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Article

The Sustainable Development Index: An Integration of the Ecological Framework Considering the Governance-development Nexus

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Abstract This paper aims to enhance the formulation of the Sustainable Development Index (SDI) by introducing a further correction term, governance lack (GL) index, in additional to the ecological impact index (EII). The GL considers a country's governance lack by calculating a governance index (GI) with the World Governance Indicators (WGIs) starting from 1996. The SDI(g) retains the original formula of the SDI, thus remaining an indicator of strong environmental sustainability but adequately considering in its formulation the differences significant in countries' governance climate. Finally, graphical relationships between DI and GI, and DI and (EII + GL) are shown, and the existence of these relationships are tested with WLS and nonparametric regressions. Our findings show that significant differences in country ranking were found; the graphical relationships are empirically proven; and countries with a worse GI have been further penalized in the SDI(g) ranking.

Keywords sustainable development; governance; performance index

1. Introduction

The Sustainable Development Index (SDI) is an indicator of strong ecological sustainability efficiently measuring the development achieved by countries [1]. It was created within the United Nations' human development framework considering the ecological impact of countries. This index discounts the Human Development Index (HDI) score for the country's ecological impact index (EII) given by the average of the extent to which consumption-based CO_2 emissions and material footprint exceed fair shares defined for planetary boundaries. A country that achieves relatively high human development while remaining within or near ecological planetary boundaries rises in the ranking.

The HDI has long been criticized for not taking into account countries' ecological and institutional sustainability [2–5]. Measuring the performance of the Sustainable Development Goals (SDGs) requires novel indicators rather than gross domestic product (GDP) as a measure of a nation's wealth and well-being. For instance, the HDI is a composite and synthetic indicator measuring, on average, a country's performance based on three aspects: life expectancy at birth, schooling, and income level. Alternatively, there are: (i) the PHDI which discounts the HDI for environmental pressures on the planet and reflects a concern for intergenerational sustainability; and (ii) the inequality-adjusted HDI which addresses concerns related to intragenerational inequality.

However, other indicators have been developed by academics and scholars over the years. An interesting indicator that considers social impacts is the Social Progress Index (SPI), developed by Porter et al. [6] based on the works by Sen [7], North [8], and Stiglitz et al. [9]. This index measures the ability of a nation to satisfy social human needs and improve people's quality of life so that everyone can aspire to achieve the best possible personal fulfillment.

Another indicator is the Gross National Happiness (GNH) index, which considers several dimensions of development in addition to those related to national wealth. Particularly, it jointly considers human development and sustainable development. It places people at the center of issues and recognizes that they have relational and emotional needs in addition to economic and income ones [10–13]. The Global Impact Inequality (GII) index is a more recent and innovative measure. It links the negative externalities produced by human economic activity to the available stock of natural resources [14].

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All these indicators highlight that development can no longer be measured exclusively in terms of economic growth. Therefore, they are well-being indicators prioritizing sustainability and could be used as alternatives to GDP. However, to conserve the cultural and environmental heritage of a nation, sound and wise governance is needed. This objective, also recommended by the SDGs, makes all these indicators more reflective of a country's real socioeconomic system than GDP, finally resulting in more comprehensive measurements.

Therefore, the limitations of the HDI are becoming increasingly problematic, especially in light of climate change due to the ecological breakdown over the past thirty years and the lack of adequate governance and policies for structural adjustment in countries [15]. For instance, the case of the bottled water industry can be emblematic [16]. In fact, countries at the top of the HDI ranking have the highest levels of ecological impact that is causing global climate change. However, the current version of the SDI does not directly consider the importance that governance has in promoting countries' structural adjustment policies [17–20].

On one hand, countries having a better institutional environment have fewer lacks in the governance climate; therefore, they should be the ones capable of implementing effective policies to promote development and adequately address crises showing resilience to change. Although the relationship between growth and governance has been widely studied by development economists [21–24]—for instance, with reference to GDP or HDI observing a significant positive correlation—less has been said about development indicators incorporating the variables capturing climate change and ecological impact [1,25–28], and even less has been said for those development indicators that also try to consider the different governance dimensions [29–32]. This last aspect therefore leaves room for debate. In other words, an increasing governance climate should correspond to higher levels of development. This relationship should also apply to environmental and ecological frameworks.

Therefore, a sustainable development index like the SDI should relate development with human concerns, ecological sustainability, and countries' institutional environment. This means that improving sustainable development should require polycentric governance [33,34]. In fact, this is now a widely accepted objective, officially enshrined by the SDGs. On the other hand, multiple challenges for countries' governance can emerge when implementing combined and interlinked SDGs [35–37].

This paper aims to enhance the formulation of the SDI by introducing a further correction term of the development index (DI) in addition to the EII which considers the country's governance lack (GL) by calculating a governance index (GI) with the World Governance Indicators (WGIs) starting from 1996. Three are the specific aims of this study: (i) to construct a modified version of the SDI by incorporating into the new version SDI(g) a measure of countries' governance; (ii) to compare the SDI and SDI(g) rankings; and (iii) to examine the nexus between DI and GI, and DI and (EII + GL).

The SDI(g) retains the original formula of the SDI, thus remaining an indicator of strong environmental sustainability but adequately considering in its formulation the significant differences in countries' governance climate. Finally, graphical relationships between DI and GI, and DI and (EII + GL) are shown, and the existence of these relationships is tested with Weighted Least Squares (WLS) and nonparametric regressions. The findings show significant differences in country rankings. Additionally, the graphical relationships have been empirically proven, and countries with a worse GI have been further penalized in the SDI(g) ranking.

The remainder of the work is structured as follows: Section 2 presents the governance-development nexus; Section 3 outlines the materials and methods; Section 4 discusses the findings; and Section 5 provides the conclusions.

2. The Governance-development Nexus: An Integration of the Ecological Framework

In the literature investigating the nexus between development and the economy of institutions, there are obviously a huge number of different potential theoretical mechanisms that can link them [38]. It is possible to attribute important consequences for development to governance, as their association has been well proven [39–46]. Sound governance focuses on processes of decision-making and their institutional foundations and encompasses values such as enhanced participation and inclusion, transparency, accountability and access to information, and respect for human rights and the rule of law. While effective governance is linked to institutional problem-solving capacity, technology, expertise, financial resources, and the ability to engage in long-term planning in the face of interconnected problems, equitable governance focuses instead on distributional outcomes and equitable treatment, especially of the poorest and most marginalized people. Therefore, good governance towards sustainable development should consider all governance dimensions within an integrated and coherent framework of analysis. Finally, unsound governance is not exogenous to processes of decision-making and their institutional foundations, but it is the result of the political decisions and a result of the political institutions and sources of power in a society that shape its political processes.

Nevertheless, there is still a great deal of uncertainty about what political institutions or socioeconomic circumstances lead to sound policies and institutions. Therefore, the findings can be contradictory and only consider a few governance dimensions [47–55].

Governance has been unbundled, but it may not be [56]. Overall governance reflects the traditions and institutions by which authority in a country is exercised [57]. Therefore, governance encompasses three dimensions and is measured through six intertwined indicators: (i) *political governance*, the process by which governance is selected, monitored, and replaced by the social base—political stability index, voice and accountability index, (ii) *economic governance*, the capability of governance to formulate and effectively implement policies—government effectiveness index, regulatory quality index, and (iii) *institutional governance*, the respect that both the people and policymakers have for the institutions governing social and economic interactions—rule of law index, control of corruption index. A positive governance climate fosters the necessary conditions for growth, facilitating development, infrastructural capital, as well as a more effective interception of foreign investments, therefore governance matters [17–20].

