



Environmental Justice – Safeguarding Environment, Ensuring Sustainability

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Abstract

Preservation of ‘Mother Nature’ is not a choice but a necessity. Development and Protection of environment needs to go hand in hand, otherwise the day is not far when the world will be bereft of natural resources and congenial climate. In this regard, the concept of ‘Environmental Justice’ is highly pertinent, as it focuses on the planetary cataclysm relating to climate change, biodiversity, damage to ecosystem, and pollution, thereby calling for concerted endeavours of the populace across the globe, irrespective of race, colour, nationality, or income, with reference to the development and enforcement of environmental laws, regulations and policies.

To gauge environmental justice, the environmental performance of various countries, broadly on the parameters of Green House Gas Emissions (GHGs), Renewable Energies and Climate has been explored through two vital indexes, i.e., Environmental Performance Index (EPI) referred from the World Population Review and CCPI published in Climate Change Performance Index.

Keywords: *Environmental Justice; Environmental Performance Index; Climate Change Performance Index*

JEL Classification Code: Q56

I. Introduction

Environmental justice entails fair approach and purposeful engagement of the populace in discussions pertaining to environment to ensure complete safeguard from disparate environmental and health risks, and ensuring equal right to use salubrious and buoyant milieu. Engendered by the social movement, environmental justice gained grounds in the 1980s...¹

The genesis of environmental justice according to several environmental justice erudite and advocates / campaigners may be traced to the protests at Warren County, North Carolina, which is considered as the inception of environmental justice movement. Subsequently, several organisations engaged in promoting civil rights, including the renowned Southern Christian Leadership Conference and the UCC (United Church of Christ) Commission for Racial Justice, offered leadership and support. Numerous civil rights organisations, including the Southern Christian Leadership Conference and the UCC Commission for Racial Justice, provided leadership and support to the demonstrators. Subsequently, the protests cajoled the attention of the national media and were among the first to sensitize the masses regarding the environmental concerns of Africa Americans and other people of colour.

Nations across the globe have made prodigious progress but it has given birth to deleterious impacts in the form of growing air (GHG emissions), water and noise pollution; natural cataclysm such as floods, droughts, cloud bursts, sporadic rainfall; serious ailments among the masses etc. Notwithstanding various initiatives taken by different organisations / forums such as UNFCCC, EU's European Sustainability Reporting Standards (ESRS), Global Reporting Initiative (GRI), BRSR Core of Securities and Exchange Board of India (SEBI) etc. still a lot to be done to save our 'Mother Nature'.

The concept of environmental justice which may be linked to climate justice also enveloped the whole world refers to the skewness in historical obligation that countries and communities shoulder in relation to the climate crisis. It states that the countries, industries, business organisations and people that have become affluent from emission of green-house gases have a responsibility to assist those affected by climate change, especially the most vulnerable nations and communities, who often are the ones whose contribution towards environmental degradation is the least.²

¹ "Environmental Justice Factsheet", Center for Sustainable Systems, Accessed from <https://css.umich.edu/publications/factsheets/sustainability-indicators/environmental-justice-factsheet>

² "Climate Change is a matter of justice – here's why", UNDP: Climate Promise, Accessed from <https://climatepromise.undp.org/news-and-stories/climate-change-matter-justice-heres-why>

As the saying goes that both people and planet need to be nurtured then only corporates can earn profits on sustained basis. In this regard, one of the six capitals. i.e. Natural Capital (*other capitals being Human Capital, Manufactured Capital, Intellectual Capital, Social Capital and Financial Capital*) propounded by the International Integrated Reporting Council (IIRC) focus on environmental preservation activities taken by the companies during a financial year and the details of the same along with information pertaining to other forms of capitals needs to be furnished by the companies in their Annual / Integrated Reports.

Thus, stakeholders today are conversant about the endeavours made by the companies towards preventing environmental degradation by espousing efficient production techniques and fostering various critical dimensions of environment, such as circular economy, plantation of trees, water conservation initiatives, lowering of incineration of waste etc.

In light of the aforesaid discussion, it engenders paramount academic and research interests to delve into environmental performance of various countries gauged by various significant indexes i.e., Environmental Performance Index (EPI) and Climate Change Performance Index (CCPI).

EPI provides a data-driven review of sustainability across the globe by using 58 performance indicators across 11 issue groups, wherein 180 nations are ranked on climate change performance, environmental health, and ecosystem vivacity.

CCPI is published annually since 2005, is an autonomous examining mechanism for tracking countries climate mitigation performance. It evinces the climate mitigation endeavours of 63 countries and the EU.

