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HDI, PHDI, EPI, and SEDI: Trade-offs Between Human Welfare, Environment, and Energy

Group 1

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Abstract

Development today cannot be understood solely through economic growth or even traditional human development measures. While the Human Development Index (HDI) highlights progress in health, education, and income, it overlooks the environmental footprint of growth. This paper evaluates four indices: the Human Development Index (HDI), the Planetary-adjusted Human Development Index (PHDI), the Environmental Performance Index (EPI), and the Sustainable Economic Development Index (SEDI) to examine how they reshape narratives of national progress.

The PHDI adjusts HDI for ecological pressures such as carbon emissions and material footprints associated with it. This adjustment can dramatically change a country’s development story, reducing the scores of nations with high consumption and emissions (for example, the United States) while relatively improving those with smaller ecological footprints (for example, Zimbabwe). Policymakers also face trade-offs between HDI and EPI. Investing in immediate gains in income, health, and education often undermines long-term ecological stability, while prioritizing environmental outcomes may slow short-term human development. Finally, the paper explores how crises affect SEDI, showing that recessions lower employment, equity, and service provision, with fragile economies suffering the greatest declines.

The study emphasizes integrating these indices for a holistic evaluation that balances human welfare, sustainable development, and ecological resilience, ensuring that short-term gains do not compromise the ability of future generations to thrive.

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Abbreviations

HDI – Human Development Index

PHDI – Planetary-adjusted Human Development Index

UNDP – United Nations Development Program

GNI – Gross National Income

PPP - Purchasing Power Parity

EPI - Environmental Performance Index

SEDI - Sustainable Economic Development Index

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2. How does the planetary adjusted Human Development Index change a country’s development story?

2.1 Introduction

The Human Development Index is a metric of overall human well-being introduced in 1990 by the United Nations Development Program[[1]](#footnote-0). It was designed to look beyond economic growth and track the world’s progress. The HDI is calculated as the geometric mean of three equally weighted dimensions: a long and healthy life, access to education (measured by years of schooling), and a decent standard of living. One crucial information to remember here is that a single parameter of HDI does not dominate the other two. However, the HDI did not account for environmental impacts or sustainability at its inception. As a result, a country can rise in HDI while depending on fossil fuels and resource-heavy production, risking long-term well-being on Earth.

The Human Development Report Office proposed an adjustment in 2020 to address this gap that directly integrates planetary pressures from human-related development activities into the development metric. The Planetary-adjusted HDI maintains the HDI’s human-centered core while applying a systematic penalty proportional to environmental pressures that addresses how the Inequality-adjusted HDI accounts for intragenerational disparities (UNDP 2020). In doing so, the Planetary-adjusted HDI transforms a country narrative from “How far did we progress?” to “How far did we advance, given our impacts on climate and the environment?”

2.2 Human Development Index

2.2.1 Methodology for calculation

The Human Development Index is the geometric mean of three normalized dimension indices: human health, knowledge, and standard of living. In equation form, the HDI equals the geometric mean of the health, education, and income indexes. Each underlying measure is first placed on a 0 to 1 scale using fixed minimum and maximum. Next, the three resulting indices are multiplied, and a cube root is taken.

HDI = (I health \* I education \* I income)

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Fig 1: Minimum and Maximum Values for Normalizing HDI Dimension Indicators

2.2.2 Components for Indicators

* Health (longevity): Life expectancy at birth captures mortality conditions and the broader performance of public health in general.
* Education (knowledge): The arithmetic mean of two sub-indicators, mean years of schooling (realized attainment) and expected years of schooling (prospective opportunity), summarizes human capital formation.
* Standard of Living (Income): Gross national income per person adjusted for purchasing power is considered a standard of living metric. The World Bank’s 2020 World Development Indicators database provides GNI per capita information in constant 2017 PPP terms. The Human Development Report Office estimates any missing data by converting local currency values into 2017 PPP, then applying real growth rates derived from nominal GNI growth and GDP deflators to construct a consistent time series.