An effective governance climate should efficiently synthesize these three governance dimensions. As a result, the GI is an efficient aggregate indicator, computed for each country and year as the arithmetic mean of the geometric means for pairs of WGIs in each of the three governance dimensions, which scale has been normalized in the range from 0 to 1 using the minimum and maximum of the estimated value of each WGI, −3.5 and 3.5 respectively[1]. This calculation has respected mathematical properties such as consistency, monotonicity, and compact synthesis of the average values. This formulation can be described as follows:

$$0 < \mathrm{GI} = \frac{\sum_{i=1}^{3} \sqrt[2]{(x_1 x_2)_i}}{3} < 1 \tag{1}$$

At the same time, the GI provides each dimension with parsimonious and equal consideration through the two different averages. This index efficiently synthesizes a set of otherwise non-interchangeable indicators—the geometric mean in fact ensures that one index cannot compensate the other—adequately considering the interdependence across governance dimensions. Therefore, considering this interdependence is important for accurately measuring the countries' governance climate.

The complement of GI as governance lack (GL) is defined in Equation (2), which together with the EII represents the overall discount factor (EII + GL) in the SDI(g) in (3), without changing the basic idea of the SDI [1]:

$$\mathrm{GL} = (1 - \mathrm{GI}) \tag{2}$$

$$\mathrm{SDI(g)} = \frac{\mathrm{DI}}{\mathrm{EII} + \mathrm{GL}} \tag{3}$$

In other words, once the average overshoot reaches four times the per-capita planetary boundary annually computed for material footprint and emissions values, the EII registers two cutting the DI in half, to which an additional discount factor GL has been added. Therefore, the governance climate perceived and measured by the GI cannot be zero (no governance) or one (perfect governance). This means that the SDI(g) remains an indicator of strong environmental sustainability as intended by its author, also considering countries' governance. Finally, it is robust in socioeconomic, political, and ecological terms.

3. Materials, Methods, and Instruments

We have estimated models with the 165 countries excluding Kerala-IND from the SDI

[1] One has been subtracted from the lower limit (−2.5) because WGIs could overshoot it even if only by a small amount. As a result, one has also been added at the upper limit (2.5) to have a homogeneous interval.

dataset online available (https://www.sustainabledevelopmentindex.org), which at the time of writing provided the data updated in time series from 1990 to 2019 (data release, 2021), however, the dataset generated during this study is available [58].

We calculated the average values for the indicators of interest every ten-time units, excluding the Nineties due to the small number of available observations in the SDI and WGI datasets for this decade (2000–2019). In this way, we hope to better capture changes in variables per time unit, as they may be subject to minimal variations.

We perform regressions for linear and cubic functions with cross-sectional data by implementing WLS-models—whose estimates are robust to heteroscedasticity in unknown form, and which can be approximated by a quadratic relationship—to represent the association between development and governance climate, and development and ecological impact plus governance lack, respectively. The models have been estimated with the open-source statistical software gretl.

The ideal would have been to perform an analysis with panel data. However, we could have come across into incomplete or insufficiently long time series, or even non-stationary ones. Nonetheless, a cross-sectional analysis can allow us to draw some interesting insights and make comparisons across countries over time. Furthermore, a nonparametric regression can represent a suitable alternative approach to confirm or refute the existence of a relationship and as a robustness check [59,60]. We have estimated the more robust LOWESS function [61]. This function is based on a locally and doubly weighted polynomial estimate of second order assigning less influence on outliers. A smoother interpolation curve at the accuracy level of 95% has been selected, enabling interpolated DI values within the interval (0–1). Therefore, the outcomes of a nonparametric regression are shown and discussed below. This approach allows us to estimate the shape of the relationship without making assumptions on its functional form, readily capturing complex nonlinear relationships of unknown form, and long time series may be subject to sharp or smooth structural breaks, or other forms of non-linearity caused by external shocks such as structural reforms and changes in environmental policies.

4. Findings

4.1. SDI and SDI(g) Datasets

By comparing the two indicators, the top and bottom countries of the SDI and SDI(g), we can see how the values of the upper limit of the SDI (the top-ten countries in the ranking) are lower than the SDI(g), while the values of the down limit remain almost unchanged (the bottom-ten countries in the ranking). These results are consistent with the assumption that the countries with a worse GI are further penalized in the SDI(g) ranking. In other words, the countries with a lower EII—the top-ten countries in the SDI ranking, but a worse (lower) GI are further penalized by the GL (higher) term added to the denominator in the original SDI formula. While the countries with a higher EII—the bottom-ten countries in the SDI ranking, but a better (higher) GI are less penalized by the additional component of discount for DI.

These results in Table 1 show the top- and bottom-ten countries in comparing the two indicators. Overall, significant differences were found in the positions of countries in the SDI(g) ranking (see Table A1 in the Appendix). The highest differences were found for Portugal (48 places), France, Malta (42), and Chile (40). While, the lowest differences were found for Syria (−34), Yemen (−29), the Democratic Republic of Congo (−28), Uzbekistan and Tajikistan (−27). These significant changes in the country's position indicate the importance of considering the impact of the governance lack for the computation of the SDI(g).

It is noteworthy that among the top-ten countries (Table 1), Georgia discounts a lower GL than Sri Lanka, such that it rises to second place, and this falls to fifth place in the SDI(g) ranking. Albania then discounts a lower GL term than Armenia, thus it goes up, while Peru discounts a higher term and thus goes down in the ranking. Cuba, Dominican Republic, Armenia, and Moldova then exit the top-ten in the SDI ranking, while Barbados, Fiji, Samoa, and Hungary enter in that of the SDI(g) ranking.

In the SDI(g) dataset, 58% of countries have a GI encompassing between 0.25 and 0.50; while 39% of them have a GI encompassing between 0.50 and 0.75; finally, the remaining 2% have a GI less than 0.25. This means that 61% of the countries have a lower GI, indicating their society perceives an unsound or unsatisfactory governance climate, while only 39% of countries have a satisfactory and sound governance climate in the dataset (Table 2).

Table 1. The top- and bottom-ten countries in the SDI and SDI(g) rankings, comparison in 2019.

SDI Ranking	2019	SDI(g) Ranking	2019	Δ Rank
Top-ten Countries				
Costa Rica	0.850	Costa Rica	0.608	0
Sri Lanka	0.836	Georgia	0.582	1
Georgia	0.823	Barbados	0.568	24
Cuba	0.811	Panama	0.560	2
Domini. Rep.	0.811	Sri Lanka	0.552	−3
Panama	0.811	Fiji	0.551	7
Peru	0.809	Albania	0.545	2
Armenia	0.807	Samoa	0.543	18
Albania	0.806	Peru	0.543	−2
Moldova	0.805	Hungary	0.542	28
Bottom-ten Countries				
Finland	0.225	Finland	0.213	0
Norway	0.188	Norway	0.180	0
Canada	0.179	Canada	0.171	0
Iceland	0.178	Iceland	0.170	0
United States	0.163	United States	0.154	0
Australia	0.156	Australia	0.150	0
Qatar	0.154	Qatar	0.143	0
Arab Emirates	0.126	Arab Emirates	0.119	0
Kuwait	0.103	Kuwait	0.097	0
Singapore	0.099	Singapore	0.096	0

Table 2. The qualitative evaluation of the governance climate based on GI.

