
Inclusion of Environment Performance in Gross State Domestic Product, evolving an Index (EPI+GSDP) and Ranking of States.

Indrani Chandrasekharan* Bhagyam Chandrasekharan@ and Shweta Srinivasan\$

Effective and balanced utilization of the country's resources is at the Core of our development strategy. In 2013, an Environmental Performance Index (PC-EPI) was evolved to recognize the efforts made by the states in India to arrest degradation of the environment as also a methodology for construction of EPI. An attempt has now been made to improve and make GSDP more meaningful by including Environmental Performance and evolve an Index (EPI+GSDP) to recognize the efforts made by the states to arrest degradation of the environment while pursuing efforts to increase per capita GSDP. This article details a methodology for constructing an EPI+ GSDP index for the country and based on the EPI+ GSDP scores, rank the States and suggest options for devolving Central funds to States and use of updated Environmental performance index, 2018 as a SDG monitoring tool.

Keywords: Gross State Domestic product, Environmental Performance, Sustainable Development Goals, EPI+GSDP index, Criteria, indicators, Scores and ranks.

Introduction

The Planning Commission Environmental Performance index , PC–EPI¹ was evolved after careful perusal of all variables and categories considered under various studies in 2013. To begin with 5 criteria comprising 16 indicators were chosen. and these integrated to arrive at a composite index. To make PC-EPI tool comprehensive, e-waste has now been added as an indicator in the waste management criteria and Biodiversity as a criteria , with 3 indicators to evolve EPI, 2018.

To recognize the efforts made by the states to arrest degradation of the environment while pursuing efforts to increase per capita GSDP a methodology to construct EPI+GSDP index has now been evolved and based on scores states ranked.

The EPI 2018 and EPI-GDP index now evolved will not only enable better understanding and efforts made by the states in pollution abatement and biodiversity conservation but also gauge the relationship between GSDP and sustainable environmental development.

As EPI, 2018 is based on indicators for which yearly data is mandated by law to be collected and published by the GOI, it could also serve as a tool for monitoring the SDG targets set out for Waste management to start with.

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Gross State Domestic Product (GSDP)

Many opine that Economic growth is 'destroying more than it is creating' and others – feel that our current GDP metric offers no indication of whether a country is becoming richer or poorer in terms of its natural resources. Some countries, argue that neglect and degradation comes from a failure to value 'natural capital' and include that within existing gross domestic product (GDP) calculations. The UN TEEB report ² attempted to put a value on ecosystems services like forests, lakes, soils, water quality and fisheries.

There has been considerable research in developing alternative measures of GDP. These include environmental adjusted or 'green' GDP. But there is no agreed definition for these adjusted versions of GDP and these tend to be undertaken by research institutions rather than by national statistical institutions. There is however an environmental index being developed by the EU Commission as a result of its report, 'Beyond GDP'³, published in 2009. The Commission plans to run a pilot of the index and publish the results alongside standard GDP figures.

As per , World Development Indicators 2017, indicators currently chosen to project environment are; use of natural resources, such as water and energy, and various measures of environmental degradation, including pollution, deforestation, and loss of habitat, all of which must be considered in shaping development strategies

As per World bank report, Environment includes more than 140 indicators related to the use of natural resources and changes in the natural and built environment. They encompass the availability and use of environmental resources (forest, water, cultivable land, and energy) and cover environmental degradation (pollution, deforestation, and loss of habitat and biodiversity). They also include aspects of the built environment such as agricultural infrastructure and urbanization. These themes mirror aspects of many of the Sustainable Development Goals: Goal 2 promotes sustainable agriculture, Goal 6 considers availability of and access to water, Goal 7 covers reliable energy, Goal 11 tackles the challenges that urbanization creates, Goal 12 focuses on the consumption and the sustainable management of the earth's resources, Goal 13 demands action on climate change, Goal 14 seeks conservation of the oceans and marine life, and Goal 15 covers protection of natural habitats and biodiversity and land restoration efforts. The Environment indicators illuminate many of these issues.

It is felt that for India an attempt could be made to improve and make GDP more meaningful by including Environmental Performance; including conservation efforts while recognizing development made by the states i.e states contribution to GDP and efforts made towards managing and conserving their natural resources.