A diagram of different stages of development

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Fig 2: HDI breakdown - The top panel shows how the HDI combines three equally weighted dimensions - long and healthy life (life expectancy), knowledge (expected and mean years of schooling), and a decent standard of living (GNI per capita) into one composite score. The bottom panel shows the Inequality-adjusted HDI, which uses the same dimensions but first adjusts each for within-country inequality in health, education, and income, and yields a lower score when achievements are unevenly distributed.

2.2.3 Rankings:

The classification of countries by HDI scores ranges from very high human development (0.800 and above), to high (0.700–0.799), medium (0.550–0.699), and low (below 0.550) (UNDESA et al. 2020). These thresholds provide a standardized way to compare and group countries based on their overall human development achievements.

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Fig 3: Human Development Index Classification Thresholds

Source (Figure 1, 2, & 3): <https://hdr.undp.org/sites/default/files/data/2020/hdr2020_technical_notes.pdf>

Countries at higher levels of human development tend to see slower proportional gains or a ceiling effect. In contrast, countries in the middle bands can achieve larger relative improvements as they close gaps in the years of schooling and health improvement. For instance, the United States rose from 0.86 in 1990 to 0.92 in 2023 (approximately 7% increase), while India climbed from 0.43 to 0.63 (approximately 47% growth) – a tremendous growth. However, it remains below the world’s HDI average. These statistics show progress in capabilities but do not mention the short- or long-term environmental implications of achieving this growth.

A graph of different colored lines

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Fig 4: HDI trends – the world vs the US and India (1990 – 2023)

Source: <https://hdr.undp.org/data-center/human-development-index#/indicies/HDI>

2.3 Planetary-Adjusted Human Development Index

2.3.1 Methodology for calculation

The Planetary-adjusted HDI was adopted in 2020 by UNDP. It discounts the original HDI by an adjustment factor A derived from the arithmetic mean of two environmental pressure measuring indices: one for carbon dioxide emissions per person (production-based) and one for material footprint per person. Each pressure is first turned into a 0 to 1 index via min-max normalization, with higher index values corresponding to a lower planetary pressure. When planetary pressures are low, the factor approaches one and the Planetary-adjusted HDI converges to the HDI; when pressures are high, the adjustment factor shrinks and the Planetary-adjusted HDI falls below the HDI.

PHDI = HDI \* A

Assumptions: A = The adjustment factor, the arithmetic mean of CO2 emissions per capita and Material footprint per capita

In an ideal scenario with no environmental impact created, PHDI = HDI as A = 0

A diagram of a diagram of a variety of indicators

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Fig 5: the Planetary-Pressures adjusted Human Development Index (PHDI) and Its Relationship to HDI

Source: <https://hdr.undp.org/system/files/documents/phditn.pdf>

2.3.2 Components for Indicators

* Carbon dioxide emissions per capita: Territorial country-specific emissions arising from anthropogenic activities such as fossil fuel-based (coal, oil, and gas) combustion, and industrial operations (aviation, gas flaring, cement, and steel manufacturing) divided by mid-year population (Human Development Report Office, n.d.). Higher observed values indicate higher pressure.
* Material footprint per person: Material footprint measures the raw materials consumed to satisfy a country’s final demand. It is measured by adding the raw material equivalents of imports to domestic extraction and subtracting the raw material equivalents of exports. Material footprint is reported across sectors such as biomass, fossil fuels, metal ores, and nonmetallic minerals, and the material footprint per capita suggests the average resource use tied to individual consumption (Human Development Report Office, n.d.).

2.3.3 Rankings

The Planetary-adjusted HDI will re-order countries with similar health, education, and income achievements if one pathway is materially less carbon-intensive. The following are the common trends we observe from PHDI rankings.

* Countries with very high human development and high pressures see larger discounts. For instance, the United States has an HDI among the highest globally, but its PHDI (26.9% reduction) (Human Development Report Office, n.d.). falls significantly due to very high per-person emissions and material use footprints.
* Countries with middle human development with comparatively lower pressures see smaller discounts. For instance, Costa Rica maintains a moderate HDI. However, because of relatively low carbon intensity and more sustainable resource use, its PHDI (7.1% reduction) (Human Development Report Office, n.d.). remains close to its HDI, narrowing the gap with wealthier nations.
* Rapidly developing countries that rely on coal-heavy grids or resource-intensive industrialization fall under this category and receive a reduced PHDI score reflecting the environmental costs of development. For instance, although India’s HDI has risen quickly over the last two decades, it is still under the world’s HDI average, and India’s reliance on coal-reliant energy and resource-intensive growth has somewhat reduced its PHDI (4.2% reduction) (Human Development Report Office, n.d.). due to the environmental cost embedded in the present development model.