II. Research Questions / Hypothesis

Q1. Does all the countries considered in the Environmental Performance Index (EPI) are at par in safeguarding the environment or their performance varies?

Hypothesis

Null Hypothesis (H₀): *There is no significant difference in the environmental performance of the countries considered in the Environment Performance Index (EPI).* **Alternative Hypothesis (H₁):** *There is a significant difference in the environmental performance of the countries considered in the Environment Performance Index (EPI).*

Q2. Do all the countries considered in the Climate Change Performance Index (CPPI) have the same performance with respect to their efforts in the areas of Greenhouse Gas Emissions (GHGs), Renewable Energies, Energy use and Climate Policy?

Hypothesis

Null Hypothesis (H_0): *There is no significant difference in the performance of countries with respect to their efforts in the areas of Greenhouse Gas Emissions (GHGs), Renewable Energies, Energy use and Climate Policy considered in the Climate Change Performance Index (CCPI).*

Alternative Hypothesis (H_1): *There is a significant difference in the performance of countries with respect to their efforts in the areas of Greenhouse Gas Emissions (GHGs), Renewable Energies, Energy use and Climate Policy considered in the Climate Change Performance Index (CCPI).*

III. Methodology and Data Collection

1) Methodology

i) Sign Test of Paired Data: It is a non-parametric test based on the direction (or sign for plus or minus) of a pair of observations and not on their numerical magnitudes. This statistical test will assist in ascertaining whether majority of countries have evinced superior performance in both environmental performance as well as in their endeavours towards reduction of greenhouse gas emissions (GHGs), renewable energies, energy use and climate policy etc.

This statistical test may be applied for various purposes, such as a pharmaceutical company may undertake a market research to ascertain the efficacy of a medicated lotion applied on one arm and non-medicated lotion on another arm of the prospective customers; an NGO or hospitality sector based organisation may conduct a perils of smoking by observing the impact on the weight of the smokers for a given period before the commencement and after the end of the study, and likewise.

2) Data Collection

a) This research study is based on the secondary data. The following data have been referred to test the hypothesis covered under questions 1 and 2 provided in the Research Questions / Hypothesis section
EPI Scores for the years 2024 and 2022 have been referred from the World Population Review.

CCPI ranks of countries for the years 2024 and 2025, published by Climate Change Performance Index. It is published annually since 2005, is an independent monitoring means for tracking countries' climate mitigation performance.

IV. Findings, Analysis and Discussion

1. Environmental Performance Index (EPI)

Based on the data published in World Population Review, the EPI of the countries for the years 2022 and 2024 is being provided in table 1

Table 1
EPIs for 2022 and 2024

Flag Code	Country	Environmental Performance Index_2024	Environmental Performance Index_2022	Flag Code	Country	Environmental Performance Index_2024	Environmental Performance Index_2022
EE	Estonia	75.7	61.4	TH	Thailand	45.7	38.1
LU	Luxembourg	75.1	72.3	TN	Tunisia	45.3	40.7
DE	Germany	74.5	62.4	VU	Vanuatu	45	36.9
FI	Finland	73.8	76.5	AM	Armenia	44.9	48.3
GB	United Kingdom	72.6	77.7	KW	Kuwait	44.4	42.4
SE	Sweden	70.3	72.7	KI	Kiribati	44.3	49
NO	Norway	69.9	59.3	MX	Mexico	44.2	45.5
AT	Austria	68.9	66.5	UY	Uruguay	44.1	37.4
CH	Switzerland	67.8	65.9	NA	Namibia	44	50.9
DK	Denmark	67.7	77.9	SN	Senegal	43.8	33.9
GR	Greece	67.3	56.2	EG	Egypt	43.7	35.5
FR	France	67	62.5	TZ	Tanzania	43.6	34.2
NL	Netherlands	66.9	62.6	BT	Bhutan	43.3	42.5
MT	Malta	66.9	75.2	CI	Ivory Coast	42.9	32.8
BE	Belgium	66.8	58.2	KG	Kyrgyzstan	42.8	35.7
IE	Ireland	65.8	57.4	ZA	South Africa	42.7	37.2
CZ	Czechia	65.5	59.9	UZ	Uzbekistan	42.6	38.2
SK	Slovakia	65.1	60	SA	Saudi Arabia	42.5	37.9
IS	Iceland	64.3	62.9	MH	Marshall Islands	42.5	36.2
PL	Poland	64.2	50.6	BF	Burkina Faso	42.2	35.5
LT	Lithuania	64.1	55.9	SB	Solomon Islands	42.2	35
ES	Spain	64	56.6	IR	Iran	41.8	34.5
AU	Australia	63.1	60.1	DZ	Algeria	41.7	29.6
SI	Slovenia	62.4	67.3	GQ	Equatorial Guinea	41.7	44.8
HR	Croatia	62.3	60.2	CG	Republic of the Congo	41.6	40.1
PT	Portugal	61.9	50.4	SV	El Salvador	41.6	40.8
JP	Japan	61.4	57.2	MY	Malaysia	41	35
CA	Canada	61.1	50	FM	Micronesia	40.8	37.4
IT	Italy	60.3	57.7	TM	Turkmenistan	40.6	37
LV	Latvia	60.2	61.1	AZ	Azerbaijan	40.5	38.6
HU	Hungary	59.8	55.1	TO	Tonga	40.4	43.8
BY	Belarus	58.2	48.5	HN	Honduras	40.2	36.5

