iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** V **Month of publication:** May 2024

DOI: https://doi.org/10.22214/ijraset.2024.63027

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

Assessing the Status of SDG-9 in Indian States

Ms. Kausar Ahmed[1], Mrs. Swapna Sarita Swain[2], Ms. Shreeparna Sahoo[3]
Odisha University of Technology and Research, Bhubaneswar

Abstract: ***This research paper evaluates the status of Sustainable Development Goal 9 (SDG 9) across Indian states, focusing on resilient infrastructure, sustainable industrialization, and innovation. It assesses progress using a comprehensive SDG 9 Index based on indicators like infrastructure development, industrial growth, and innovation capacity, derived from credible data sources.***
The Index employs a weighted scoring system to assign scores to each state, enabling comparative evaluation. Findings reveal significant disparities in SDG 9 performance among states, highlighting areas needing improvement. The study provides valuable insights for policymakers to allocate resources effectively and advance sustainable development in India.
Keywords: Sustainable Development, SDG-9, SDG-9 Index, Indicators

I. INTRODUCTION

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership.
They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

II. SDG 9: TARGETS AND INDICATORS

1) Develop quality, reliable, sustainable, and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.
- Proportion of the rural population who live within 2 km of an all-season road
- Passenger and freight volumes, by mode of transport

2) Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries
- Manufacturing value added as a proportion of GDP and per capita
- Manufacturing employment as a proportion of total employment

3) Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets.
- Proportion of small-scale industries in total industry value added
- Proportion of small-scale industries with a loan or line of credit

4) By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.
- CO2 emission per unit of value added.

5) Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.
- Research and development expenditure as a proportion of GDP
- Researchers (in full-time equivalent) per million inhabitants

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6) Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States.

- Total official international support (official development assistance plus other official flows) to infrastructure

7) Support domestic technology development, research, and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.

- Proportion of medium and high-tech industry value added in total value added

8) Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020.

- Proportion of population covered by a mobile network, by technology

III. SDG INDEX

The Sustainable Development Goals (SDG) Index is a composite measure designed to evaluate and compare the performance of countries or regions in achieving the United Nations' Sustainable Development Goals (SDGs). Introduced to provide a comprehensive overview of progress towards the 17 SDGs, the index integrates various indicators that reflect economic, social, and environmental dimensions of sustainability.

Each SDG encompasses specific targets, and the SDG Index aggregates relevant indicators for these targets, generating a score for each goal.

These scores are then averaged or combined to create an overall SDG Index score for a country or region, which facilitates a clear and comparative assessment of progress.

The construction of the SDG Index involves several steps:

1) Indicator Selection: Indicators are chosen based on their relevance, data availability, and reliability, ensuring they effectively measure progress towards each SDG target.

2) Normalization: Indicators are normalized to ensure comparability, often transforming them to a common scale.

3) Weighting: Each indicator may be assigned a weight based on its importance to the specific SDG.

4) Aggregation: Weighted indicators are aggregated to produce a score for each SDG and subsequently, an overall index score.

IV. METHODOLOGY ADOPTED

The methodology for the thesis "Assessing the Status of SDG-9 in Indian States" involves a structured approach to evaluate the industry, infrastructure, and innovation in alignment with SDG 9. The study begins with issue identification, highlighting the necessity of assessing the status and progress of Indian states to monitor India's position in achieving the Sustainable Development Goals by 2030.

The aim is to assess the status of SDG 9 across Indian states, with objectives to study the goals outlined in SDG 9, investigate relevant indicators for the SDG 9 Index, and analyse the variation of the index across states.

Data collection is undertaken from diverse sources such as journals, survey reports, annual ministry reports, published research papers, and official UN websites.

Data analysis involves graphical representation to interpret state-wise data for the SDG 9 Index creation. Inference includes creation of the SDG 9 Index, and evaluation based on index scores. Finally, recommendations are made to identify states with low SDG 9 Index scores and propose measures for improvement.