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Fig 6: HDI vs PHDI – Comparison between United States, Costa Rica, and India

Source: <https://hdr.undp.org/planetary-pressures-adjusted-human-development-index#/indicies/PHDI>

2.4 Concluding thoughts

To sum up, the Planetary-adjusted HDI is an extension of the original Human Development Index that internalizes environmental impacts of growth into a human-centered measure of progress. It is a guideline as well as an indicator of sustainable development nationally or globally. Although PHDI aims to cover country-specific environmental accountability, it has certain limitations. First, the adjustment factor includes two stressors, which do not include water stress, biodiversity loss, imbalance of nitrogen-phosphorus cycles, land use and land cover changes, or local air pollution, creating community health problems. Second, the carbon accounting boundary has some gaps. For instance, nations that import carbon-intensive goods rather than produce them in their territories might look cleaner under a consumption-based lens. Though the material-footprint component partly addresses this issue, it still relies on modeling, so accuracy has the scope to be improved. Third, the PHDI does not distinguish between emissions from the necessary vs non-necessary footprint, which could have a different outcome regarding human-welfare realities for the same amount of per-person carbon emissions. Finally, regular monitoring and verification of boundaries are crucial to maintain accuracy. The material footprints depend on modelling, so any associated data uncertainty or quality gaps can make the results less accurate.

3. Trade-offs Between HDI and EPI: Decisions and Considerations for Policymakers

3.1 Introduction

The tension between human well-being and environmental sustainability is increasingly influencing development debates. The Human Development Index (HDI) measures achievements in health, education, and standard of living, while the Environmental Performance Index (EPI) assesses ecological health and sustainability results (UNDP, 2023; Wendling et al., 2022). Although both indices are essential for understanding a country’s progress, they can lead policymakers in conflicting directions. Investments that improve HDI, such as expanding industrial capacity, often increase pollution and resource consumption, which reduces EPI scores. Conversely, policies that strongly limit emissions might hinder short-term growth and slow down HDI progress.

3.2 Historical Background of HDI, EPI, and PHDI

The HDI was introduced by the United Nations Development Programme in 1990 as a counterweight to GDP-centric measures of progress. It broadened the definition of development beyond income to include education and health (UNDP, 2023). Since its introduction, HDI has become a central benchmark in global development debates. However, it has been criticized for neglecting ecological sustainability.

The EPI emerged in the early 2000s, developed by Yale and Columbia universities, to provide a quantitative measure of environmental performance across countries (Wendling et al., 2022). Unlike HDI, it focuses on indicators such as climate change mitigation, biodiversity, and environmental health. The EPI thus captures long-term ecological viability but does not account for immediate social progress.

The more recent Planetary-Pressures–Adjusted HDI (PHDI) addresses this gap by discounting HDI achievements based on per capita carbon emissions and material footprint (UNDP, 2020). A high HDI combined with high ecological stress results in a lower PHDI, effectively reminding policymakers that unsustainable development is not genuine progress. The emergence of PHDI underscores the need for integrated thinking when considering HDI-EPI trade-offs.

The policymaker’s dilemma is not simply a question of resource allocation but one of temporal trade-offs: should governments maximize short-term well-being or secure ecological integrity for future generations?

