

Impact of E-Resources Consortium on Research Productivity of Centrally Funded Technical Institutes in India

Shankar B. Chavan^{1*} and Keshava²

¹*Department of Studies & Research in Library-Information Science, Tumkur University, Tumkur- 572 103, & Indian Institute of Technology, Delhi- 110 016, India*

²*Department of Studies & Research in Library- Information Science, Tumkur University, Tumkur- 572 103, India*
**E-mail: shankaraochavan@gmail.com*

ABSTRACT

The main objective of the study is to find the impact of the e-resources consortium on the research output of the publications of Centrally Funded Technical Institutes in India (CFTIs) using the scientometric analysis. A total of fifty-seven institutes were taken for analysis for the period of three decades from 1991 to 2020. A total of 401171 publication records were extracted from the Scopus bibliographic database using the affiliations search. The research publications of CFTIs increased 14 times in 2015-2020 compared to 1991-1995, and the trend continuously increases. In a decade-wise comparison of the publications per institute in 1991-2000 versus 2011-2020, it grew 4.72 times. The correlation of research publications and research output analysis using the compound annual growth rate of CFTIs in 1991-2001 was 4.38 %, whereas 11.82 % in 2002-2020. The preferred publication sources are largely journals 71.61 %, and conference proceedings 22.08 %. Positive correlation was found between the accessibility of scholarly journals and the research output of CFTIs after the INDEST-AICTE Consortium. The increase in publications of IISc, IITs and NITs are 2.63 times, 8.09 times, and 55.57 times respectively.

Keywords: CFTIs; E-resources consortia, Research trend analysis; Scientometrics; Bibliometrics; Impact analysis; Mapping science

1. INTRODUCTION

A library consortium is a cooperation of two or more libraries to fulfil their need by sharing their resources and services. The collaboration among the libraries has been for many years. It had developed in several phases as and when the need arose. With the shifting of publishing industries from print to electronic, the development of internet technology and access to online resources through the web browser. The history of library e-resources consortia is relatively recent, dating back to the late 20th century when electronic resources first became widely available for libraries. The earliest example of a library e-resources consortium is the Ohio Library and Information Network (OhioLINK), which was established in 1988. In the 1990s, many e-resource consortia began worldwide for resource sharing, negotiation, etc. According to ICOLC, there are 231 registered library consortia worldwide.

In India, the library consortia became active after 2000 with the beginning of e-resources. The access of e-resources to Centrally Funded Technical Institutes (CFTIs) through the INDEST-AICTE Consortium was started in 2002. In 2015, e-ShodhSindhu was formed

by merging three consortia, i.e., INDEST-AICTE Consortium, UGC-Infonet Digital Library and N-LIST. The growing rate of scholarly publications is enormous, and consortia are essential in enabling access to the member institutes. To correlate the access and impact on the scientific output, the assessment of the research productivity of the institutes is critical. This study helps the librarian, academician and administrator understand and plan in decision-making and provides a landscape of academic research of the institutions.

2. REVIEW OF LITERATURE

According to Braun¹, *et al.* the assessment of scientific research is an extremely delicate and sophisticated venture. Several quantitative and qualitative techniques have been used to measure the research productivity of universities and institutes. A scientometric study is a quantitative method to measure the research productivity of the institute/university. Zhang & Zhang² analysed China's research performance from 1987 to 1993, the annual growth of output in foreign periodicals at the rate of 1.75. Sandström³ studied the average funding and publishing quality of publications. Prathap⁴ applied the second-order indicator to measure the productivity of the top-ranked NIRF institutes using econometric

factors. Inglesi-Lotz & Pouris⁵ examined the impact of NRF evaluation and rating on the social science research profile of the country. Sahoo & Agarwal⁶ indicated the growth of members, usage of a resource based on the number of downloads and cumulative growth of publications before and after the access of e-resources through the consortium.

Yadav⁷, *et al.* access the usage statistics of universities in Gujarat state by analysing the InfiStats usage data along with the publications output in Scopus. Arora⁸, *et al.* correlated the relationship between the number of downloads and universities research productivity, using the universities research output from 1975 to 2009. There are many scientometric studies on the productivity of the institutes, but no study exhibits the impact of e-resources access on the research productivity of CFTIs. This study analyses the impact of the e-resources consortium on the publications output of centrally funded technical institutes in India.

3. OBJECTIVES

The main objectives of the study are to find the growth trend of research publications of CFTIs from 1991 to 2020; to correlate the impact of the e-resources consortium on the growth of research publications of CFTIs in India.