	Unsound			Unsatisfactory		Satisfactory			Sound	
	0.00–0.10	0.10–0.20	0.20–0.30	0.30–0.40	0.40–0.50	0.50–0.60	0.60–0.70	0.70–0.80	0.80–0.90	0.90–1.00
#Obs.	0.00	0.00	11.00	31.00	58.00	32.00	20.00	13.00	0.00	0.00
Percentage	0.00	0.00	7.00	19.00	35.00	19.00	12.00	8.00	0.00	0.00

In Table 3, the top- and bottom-ten countries in the GI ranking in 2019 are shown. The three best-performing countries are New Zealand, Norway, and Finland, achieving higher levels of the governance climate index. Conversely, the worst countries are Yemen, Syria, and Libya. The top-ten highest-ranked countries have a lower GL—averaging 0.27—while the bottom-ten lowest-ranked countries, on average, have a GL of 0.75. A world heat-map for the GI in 2019 is shown in Figure 1.

The top- and bottom-ten countries in the SDI(g) ranking in 2019 are listed in Table 4. The best three performers are Costa Rica, Sri-Lanka, and Georgia, achieving higher levels of social performance with low levels of ecological impact considering their governance lack. However, there are no countries achieving the highest scores in the SDI(g) ranking while respecting ecological boundaries and paying for their lack of governance. Instead, at the bottom of the SDI(g) ranking are the more developed countries with a better governance climate but with higher ecological impact (like Singapore, Iceland, and Canada), just as there are also countries with higher ecological impact and higher governance lack (like Kuwait, Qatar, and Arab Emirates).

The countries with higher DI, lower EII, and higher GI rise to the top of the SDI(g) ranking. Instead, countries with lower DI, or those with higher DI but higher EII and a lower GI, fall to the bottom of the SDI(g) ranking (see also Figure 2).

In this way, the SDI(g) fosters socioeconomic and political progress by adequately considering the main ecological and governance issues that are characterizing the countries in this century. To succeed in terms of the SDI(g), low- and lower-middle-income economies must significantly improve DI while keeping their EII within global boundaries and seeking to improve their governance climate. Meanwhile, upper-middle and high-income economies must maintain or enhance DI, while significantly reducing their EII, doing it sustainable, given the more favorable governance climate.

Table 3. The top- and bottom-ten countries in the 2019 GI ranking, trend, and average percent variation on available data since 1996, countries by income level groups (World Bank).

Trend	All	GI	Δ	Trend	High Income	GI	Δ	Trend	Upper-middle Income	GI	Δ	Trend	Lower-middle Income	GI	Δ	Trend	Low Income	GI	Δ
	Top-ten Countries																		
	New Zealand	0.748	−0.02		New Zealand	0.748	−0.02		Mauritius	0.603	0.16		Samoa	0.592	0.06		Rwanda	0.488	0.88
	Norway	0.747	−0.02		Norway	0.747	−0.02		Botswana	0.585	−0.10		Cabo Verde	0.580	0.22		Gambia	0.444	0.05
	Finland	0.745	0.00		Finland	0.745	0.00		Costa Rica	0.584	−0.07		Bhutan	0.573	0.28		Malawi	0.426	−0.14
	Switzerland	0.742	0.01		Switzerland	0.742	0.01		Fiji	0.563	0.09		Vanuatu	0.514	−0.06		Burkina Faso	0.416	−0.06
	Sweden	0.736	−0.03		Sweden	0.736	−0.03		Georgia	0.557	1.01		Ghana	0.502	0.18		Sierra Leone	0.415	0.45
	Denmark	0.735	−0.08		Denmark	0.735	−0.08		Malaysia	0.555	−0.03		Mongolia	0.500	−0.10		Uganda	0.405	0.06
	Netherlands	0.726	−0.13		Netherlands	0.726	−0.13		Namibia	0.544	−0.15		Senegal	0.494	0.07		Madagascar	0.390	−0.29
	Singapore	0.725	0.09		Singapore	0.725	0.09		Bulgaria	0.533	0.23		Jordan	0.484	−0.07		Togo	0.388	−0.07
	Canada	0.721	−0.05		Canada	0.721	−0.05		Jamaica	0.529	0.04		Sri Lanka	0.478	0.16		Niger	0.387	0.07
	Iceland	0.718	−0.01		Iceland	0.718	−0.01		Montenegro	0.513	0.21		India	0.476	0.05		Liberia	0.387	0.71
	Bottom-ten Countries																		
	Turkmenistan	0.290	−0.25		Croatia	0.560	0.46		Mexico	0.434	−0.10		Myanmar	0.359	0.37		Mozambique	0.383	−0.30
	Congo Dem. Rep.	0.274	0.22		Qatar	0.547	0.20		Turkey	0.430	−0.14		Uzbekistan	0.359	0.19		Mali	0.349	−0.46
	Iraq	0.272	0.18		Greece	0.546	−0.26		Cuba	0.420	0.12		Pakistan	0.349	−0.18		Chad	0.303	−0.20
	Central Afr. Rep.	0.269	−0.34		Romania	0.533	0.14		Russian Fed.	0.410	0.05		Congo	0.342	−0.03		Burundi	0.293	0.06
	Afghanistan	0.264	0.21		Oman	0.515	−0.10		Guatemala	0.405	0.01		Nigeria	0.337	0.02		Congo Dem. Rep.	0.274	0.22
	Eritrea	0.256	−0.61		Panama	0.512	−0.03		Azerbaijan	0.402	0.30		Cameroon	0.337	0.00		Central Afr. Rep.	0.269	−0.34
	Venezuela	0.238	−0.89		Trinidad-Tobago	0.503	−0.31		Gabon	0.387	−0.31		Iran	0.332	−0.25		Afghanistan	0.264	0.21
	Libya	0.221	−0.50		Kuwait	0.489	−0.21		Turkmenistan	0.290	−0.25		Tajikistan	0.327	0.27		Eritrea	0.256	−0.61
	Syria	0.210	−0.79		Bahrain	0.476	−0.21		Iraq	0.272	0.18		Haiti	0.323	−0.17		Syria	0.210	−0.79
	Yemen	0.206	−0.80		Saudi Arabia	0.456	0.06		Libya	0.221	−0.50		Zimbabwe	0.322	−0.48		Yemen	0.206	−0.80

High income: Antigua-Barbuda, Arab Emirates, Australia, Austria, Bahamas, Bahrain, Barbados, Belgium, Brunei, Canada, Chile, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Kuwait, Latvia, Lithuania, Malta, Netherlands, New Zealand, Norway, Oman, Panama, Poland, Portugal, Qatar, Romania, Saudi Arabia, Seychelles, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, Trinidad-Tobago, United Kingdom, United States, Uruguay.

Upper-middle income: Albania, Argentina, Armenia, Azerbaijan, Belize, Bosnia-Herzegovina, Botswana, Brazil, Bulgaria, China, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Eswatini, Fiji, Gabon, Georgia, Guatemala, Indonesia, Iraq, Jamaica, Kazakhstan, Libya, Malaysia, Maldives, Mauritius, Mexico, Moldova, Montenegro, Namibia, North Macedonia, Paraguay, Peru, Russian Federation, Serbia, South Africa, Suriname, Thailand, Turkey, Turkmenistan.

Lower-middle income: Algeria, Angola, Bangladesh, Benin, Bhutan, Bolivia, Cabo Verde, Cambodia, Cameroon, Congo, Côte d'Ivoire, Djibouti, Egypt, Ghana, Guinea, Haiti, Honduras, India, Iran, Jordan, Kenya, Kyrgyzstan, Laos, Lebanon, Lesotho, Mauritania, Mongolia, Morocco, Myanmar, Nepal, Nicaragua, Nigeria, Pakistan, Papua New Guinea, Philippines, Samoa, Sao Tome-Principe, Senegal, Sri-Lanka, Tajikistan, Tanzania, Tunisia, Ukraine, Uzbekistan, Vanuatu, Vietnam, Zambia, Zimbabwe.