3.3 EPI Case Insights

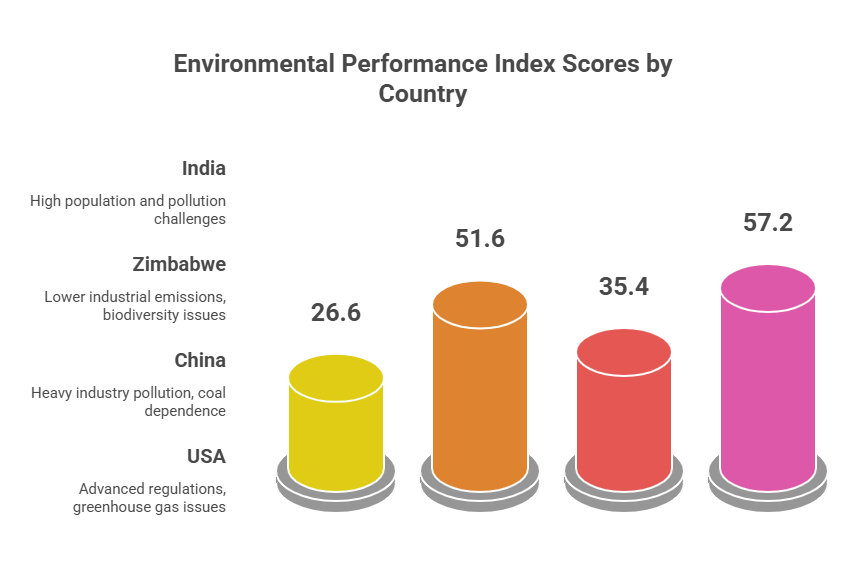


Figure 7: EPI Performance Index Score by Country

Source [24 Environmental Performance Index - Environmental Performance Index](https://epi.yale.edu/measure/2024/EPI)

3.3.1 United States

The United States represents a different version of the trade-off. With one of the highest HDI scores globally, the U.S. has strong education, healthcare, and income metrics. However, its EPI scores expose systemic weaknesses in environmental policy.

The U.S. has high per-capita carbon emissions, partly due to reliance on fossil fuels, suburban sprawl, and car-dependent lifestyles. While its innovation ecosystem supports renewable technologies, political polarization has hindered decisive action on climate policy.

Natural resource consumption in the U.S. far exceeds sustainable levels, and biodiversity protection remains under pressure from agriculture, energy development, and urban expansion.

3.3.2 India and China

India and China represent powerful examples of how rapid development can drive HDI upward while simultaneously eroding environmental conditions.

Over the last three decades, India has lifted millions out of poverty and improved literacy rates significantly. Between 1990 and 2020, its HDI score rose by nearly 50%. However, this improvement has been accompanied by rising carbon emissions, severe air pollution in cities like Delhi, and unsustainable groundwater extraction. India’s EPI ranking remains low, largely due to air quality issues, water stress, and dependence on coal for electricity generation.

China’s HDI has soared as it became the world’s second-largest economy, raising life expectancy, income, and education levels. Yet, China’s EPI ranking reveals the environmental costs of this progress: air pollution, heavy industrial emissions, and high fossil fuel dependency. At the same time, China is paradoxically a global leader in renewable energy investment, signaling recognition of this trade-off.

3.3.3 Zimbabwe

Zimbabwe provides a contrasting case where low HDI coexists with relatively low environmental impact. Zimbabwe’s HDI has stagnated due to political instability, economic collapse, and weakened social systems. Yet its limited industrialization means its ecological footprint is modest. This does not indicate successful environmental policy but rather a lack of development activity.

The challenge for Zimbabwean policymakers is to increase HDI without repeating the unsustainable growth patterns of wealthier nations. For example, investing in renewable energy, sustainable agriculture, and eco-tourism could allow Zimbabwe to develop in a way that strengthens both HDI and EPI simultaneously.

3.4 The Nature of the Trade-off

The HDI captures immediate human welfare. Countries with low HDI are under pressure to increase access to health care, expand educational opportunities, and raise per capita income. Such efforts frequently require infrastructure expansion, industrialization, and higher energy consumption. Yet these activities often rely on fossil fuels and intensive resource extraction, which undermine air quality, accelerate carbon emissions, and deplete ecosystems (Wendling et al., 2022).

The trade-off thus reflects a temporal dimension: HDI represents today’s well-being; EPI represents tomorrow’s sustainability. Decisions hinge on whether policymakers prioritize short-term gains or long-term resilience. Importantly, neglecting EPI can eventually weaken HDI itself, since environmental degradation reduces life expectancy and quality of life (UNDP, 2020).