4. SCOPE AND LIMITATIONS

The study covered the 57 CFTIs in India, i.e. IISc, IISERs, IITs and NITs, which were established before 2015. The study period is limited to three decades, from 1991 to 2020.

5. METHODOLOGY

Scopus is the largest abstract and citation database of peer-reviewed literature: scientific journals, books, conference proceedings, etc. A list of 57 CFTIs was compiled by gathering information on the institutes from the Ministry of Education (MoE), the Government of India website and the institutes' respective websites. A search was performed using the affiliation field for individual institutes and extracted publication data from the Scopus database, covering the period from 1991 to 2020. The step of data collection is given below:

5.1 Data Collection

- The publication records of each institute were downloaded for each year from 1991 to 2020.
- Combined the years' publications in a single file to analyse each institute's research outputs.
- Combined the publications of the institutes of different categories of institutes like IITs, NITs, and IISERs and removed the duplicated records.

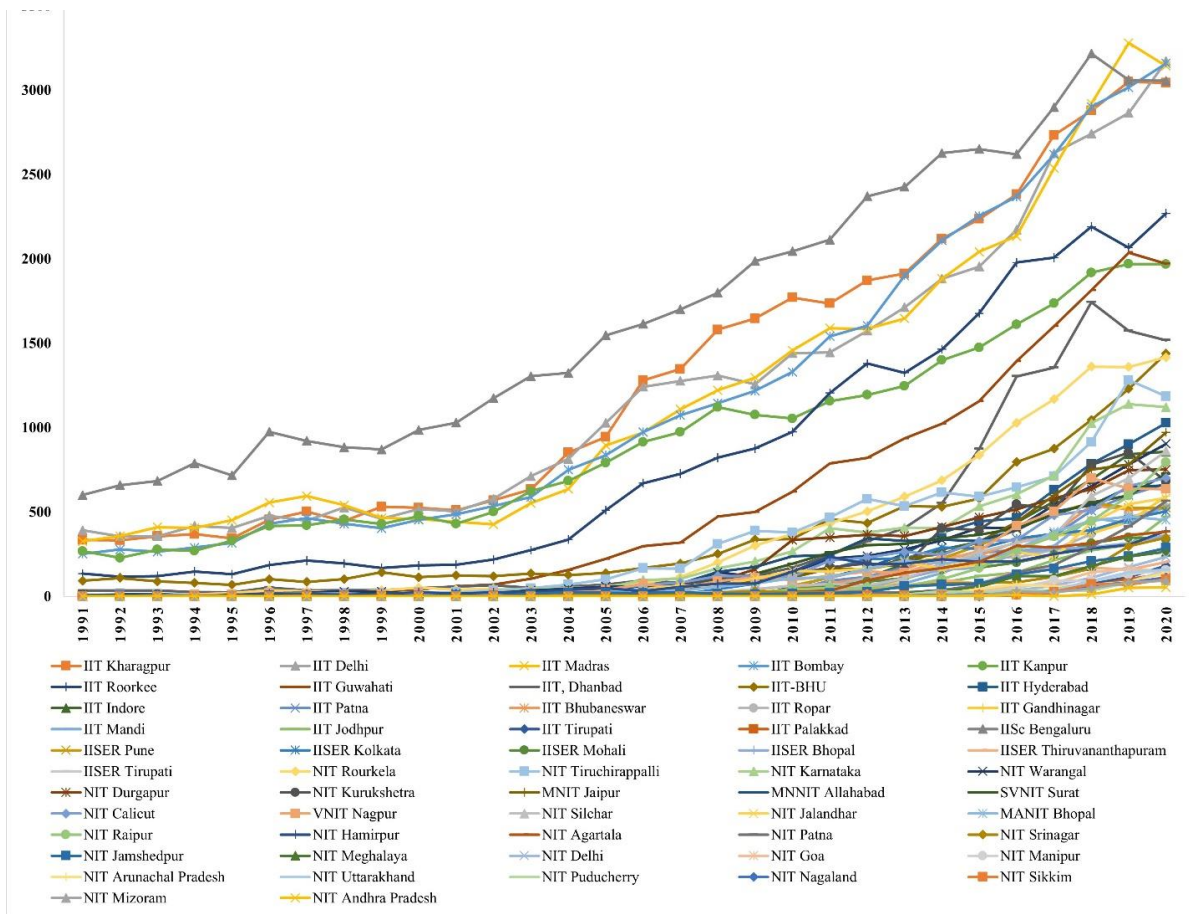


Figure 1. Growth of research publications of CFTIs from 1991 to 2020.