Environmental Performance Index-Planning Commission (now Niti Aayog)

The adverse impact of development is felt due to, natural resource depletion and the health consequences of air, soil and water pollution and inadequate waste management. Recognising the influence of natural resources depletion and unabated pollution on many sectors of the economy and well being of the citizens, an Environment Performance Index (PC-EPI) was evolved in 2013 and suggestion made to recognize environmental performance by states and devolve central funds.

EPI-BD Index for funding.

Further to the Environmental Performance Index (PC-EPI) evolved in the Planning Commission , which consisted of 5 criteria and 16 indicators., at the behest of the Ministry of Environment and Forests , GOI a bio-diversity criteria comprising 3 indicators were finalized after deliberation with experts and an EPI+BD index has been evolved which is as indicated in Table-1. With the evolution of the Sustainable Development Goals (SDG)⁵ and identification and near finalization of Targets and indicators for monitoring the progress in achieving the Goals , e-waste has been added to the waste category. With the addition of e-waste in waste management criteria and a new criteria , Biodiversity, the number of indicators now stand at 20.

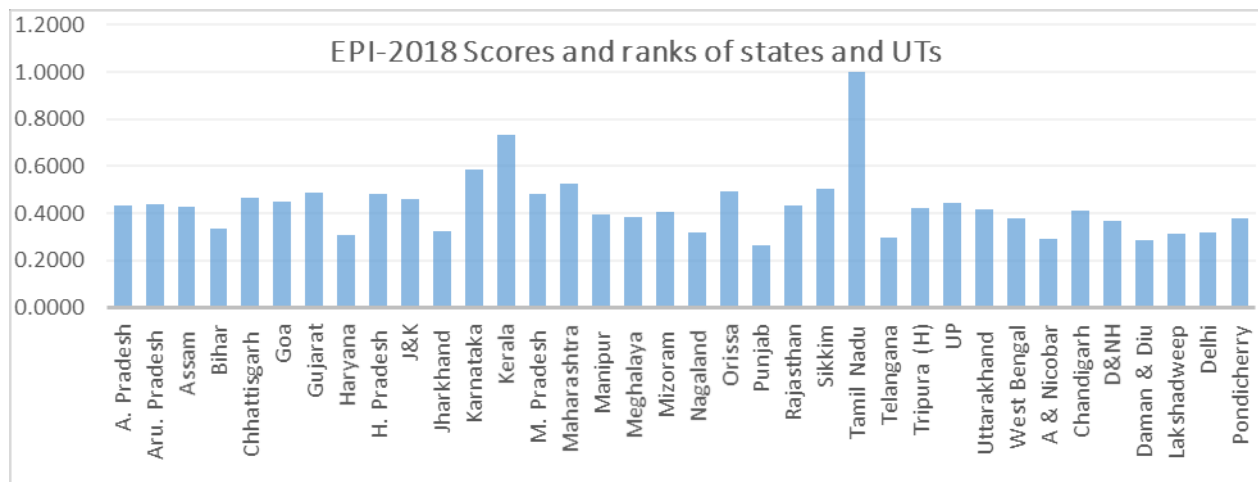
Table-1:- EPI 2018 Criteria and indicators.

S. No	Criteria	Indicators	No. of variables
1	Air Pollution	1. NO _x , 2. SO _x , 3. RSPM ,	3
2	Forests	1. TFC as % of state GA and Contribution to national FC, 2. Change in forest cover, 3. Growing Stock and 4. Afforestation efforts.	4
3	Water quality	1. % Dom. Waste water, and 2. Surface water quality(.DO , BOD & TFC) . 3. Ground water extraction %.	3
4	Waste Management	1. MSW, 2.Bio-med.,3.Hazardous Wastes and 4.E-waste.	4
5	Climate Change	1. Preparation of SAPCCs , 2. RE growth Rate including mini Hydro., 3. Electricity intensity of SGDP.	3
6	Biodiversity	1.Indigenous livestock population change, 2. change in wetland and 3. change in Protected Area Network	3
TOTAL			20

The cumulative (EPI+BD), EPI 2018 is a measure of the environmental well being of the States, i.e., the States with a score of 1 are characterized by cleaner environment, adherence to environmental standards including implementation of legislation and institutional mechanisms and efforts towards Natural resource conservation. EPI 2018 can also be used as a monitoring tool for SDG.