3.5 Factors Policymakers Must Consider

3.5.1 Development Stage

A country’s stage of development strongly determines priorities. High-income nations such as the United States, with already elevated HDI scores, can afford to prioritize EPI. Emerging economies like China and India must still raise HDI while managing ecological stress. Low-HDI countries like Zimbabwe often must focus on immediate survival needs, but doing so without regard to sustainability risks undermines long-term stability (UNDP, 2023).

3.5.2 Governance Capacity

Strong institutions can design integrated policies that pursue HDI and EPI simultaneously. For example, green industrial policies can create jobs (raising HDI) while promoting renewable energy (boosting EPI). Weak institutions, by contrast, often privilege short-term HDI gains and neglect environmental concerns. Research on sustainable energy indices emphasizes that institutional quality is a decisive determinant of outcomes (Iddrisu & Bhattacharyya, 2015).

3.5.3 External Pressure

Global trade regimes, international investment flows, and climate treaties increasingly create incentives to prioritize EPI. The European Union’s Carbon Border Adjustment Mechanism illustrates how environmental standards abroad can shape domestic priorities (European Commission, 2022). Even developing economies cannot ignore EPI entirely without risking economic marginalization.

3.5.4 Intergenerational Equity

Policymakers must weigh the ethical obligation to improve present welfare against the duty to preserve future livability. Policies that overemphasize HDI may trap future generations in ecological crises, while policies that overemphasize EPI may prolong present poverty. The PHDI framework embodies this ethical dilemma by explicitly linking development scores to environmental pressures (UNDP, 2020).

3.6 Country Cases

The United States maintains a very high HDI but struggles with carbon emissions and ecosystem vitality. Policymakers face decisions about how to reconcile economic competitiveness with environmental leadership. Shifting resources toward renewable energy infrastructure and climate adaptation would improve EPI while maintaining HDI (Wendling et al., 2022).

China’s rapid HDI improvements have been accompanied by severe environmental stress. Air pollution, water scarcity, and carbon emissions have created intense pressures. The government’s carbon neutrality pledge by 2060 represents an attempt to rebalance HDI and EPI priorities (UNDP, 2023).

India continues to pursue HDI gains, particularly in health and education, yet suffers from severe air and water pollution. Policymakers must decide whether to accept slower HDI growth in exchange for stricter environmental policies, or whether to pursue rapid growth now and risk long-term ecological harm (Wendling et al., 2022).

Zimbabwe struggles with low HDI and weak institutional capacity. The government’s immediate priority is basic human development. However, environmental degradation from deforestation and drought threatens to trap the country in poverty, illustrating the costs of neglecting EPI (Iddrisu & Bhattacharyya, 2015).

3.7 Conclusion and Future Outlook

The trade-off between HDI and EPI presents one of the most complex challenges in development policy. While HDI reflects the urgency of raising present well-being, EPI represents the necessity of ensuring long-term viability. The key considerations—development stage, governance capacity, external pressures, and intergenerational equity—demonstrate that no universal solution exists.

Future policy debates will likely emphasize integrated frameworks like the PHDI that explicitly link human welfare and ecological sustainability. Global governance mechanisms, including the Sustainable Development Goals, will continue to push countries toward balance. The overarching lesson is clear:HDI ensures people live better lives, while EPI ensures people live longer lives. Policymakers must dynamically balance both.

4. A Recession’s effect on a country’s Sustainable Economic Development Index (SEDI)

4.1 Introduction

Economic recessions are moments of profound disruption that ripple across all sectors of society. Beyond the immediate financial turbulence, their influence extends into the broader dimensions of sustainability and well-being, which are increasingly measured through indices such as the Sustainable Economic Development Index (SEDI). This index evaluates a country’s ability to convert economic growth into human well-being while balancing environmental protection and social equity. A recession, therefore, does not simply reduce output or employment; it reshapes the pathways through which nations pursue sustainable development. Interestingly, the effects of recessions on SEDI are neither uniformly negative nor positive. Instead, they represent a double-edged sword, presenting opportunities for accelerated progress in some areas while undermining others.