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V. SDG INDEX AND ITS CALCULATION

		TARGET 9.1		TARGET 9.C			TARGET 9.2			TARGET 9.4		TARGET 9.3		TARGET 9.5		TARGET 9.A		
S_NO	State/ UT	Percentage of Targeted Habitations covered under by Pradhan Mantri Gram Sadak Yojana (2022-23)	Normalised Value	Number of Mobile Connections per 100 Persons (2022-23)	Normalised Value	Number of Internet Subscribers per 100 Persons (2022-23)	Percentage of Gram Panchayats covered under Bharat Net (2022-23)	Gross State Value Added by economic activity at current prices (in Lakhs) (2022-23)	Normalised Value	Per Capita GSDP (in Rs.) (2022-23)	CO2 Emission (Tons) (2022-23)	Normalised Value	Number of Registered MSMEs (2022-23)	Normalised Value	R&D Expenditure as a proportion of GSDP (2022-23)	Normalised Value	Yearly FDI Equity Inflow (Amount in USD Million) (2022-23)	Normalised Value	SDG Index Score
1	Andhra Pradesh	18	0.2	90.92	0.4	37.21	0	14015308.77	3.0	219799	59623205.9	0.3	838696	0.2	0.08	0.1	284.2	0.0	3.1
2	Arunachal Pradesh	32	0.4	0	0.0	0	0.78	47076	0.0	223610	0.0	0.0	12655	0.0	0.48	0.7	0.0	0.0	0.8
3	Assam	38.67	0.5	63.69	0.3	25.18	64.34	468797	1.0	115761	14503920.1	0.3	475289	0.1	0.12	0.1	2.1	0.0	1.2
4	Bihar	50.18	0.6	74.32	0.3	17.03	55.57	5315782.465	1.1	28679	32225679.3	0.2	1053606	0.2	0.07	0.1	47.4	0.0	1.3
5	Chhattisgarh	24.22	0.3	0	0.0	0	36.56	670651	1.4	232825	9563012.9	0.6	389498	0.1	0.06	0.1	2.4	0.0	1.6
6	Goa	0	0.0	0	0.0	0	0	2959857.362	0.4	533131	0.0	0.0	52407	0.0	0.19	0.3	11.7	0.0	0.5
7	Gujarat	100	1.2	103.94	0.4	41.85	31.45	6223930.10	13.4	274393	101220805.3	0.1	1865507	0.4	0.07	0.1	4713.9	0.3	13.5
8	Haryana	0	0.0	91.18	0.4	35.57	93.65	1490921.43	3.2	293525	2976.4	0.0	955545	0.2	0.08	0.1	2589.6	0.2	3.2
9	Himachal Pradesh	24.55	0.3	126.53	0.5	52.23	4.9	4090930.322	1.0	232100	0.0	0.0	153086	0.0	0.12	0.1	34.0	0.0	1.2
10	Jammu & Kashmir	23.75	0.4	92.49	0.4	35.71	4.07	1627866.233	0.3	145396	0.0	0.0	413621	0.1	0.69	1.0	0.7	0.0	1.2
11	Jharkhand	61.18	0.7	0	0.0	0	32.42	6945527	1.5	92581	33127726.0	0.2	445474	0.1	0.06	0.1	5.6	0.0	1.7
12	Karnataka	0	0.0	98.48	0.4	44.32	100	24562342.83	5.3	394633	77354894.9	0.5	1479472	0.3	0.05	0.0	10429.4	0.7	5.3
13	Kerala	33.33	0.4	110.99	0.4	46.04	100	7713954.87	1.7	265590	0.0	0.0	612271	0.1	0.13	0.2	164.5	0.0	1.8
