the realized values for both indicators towards the maximum indicates an intensification of the pressures exerted on the planet. Concomitantly with the augmentation of the values of the indicators, as a consequence of the method of calculation, the PHDI assumes a diminished value. Therefore, there is a greater loss in HDI value (UNDP, 2024a, p. 15).

In the second step, the adjustment factor for the planetary pressures indicated by the letter 'A' is calculated. As the pressures on the planet decrease, the 'A' value increases, resulting in a closer alignment with the HDI. The requisite formulation for attaining the value 'A' can be demonstrated as follows (UNDP, 2024a, p. 15):

„A= (Carbon Dioxide Emissions Index+ Material Footprint Index) / 2“ (2)

Finally, in the third stage of the process, the PHDI value is reached through the application of a multiplication operation to the HDI and 'A' values. The third step is illustrated in Formula 3, while the calculation for the percentage change in HDI value is provided in Formula 4 (UNDP, 2024a, p. 15):

„PHDI= HDI * A“ (3)

„Difference From HDI Value= [(HDI-PHDI)/HDI] * 100“ (4)

Comparison of Data According to PHDI

Tables 1 and 2 present data for the 27 EU member states, Turkey, the EU average, six developing regions, and the world average. In the UNDP Human Development Reports, official datasets are available for three different years. Table 1 presents HDI, PHDI, and the deviation from the HDI value. Given that the PHDI value is contingent upon the human development level of the countries in question, due to the specific calculation method employed, it would be appropriate to analyze the data on divergence from the HDI value to interpret the net impact of the pressures created on the environment. Table 2 presents data on the adjustment factor for planetary pressures, the carbon dioxide emission index, and the material footprint index. At this juncture, an evaluation of the adjustment factor for planetary pressures can be conducted, given that it provides the arithmetic mean of the two indices.

Upon analysis of Table 1, it becomes evident that there are notable differences between countries and regions. While Luxembourg, Estonia, and Finland exhibit the highest values in terms of deviation from the HDI value, Portugal, Romania, and Croatia represent countries with the lowest values. On the other hand, although Turkey is below the EU average, it is above the world average. At the regional level, the deviation of the HDI data for East Asia and the Pacific, Europe and Central Asia, and the EU-27 regions exceed the world average. In light of these data, it is important to state the significant environmental pressures exerted by these regions on the planet. Conversely, the Sub-Saharan Africa and South Asia regions exhibit values that are markedly lower than the global average. The very low level of industrialization and urbanization, particularly in sub-Saharan Africa, may explain this situation.

Table 1. PHDI Data by Selected Countries and Regions-I

Countries/Regions	HDI			PDHI			Difference From HDI Value (%)		
	2019	2021	2022	2019	2021	2022	2019	2021	2022
Austria	.922	.916	.926	.771	.766	.789	16.4	16.4	14.8
Belgium	.931	.937	.942	.800	.742	.803	14.1	20.8	14.8
Bulgaria	.816	.795	.799	.745	.708	.720	8.7	10.9	9.9
Crotia	.851	.858	.878	.779	.764	.807	8.5	11.0	8.1
Cyprus	.887	.896	.907	.767	.708	.803	13.5	21.0	11.5
Czechia	.900	.889	.895	.768	.748	.782	14.7	15.9	12.6
Denmark	.940	.948	.952	.824	.803	.839	12.3	15.3	11.9
Estonia	.892	.890	.899	.711	.684	.766	20.3	23.1	14.8
Finland	.938	.940	.942	.770	.731	.787	17.9	22.2	16.5
France	.901	.903	.910	.801	.803	.823	11.1	11.1	9.6
Germany	.947	.942	.950	.814	.804	.833	14	14.6	12.3
Greece	.888	.887	.893	.768	.792	.809	13.5	10.7	9.4
Hungary	.854	.846	.851	.781	.755	.769	8.5	10.8	9.6
Ireland	.955	.945	.950	.833	.682	.814	12.8	27.8	14.3
Italy	.892	.895	.906	.792	.813	.825	11.2	9.2	8.9
Latvia	.866	.863	.879	.777	.716	.782	10.3	17.0	11.0
Lithuania	.882	.875	.879	.746	.679	.748	15.4	22.4	14.9
Luxembourg	.916	.930	.927	.495	.645	.685	46.0	30.6	26.1
Malta	.895	.918	.915	.794	.720	.806	11.3	21.6	11.9
Netherlands	.944	.941	.946	.794	.745	.769	15.9	20.8	15.9
Poland	.880	.876	.881	.752	.753	.780	14.5	14.0	11.5
Portugal	.864	.866	.874	.780	.792	.807	9.7	8.5	7.7
Romania	.828	.821	.827	.760	.738	.759	8.2	10.1	8.2