Table-2 and **Fig-1** presents EPI 2018 scores and ranking of the states and UT's as of 2018 for the 6 categories separately, based on arithmetic mean of scores of all the indicators covered under each category and Ranking of the states, based on mean cumulative Scores.

Fig-1: EPI- 2018 scores and ranking of the states and UT's



C. Environmental Performance + Gross Domestic Product (E+GSDP) Index

After deliberations with regard to possible integration of the cumulative EPI 2018 scores with that of GSDP to evolve the Environment Performance + Gross Domestic Product index, it was resolved that scores be assigned to the % contribution of states to the National GDP and it be integrated with EPI 2018 scores, averaged to arrive at Environment + Gross Domestic Product Scores E+GSDP for each states and states ranked. **Table -3** details the % contribution to GDP Scores, EPI 2018 scores and E+GDP scores and Ranking.

Fig-2 depicts **E-GSDP scores** and **Fig-3 percent contribution of GSDP to GDP states wise**, **EPI 2018 and EPI-GDP scores** based on the PC-Environmental Performance Index (EPI) method, evolved in the earlier paper and performance of the states in addressing environment issues can thus be adjudged. The E+GDP index now evolved integrates both environmental performance and developmental efforts of the states

Table-2: EPI 2018 Scores and Ranking (RK) * Based on 2016 data published

No	STATE / UTs	AIRPOL		WATER		FORESTS		WASTES		Climate Change		Bio-Diversity		EPI-2018	
		Scores	Rank	Scores	Rank	Scores	Rank	Scores	Rank	Scores	Rank	Scores	Rank	N.Scores	Rank
1	A. Pradesh	0.9406	10	0.4554	30	0.5052	11	0.4227	23	0.2638	22	0.4642	3	0.4313	16
2	Aru. Pradesh	0.8107	24	0.3333	32	0.8733	5	0.2500	34	0.4879	6	0.3365	10	0.4369	14
3	Assam	0.9298	11	0.6536	18	0.3078	21	0.4604	17	0.3654	17	0.3175	13	0.4288	17
4	Bihar	0.8362	20	0.6074	25	0.1207	28	0.5381	11	0.0339	34	0.2519	21	0.3375	27
5	Chhattisgarh	0.8536	19	0.6656	16	0.7605	6	0.5149	13	0.2546	23	0.2502	22	0.4662	10
6	Goa	1.0000	3	0.9360	2	0.1754	26	0.6123	5	0.0637	30	0.3769	6	0.4472	12
7	Gujarat	0.8914	15	0.6969	7	0.2857	23	0.5490	10	0.5223	4	0.5117	1	0.4885	7
8	Haryana	0.7836	28	0.6524	19	0.0679	31	0.3818	25	0.1405	29	0.1461	36	0.307	32