14	Madhya Pradesh	55.38	0.7	57.03	0.2	22.25	45.63	8831078	1.7	129406	14269657.3	0.1	1240918	0.3	0.06	0.1	39.0	0.0	1.9
15	Maharashtra	32.5	0.4	102.7	0.4	43.89	49.13	44734121.24	9.6	246632	81447700.8	0.5	4362490	1.0	0.05	0.0	14806.4	1.0	9.7
16	Manipur	69.41	0.8	0	0.0	0	74.55	95389	0.0	101920	0.0	0.0	66055	0.0	0.24	0.3	0.0	0.0	0.9
17	Meghalaya	41.67	0.5	0	0.0	0	0	322664.5187	0.1	115396	0.0	0.0	28955	0.0	0.06	0.1	0.0	0.0	0.5
18	Mizoram	0	0.0	0	0.0	0	0	132913.35589	0.0	227675	0.0	0.0	22710	0.0	0.09	0.1	0.0	0.0	0.1
19	Nagaland	0	0.0	0	0.0	0	0	275724.338	0.0	240257	0.0	0.0	29817	0.0	0.07	0.1	0.0	0.0	0.1
20	Odisha	37.43	0.5	73.13	0.3	24.08	38.53	13208116.07	2.8	244530	91955832.2	0.6	823505	0.2	0.05	0.0	31.6	0.0	2.9
21	Punjab	0	0.0	124.4	0.5	52.67	49.35	9209844	2.0	193850	41729711.9	0.3	993285	0.2	0.08	0.1	93.6	0.0	2.1
22	Rajasthan	81.88	1.0	82.06	0.3	30.17	88.56	13249772.57	2.8	194579	94438.1.0	0.0	1307346	0.4	0.03	0.0	970.8	0.1	3.1
23	Sikkim	2.86	0.0	0	0.0	0	0	1345202.946	0.3	552315	0.0	0.0	10466	0.0	0.05	0.0	0	0.0	0.3
24	Tamil Nadu	0	0.0	111.73	0.5	47.34	0	37818644.33	8.1	270629	13978526.7	0.1	2291674	0.6	0.06	0.1	2169.0	0.1	8.2
25	Telangana	16.36	0.2	0	0.0	0	0	11080228.146	2.4	297283	53039948.7	0.4	907080	0.2	0.06	0.1	1302.6	0.1	2.4
26	Tripura	28	0.3	0	0.0	0	47.11	139471	0.0	152835	4907754.4	0.0	56313	0.0	0.02	0.0	0.0	0.0	0.3
27	Uttar Pradesh	11	0.1	74.76	0.3	22.2	49.17	22492198	4.8	89245	163316839.0	1.0	2480007	0.6	0.02	0.0	409.7	0.0	5.0
28	Uttarakhand	47.67	0.6	0	0.0	0	18	8163775.995	1.7	232947	0.0	0.0	256457	0.1	0.12	0.1	2.9	0.0	1.8
29	West Bengal	37.1	0.5	83.2	0.3	28.34	60.28	18352409.73	4.0	133080	79465513	0.5	1064530	0.2	0.03	0.0	394.3	0.0	4.1
30	Andaman & Nicobar Islands	0	0.0	0	0.0	0	0	71182.451007	0.0	257873	0.0	0.0	12412	0.0	0	0.0	0.0	0.0	0.0
31	Chandigarh	0	0.0	0	0.0	0	76.47	118040	0.0	378388	0.0	0.0	40469	0.0	0	0.0	13.5	0.0	0.0
32	Ladakh	0	0.0	0	0.0	0	0	0	0.0	0	0.0	0.0	10667	0.0	0	0.0	0.1	0.0	0.0
33	Daman Diu and Dadra Nagar Haveli	0	0.0	0	0.0	0	0	0	0.0	0	0.0	0.0	19116	0.0	0	0.0	17.6	0.0	0.0
34	Delhi	0	0.0	247.34	1.0	125.94	0	4122382.217	0.9	402699	17949.6.4	0.0	644008	0.1	0	0.0	7534.2	0.5	1.4
35	Lakshadweep	0	0.0	0	0.0	0	0	0	0.0	0	0.0	0.0	993	0.0	0	0.0	0.0	0.0	0.0
36	Puducherry	0	0.0	0	0.0	0	100	1189578.917	0.2	273515	13221719	0.0	38100	0.0	0.07	0.1	4.4	0.0	0.3