Low income: Afghanistan, Burkina Faso, Burundi, Central African Rep., Chad, Congo Dem. Rep., Eritrea, Ethiopia, Gambia, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Rwanda, Sierra Leone, Syria, Togo, Uganda, Yemen.

Not classified: Venezuela.

Table 4. The top- and bottom-ten countries in the 2019 SDI(g) ranking, trend, and average percent variation on available data since 1996, countries by income level groups (World Bank).

Trend	All	SDI(g)	Δ	Trend	High Income	SDI(g)	Δ	Trend	Upper-middle Income	SDI(g)	Δ	Trend	Lower-middle Income	SDI(g)	Δ	Trend	Low Income	SDI(g)	Δ
Top-ten Countries																			
	Costa Rica	0.608	0.32		Barbados	0.568	0.02		Costa Rica	0.608	0.32		Sri-Lanka	0.552	0.45		Rwanda	0.390	1.05
	Georgia	0.582	0.61		Panama	0.560	0.21		Georgia	0.582	0.61		Samoa	0.543	0.30		Uganda	0.370	0.66
	Barbados	0.568	0.02		Hungary	0.542	−0.16		Fiji	0.551	0.19		Jordan	0.509	0.05		Madagascar	0.355	0.15
	Panama	0.560	0.21		Croatia	0.533	0.19		Albania	0.545	0.51		Cabo Verde	0.504	0.39		Togo	0.348	0.30
	Sri-Lanka	0.552	0.45		Chile	0.529	−0.23		Peru	0.543	0.42		Philippines	0.501	0.30		Gambia	0.346	0.40
	Fiji	0.551	0.19		Portugal	0.513	−0.29		Armenia	0.539	0.48		Ukraine	0.495	0.18		Syria	0.341	−0.23
	Albania	0.545	0.51		Romania	0.509	0.05		Argentina	0.535	−0.02		Algeria	0.487	0.44		Malawi	0.334	0.32
	Samoa	0.543	0.30		Malta	0.461	−0.27		Domini. Rep.	0.533	0.39		Bhutan	0.482	0.65		Ethiopia	0.327	0.71
	Peru	0.543	0.42		Uruguay	0.460	−0.43		Colombia	0.532	0.45		Bolivia	0.482	0.29		Liberia	0.323	0.26
	Hungary	0.542	−0.16		Antigua-Barbuda	0.456	0.44		Jamaica	0.530	0.19		Morocco	0.481	0.59		Afghanistan	0.321	0.55
Bottom-ten Countries																			
	Finland	0.213	−1.15		Finland	0.213	−1.15		Guatemala	0.450	0.47		Mauritania	0.369	0.25		Burkina Faso	0.312	0.56
	Norway	0.180	−1.08		Norway	0.180	−1.08		Libya	0.412	−0.25		Zimbabwe	0.368	0.27		Sierra Leone	0.310	0.60
	Canada	0.171	−0.72		Canada	0.171	−0.72		Iraq	0.407	0.30		Cameroon	0.368	0.41		Mozambique	0.307	0.59
	Iceland	0.170	−1.30		Iceland	0.170	−1.30		Malaysia	0.393	−0.43		Pakistan	0.366	0.36		Congo Dem. Rep.	0.301	0.41
	United States	0.154	−0.47		United States	0.154	−0.47		Serbia	0.380	−0.34		Tanzania	0.361	0.52		Mali	0.287	0.45
	Australia	0.150	−0.57		Australia	0.150	−0.57		Montenegro	0.371	−1.05		Lesotho	0.361	0.09		Yemen	0.286	0.00
	Qatar	0.143	−0.14		Qatar	0.143	−0.14		China	0.352	−0.14		Nigeria	0.351	0.36		Burundi	0.277	0.45
	Arab Emirates	0.119	0.03		Arab Emirates	0.119	0.03		Botswana	0.303	−0.51		Djibouti	0.349	0.55		Niger	0.266	0.49
	Kuwait	0.097	−0.06		Kuwait	0.097	−0.06		Kazakhstan	0.293	−0.59		Haiti	0.329	0.22		Chad	0.255	0.32
	Singapore	0.096	−0.35		Singapore	0.096	−0.35		Turkmenistan	0.227	−1.20		Guinea	0.319	0.55		Central Afr. Rep.	0.249	0.20

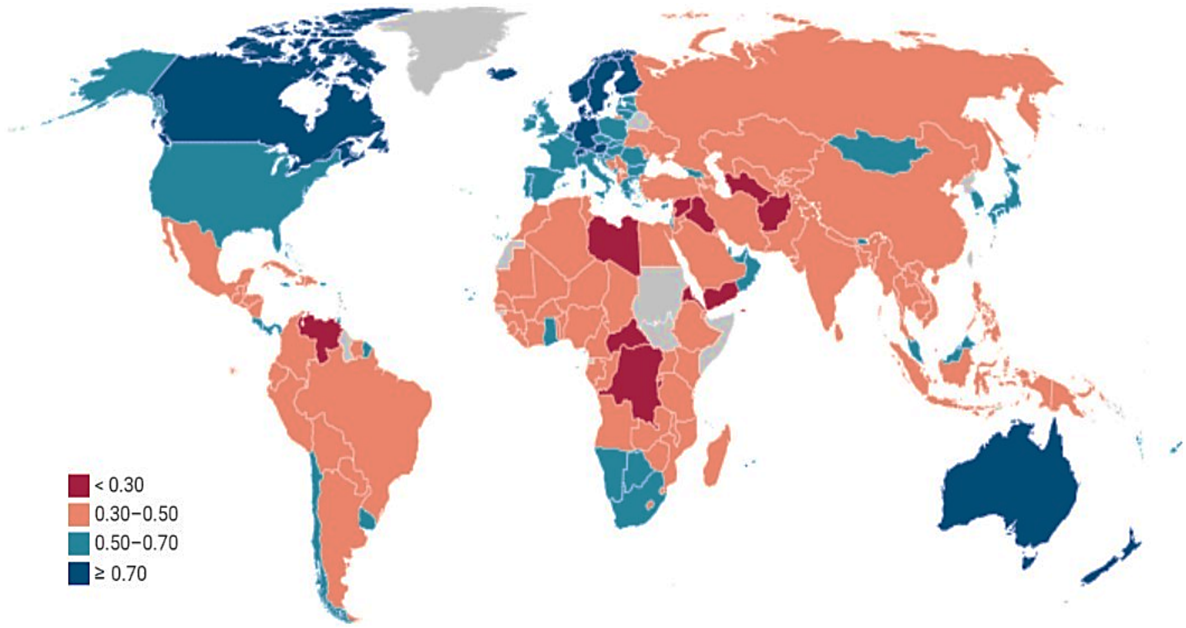


Figure 1. The world heat-map for the GI in 2019, chromatic gradient based on qualitative evaluation.