9	H. Pradesh	0.8939	14	0.9843	1	0.5111	10	0.3818	25	0.3196	19	0.3294	11	0.4833	9
10	J&K	0.5238	34	0.6758	10	1.2268	3	0.3149	30	0.2124	26	0.3171	14	0.4622	11
11	Jharkhand	0.7703	30	0.6667	11	0.3811	14	0.2618	33	0.0369	33	0.1879	29	0.3257	28
12	Karnataka	0.9524	8	0.6825	9	1.0632	4	0.6321	3	0.4826	8	0.3160	18	0.5835	3
13	Kerala	1.0000	3	0.6433	23	2.4842	2	0.4470	18	0.3717	15	0.2402	23	0.7329	2
14	M. Pradesh	0.8127	23	0.7014	6	0.6993	7	0.4226	24	0.4617	9	0.3247	12	0.4836	8
15	Maharashtra	0.8647	17	0.8946	3	0.6611	9	0.5644	9	0.4358	10	0.3162	17	0.5281	4
16	Manipur	0.9048	12	0.6667	12	0.3304	19	0.3500	28	0.3736	14	0.1609	32	0.3938	22
17	Meghalaya	0.8647	17	0.6544	17	0.2052	25	0.4249	22	0.4056	13	0.1657	30	0.3845	23
18	Mizoram	1.0000	3	0.6667	11	-0.1143	36	0.4742	16	0.6275	2	0.2008	27	0.4035	21
19	Nagaland	0.9608	7	0.6458	21	0.1714	27	0.2900	32	0.0373	32	0.1595	33	0.3201	29
20	Orissa	0.8992	13	0.6486	20	0.6704	8	0.4372	20	0.5786	3	0.2646	20	0.4944	6
21	Punjab	0.4403	35	0.5673	29	0.0489	33	0.4319	21	0.2401	24	0.1475	35	0.2651	36
22	Rajasthan	0.7857	26	0.5921	27	0.3462	17	0.3464	29	0.6532	1	0.3396	9	0.4329	15
23	Sikkim	0.8107	24	0.6933	8	0.4286	13	0.6675	2	0.4873	7	0.4708	2	0.5028	5
24	Tamil Nadu	0.9524	8	0.7431	5	4.3106	1	0.5942	7	0.1596	28	0.3165	16	1	1
25	Telangana	0.5628	33	0.3253	35	0.0424	34	0.5270	12	0.1884	27	0.4642	3	0.2982	33
26	Tripura	0.8293	22	0.6667	11	0.3149	20	0.6021	6	0.3708	16	0.2156	25	0.4239	18
27	UP	0.7772	29	0.6456	22	0.4853	12	0.6872	1	0.3035	20	0.2238	24	0.4413	13
28	Uttarakand	0.7850	27	0.5948	26	0.3410	18	0.4788	15	0.4341	11	0.3170	15	0.417	19
29	West Bengal	0.7425	31	0.5739	28	0.3004	22	0.3516	27	0.4904	5	0.2034	26	0.3762	25
30	A & Nicobar	0.4071	36	0.3333	32	0.3776	15	0.3075	31	0.2849	21	0.3544	7	0.2918	34
31	Chandigarh	0.8841	16	0.6132	24	0.3785	15	0.5931	8	0.0380	31	0.3903	5	0.4094	20
32	D & NH	1.1795	1	0.6667	11	0.1114	29	0.4418	19	0	35	0.1900	28	0.3659	26
33	D& Diu	1.2381	2	0.3100	36	0.0972	30	0.0225	36	0	35	0.3534	8	0.2856	35
34	Lak'dwp	0.8306	21	0.3333	32	0.2109	24	0.2039	35	0.3267	18	0.3070	19	0.3127	31
35	Delhi	0.6524	32	0.3571	31	0.0563	32	0.6320	4	0.4177	12	0.1476	34	0.3198	30
36	Pondi	1.0000	3	0.7500	4	0.0428	34	0.5066	14	0.2151	25	0.1619	31	0.3782	24

