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India's Stance on SDG 7: Assessing Government policies and commitments to Affordable and Clean Energy

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Abstract

Coaching is a method of direct instruction to teach specific skills but training is to sharpen that skill. The research in coaching and training is a very advanced term. In today's era research is the main part of education. The research is not bound to a field but its endless result in any field. Its true research can be changed the scenario of coaching and training because this time a coach must have deep knowledge of other subjects like anatomy, physiology, kinesiology, biomechanics, sports training, psychology etc. Results of 100 mt changing day by day and its only caused by advance research work. This research can help a coach to know how much load should be given to an athlete to consider these three energy sources according to the event.

Keywords- A Study, Research Changed, teach specific skills and Sports Scenario.

Introduction

The Sustainable Development Goals (SDGs) are a group of 17 goals that were adopted by all 193 United Nations members during the historic summit that took place in New York on September 25, 2015. The Sustainable Development Goals (SDGs), which went into effect on January 1st, 2016, are anticipated to spur developmental actions in crucial areas until 2030, including eradicating poverty and hunger, ensuring healthy lives and quality education, achieving gender equality, providing modern energy, fostering sustainable economic growth, and reducing inequality. The SDGs, sometimes referred to as the 2030 Agenda for Sustainable Development (World), are intended to drastically alter people's lives and means of subsistence. It is commonly agreed that India's progress towards the SDGs will have a substantial impact on the 2030 Agenda's overall success. It is not only due to the population's size but also to the robustness and adaptability of the Indian economy. Additionally, India has been a global leader in the fight against climate change. The Sustainable Development Goal's major objective is to achieve reliable, affordable, clean, and sustainable energy reflecting SDG7. Environmental and economic challenges are centered on energy. Despite this importance, 20% of the world's population will not have access to power by 2021 given the circumstances, the Indian government has committed to generating 9% of its electricity from nuclear sources, which would effectively help it meet its carbon emissions target by 2047.While government spending and corporate investments in industrialized nations concentrate on increasing efficiency and the generation of renewable energy, emerging nations place more of emphasis on gaining access to electricity and clean energy sources. It is now appropriate to assess the nation's progress towards SDG 7 after two consecutive terms of administration after the adoption of the ambitious agenda and programmes.

REVIEW OF LITERATURE: - With regards to SDG of "Energy", the challenges of conserving energy, the current mix of energy sources in India and the role of energy security and sustainable development

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in India were described by (Gouri 2015). The role of globalization in the energy demand in India was analyzed by (Shahbaz et al.)

2016).The study was conducted by (Srikanth 2018). The study results of (Kar 2015) had concluded that natural gas would be the most preferred green energy for India in the upcoming decades. Biogas potential as an energy solution to energy basket of India was suggested in the study of (Lohan et al. 2015). The need, prospects, application and barriers of solar energy infusion into Indian energy Basket had been reviewed by (Manju and Sagar 2017). The work of had described the issue of energy poverty, the effects of new energy policies, the popularity of alternative fuels, and associated difficulties with the sustainable development of energy in India. (Jewitt and Raman 2017). Rural electrification is a great challenge in India, especially in remote areas and the need for micro solar energy systems for facilitating rural electrification and sustainable development in rural and remote areas of North Eastern India was pointed out in the study of (Dhiman et al. 2017) , after considering the challenges of remote locations, dispersed population density and high transmission cost Energy derived from fossil fuels contributes significantly to global climate change, accounting for more than 75% of global greenhouse gas emissions and approximately 90% of all carbon dioxide emissions. Alternative energy from renewable sources must be utilized to decarbonize the energy sector. However, the adverse effects of climate change, such as increasing temperatures, extreme winds, rising sea levels, and decreased precipitation, may impact renewable energies (Ahmed I. Osman, 2022)