RO	Romania	57.3	56	AO	Angola	40.1	30.5
NZ	New Zealand	57.3	56.7	NE	Niger	40	37.7
US	United States	57.2	51.1	SL	Sierra Leone	39.9	32.7
SR	Suriname	56.9	45.9	LB	Lebanon	39.9	32.2
BG	Bulgaria	56.2	51.9	CD	DR Congo	39.5	36.9
BS	Bahamas	55.9	56.2	MA	Morocco	39.5	28.4
AG	Antigua and Barbuda	55.6	52.4	PY	Paraguay	39.5	40.9
CR	Costa Rica	55.5	46.3	SD	Sudan	39.1	27.6
UA	Ukraine	54.6	49.6	MZ	Mozambique	39	31.7
VC	Saint Vincent and the Grenadines	54.2	53.2	CF	Central African Republic	39	44.9
CY	Cyprus	53.9	58	LK	Sri Lanka	38.8	34.7
VE	Venezuela	53.3	46.4	SZ	Eswatini	38.7	44.9
GA	Gabon	53.3	49.7	CM	Cameroon	38.6	30.2
BB	Barbados	53.1	53.2	KM	Comoros	38.2	42.5
BR	Brazil	53	43.6	MV	Maldives	38.1	37.4
SG	Singapore	53	50.9	CV	Cape Verde	38	41.9
PA	Panama	52.9	50.5	NG	Nigeria	37.9	28.3
CU	Cuba	52.5	47.5	BJ	Benin	37.8	29.6
TT	Trinidad and Tobago	52.5	47.8	GM	Gambia	37.6	36.4
AL	Albania	52.2	47.1	TR	Turkey	37.2	26.3
ZW	Zimbabwe	51.6	46.2	MN	Mongolia	37.2	29.6
AE	United Arab Emirates	51.6	52.4	KE	Kenya	36.9	30.8
EC	Ecuador	51.3	46.5	GH	Ghana	36.9	27.7
OM	Oman	51.3	30.7	PG	Papua New Guinea	36.9	24.8
LC	Saint Lucia	51.1	49.4	LS	Lesotho	36.9	32.3
KR	South Korea	50.6	46.9	GN	Guinea	36.5	31.6
MK	North Macedonia	50.3	54.3	HT	Haiti	36.4	26.1
TW	Taiwan	50.1	45.3	ET	Ethiopia	36.3	31.8
TL	Timor-Leste	49.9	35.1	ST	Sao Tome and Principe	36.2	52.9
RS	Serbia	49.8	43.9	TD	Chad	35.9	28.1
CO	Colombia	49.7	42.4	UG	Uganda	35.8	35.8
CL	Chile	49.6	46.7	TG	Togo	35.7	34
DM	Dominica	49.3	51.2	CN	China	35.4	28.4
BW	Botswana	49.2	54	BH	Bahrain	35.3	42
GY	Guyana	49	38.5	MW	Malawi	35.1	40.6
JM	Jamaica	48.5	45.6	MR	Mauritania	34.6	28.1
BN	Brunei	48.3	45.7	ML	Mali	34.5	28.5
IL	Israel	48	48.2	LR	Liberia	34.3	24.9
SC	Seychelles	47.9	55.6	RW	Rwanda	33.9	32.8
KZ	Kazakhstan	47.8	40.9	ID	Indonesia	33.6	28.2
DO	Dominican Republic	47.7	42.2	BI	Burundi	33.5	30.5
ME	Montenegro	47.7	46.9	NP	Nepal	33.1	28.3
NI	Nicaragua	47.4	37.7	GT	Guatemala	32.5	28
BZ	Belize	47.4	50	TJ	Tajikistan	32.3	37.1
JO	Jordan	47.3	43.6	DJ	Djibouti	32.3	47.5
GE	Georgia	47.3	39.1	PH	Philippines	32.1	28.9
MU	Mauritius	47.3	44.8	KH	Cambodia	31.2	30.1
WS	Samoa	47.1	36.4	AF	Afghanistan	31	43.6