Countries/Regions	HDI			PDHI			Difference From HDI Value (%)		
	2019	2021	2022	2019	2021	2022	2019	2021	2022
Slovakia	.860	.848	.855	.720	.738	.776	16.3	13.0	9.2
Slovenia	.917	.918	.926	.800	.769	.832	12.8	16.2	10.2
Spain	.904	.905	.911	.795	.819	.839	12.1	9.5	7.9
Sweden	.945	.947	.952	.817	.803	.839	13.5	15.2	11.9
Türkiye	.820	.838	.855	.746	.741	.783	9.0	11.6	8.4
Arab States	.705	.708	.704	.666	.646	.658	5.5	8.8	6.5
East Asia and the Pacific	.747	.749	.766	.676	.657	.683	9.5	12.3	10.8
Europe and Central Asia	.791	.796	.802	.728	.713	.743	8.0	10.4	7.4
EU-27*	.897	.896	.903	.769	.749	.792	14.2	16.3	12.1
Latin America and the Caribbean	.766	.754	.763	.720	.695	.716	6.0	7.8	6.2
South Asia	.641	.632	.641	.622	.609	.622	3.0	3.6	3.0
Sub-Saharan Africa	.547	.547	.549	.539	.536	.539	1.5	2.0	1.8
World	.737	.732	.739	.683	.667	.685	7.3	8.9	7.3

Source: UNDP, 2020; UNDP, 2022; UNDP, 2024.
* The calculation was performed by the authors.

Table 2. PHDI Data by Selected Countries and Regions-II

Countries/Regions	Adjustment Factor for Planetary Pressures			Carbon Dioxide Emissions Index			Material Footprint Index		
	2019	2021	2022	2018	2020	2021	2017	2019	2022
Austria	.837	.836	.852	.889	.902	.903	.784	.771	.801
Belgium	.859	.792	.852	.876	.895	.892	.842	.689	.811
Bulgaria	.913	.891	.901	.910	.922	.920	.916	.860	.883
Crotia	.916	.890	.920	.936	.940	.944	.895	.841	.895
Cyprus	.865	.791	.886	.910	.922	.926	.820	.659	.845
Czechia	.853	.841	.874	.858	.880	.880	.849	.802	.868
Denmark	.876	.847	.881	.913	.934	.934	.839	.759	.828
Estonia	.797	.768	.852	.788	.885	.898	.806	.651	.806
Finland	.821	.777	.835	.878	.897	.911	.763	.658	.760
France	.889	.890	.905	.926	.938	.938	.853	.841	.872
Germany	.859	.854	.876	.869	.888	.894	.849	.819	.859