Almost 80% of the global population lives in countries that are net importers of fossil fuels. Due to their dependence on foreign fossil fuels, approximately six billion people are vulnerable to geopolitical shocks and crises. In contrast, renewable energy sources are available in all nations, but their full potential has yet to be realized. The International Renewable Energy Agency (IRENA) estimates that by 2050, 90% of the world's energy can and should come from renewable sources (IRENA, 2016). Rapidly increasing energy demand and growing concern about economic and environmental consequences call for renewable/sustainable energy technologies′ adoption in India. Renewable/sustainable energy technologies have faced a number of constraints that have affected their rate of adoption ., the barriers that came along the way of implementing the policies that affect the faster adoption of clean, renewable and affordable energy are These identified barriers have been categorized into seven dimensions of barriers, i.e. Economical & Financial; Market; Awareness & Information; Technical; Ecological and Geographical; Cultural & Behavioral; and Political & Government Issues (Luthra, S., Kumar, S., Garg, D., & Haleem, A. 2015). All countries now face a range of energy challenges in promoting energy security, tackling energy poverty and de- carbonizing their economies to address climate change. But some countries face the dilemmas and conflicts between these objectives more acutely than others. In governance terms, India presents a particularly challenging case for domestic energy planners and international climate policy advocates alike. India is the fifth largest greenhouse gas emitter in the world and projected to become the third largest emitter by 2015. The majority of India's emissions are produced by the energy sector, yet the carbon intensity of India's economy is around half that of China and lower than the US. Indeed, while India is a major global producer and consumer of energy, it also faces huge suppressed demand for energy, with more than 400 million people lacking access to electricity and 700 million people depending on biomass for cooking fuel Yet the political thrust of India's

drive for 'energy independency' (Planning Commission, 2006) is provided by the current energy supply-demand gaps and the huge increase in primary energy consumption required to meet economic growth targets of 8–10 per cent in the medium term. Reconciling climate change concerns with India's economic growth will clearly require a significant transformation of the country's energy supply. (Phillips, J., & Newell, P. 2013).

The research addressing challenges of sustainable development is fairly distributed across the different subject areas In India, the SDG India Index published by the NITI Aayog performs a similar function on the level of individual states within India (NITI Aayog, SDG India index & dashboard 2020-21) the engagement of researchers and academic staff in universities across the world as key players in promoting SDGs. Studies have provided useful methodologies and insights for analytical exercises in assessment of research in SDGs over the years. Keyword analysis is a widely used method for studying evolution of research topic and knowledge mapping. This has been utilized by authors to identify and study the research in SDG (Meschede C, **2020**) (Vargas G M, Gonzalez-Campo C H & Brath 2020) United States, United Kingdom and China are among the top three active countries for research in the different SDGs. SDG 17 i.e., partnerships for SDGs, has the most research publications associated with it, followed by SDG 13, i.e., climate action. Other SDGs with high research activity include SDG 12 (responsible consumption and production), SDG 15 (life on land), SDG 3 (good health and well-being), and SDG 1 (no poverty) (Sweileh 2020)

Research gap and Objectives- The STI (science technology and innovation) activities in India that are relevant to the SDGs are only vaguely mentioned in a few reports, despite the fact that numerous studies have been undertaken globally to evaluate the STI activities related to the SDGs.7 In the bibliometric research (Bibliometric analysis is a statistical technique applied to examine the scientific production in a field of research. It allows to study the evolution of knowledge on a given topic during a certain period of time based on data publication (Belmonte-Ureña LJ, 2021).It combines two main procedures: (i) the performance analysis and (ii) science mapping. The performance analysis is established on indicators that provide data about the amount and impact of the research through the application of several techniques, as citation analysis, counting publications, word frequency analysis by a unit of analysis (João Paulo Romanelli, 2021). Science mapping is a graphic representation of how different scientific elements (knowledge areas, documents or authors) are interrelated. It shows the impact, structural, and dynamic organization of a knowledge topic, a field of research, a group of researchers, or a document, based on relation indicators. Science mapping allows finding insights into patterns of a knowledge area that would be difficult to identify using traditional research review methods. (Chatpinyakoop, 2019). Furthermore, science mapping analysis can be used to show or uncover some invisible key elements in a specific interest area The main reason for conducting this study is to fill this knowledge gap. The study explicitly aims to respond to the following questions:

RQ1: How many research articles about the SDGs have been published globally from India (see fig 1under methodology section)

RQ2: At the national level as well as in specific universities and research institutions, what is the relative contribution of research publications to each SDG?