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1) Identifying SDG-9 Targets/Indicators:

SDG-9 (Sustainable Development Goal 9) focuses on building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. The first step involves identifying all the targets and indicators under SDG-9 as outlined by the United Nations. The indicators considered for calculating the SDG Index Score here are,

- Develop quality, reliable, sustainable, and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.
- Manufacturing value added as a proportion of GDP and per capita
- Proportion of small-scale industries in total industry value added
- CO2 emission per unit of value added
- Research and development expenditure as a proportion of GDP
- Total official international support (official development assistance plus other official flows) to infrastructure
- Proportion of population covered by a mobile network, by technology

2) Normalizing Data:

Raw data collected from different sources may be in different formats and units, making direct comparison difficult. Normalization ensures that each indicator contributes proportionately to the overall SDG-9 Index score.

$$x_n = \frac{x_r - x_{min}}{x_{max} - x_{min}}$$

Where, x_n = Normalized value of the data of each indicator, x_r = Raw Data, x_{min} = Lowest value for that indicator among all the states, $x_{\max\ -}$= Highest value for that indicator among all the states

3) Calculating SDG-9 Index Score:

Once the data is normalized, the next step is to calculate the SDG-9 Index score for each state. The index score is typically calculated by aggregating the normalized values of all selected indicators. The final index score provides a comprehensive assessment of each state's progress towards achieving SDG-9 targets.

$$C_i = \sqrt{\frac{x_n^2 + x_n^2 + x_n^2 + x_n^2 + x_n^2 + x_n^2 + x_n^2}{T}}$$

Where, C_i = Cumulative SDG Index Score for each Indian state, x_n^2 = the square of the normalized value of each indicator, T = Total number of Indicators considered for each state.

VI. KEY FINDINGS

After calculating the SDG-9 Index Score for all the Indian states it was found that the states which are performing well are Gujarat, Maharashtra and Tamil Nadu and the potential states/UTs are Jammu and Kashmir, Ladakh, Uttarakhand, Himachal Pradesh, Sikkim, Tripura, Assam, Arunachal Pradesh, Mizoram, Meghalaya, Manipur, Daman and Diu, Dadar Nagar Haveli and Goa.

VII. RECOMMENDATIONS

1) Strengthening Infrastructure

- Transport Networks: Improve road, rail, and port connectivity to ensure efficient movement of goods and people. This includes upgrading existing infrastructure and constructing new highways, rail links, and airports.
- Digital Infrastructure: Expand broadband and mobile network coverage, especially in rural and remote areas, to enable digital inclusion and support e-governance, e-commerce, and digital education.

2) Skill Development: Implement skill development programs to equip the workforce with the skills required for modern industries. Focus on vocational training, technical education, and lifelong learning opportunities.

3) Enhancing Regulatory and Policy Framework

4) Ease of Doing Business: Simplify regulatory processes and reduce bureaucratic hurdles to create a business-friendly environment. Implement single-window clearance systems for faster approvals.

5) Public-Private Partnerships (PPPs): Encourage PPPs for infrastructure development, leveraging private sector expertise and investment while ensuring public welfare.