4.2 Positive Impacts of Recessions on SEDI

One of the more promising consequences of economic recessions is the drive toward efficiency improvements. When resources become scarce, governments and private actors must streamline their operations. Firms adopt cost-saving technologies, and governments reevaluate spending priorities, often discovering opportunities to reduce waste and increase energy efficiency. These adaptations, born out of necessity, can align with sustainable development principles. For example, industries may upgrade outdated machinery with more energy-efficient alternatives, reducing emissions per production unit and enhancing long-term productivity. Regarding SEDI, such efficiency gains strengthen the economic and environmental pillars, signaling that a country can innovate even under constrained circumstances.

Another beneficial outcome of recessions is the temporary reduction in emissions. Economic slowdowns naturally suppress industrial activity, limit transportation, and curb consumer demand, reducing greenhouse gas output. For instance, during the Great Recession, carbon emissions dropped measurably worldwide as economic activity stalled (Baigorri et al., 2025). While such reductions are typically short-lived and often reversed during recovery, they highlight the direct connection between economic growth and environmental degradation. In the context of SEDI, these emission declines temporarily boost the ecological component of the index, though they do not necessarily represent sustainable progress in themselves. They are, however, helpful reminders of what is possible when nations intentionally pursue decarbonization strategies.

Recessions also expose vulnerabilities within national energy systems, creating opportunities for renewal. As economic crises destabilize existing infrastructure, governments may direct recovery spending toward rebuilding energy plants or modernizing outdated facilities. If these efforts prioritize renewable energy and resilient systems, recessions can serve as inflection points that accelerate the transition to cleaner power sources. This process strengthens energy security and reinforces a nation’s ability to meet long-term climate commitments. In this way, the rebuilding process can raise SEDI scores by embedding sustainability into the foundations of future growth.

Furthermore, the very experience of navigating a recession functions as a stress test for a country’s energy and sustainability policies. Policies that remain intact during economic hardship, such as subsidies for renewable energy or efficiency standards, demonstrate resilience. Nations that successfully uphold these commitments during downturns can expect higher SEDI scores, as the index rewards consistency in converting wealth into well-being across economic cycles.

4.3 Negative Impacts of Recessions on SEDI

Despite these positive dynamics, recessions also bring significant setbacks that can weaken a country’s SEDI performance. Chief among these is the reduction in investment. Private investors become risk-averse, and governments often face severe fiscal constraints as revenues decline. With less capital available, projects aimed at expanding renewable energy, improving infrastructure, or reducing inequality are delayed or abandoned. These limitations directly undermine a nation’s ability to enhance its sustainable development performance, as the SEDI depends on continuous investment in long-term well-being rather than short-term relief. Therefore, the contraction of financial resources poses a fundamental challenge to sustaining progress in times of crisis.

Government budgets also come under immense pressure during recessions. The simultaneous need to expand social safety nets and contend with lower tax revenues produces a fiscal squeeze that leaves little room for sustainability initiatives (Anbumozhi & Bauer, 2010). Environmental regulations may be postponed, clean energy incentives reduced, and social programs cut to prioritize immediate economic stabilization. While such measures may seem necessary in the short term, they have long-term consequences for the social and environmental balance captured by SEDI. A government’s inability to sustain these programs erodes trust in institutions and diminishes the progress that had previously been made toward integrating sustainability into economic policy.

Consumer demand likewise declines during recessions, producing mixed but often adverse effects on sustainability (Buechler et al, 2020). While a drop in consumption reduces short-term environmental pressures, such as emissions from production and transport, it also weakens economic stability and harms employment. Rising unemployment and reduced household income undermine the well-being of citizens, directly lowering the social dimension of SEDI. Furthermore, consumer retrenchment discourages the market for sustainable goods and services, stifling innovation in green industries. Over time, this dynamic slows the cultural and economic transition toward more sustainable consumption patterns, further hindering progress on the index.

Finally, the social consequences of recessions cannot be overlooked. Economic hardship exacerbates inequality, erodes social cohesion, and diminishes trust in institutions. Citizens under strain often prioritize immediate survival over long-term sustainability, pressuring governments to abandon environmental protections in favor of short-term economic relief. This trade-off particularly damages SEDI scores, which reward countries for balancing growth with equity and environmental stewardship. In contexts where sustainability is viewed as a secondary concern during downturns, recessions can undo years of progress in building resilient and equitable societies.