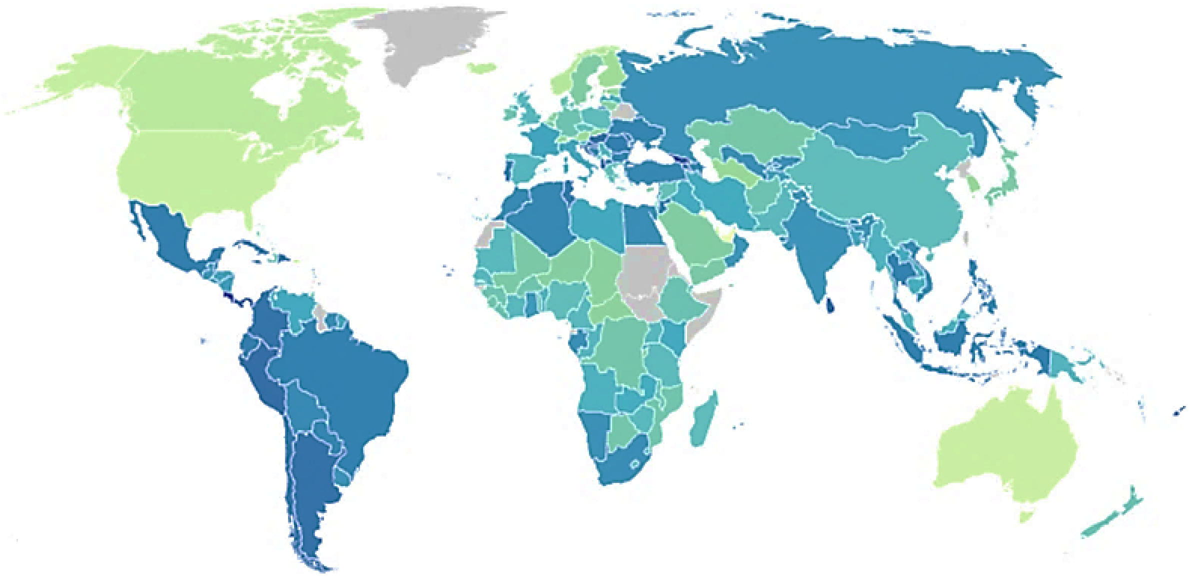


Figure 2. The world heat-map for the SDI(g) in 2019, continued gradient from light (low) to dark (high).

4.2 Model Specification, Regressions, and Graphical Relationships

The model specification follows the linear form for the relationship between DI and GI, while the cubic one was used for the relationship between DI and (EII + GL). The main descriptive statistics of the variables and their correlation are reported in Table 5. The estimations are shown in Table 6. At the 1% level, all estimates are statistically significant and the F-test on the linear and cubic models is also significant. Finally, our results do not show evidence of a de-linking, and the regressions empirically confirm the evidence shown in Figure 3 about the existence of a positive linear relationship between DI and GI—for higher levels of GI the correlation with DI becomes stronger showing less dispersion—and about the existence of the N-shape for the relationship between DI and (EII + GL). As a result, our empirical framework supports evidence of a bounded development by the increasing ecological impact and a lack of governance. The statistical associations between DI and GI, and DI and (EII + GL) are significant and with a positive sign, which are 0.78 and 0.45 respectively.

Table 5. The main descriptive statistics of the variables and their correlation.

	#Non-obs.	μ	σ	**Min**	**Max**	ρ
DI	1.000[(a)]	0.747	0.173	0.321	1.059	
GI	0.000	0.488	0.127	0.252	0.768	
(EII + GL)	2.000[(b)]	2.086	1.174	1.412	10.971	
DI−GI						0.781***
DI−(EII + GL)						0.451***

Note: *** significant for α = 0.01; ** significant for α = 0.05; * significant for α = 0.10; [(a)] Turkmenistan (2000–2009); [(b)] Eritrea (2010–2019), Turkmenistan (2000–2009).

Table 6. WLS-models for the relationships DI−GI and DI−(EII + GL), standard errors in brackets.

	2000–2009	**2010–2019**
	DI	
GI	1.042*** (0.040)	0.968*** (0.035)
Constant	0.211*** (0.026)	0.308*** (0.023)
Standard Error	0.115	0.103
F-Test (p-value)	(0.000)	(0.000)
Log-likelihood	−315.411	−325.982
Observations (%)	164 (99)	165 (100)
R-squared	0.810	0.824
$(EII + GL)^3$	0.007*** (0.002)	0.004*** (0.001)
$(EII + GL)^2$	−0.120*** (0.021)	−0.075*** (0.005)
(EII + GL)	0.631*** (0.082)	0.452*** (0.025)
Constant	−0.060 (0.093)	0.165*** (0.039)
Standard Error	0.150	0.125
F-Test (*p*-value)	(0.000)	(0.000)
Log-likelihood	−299.808	−298.332
Observations (%)	164 (99)	164 (99)
R-squared	0.609	0.717

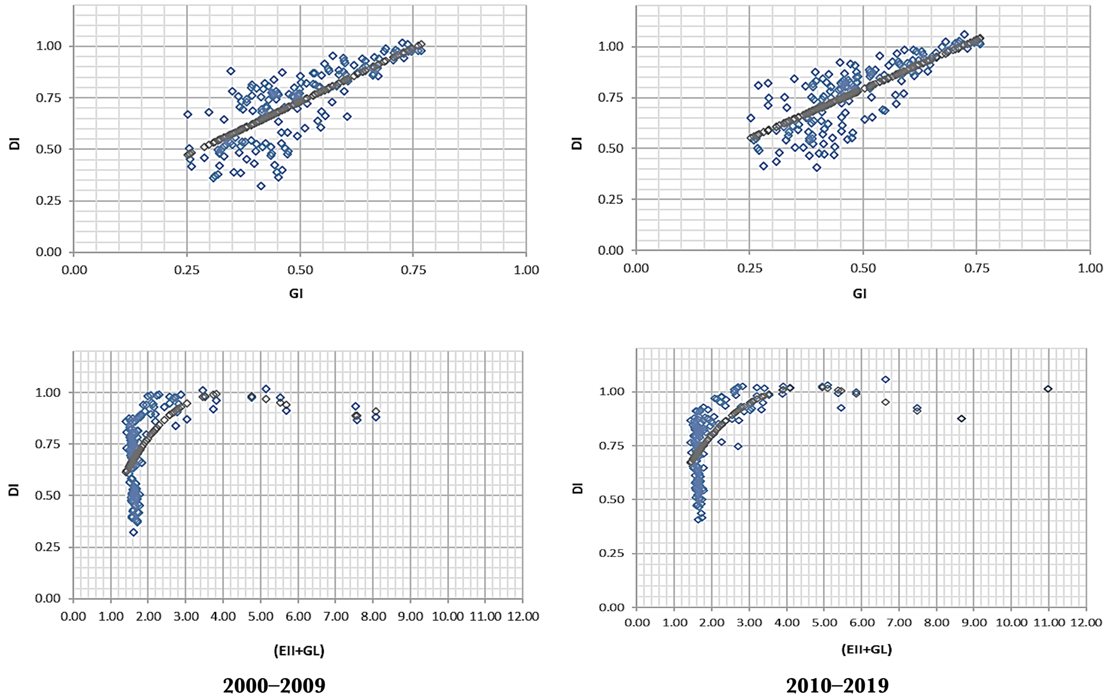
Note: *** significant for α = 0.01; ** significant for α = 0.05; * significant for α = 0.10.

4.3. Discussion

The function shown in Figure 3 for the relationship DI−(EII + GL) has a positive cubic term that depicts a model in which higher levels of environmental degradation and governance lack are associated with higher DI, particularly above 0.50. In fact, for DI values lower than this threshold, countries' performance in terms of ecological impact considering the governance lack is similar. The two curves, however, show different trends. The left tail progressively rises, indicating a decrease in the overall number of countries with a DI encompassing between 0.25 and 0.50. These different trends are also confirmed by the magnitude of the estimated coefficients with the regressions in Table 6. In other words, over the two decades (EII + GL) has moved from a maximum of 8.10 in the first decade to 11.0 in the second decade.