RQ3: In terms of the SDGs, what are the primary subject areas that have the most research activity?

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To answer these questions, we have used data on publications from India to identify trends and publication patterns through a bibliometric analysis in order to respond to these queries. The volume of research papers on different SDGs, the major contributing institutions and subject areas, and the issues that are commonly covered in research publications on SDGs are all recognized. The conclusions drawn from the study's observations can serve as valuable inputs for decisions about research funding, evidence-based policymaking, and choosing the areas of emphasis for new technology development by both public and commercial organizations.

Research Methodology: - A methodology comprising of standard bibliometrics and textual analysis has been adopted for this study. The data characteristics were utilized to conduct the bibliometric analysis as follows: -

Estimating the trend in research publications*:* The profile and volume of Indian research outputs were categorized under the 17 SDGs during 2016–2020. A regression model was deployed on the available data using curve fitting technique. It is an iterative model that tries to estimate suitable values for the constants in an equation befitting the data points, in this case 1,00,000 was chosen to be the number of iterations in order to achieve high accuracy. Further, year- wise distribution was analyzed during the same period for various SDG. The 'category's' field of metadata was utilized to carry out the analysis.

Gender distribution in authorship*:* To estimate the percentage of authors who are female and male,

Gender API service was utilized. This is a machine learning algorithm which analyses the author names and predicts the gender of the author. The algorithm provides its prediction with an associated confidence level. For this study, all the results with confidence greater than or equal to 70% were included.

***Institutional contribution towards the SDG Research*:**

Further, analysis was carried out keeping the research output of various institution into primary focus. A field called 'research_ orgs' which contain detailed information about participating institutions and 'times cited' that tells total citation received by the publication were present in metadata. The same was exploited to produce various other results which include Total citation vs Total publication chart, an SDG vs top producing institution bipartite graph where edge weight is in proportional with number of publications output from that institution relating to various SDGs.

vThe total number of publications relating to the SDGs was determined using the first search query in Dimensions and applying the appropriate filters for each SDG. The overall publications on SDGs in India amount to 77,005 which is about 12% of the total research publications from India in the five-year period, 2016–2020. A comparison between global and Indian publication trends is shown in Fig. 1. An exponential growth in the number of publications is observed. A prediction of the publication growth using a curve fitting-based regression model on Indian research outputs has also been carried out. As the data points available were too few to fit regression-based model, all points were considered in the training phase. We have obtained a non-liner regression curve with R^2 score 0.96, the equation for the curve is shown in Fig. 1. Assuming that the trend observed will remain intact in the future, this model suggests that India will be able to produce 8,91,142 SDG based research outputs in total by the end of 2030 (2016–2030) Apart

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from these Selection of journal and proceedings, study of multiple data source such as SDG baseline report 2020-21, Newspapers, Niti Ayog report on SDG, Government official websites, UNDP report etc.

Results And Discussion: -

Table 1number of research paper published for each SDG from 2016 to 2020(Authors own)

	2016	2017	2018	2019	2020	Total	
India's total research output	108,234	113,819	121,322	129,430	164,104	636,909	8.68
India research output on all SDGs	10,438	12,412	14,238	16,714	23,203	77,005	17.32
SDG	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**	**CAGR (%)**
7 Affordable and Clean Energy	3,308	4,283	5,574	6,782	9,411	29,358	23.26
3 Good Health and Well Being	4,236	4,730	4,724	5,164	7,233	26,087	11.29
13 Climate Action	1,024	1,282	1,558	1,933	2,593	8,390	20.42
2 Zero Hunger	448	485	529	659	907	3,028	15.15
11 Sustainable Cities and Communities	316	391	450	592	966	2,715	25.04
16 Peace, Justice and Strong Institutions	321	418	436	536	681	2,392	16.23
4 Quality Education	270	370	383	496	682	2,201	20.36
8 Decent Work and Economic Growth	242	268	347	463	652	1,972	21.92
12 Responsible Consumption and Production	201	270	361	422	715	1,969	28.89
6 Clean Water and Sanitation	243	243	311	361	555	1,713	17.96
10 Reduced Inequalities	208	251	272	301	370	1,402	12.21
15 Life on Land	106	114	144	127	171	662	10.04
1 No Poverty	83	95	101	101	124	504	8.36
14 Life Below Water	60	62	80	88	133	423	17.26
5 Gender Equality	35	24	55	55	38	207	1.66
9 Industry, Innovation and Infrastructure	21	25	35	44	65	190	25.35
17 Partnerships for the Goals	15	13	12	23	19	82	4.84