Table-3:-Percent contribution to GDP,EPI-2018,E+GSDP Scores and Ranking

S.No	States	GDP Cr.				EPI 2018			EPI+GSDP	
		GDP Cr.	% C-GDP	Score	Rank	Scores	Norm.Scr	Rank	Score	Rank
1	A. Pradesh	699307	4.554397	0.309835	8	0.5087	0.4313	16	0.3706	10
2	Aru. Pradesh	20259	0.131941	0.008976	30	0.5153	0.4369	14	0.2229	24
3	Assam	254341	1.656454	0.112688	18	0.5058	0.4288	17	0.2707	17
4	Bihar	487628	3.175789	0.216048	14	0.398	0.3375	27	0.2768	15
5	Chhattisgarh	291681	1.899639	0.129232	17	0.5499	0.4662	10	0.2977	12
6	Goa	62661	0.408094	0.027763	23	0.5274	0.4472	12	0.2375	22
7	Gujarat	1162282	7.569628	0.51496	4	0.5762	0.4885	7	0.5017	5
8	Haryana	547396	3.565042	0.242529	13	0.3621	0.307	32	0.2748	16
9	H. Pradesh	126020	0.820734	0.055834	22	0.57	0.4833	9	0.2696	18
10	J&K	126842	0.826088	0.056199	21	0.5451	0.4622	11	0.2592	19
11	Jharkhand	235560	1.534138	0.104367	19	0.3841	0.3257	28	0.2150	26
12	Karnataka	1132393	7.374969	0.501718	5	0.6881	0.5835	3	0.5426	3
13	Kerala	621700	4.048964	0.27545	11	0.8644	0.7329	2	0.5042	4
14	M. Pradesh	647304	4.215716	0.286794	10	0.5704	0.4836	8	0.3852	7
15	Maharashtra	2257032	14.69944	1	1	0.6228	0.5281	4	0.7641	2
16	Manipur	21066	0.137197	0.009333	29	0.4644	0.3938	22	0.2016	29
17	Meghalaya	27228	0.177329	0.012064	27	0.4534	0.3845	23	0.1983	30
18	Mizoram	17613	0.114709	0.007804	32	0.4758	0.4035	21	0.2057	28
19	Nagaland	21488	0.139946	0.00952	28	0.3775	0.3201	29	0.1648	33
20	Orissa	415982	2.709178	0.184305	16	0.5831	0.4944	6	0.3394	11
21	Punjab	428340	2.789662	0.18978	15	0.3127	0.2651	36	0.2274	23
22	Rajasthan	759235	4.944692	0.336386	7	0.5105	0.4329	15	0.3846	8
23	Sikkim	20020	0.130385	0.00887	31	0.593	0.5028	5	0.2558	20
24	Tamil Nadu	1270499	8.274416	0.562907	2	1.1794	1	1	0.7815	1
25	Telangana	659074	4.29237	0.292009	9	0.3517	0.2982	33	0.2951	14
26	Tripura (H)	29666	0.193207	0.013144	25	0.4999	0.4239	18	0.2185	25
27	UP	1250213	8.142299	0.553919	3	0.5204	0.4413	13	0.4976	6
28	Uttarakhand	195606	1.273929	0.086665	20	0.4918	0.417	19	0.2518	21
29	West Bengal	879167	5.725777	0.389523	6	0.4437	0.3762	25	0.3829	9
30	A & Nicobar	6649	0.043303	0.002946	33	0.3441	0.2918	34	0.1474	35
31	Chandigarh	31823	0.207255	0.014099	24	0.4829	0.4094	20	0.2117	27
32	D&NH	2440	0.015891	0.001081	34	0.4316	0.3659	26	0.1835	32
33	Daman & Diu	1059	0.006897	0.000469	35	0.3369	0.2856	35	0.1430	36
34	Lakshadweep	407	0.002651	0.00018	36	0.3687	0.3127	31	0.1564	34
35	Delhi	616826	4.017221	0.273291	12	0.3772	0.3198	30	0.2965	13
36	Pondicherry	27739	0.180657	0.01229	26	0.446073	0.3782	24	0.1952	31