The countries' performance in terms of ecological impact considering the governance lack has increased by 2.90 points over one decade. Additionally, there is a rather numerous clusters of countries above 0.50 showing a low (EII + GL) associated with higher DI. However, there are also an increasing number of countries with very high DI that have overall worsened their environmental performance and governance climate over the two decades.

The form of the two functions is an N-shaped one, where—after an initial phase like that shown by the ecological Kuznets curve [62,63] in which for higher levels of development the environmental impact and governance lack increase up to the maximum point of the function



Note: small overshoots of the upper limit in the computation of the DI have been recognized.

Figure 3. The graphical relationships DI−GI and DI−(EII + GL), effective (blue), and interpolated (grey) values.

beyond which they begin to decrease—the highest level of development is associated with the highest environmental impact and governance lack.

Frankel [64] and Dinda [65] have identified three effects related to development affecting environmental degradation which can be useful for better understanding the increasing trend shown up to the maximum point of the functions: (i) scale effect—production on a larger scale necessarily requires a greater amount of input, this increases waste and polluting emissions, as a result, if the level of technology does not improve as the scale of production increases there will be an overall deterioration in environmental quality; (ii) composition effect—productions change over the country's development path. In the early stages, the economy moves from agriculture to the manufacturing industry using energy intensively, thus with a considerable increase in emissions. In the following phases, the manufacturing industry share decreases while that of the service sector increases. In the long run, service growth will cause a decrease in waste and pollution resulting from the manufacturing industry, while, in the short term, development will still cause an increase in overall pollution; and (iii) technology effect—the investments in R&D to obtain clean technologies increase when a country develops, just as the investments aimed at developing new processes and products with lower environmental impact also rise. On the supply side, this leads to increased returns from pollution abatement as the efficiency scale of the new technologies adopted rises. While, on the demand side, there is an increased demand for green productions and effective environmental regulations. As a result, by producing the same amount of goods and services, polluting emissions will be lower, therefore, in the long run, development will increase, and the available technology will improve, ultimately decreasing environmental degradation.

Instead, the decreasing trend shown by the functions beyond its maximum point can depend on several interconnected or partially overlapping factors, mainly referring to the ecological impact [66]: (i) higher incomes may induce changes on the demand side and shift consumption habits towards goods or services with higher environmental impact, both in terms of environmental unfriendly ways of satisfying given needs and in terms of the creation of new needs; (ii) there may be decreasing returns to pollution control technologies; (iii) an environmentally unfriendly technological change may occur, both in the sense of the increased extractive capacity of certain industries and of resource-intensive productions; and (iv) even technological change implying resource or energy saving per unit of product may induce a "rebound effect" due to behavioral responses by which increases in efficiency can be overcompensated by a rise in demand for the same or other commodities.

The first effect can be seen as the consumption side of the composition effect, the second and third can result from the technology effect, and the fourth can instead arise from an interaction between the technology and the scale effects. These effects combined can lead to an increasing rate of environmental degradation for the cluster of upper middle- and high-income economies, more developed.

In conclusion, the combination of such effects can justify the emergence of a positive relationship between DI and (EII + GL). The relationship shown could suggest that wealthy and more developed countries damage their environment more than poor and less developed countries. Furthermore, less developed countries tend to have a higher governance lack. Typically, an underdeveloped country would do well to enhance the institutional environment and the rule of law with regulatory reforms to improve the management of its environmental resources. As a result, the SDI(g) also takes these governance aspects into account.

The curves shown in Figure 4 are nonparametric regressions. In the first part the two functions rapidly grow up to the maximum point (increasing monotonicity), beyond this limit they decrease or are almost stationary (decreasing or non-increasing monotonicity). In other words, the functions have a reversed U-shape and depict environmental Kuznets curves with a vertex at the highest level of DI [67]. This means that (EII + GL) rapidly increases at the initial stages of development but with a decelerating rate up to the point where the first derivative of the function changes its sign, beyond which a decoupling between DI and (EII + GL) takes place, finally, highlighting a scenario in which rapid environmental degradation primarily occurs [68,69]. This framework, in which higher levels of development correspond to a higher ecological impact and lack of governance, can lead to the downfall of ecological and economic systems, pushing them towards their point of maximum entropy [70–73]. Finally, the relationships shown confirm the existence of at least a negative quadratic relationship between DI and (EII + GL).

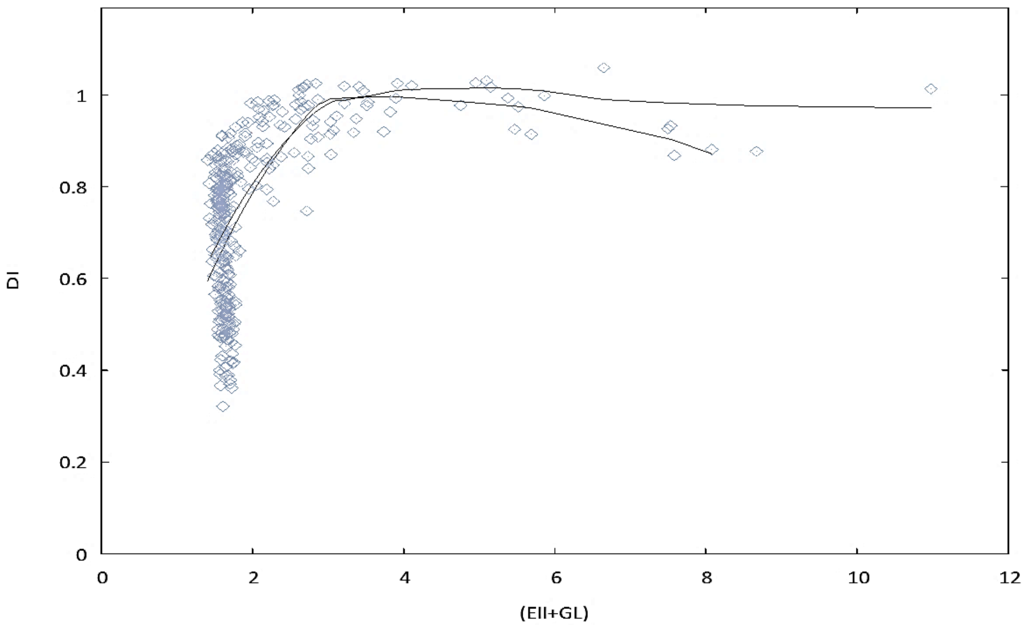


Figure 4. The nonparametric regressions for the relationship DI−(EII + GL), 2010–2019 (above), and 2000–2009 (below), smooth interpolation curves compared.

5. Conclusions

5.1. Concluding Remarks and Contribution

The SDI(g), like the SDI, does not allow a compromise between the dimensions of development, governance, and ecological ones. By adding a further discount term, represented by the GL, compared to other indices that try to capture only several aspects of governance, the SDI(g) captures all governance dimensions based on the standards provided by the WGIs, representing a more comprehensive framework of the sustainable development achievement.

We add that the SDGs are an integrated and coherent agenda and framework for economic, environmental, and social solutions that can be implemented by the countries' governance. In this direction, the green Solow model of economic growth presented in [74] may be interesting.

According to its authors, environmental policies can increase economic output directly by improving environmental conditions and utilizing natural capital, however, empirical evidence on CO_2 emissions and material footprint may not support green growth theory [75].