Countries/Regions	Adjustment Factor for Planetary Pressures			Carbon Dioxide Emissions Index			Material Footprint Index		
	2019	2021	2022	2018	2020	2021	2017	2019	2022
Greece	.865	.893	.906	.899	.927	.928	.831	.859	.885
Hungary	.915	.893	.904	.926	.927	.935	.903	.858	.873
Ireland	.872	.722	.857	.884	.902	.902	.859	.542	.813
Italy	.888	.908	.910	.920	.927	.926	.857	.890	.895
Latvia	.897	.829	.890	.947	.948	.950	.848	.711	.830
Lithuania	.846	.776	.851	.931	.926	.935	.762	.626	.767
Luxembourg	.541	.693	.739	.773	.810	.828	.308	.577	.651
Malta	.887	.784	.881	.948	.947	.960	.826	.621	.801
Netherlands	.842	.791	.842	.864	.883	.896	.819	.700	.788
Poland	.855	.859	.885	.870	.885	.887	.839	.834	.883
Portugal	.903	.914	.924	.929	.942	.949	.878	.886	.898
Romania	.917	.898	.917	.946	.946	.948	.889	.851	.887
Slovakia	.837	.870	.907	.905	.918	.916	.769	.822	.899
Slovenia	.873	.838	.898	.901	.912	.920	.845	.764	.877
Spain	.880	.905	.921	.918	.935	.937	.842	.875	.906
Sweden	.865	.848	.881	.941	.944	.952	.789	.751	.811
Türkiye	.910	.885	.916	.926	.932	.930	.894	.837	.902
Arab States	.944	.912	.935	.931	.937	.940	.958	.885	.929
East Asia and the Pacific	.905	.877	.891	.921	.916	.919	.890	.838	.863
Europe and Central Asia	.920	.986	.927	.921	.924	.931	.920	.869	.923
EU-27*	.858	.837	.880	.898	.914	.919	.818	.760	.840
Latin America and the Caribbean	.940	.921	.939	.960	.966	.966	.919	.876	.912
South Asia	.971	.963	.970	.972	.973	.975	.970	.952	.965
Sub-Saharan Africa	.985	.980	.982	.988	.989	.991	.982	.971	.973
World	.927	.912	.926	.934	.937	.941	.919	.885	.911

Source: UNDP, 2020; UNDP, 2022; UNDP, 2024.
* The calculation was performed by the authors.

On the other hand, it is important to assess the regions that exert the most pressure on the planet within themselves, as they exhibit values that exceed the global average. The deviation in HDI values among EU-27 countries is higher than that observed in East Asia and the Pacific and Europe and Central Asia regions. The argument is put forth that capital and polluting industrial production have been relocated to the East Asia and Pacific region as a consequence of the process of globalization and the

implementation of neo-liberal policies since the 1980s. Conversely, it is asserted that European countries have undergone a process of deindustrialization, and the services sector assuming a primary position. However, the data indicate that the environmental pressures of the EU-27 are higher than those of developing and rapidly industrializing countries.

Furthermore, the data presented in Table 2 exhibits a parallel trend with that observed in Table 1. The countries and regions exhibiting the greatest deviation from the HDI are those with the lowest adjustment factor for planetary pressures. The EU-27 region exhibits the lowest adjustment factor for planetary pressure, attributable to its low carbon dioxide emissions and material footprint indices. The relatively low values of these indices indicate that EU countries have high carbon dioxide emissions and a high demand for raw materials, including metals, non-metal ores, and fossil fuels. This is a consequence of their dependence on traditional energy sources.

Conclusion

The concept of sustainable development is a significant contemporary issue for countries and international organizations. In this regard, significant progress has been made on a global scale since the final quarter of the 20th century. It can be argued that the 2020 UNDP Human Development Report marks another notable advance in environmental awareness with its official sharing of PHDI values. This index allows the comparison of the pressures that countries and regions exude upon the planet. Thus, possible to evaluate sustainable development in terms of its environmental dimension.

A review of UNDP data reveals significant disparities in environmental pressures across EU member states and between different regions on a global scale. Nevertheless, despite the considerable divergence in values observed across EU member states, when considered collectively, the EU-27 represents the region with the greatest environmental pressures. In fact, environmental pressures are often associated with countries that are undergoing development processes and industrializing. Conversely, the pressure exerted on the planet by the EU countries, where the services sector is of particular significance and which are claimed to have transferred their less environmentally friendly industrial production to the East with globalization, is even higher than that observed in East Asia and the Pacific. It can thus be concluded that the EU-27 countries continue to exhibit elevated levels of carbon dioxide emissions and a pronounced reliance on conventional energy sources. As outlined in the conferences and documents that represent the landmarks in the history of sustainable development, also developed countries must bear certain responsibilities. The EU must implement more environmentally conscious policies to reduce carbon dioxide emissions and augment the utilization of renewable energy sources, in addition to assisting developing countries.

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