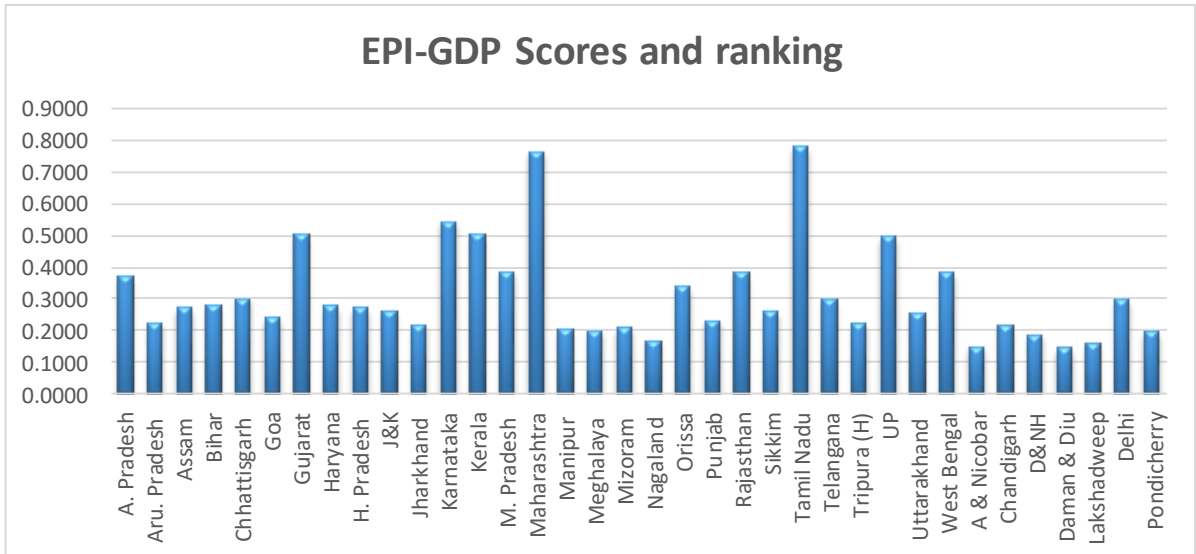
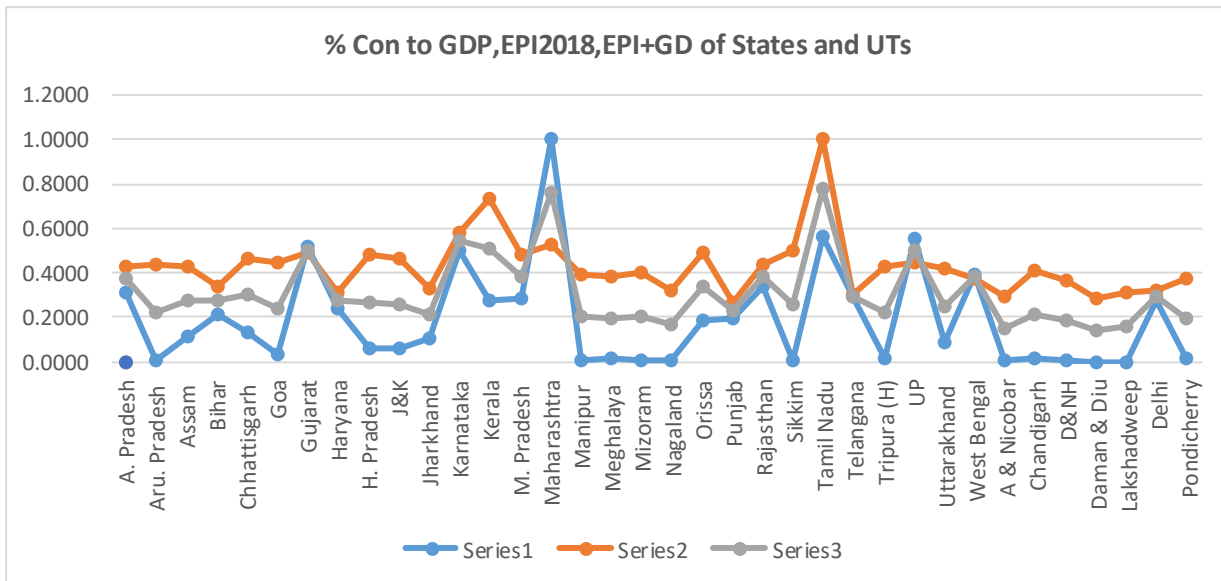


Fig-2:- EPI-GDP Scores and ranking of States.