In conclusion, we have updated the SDI dataset available online by calculating the GI and its complement GL, which increased the discount factor (EII) used in the denominator in the calculation of the SDI. Therefore, we add this further component in the denominator of the SDI(g) formula. While we can imagine that a country has notable improvements in terms of governance without any ecological impact, we cannot think that development does not correlate with governance. We believe that it is important to also consider countries' governance when calculating an indicator attempting to objectively measure sustainable development.

Our findings show that significant differences in country ranking were found; the graphical relationships have been empirically proven; and countries with a worse GI have been further penalized in the SDI(g) ranking. Therefore, given these assumptions, it was possible to identify countries with a lower ecological impact considering their lack of governance.

5.2. Policy Implications

The global economic development has rapidly exacerbated well-known environmental imbalances—global warming and climate change—also highlighting the limit of the Earth's carrying capacity. In fact, it has been recognized that the global ecological footprint may exceed the Earth's biocapacity. As a result, there is a need for common and pressing environmental policy coordinates among countries aimed to reduce the environmental impact. However, it is difficult to find solutions to global climate challenges, without an efficient and coordinated application of these policies [76]. In particular, the hardships related to obtaining a global international agreement on climate change are caused by free-riding behaviors linked to development differences between advanced and emerging economies, which exactly reflect the heterogeneity across countries in terms of multilevel governance [77–80]. Therefore, a new cooperative approach to global concerns is required to strengthen existing and new international governance institutions in the interest of inclusive and sustainable development [81]. Development and progress would come if only environmental, social, and governance issues were globally addressed through debates on long-run resilience, perseverance, and sustainability [82].

The circular economy principles can be valuable in addressing the challenges posed by sustainable development and new ways of conceiving the future, modernity, capitalism, and society [14]. As a result, a prospering, dynamic, and flourishing society requires not only sound governance to facilitate progress and societal change, but also requires wise people, who should be able to positively interpret the value of modernity and the intrinsic change it can bring [83]. However, to implement these proceedings globally, structural changes that can no longer be delayed are needed due to rising populations and rapid development in many areas of the world. Consequently, the increasing demand for natural resources, essential for countries' economic growth—and many of which are not inexhaustible—is leading to heightened environmental degradation. Considering this, big corporations could focus more on promoting sustainable growth, while small firms could prioritize improving employment levels and worker wellbeing [84].

In conclusion, finding adequate solutions to the environmental issue is becoming increasingly challenging as it is difficult to reach a common global vision. Therefore, we believe that considering countries' overall governance towards the SDGs is important because sets of policies could be implemented at the national level based on countries' development paths, macroeconomic structures, and comparative advantages [85]. The difficulty in finding feasible solutions—consisting of policies needed to implement the proper mix of renewable sources, energy efficiency, and energy savings—to address climate change could therefore be a more political and not economic problem [86].

An effort toward new technologies adoption and focused investments could allow sustained economic growth without endangering the environment [87,88]. However, the lack of governance and political will to cooperate across countries is not an exclusive characteristic of the climate change issue alone, but it can be connected more generally to the development issue. In other words, countries' governance could direct citizens towards the adoption of green technological innovations by shifting the socioeconomic systems from an environmentally harmful equilibrium path to a more sustainable one through viable policies [89–92]. The governance generally matters and should be sufficiently sound.

5.3. Limitations and Suggestions for Research

The methodological and practical limits already raised for the SDI regarding the ecological impact which could be understated in richer countries and overstated in poorer countries remain unchanged [93,94]. Among the other limitations, we highlight that the SDI(g) may imply heterogeneous prescriptions for the sustainable development of a nation, which considers the governance of countries together with their varied internal institutional predicaments and macroeconomic unbalances. On one hand, there are underdeveloped countries that can achieve a high level of development with a sustainable level of ecological impacts, because they invest in universal goods like public health and education [95]. On the other hand, there are developed countries instead have serious difficulties in reducing ecological impacts to bring them to sustainable levels and which require not only substantial improvements in productive efficiency but also societal changes and alternative forms of progress to move beyond the maximization logic and to adopt satisficing choices for sustainable development [14,81,83], in a manner that may also improve the performance of social indicators [96]. Therefore, the SDI(g) could consider all these challenges and find applications in future research to test its robustness. For instance, future studies that use the three-stage least square (3SLS) estimation method could produce more efficient and accurate results. Additionally, future research could use indicators of new conception as a measure of development reached by the countries instead of the HDI. Finally, data release 2024 could be used to update the SDI(g) dataset. In fact, it could be that for many nations life expectancy index declined after 2019 due to pandemic shock and some nations may have not recovered the pre-pandemic levels. This obviously impacts the SDI and SDI(g) scores and rankings. Furthermore, for several countries—Chad, Cote d'Ivoire, Lao, Lesotho, and Panama, CO_2 emission and material footprint data used in the original SDI formula have been cleaned of the outliers [97].

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Data Availability

Data supporting this study are openly available from Mendeley Data at https://doi.org/10.17632/247h9zc32d.5.

Conflicts of Interest

The author has no conflict of interest to declare.

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Appendix A

Table A1. Comparison between SDI and SDI(g), country rankings.

Code	Country	2019		Rank		
		SDI	SDI(g)	SDI	SDI(g)	Δ
PRT	Portugal	0.634	0.513	70	22	48
FRA	France	0.490	0.419	112	70	42
MLT	Malta	0.563	0.461	96	54	42
CHL	Chile	0.678	0.529	57	17	40
ITA	Italy	0.510	0.417	108	71	37
SVN	Slovenia	0.455	0.391	121	84	37
URY	Uruguay	0.569	0.460	93	56	37
LVA	Latvia	0.465	0.391	118	83	35
GBR	United Kingdom	0.420	0.373	128	93	35
MUS	Mauritius	0.609	0.478	78	46	32
ESP	Spain	0.443	0.378	123	91	32
HRV	Croatia	0.714	0.533	42	13	29
HUN	Hungary	0.728	0.542	38	10	28
MYS	Malaysia	0.491	0.393	110	82	28
ATG	Antigua-Barbuda	0.597	0.456	85	58	27
ROU	Romania	0.692	0.509	52	25	27
BGR	Bulgaria	0.666	0.493	61	36	25
MNE	Montenegro	0.464	0.371	119	94	25
BRB	Barbados	0.758	0.568	27	3	24
SRB	Serbia	0.490	0.380	113	89	24
OMN	Oman	0.602	0.453	82	60	22
POL	Poland	0.420	0.356	127	105	22
CZE	Czech Republic	0.399	0.347	132	112	20
DNK	Denmark	0.370	0.338	135	115	20
GRC	Greece	0.417	0.349	129	109	20
SYC	Seychelles	0.445	0.365	122	102	20
NZL	New Zealand	0.357	0.328	138	119	19
BTN	Bhutan	0.673	0.482	59	41	18
WSM	Samoa	0.761	0.543	26	8	18
CPV	Cabo Verde	0.710	0.504	46	29	17
ISR	Israel	0.383	0.331	133	117	16
MNG	Mongolia	0.615	0.445	76	62	14
CHN	China	0.461	0.352	120	107	13
DEU	Germany	0.351	0.319	139	127	12
IRL	Ireland	0.350	0.317	140	128	12
ARG	Argentina	0.764	0.535	22	12	10
NAM	Namibia	0.660	0.463	63	53	10
ZAF	South Africa	0.678	0.472	58	48	10
TUR	Turkey	0.703	0.487	48	38	10
BHS	Bahamas	0.379	0.320	134	125	9
BHR	Bahrain	0.401	0.327	130	121	9
MKD	North Macedonia	0.739	0.510	33	24	9
TTO	Trinidad-Tobago	0.401	0.326	131	122	9
BEL	Belgium	0.321	0.291	143	136	7
CYP	Cyprus	0.334	0.295	141	134	7
FJI	Fiji	0.786	0.551	13	6	7
RUS	Russian Fed.	0.661	0.460	62	55	7