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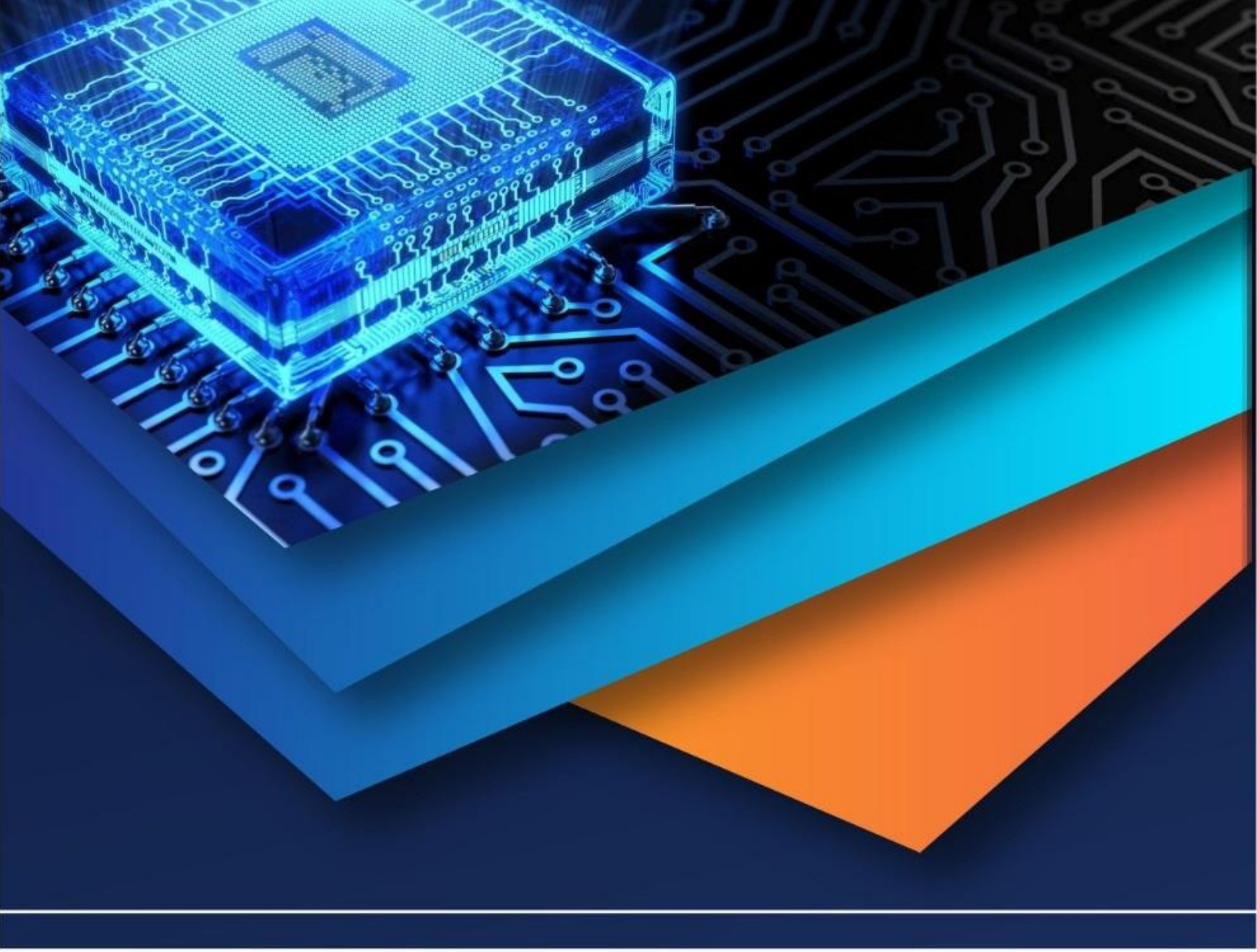
VIII. CONCLUSION

This study evaluates the status of Sustainable Development Goal 9 (SDG 9) across Indian states, highlighting significant disparities in infrastructure, industrialization, and innovation. By constructing a comprehensive SDG 9 Index using key indicators, the research identifies top-performing states like Gujarat, Maharashtra, and Tamil Nadu, while highlighting areas for improvement in others. The findings provide actionable insights for policymakers to enhance infrastructure, promote sustainable industrialization, and foster innovation, contributing to India's progress towards sustainable development.

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