Table 1. Research publications of CFTIs from 1991-2020

S. No	Institute	Estd.	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015	2016-2020	Total
1	IISc Bengaluru	1909	3449	4639	6380	9147	12188	14850	50653
2	IISER Pune	2006	0	0	0	137	1000	2493	3630
3	IISER Kolkata	2006	0	0	0	261	1181	2069	3511
4	IISER Mohali	2007	0	0	0	81	585	1451	2117
5	IISER Bhopal	2008	0	0	0	34	523	1506	2063
6	IISER Thiruvananthapuram	2008	0	0	0	53	333	844	1230
7	IISER Tirupati	2015	0	0	0	0	7	355	362
8	IIT Kharagpur	1951	1736	2460	3512	7625	9876	14084	39293
9	IIT Delhi	1961	1927	2430	3637	6524	8570	13576	36664
10	IIT Madras	1959	1950	2614	2952	6056	8745	14013	36330
11	IIT Bombay	1958	1402	2182	3198	5740	9408	14061	35991
12	IIT Kanpur	1959	1373	2199	3029	5140	6472	9202	27415
13	IIT Roorkee	2001	651	945	1528	4071	7051	10511	24757
14	IIT Guwahati	1994	1	117	614	2210	4723	8816	16481
15	IIT Dhanbad**	1926	155	213	305	562	2402	7496	11133
16	IIT-BHU***	2012 1919	440	547	647	1294	2539	5387	10854
17	IIT Hyderabad	2008	2	0	0	62	1357	3809	5230
18	IIT Indore	2009	0	0	0	16	944	3393	4353
19	IIT Patna	2008	0	0	0	59	863	2412	3334
20	IIT Bhubaneswar	2008	0	0	0	61	823	2275	3159
21	IIT Ropar	2008	0	0	0	22	727	1871	2620
22	IIT Gandhinagar	2008	0	0	0	40	547	2053	2640
23	IIT Mandi	2009	0	0	0	2	505	2000	2507
24	IIT Jodhpur	2008	0	0	0	8	334	1406	1748
25	IIT Tirupati	2015	0	0	0	0	0	408	408
26	IIT Palakkad	2015	0	0	0	0	2	330	332
27	NIT Rourkela*	1961	57	180	225	1067	3053	6337	10919
28	NIT Tiruchirappalli*	1964	46	104	279	1410	2787	4740	9366
29	NIT Karnataka*	1961	32	50	178	843	2127	4609	7839
30	NIT Warangal*	1959	30	112	174	525	1485	3284	5610
31	NIT Durgapur*	1960	19	63	99	662	1953	3232	6028
32	NIT Kurukshetra*	1963	44	45	126	472	1346	3376	5409
33	MNIT Jaipur*	1963	10	30	96	353	1124	3547	5160
34	MNNIT Allahabad*	1961	53	53	114	695	1581	2738	5234
35	SVNIT Surat*	1961	0	0	24	445	1584	2768	4821
36	NIT Calicut*	1961	28	68	79	508	1282	2684	4649
37	VNIT Nagpur*	1960	31	80	119	422	893	2898	4443
38	NIT Silchar*	1967	5	20	30	168	690	2835	3748
39	NIT Jalandhar*	1987	6	32	80	430	868	2061	3477

40	MANIT Bhopal*	1960	21	31	73	318	907	2037	3387
41	NIT Raipur*	1956	0	0	0	82	430	2466	2978
42	NIT Hamirpur*	1986	26	82	154	386	1047	1437	3132
43	NIT Agartala*	1965	2	5	1	44	643	1653	2348
44	NIT Patna*	1924	4	4	2	17	167	1601	1795
45	NIT Srinagar*	1960	13	21	25	102	265	1010	1436
46	NIT Jamshedpur*	1960	12	18	72	93	251	1027	1473
47	NIT Meghalaya	2010	0	0	0	0	107	922	1029
48	NIT Delhi	2010	0	0	0	0	46	619	665
49	NIT Goa	2010	0	0	0	0	46	592	638
50	NIT Manipur	2010	0	0	0	0	46	522	568
51	NIT Arunachal Pradesh	2010	0	0	0	0	67	427	494
52	NIT Uttarakhand	2009	0	0	0	0	15	460	475
53	NIT Puducherry	2009	0	0	0	0	65	289	354
54	NIT Nagaland	2009	0	0	0	0	31	306	337
55	NIT Sikkim	2009	0	0	0	0	25	284	309
56	NIT Mizoram	2010	0	0	0	0	15	278	293
57	NIT Andhra Pradesh	2015	0	0	0	0	2	128	130
Total			13276	18674	26871	55510	100822	186018	401171
Percentage (%)			3.31	4.65	6.70	13.84	25.13	46.37	100.00

* Regional Engineering Colleges (RECs)/Engineering Colleges upgraded to NIT during 2002 to 2006; ** ISM Dhanbad upgraded to IIT in 2016; *** Banaras Engineering College upgraded to IIT-BHU in 2012.