Table A1. (*Continued*)

THA	Thailand	0.736	0.503	36	30	6
BIH	Bosnia-Herzegovina	0.712	0.485	44	39	5
IRN	Iran	0.602	0.409	81	76	5
JPN	Japan	0.310	0.282	144	139	5
BWA	Botswana	0.360	0.303	136	132	4
BRA	Brazil	0.747	0.506	32	28	4
JAM	Jamaica	0.771	0.530	20	16	4
NLD	Netherlands	0.282	0.262	149	145	4
RWA	Rwanda	0.585	0.390	89	85	4
SUR	Suriname	0.700	0.478	49	45	4
SWE	Sweden	0.294	0.274	145	141	4
SEN	Senegal	0.552	0.370	99	96	3
VUT	Vanuatu	0.654	0.443	66	63	3
ALB	Albania	0.806	0.545	9	7	2
KAZ	Kazakhstan	0.357	0.293	137	135	2
KOR	Korea	0.251	0.230	153	151	2
LTU	Lithuania	0.293	0.263	146	144	2
PAN	Panama	0.811	0.560	6	4	2
CHE	Switzerland	0.260	0.244	151	149	2
GEO	Georgia	0.823	0.582	3	2	1
MDV	Maldives	0.715	0.483	41	40	1
SVK	Slovakia	0.285	0.253	148	147	1
AUS	Australia	0.156	0.150	160	160	0
AUT	Austria	0.239	0.223	154	154	0
BRN	Brunei	0.255	0.228	152	152	0
CAN	Canada	0.179	0.171	157	157	0
CRI	Costa Rica	0.850	0.608	1	1	0
EST	Estonia	0.260	0.239	150	150	0
FIN	Finland	0.225	0.213	155	155	0
GHA	Ghana	0.659	0.442	64	64	0
ISL	Iceland	0.178	0.170	158	158	0
KWT	Kuwait	0.103	0.097	163	163	0
NOR	Norway	0.188	0.180	156	156	0
QAT	Qatar	0.154	0.143	161	161	0
SAU	Saudi Arabia	0.324	0.272	142	142	0
SGP	Singapore	0.099	0.096	164	164	0
ARE	Arab Emirates	0.126	0.119	162	162	0
USA	United States	0.163	0.154	159	159	0
BEN	Benin	0.587	0.382	87	88	−1
JOR	Jordan	0.763	0.509	25	26	−1
PER	Peru	0.809	0.543	7	9	−2
ARM	Armenia	0.807	0.539	8	11	−3
LKA	Sri Lanka	0.836	0.552	2	5	−3
COL	Colombia	0.801	0.532	11	15	−4
PRY	Paraguay	0.756	0.496	28	33	−5
STP	Sao Tome-Principe	0.673	0.441	60	65	−5
UKR	Ukraine	0.754	0.495	29	34	−5
CIV	Côte d'Ivoire	0.580	0.370	91	97	−6
SWZ	Eswatini	0.621	0.402	74	80	−6
IDN	Indonesia	0.768	0.507	21	27	−6
MEX	Mexico	0.774	0.511	17	23	−6

Table A1. (*Continued*)

NPL	Nepal	0.648	0.412	67	73	−6
PNG	Papua New Guinea	0.598	0.379	84	90	−6
TUN	Tunisia	0.792	0.523	12	18	−6
TKM	Turkmenistan	0.286	0.227	147	153	−6
ECU	Ecuador	0.783	0.513	14	21	−7
IND	India	0.696	0.459	50	57	−7
KEN	Kenya	0.647	0.411	68	75	−7
LSO	Lesotho	0.555	0.361	97	104	−7
UGA	Uganda	0.586	0.370	88	95	−7
VNM	Viet Nam	0.736	0.479	37	44	−7
MAR	Morocco	0.738	0.481	35	43	−8
ZMB	Zambia	0.629	0.403	71	79	−8
BLZ	Belize	0.764	0.499	23	32	−9
DOM	Dominican Republic	0.811	0.533	5	14	−9
SLV	El Salvador	0.723	0.470	39	49	−10
MDA	Moldova	0.805	0.520	10	20	−10
GMB	Gambia	0.534	0.346	102	113	−11
TZA	Tanzania	0.569	0.361	92	103	−11
KHM	Cambodia	0.640	0.400	69	81	−12
LAO	Laos	0.658	0.408	65	77	−12
LBN	Lebanon	0.708	0.455	47	59	−12
MDG	Madagascar	0.568	0.355	94	106	−12
MWI	Malawi	0.521	0.334	104	116	−12
MRT	Mauritania	0.588	0.369	86	98	−12
AGO	Angola	0.626	0.389	73	86	−13
PHL	Philippines	0.773	0.501	18	31	−13
TGO	Togo	0.555	0.348	98	111	−13
BGD	Bangladesh	0.681	0.423	55	69	−14
HND	Honduras	0.683	0.429	54	68	−14
BFA	Burkina Faso	0.487	0.312	114	129	−15
CUB	Cuba	0.811	0.522	4	19	−15
DJI	Djibouti	0.564	0.349	95	110	−15
MMR	Myanmar	0.628	0.386	72	87	−15
SLE	Sierra Leone	0.486	0.310	115	130	−15
KGZ	Kyrgyzstan	0.738	0.468	34	50	−16
COG	Congo	0.618	0.375	75	92	−17
EGY	Egypt	0.752	0.472	30	47	−17
ETH	Ethiopia	0.523	0.327	103	120	−17
HTI	Haiti	0.549	0.329	101	118	−17
LBR	Liberia	0.517	0.323	106	123	−17
NER	Niger	0.424	0.266	126	143	−17
GTM	Guatemala	0.714	0.450	43	61	−18
NGA	Nigeria	0.581	0.351	90	108	−18
PAK	Pakistan	0.600	0.366	83	101	−18
AZE	Azerbaijan	0.774	0.495	16	35	−19
GIN	Guinea	0.514	0.319	107	126	−19
MLI	Mali	0.467	0.287	117	137	−20
MOZ	Mozambique	0.491	0.307	111	131	−20
CMR	Cameroon	0.607	0.368	79	100	−21
TCD	Chad	0.428	0.255	125	146	−21
GAB	Gabon	0.748	0.468	31	52	−21

Table A1. (*Continued*)

LBY	Libya	0.691	0.412	53	74	−21
NIC	Nicaragua	0.711	0.437	45	66	−21
VEN	Venezuela	0.696	0.412	51	72	−21
DZA	Algeria	0.781	0.487	15	37	−22
IRQ	Iraq	0.681	0.407	56	78	−22
ZWE	Zimbabwe	0.615	0.368	77	99	−22
BOL	Bolivia	0.771	0.482	19	42	−23
AFG	Afghanistan	0.551	0.321	100	124	−24
BDI	Burundi	0.467	0.277	116	140	−24
CAF	Central African Rep.	0.428	0.249	124	148	−24
TJK	Tajikistan	0.719	0.430	40	67	−27
UZB	Uzbekistan	0.764	0.468	24	51	−27
COD	Congo Dem. Rep.	0.517	0.301	105	133	−28
YEM	Yemen	0.506	0.286	109	138	−29
SYR	Syria	0.604	0.341	80	114	−34
KRL	Kerala	0.803	n.a.	omit	n.a.	n.a.
ERI	Eritrea	n.a.	n.a.	n.a.	n.a.	n.a.