4.4 Institutional Strength and Long-Term Outcomes

The overall effect of a recession on a country’s SEDI score varies considerably depending on the institutional framework in place. Nations with strong governance, diversified economies, and established sustainability policies are better equipped to turn crises into opportunities. These countries may leverage recovery packages to invest in renewable energy, expand social protections, and embed resilience into their economic systems. By contrast, nations heavily reliant on fossil fuels or lacking robust social safety nets may find their scores deteriorating rapidly as recessions amplify structural weaknesses. Thus, the SEDI score reflects the immediate economic consequences of downturns and the strength of a country’s policy responses.

In the final analysis, recessions are defining moments for sustainable development. They test whether nations view sustainability as a luxury to be deferred until times of prosperity or as a foundation for resilience during hardship. The impacts on SEDI illustrate this duality: efficiency improvements, emission reductions, and infrastructure renewal can raise scores, while reduced investment, strained budgets, and social fragmentation can lower them. The trajectory ultimately depends on whether governments and societies harness the crisis as an opportunity for transformation or retreat into short-term fixes. Therefore, the recession’s imprint on SEDI is less a matter of economic inevitability than political and institutional will, underscoring the importance of embedding sustainability not as an afterthought but as the core of national resilience strategies.

References

Anbumozhi, V., & Bauer, A. (2010, July 8). *Impact of global recession on Sustainable Development and Poverty Linkages*. Asian Development Bank. <https://www.adb.org/publications/impact-global-recession-sustainable-development-and-poverty-linkages>

Buechler, E., S. Powell, T. Sun, C. Zanocco, N. Astier, J. Bolorinos ... R. Rajagopal (2020) ‘Power and the pandemic: exploring global changes in electricity demand during COVID-19’, arXiv preprint arXiv:2008.06988

Baigorri, B., Montañés, A., & Simón-Fernández, M.-B. (2025). The influence of the Great Recession on the relationship between ecological footprint, renewable energy and economic growth. *Environmental and Sustainability Indicators*, *25*, 100556. <https://doi.org/10.1016/j.indic.2024.100556>

European Commission. (2022). *Carbon Border Adjustment Mechanism (CBAM)*. <https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/carbon-border-adjustment-mechanism_en>

Human Development Report Office. n.d. “Technical Note. Planetary Pressures–adjusted Human Development Index.”

<https://hdr.undp.org/system/files/documents/phditn.pdf>.

Iddrisu, I., & Bhattacharyya, S. C. (2015). Sustainable Energy Development Index: A multi-dimensional indicator for measuring sustainable energy development. *Renewable and Sustainable Energy Reviews, 50*, 513–530. https://doi.org/10.1016/j.rser.2015.05.032

United Nations Development Programme (UNDP). (2020). *Planetary pressures–adjusted Human Development Index*. Human Development Report 2020. https://hdr.undp.org/

United Nations Development Programme (UNDP). (2023). *Human Development Report 2023/24*. https://hdr.undp.org/

United Nations. n.d. “Planetary Pressures–adjusted Human Development Index.” Human Development Reports. <https://hdr.undp.org/planetary-pressures-adjusted-human-development-index#/indicies/PHDI>.

UNDESA, UNESCO Institute for Statistics, ICF Macro Demographic and Health Surveys, United Nations Children’s Fund (UNICEF) Multiple Indicator Cluster Surveys, OECD, Barro and Lee, World Bank, et al. 2020. “Technical Notes.”

<https://hdr.undp.org/sites/default/files/data/2020/hdr2020_technical_notes.pdf>.

Wendling, Z. A., Emerson, J. W., Esty, D. C., Levy, M. A., & de Sherbinin, A. (2022). *2022 Environmental Performance Index*. Yale Center for Environmental Law & Policy. https://epi.yale.edu/

1. United Nations Development Programme, *Human Development Report 1990* (New York: Oxford University Press, 1990). [↑](#footnote-ref-0)