Fig-3 :-Percent contribution of GSDP to GDP , EPI-2018 and EPI-GDP scores



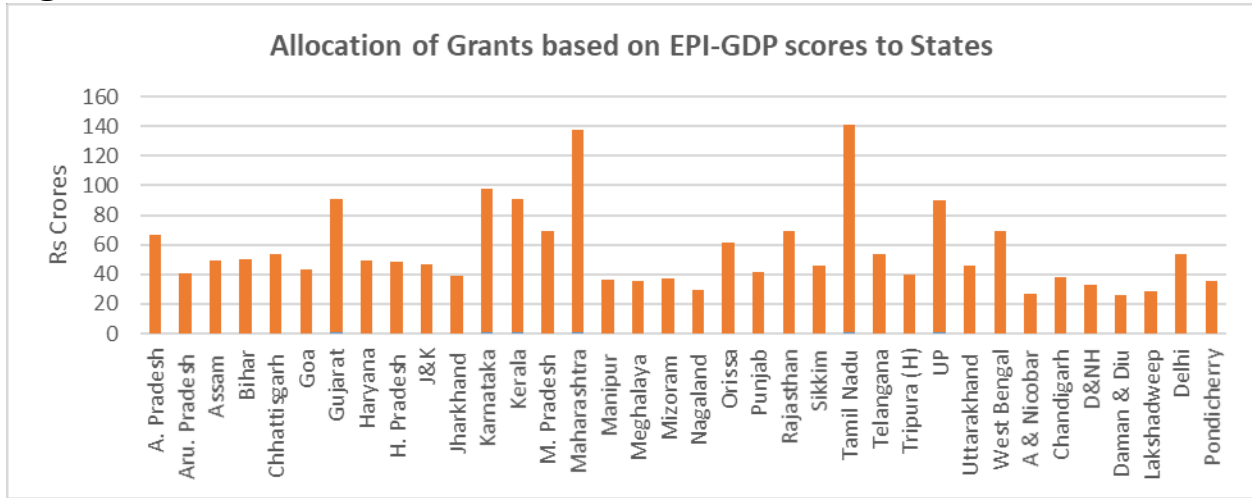
DEVOLVE FUNDS BASED ON E-GDP RANKING OF THE STATES

Table-4 and Fig-4 indicates resource allocation of Rs 2000 Crores based on cumulative E-GDP Scores and ranking of the states in 2018. An attempt has also been, made to evaluate the difference brought about by the EPI-2018 index on the E-GDP scores and allocation. As can be seen, inclusion of the biodiversity criteria , which helps conservation of bio-resources, enhances allocation to Tamil Nadu, Maharashtra, , Karnataka, Kerala ,Gujarat and Uttar Pradesh and States like Andhra Pradesh, Uttarakhand, Himachal Pradesh, Assam, Jharkhand and UT’s such as Puducherry, Chandigarh, etc see a drop in allocation

Table-4:- Resource allocation based on E+GSDP Scores to States.

S.No	States	EPI+GSDP		2000 Cr grant
		Score	Rank	Allocaion PY
1	A. Pradesh	0.3706	10	66.58
2	Aru. Pradesh	0.2229	24	40.06
3	Assam	0.2707	17	48.65
4	Bihar	0.2768	15	49.73
5	Chhattisgarh	0.2977	12	53.49
6	Goa	0.2375	22	42.67
7	Gujarat	0.5017	5	90.15
8	Haryana	0.2748	16	49.37
9	H. Pradesh	0.2696	18	48.43
10	J&K	0.2592	19	46.57
11	Jharkhand	0.2150	26	38.64
12	Karnataka	0.5426	3	97.49
13	Kerala	0.5042	4	90.59
14	M. Pradesh	0.3852	7	69.21
15	Maharashtra	0.7641	2	137.28
16	Manipur	0.2016	29	36.22
17	Meghalaya	0.1983	30	35.63
18	Mizoram	0.2057	28	36.95
19	Nagaland	0.1648	33	29.61
20	Orissa	0.3394	11	60.97
21	Punjab	0.2274	23	40.86
22	Rajasthan	0.3846	8	69.11
23	Sikkim	0.2558	20	45.97
24	Tamil Nadu	0.7815	1	140.41
25	Telangana	0.2951	14	53.02
26	Tripura (H)	0.2185	25	39.26
27	UP	0.4976	6	89.41
28	Uttarakhand	0.2518	21	45.25
29	West Bengal	0.3829	9	68.79
30	A & Nicobar	0.1474	35	26.48
31	Chandigarh	0.2117	27	38.05
32	D&NH	0.1835	32	32.97
33	Daman & Diu	0.1430	36	25.70
34	Lakshadweep	0.1564	34	28.11
35	Delhi	0.2965	13	53.28
36	Pondicherry	0.1952	31	35.08

Fig-4:-Allocation of Rs 2000 Cr to states based on EPI-GDP Scores.



EPI 2018-Monitoring tool for SDGs

In 2015, Member States of the United Nations adopted Agenda 2030 and 17 Sustainable Development Goals (SDGs) with 169 associated targets to be achieved by the year 2030 by all countries.

Of the 17 SDGs ,169 targets adopted and 230 indicators⁶ identified , three targets namely; 12.3, 12.4 and 12.5 under SDG-12 deal with MSW management and a target; 11.6 under SDG 11, to reduce by 2030 the adverse Per Capita environmental impact of Cities, including air quality and municipal & other Waste management have been set as targets.

The EPI 2018 evolved could serve as a monitoring mechanism for SDG as indicated in Table-2 and Figure 1 which ranks Tamil Nadu as number 1, followed by Kerala, Karnataka, Maharashtra and Sikkim. As per 2013 PC-EPI scores, Uttarakhand was number 1, followed by Himachal Pradesh, Chandigarh, Andhra Pradesh and Puducherry.

Recommendation

The EPI 2018 and EPI-GDP index now evolved will not only enable better understanding and efforts made by the states in pollution abatement and biodiversity conservation but also gauge the relationship between GSDP and sustainable environmental development.

The EPI 2018 index can also serve as a tool to monitor Sustainable Development Goals and facilitate annual reporting as data availability and analysis can be ensured as the indicators are backed by legislations which require annual reporting by the states.

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