AR	Argentina	47	41.1	IQ	Iraq	30.3	27.8
QA	Qatar	46.8	33	MG	Madagascar	30.1	28
PE	Peru	46.5	39.8	ER	Eritrea	29	31.7
MD	Moldova	46.1	42.7	BD	Bangladesh	28.1	23.1
BA	Bosnia and Herzegovina	46	39.4	IN	India	27.6	18.9
FJ	Fiji	46	31.3	MM	Myanmar	27.1	19.4
GD	Grenada	45.8	47.9	LA	Laos	26.3	30.7
BO	Bolivia	45.3	40.1	PK	Pakistan	25.5	24.6
				VN	Vietnam	24.6	20.1

Source: World Population Review (<https://worldpopulationreview.com/country-rankings/environmental-performance-index-by-country>)

To comprehend the environmental performance of the countries considered in the Environment Performance Index (EPI), Sign Test of Paired Data statistical tool have been applied and the outcome obtained is provided in table 2.

Table 2
Outcome of the Sign Test of Paired Data on EPI

Number of '+' signs	139
Number of '-' signs	37
Number of 0's	01
Total sample size	177
Total usable samples	176
Sample size: n	176
Proportion: $p = 139/176$	0.79
$\therefore q = 1-p$	0.21
Since np and nq are both greater than 5, so we use the normal distribution to approximate the binomial	
Level of significance: $\alpha = 0.05$	
Z_{α} for two tailed test = 1.96 (from the tables)	
Standard error of the proportion $(\sqrt{0.79 \times 0.21 / 176})$	0.03
Limits of Acceptance Region	
Upper Limit: $PH_0 + 1.96\sigma_p = 0.5 + (1.96) \times (0.03)$	0.56
Lower Limit: $PH_0 - 1.96\sigma_p = 0.5 - (1.96) \times (0.03)$	0.44

Decision: The two limits of acceptance region are 0.56 and 0.44. The sample proportion $p = 0.79$ lies outside these two limits, so the sample proportion falls outside the acceptance region for this hypothesis. We reject the null hypothesis and accept the alternative hypothesis $H_1 \Rightarrow$ **there is a**

significant difference in the environmental performance of the countries considered in the Environment Performance Index (EPI).³

2. Climate Change Performance Index (CCPI)

Based on the data published in Climate Change Performance Index (CCPI), the ranks of the countries for the years 2025 and 2026 selected on random basis is being provided in table 3

Table 3
Ranks of Countries in Climate Change Performance Index (CCPI)

Sr. No.	Countries	CLIMATE CHANGE PERFORMANCE INDEX RANKINGS		Difference between the CCPI Rankings
		2025	2026	
1	Algeria	51	40	11
2	Argentina	59	58	1
3	Australia	52	56	-4
4	Austria	23	35	-12
5	Belarus	56	55	1
6	Belgium	35	37	-2
7	Brazil	28	27	1
8	Bulgaria	50	51	-1
9	Canada	62	61	1
10	Chile	12	7	5
11	China	55	54	1
12	Chinese Taipei	60	59	1
13	Colombia	27	36	-9
14	Croatia	40	45	-5
15	Cyprus	44	39	5
16	Czech Republic	49	42	7
17	Denmark	4	4	0
18	Egypt	20	38	-18
19	Estonia	14	18	-4
20	European Union (EU)	17	20	-3
21	Finland	37	29	8
22	France	25	21	4
23	Germany	16	22	-6
24	Greece	22	30	-8
25	Hungary	45	48	-3
26	India	10	23	-13
27	Indonesia	42	43	-1
28	Ireland	29	33	-4
29	Iran	67	66	1
30	Italy	43	46	-3

³ Comprehensive Statistical Methods by P.N. Arora, Sumeet Arora and S.Arora, Published by S.Chand)

Source: Climate Change Performance Index (<https://ccpi.org/>)

To comprehend the performance of the countries selected on random basis on the basis of ranks secured by them for the years 2025 and 2026 featuring in Climate Change Performance Index (CCPI), in this regard, Sign Test of Paired Data statistical tool have been applied and the outcome obtained is provided in table 4