Category **Number of Research Papers** **CAGR (%)**

From the above table it is quite clear that the highest publication activity is observed in SDG 7 (Affordable and Clean Energy) and SDG 3 (Good Health and Well Being) both having more than 25,000publications in the five-year period. Fastest annual growth in research activity is observed in SDG 12 (Responsible Consumption and Production, followed by SDG 9 (Industry, Innovation and Infrastructure) and SDG 11 (Sustainable Cities and Communities) with all of them showing a CAGR (Compounded Annual Growth Rate) higher than 25%. This may be caused due to low number of publications due to which the annual growth rate may be faster. It may also be noted that the SDGs which correspond to basic and applied sciences disciplines have higher research activity (refer to SDGs 7, 3, 13, 12, 6). On the other hand, SDGs which require political and/or socio-cultural issues to be addressed have lower research activity (refer to SDGs 16, 4, 8, 11, 15, 1, 5,17). Among these, three SDGs namely 3, 7 and 13 have received the most attention from the Indian research community with

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60,022 publications assigned to them out of 77,005 total publications relating to SDGs. It is also noteworthy to observe that SDG 5 on Gender Equality has low number of publications and also has a very low annual growth rate in terms of publication activity (CAGR of only 1.66%)

Reason for most publication for SDG 7

The observations that relate to SDG 7 demonstrate that the scientific community places a high priority on research in the fields of energy sciences and material sciences. Energy Generation, Energy Storage (Batteries and cells), and Consumption are three areas that the keywords suggest are quite important in the domain. The high level of relevance for terms referring to clean and renewable energy sources further demonstrates the significance placed on these fields. For instance, there is a high relevance and frequency for wireless sensor networks, sensor networks, the Internet of Things, solar cells, electric vehicles, wind turbines, and lithium- ion batteries.

Table 2India's Performance on each of the SDGs along with States/ UTs (SDG INDIA INDEX BASELINE REPORT 2018)

State/UT	SDG1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 9	SDG 1 0	SD G 11	SD G 15	SD G 16	Comp -osite SDG
INDEX SCORE														
Andhra Pradesh	67	50	68	77	44	59	76	81	31	75	26	87	90	64
Arunachal Pradesh	52	58	38	44	32	64	44	72	16	47	44	73	77	51
Assam	53	53	30	54	36	42	18	61	35	75	32	100	53	49
Bihar	45	39	40	36	24	31	67	58	38	82	43	56	60	48
Chhattisgarh	50	46	42	53	49	98	36	56	30	73	54	100	65	58
Goa	62	80	65	71	35	65	61	90	0	50	71	100	87	64
Gujarat	48	49	52	67	31	100	67	80	65	79	52	71	73	64
Haryana	50	53	57	65	31	80	50	72	50	55	30	43	78	55
Himachal Pradesh	60	58	62	82	42	95	62	71	43	98	41	93	91	69
Ja m mu & Ka sh mir	61	60	63	51	39	52	58	43	35	71	23	74	69	53
Jharkhand	37	35	40	58	32	51	20	52	47	72	52	96	64	50
Karnataka	52	54	69	76	43	62	77	72	57	68	36	88	74	64
Kerala	66	72	92	87	50	62	60	61	68	72	46	75	82	69
Madhya Pradesh	44	41	38	49	33	63	58	57	27	75	39	91	59	52
Maharashtra	47	47	60	74	43	81	69	74	53	76	34	86	82	64
Manipur	44	74	67	65	25	44	39	33	72	98	31	100	70	59
Meghalaya	68	43	52	38	36	40	11	62	42	100	39	94	53	52
Mizoram	71	69	53	54	43	67	78	65	0	100	32	69	71	59
Nagaland	59	69	34	45	42	58	45	40	0	80	32	75	87	51
Odisha	59	46	54	46	43	46	23	53	32	78	34	100	55	51
Punjab	56	71	71	63	43	60	61	57	48	62	36	67	84	60
Rajasthan	59	45	49	73	37	43	63	57	62	79	45	68	81	59
Sikkim	64	67	52	47	50	78	47	57	1	67	56	98	66	58
Tamil Nadu	76	61	77	75	38	66	89	71	46	85	33	74	61	66
Telangana	52	53	73	66	43	55	63	75	16	100	44	83	66	61
Tripura	71	58	53	56	38	38	32	52	38	89	38	86	71	55

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Uttar Pradesh	48	43	25	53	27	55	23	55	29	38	37	55	61	42

Contribution of female researchers in SDG research- Out of the total 77,005 articles, gender prediction with a confidence level greater than or equal to 70% was received for 61,684 articles. It is observed that a total of 30.5% articles (18,801), have female researchers as their lead author. There are some collaborative articles which have foreign researchers as lead authors and some which have Indian researchers as lead authors. This number is higher than the overall percentage of female researchers (18.6%) in India.is 26 It can be observed that SDG 5 has a higher contribution (approx. 57%) from the female authors and SDG 16 and SDG 17 have 40 and 41% contributions, respectively (Fig.1) This trend has remained the same for all the five years under consideration for this study.

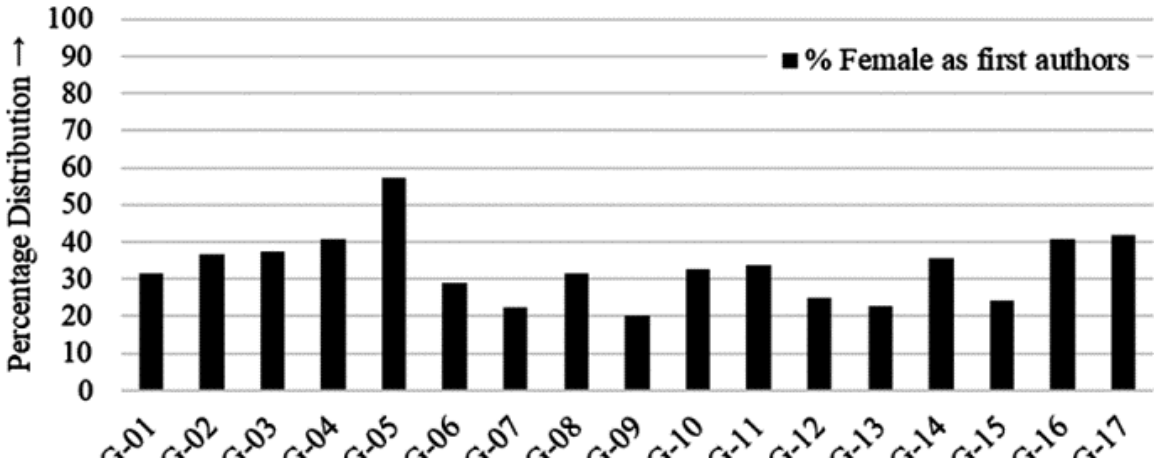

Figure 1 contribution of female researcher in SDG research (Authors own)

Top institutions contributing to SDG research- The top 10 institutions with highest number of publications were identified in Table 3 and a plot was developed with the total publications vs. total citations received by the major research institutions which have researchers publishing research articles on SDGs. This data was retrieved from the metadata using the parameter *Research_orgs* and *times cited*. This analysis showed that Anna University has the largest number of publications with highest number of citations. The Indian Institute of Technology at Delhi Kharagpur Bombay Madras and Roorkee also have significant contribution in research publications on SDGs overall (Table 3) Two institutions Post Graduate Institute of Medical Education and Research (PGIMER) Chandigarh and All India Institute of Medical Sciences (AIIMS) New Delhi have relatively high number of publications corresponding to SDG3 which relates to health care.