Table 4
Outcome of Analysis of Ranks of Countries in CCPI

Number of '+' signs	13
Number of '-' signs	16
Number of 0's	01
Total sample size	30
Total usable samples	29
Sample size: n	29
Proportion: $p = 13/29$	0.45
$\therefore q = 1-p$	0.55
Since np and nq are both greater than 5, so we use the normal distribution to approximate the binomial	
Level of significance: $\alpha = 0.05$	
Z_{α} for two tailed test = 1.96 (from the tables)	
Standard error of the proportion ($\sqrt{0.45 \times 0.55 / 29} = 0.09$)	0.09
Limits of Acceptance Region	
Upper Limit: $PH_0 + 1.96\sigma_p = 0.5 + (1.96) \times (0.09)$	0.68
Lower Limit: $PH_0 + 1.96\sigma_p = 0.5 - (1.96) \times (0.09)$	0.32

Decision: The two limits of acceptance region are 0.68 and 0.32. The sample proportion $p = 0.45$ lies within these two limits, so the sample proportion falls within the acceptance region for this hypothesis. We accept the null hypothesis and reject the alternative hypothesis $H_0 \Rightarrow$ ***there is no significant difference in the performance of countries with respect to their efforts in the areas of Greenhouse Gas Emissions (GHGs), Renewable Energies, Energy use and Climate Policy considered in the Climate Change Performance Index (CCPI).***⁴

From the analysis of the performance of countries covered under the two indexes – EPI and CCPI evince that there have been substantial changes in the rankings of the countries, both in favourable as well as unfavourable direction. This may be due to enhanced focus on the vital elements of environment, i.e. greenhouse gas emissions (GHGs), renewable energy use and climate policy by the

⁴ Comprehensive Statistical Methods by P.N. Arora, Sumeet Arora and S.Arora, published by S.Chand

countries whose ranks have improved in Climate Change Performance Index (CCPI) in 2026 in comparison to 2025. For instance, it may be observed that countries like Algeria, Czech Republic and Cyprus have improved registered a prodigious improvement in CCPI from 51st in 2025 to 40th in 2026, 49th in 2025 to 42nd in 2026 and 44th in 2025 to 39th in 2026 respectively.

Out of the 30 economies selected for CCPI analysis by random sampling, there is a mixed performance. 13 economies ranks have improved whereas 16 economies ranks have declined with one economy's rank remaining the same during the period 2025 and 2026.

It may also be observed that some countries though they have improved in ranks, but it is a small jump. As can be observed from the ranks of countries like Argentina and China which have moved up by only one step, i.e. Argentina moved from 59th position in 2025 to 58th position in 2026 and China captured the 54th rank in 2026 from 55th in 2025.

Moreover, from the magnitude of improvement or decline in rank, it may be inferred that either due to implementation of robust environmental safeguard measures; transition towards green energy or drastic changes in climate policy there have been improvement in the ranks of some countries whereas the countries witnessing deterioration in ranks may be attributed to rise in industrial activities, thereby enhancing the level of GHGs; more usage of thermal power; unable to fully utilise or harness the green energy properly and so on and so forth.

Similarly, from the EPI Scores of the countries, it is quite impressive to see that numerous economies from various continents have improved their scores in 2024 vis-a-vi 2022 and certain countries have made remarkable improvement in EPI Scores, whereas others have exhibited a lacklustre performance. Like in cases of Estonia and Germany, the EPI scores have increased significantly in 2024, i.e., 75.7 and 74.5 respectively, registering a hike of 14.3 (Estonia) and 12.1 (Germany). On the contrary, United Kingdom and Namibia have EPI Scores moved down by 5.1 and 6.9 respectively in 2024 in comparison to their 2022 scores.

If we see the overall environmental performance of the 177 economies considered for EPI Scores, it can be seen that a whopping 139 economies have put up a scintillating performance, whereas 37 economies performance have been bland and one country's score remained constant in 2024, in relation to 2022.

Thus, from the EPI Scores and CCPI rankings, it may be concluded that majority of economies have put up a brilliant show while some are lagging behind. However, it may be stated that economies are investing their sincere endeavours in enhancing climate safeguarding measures and merely on looking

the EPI scores and CCPI rankings it should not be hypothesized that economies which have scored less or slipped in ranking are not faring well, as there are numerous yardsticks to gauge the environmental performance of a country

V. Conclusion

Thus, it may be opined that majority of the economies across the globe are making rapid strides towards creating a green economy. However, in index and rankings as covered under the Environmental Performance Index (EPI) and Climate Change Performance Index respectively (CCPI), it can be seen that some economies have performed exceedingly well, while some have performed fairly. But on the whole, there is an optimism towards safeguarding the environment and the ‘mother nature’ by throttling GHG emissions. To foster environment protection, the need of the hour is concerted endeavours on the part of the governments of various countries, so that environmental degradation may be prevented and a congenial business ecosystem may be created wherein growth and sustainability both are ensured.

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