Table 3 — Top Institutions publishing in the field of SDGs

Institution	***TP***	***TC***	***CPP***	***Inter Institution Collaboration (% Publications***
Anna University,	*2721*	*28186*	*10.36*	*40.9*

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Chennai				
Indian Institute of Technology Delhi	*1534*	*22099*	*14.41*	*49.0*
All India Institute of Medical Sciences	*1511*	*15042*	*9.96*	*55.9*
Indian Institute of Technology Kharagpur	*1317*	*16501*	*12.53*	*46.8*
Vellore Institute of Technology University	*1290*	*16812*	*13.03*	*50.5*
Indian Institute of Technology Bombay	*1093*	*13459*	*12.31*	*52.2*
Indian Institute of Technology Roorkee	*990*	*13219*	*13.35*	*45.4*
Indian Institute of Technology Madras	*965*	*10732*	*11.12*	*45.1*
University of Delhi	*890*	*7973*	*8.96*	*54.8*
Indian Institute of Science Bangalore	*849*	*9567*	*11.27*	*60.3*

Performance on goal 7

Three national level indicators, which cover two of the five SDG targets for 2030, have been identified to assess India's progress towards meeting the Goal of Affordable and Clean Energy. The three metrics are (i) the percentage of electrified households, (ii) the percentage of households utilizing clean cooking fuel, and (iii) renewable energy. The SDG Index Score for Goal 7 for India is 51 based on these three national indicators.

With scores of 89, 78, and 77, respectively, the top three States on this Goal are Tamil - 13 - Nadu, Mizoram, and Karnataka. With a score of 96, Chandigarh performs the best among the UTs. India wants to fulfil the twin goals of affordable and clean energy by making energy accessible to everyone at reasonable costs. The National Electricity Plan and the National Energy Policy are already in existence. Additionally, the Indian government has begun implementing a number of programs, including the National Solar Mission, Dedicated Green Energy Corridor, Off-Grid and Decentralized Solar PV Applications Programme, National Biogas and Manure Management Programme, Pradhan Mantri Sahaj Bijli Har Ghar Yojana- Saubhagya, LPG subsidy (under PAHAL), Deen Dayal Upadhyaya Gramme Jyoti Yojana, Pradhan Mantri Ujjwala yojana

ADDITIONAL INFORMATION (IF REQUIRED)

Additional website and link(s) are attached hereby which may contain relevant key documents, photos, short video clips etc.

1. Ministry of New and Renewable Energy: mnre.gov.in
2. Ministry of Petroleum and Natural Gas: petroleum.nic.in Ministry of Power: powermin.gov.in PM Ujjwala Yojana: pmuy.gov.in
3. Bureau of Energy Efficiency: beeindia.gov.in
4. Energy Efficiency Services Limited: https://eeslindia.org/ India's official HLDE website:energytransition.in

Conclusion: -

The study examined several perspectives on the SDGs, including those found in scholarly articles, state- specific SDG indices, the Government of India's Energy Compact, all of these studies were conducted to develop an analytical understanding of the response of the Indian research community to the SDGs, the commitment of different states, and thereby reflecting India's position towards the SDGs. SDG7 on sustainable energy for all is one of the goals of the Paris Agreement on Climate Change. All disciplines saw a substantial rise in the quantity of SDG-related research publications (CAGR = 17.32%). The top three SDGs that received the most contributions were 3, 7, and 13. The highest number of publications were found in SDGs 7 and 3, which together accounted for 23.26 and 11.29% of all publications, respectively. This typically illustrates how difficult it will be for India to achieve its goal of providing affordable and clean energy, and how a persistent commitment will be needed to do so in the near future. Goal 7 for India has an SDG Index Score of 51. With scores of 89, 78, and 77, respectively, Tamil Nadu, Mizoram, and Karnataka are the top three States when it comes to achieving this goal. With a score of 96, Chandigarh performs the best among the UTs. The findings offer helpful insights and pointers for scientific policy with planning activities, and they also offer information for combining intelligence, information, and resources in a productive way to achieve the desired goals. We contend that this will give scholars, decision-makers, and other groups trying to meet various SDG targets useful insights.

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