- To analyse the overall research output of the CFTIs, the publications across all categories were once again combined.

A total of 401171 extracted records were analysed using Excel and scientometric techniques. This study covered all the publications indexed in the Scopus database till 2020. Further, to correlate the impact of access to e-resources on research productivity, the institutes established before 1991 were considered.

6. ANALYSIS AND INTERPRETATION

6.1 Growth of Publications of CFTIs from 1991-2020

Table 1 and Figure 1 present the details of the publications of CFTIs (IISc, IISERs, IITs and NITs) in India from 1991 to 2020. It indicates the publication growth of the institutes, which is continuously increasing. Thirty institutes contributed the share of publications in 1991-1995 is 3.31 %, and in 2016-2020 contribution by 57 institutes was 46.37 %. The increase in the number of institutes is 1.9 times, whereas the growth in the contribution is 14 times. The details of the publications by institute-wise are given in Table 1. It indicated the research growth in CFTIs after access to e-resources is increased manifold. The increase in research publications also depends on the number of faculty, research scholars, and access to global research publications. It can be interpreted that the influencing factors in increasing research publications are the increased number of research

scholars, faculty and the accessibility of international research publications.

6.2 Decade-wise Research Publications and Compound Annual Growth Rate (1991-2020)

Table 2 presents the decade-wise research publications and compound annual growth rate (CAGR) of 57 Central Funded Technical Institutes (CFTIs) in India from 1991 to 2020. The CAGR is calculated for each group and decade. Overall, the table indicates that the research output of all the CFTIs has increased substantially over the past three decades, with the highest CAGR observed for the IISERs in the 2011-2020 decade. In each decade, the contribution percentage of IITs and IISc decreased, whereas it increased in NITs. This is because NITs are given the Institute of National Importance status and new institutes of IISERs are established. Also, these institutes were accessing scholarly publications through the e-resources consortium.

6.3 Correlation Between the Number of Publications and Access to Scholarly E-resources

Table 3 presents the total number of publications and compound annual growth rate (CAGR) for two different periods, 1991-2001 and 2002-2020. To compare and correlate the impact of access to e-resources through the consortium on research output, thirty institutes, i.e., IISc, 9 IITs and 20 NITs, were considered for this analysis,

Table 2. Decade-wise research publications and compound annual growth rate (CAGR) from 1991 to 2020

Decades	Institute	No. of institute	Total publication	Pub. per institute	Pub. share (%)	CAGR (%)
1991-2000	IISc	1	8088	8088	25.31	5.09
	IITs	9	22929	2548	71.77	4.25
	NITs	20	1413	71	4.42	10.41
	IISERs	0	0	0	0	0
	Total institutes	30	31950	1065	100	4.65
2001-2010	IISc	1	15530	15530	18.85	7.1
	IITs	17	57509	3383	69.81	12.67
	NITs	20	10774	539	13.08	30.09
	IISERs	5	565	113	0.69	124
	Total institutes	43	82381	1916	100	13.4
2011-2020	IISc	1	20155	27044	7.03	3.76
	IITs	19	174949	9208	60.99	9.63
	NITs	31	83723	2701	29.19	15.27
	IISERs	6	11944	1991	4.16	17.45
	Total institutes	57	286840	5032	100	10.66
1991-2020	IISc	1	50662	50662	12.63	5.58
	IITs	19	255387	13441	63.66	9.24
	NITs	31	95910	3094	23.91	19.25
	IISERs	6	12509	2085	3.12	22.17
	Total institutes	57	401171	7038	100	10.09

Table 3. Correlation between the number of research publications and access to scholarly e-resources

Year	IISc		IITs		NITs		Combined all	
	Pub.	CAGR (%)	Pub.	CAGR (%)	Pub.	CAGR (%)	Pub.	CAGR (%)
1991-2001	9118	5.16	25721	3.87	1621	9.32	35935	4.38
2002-2020	41544	5.03	208300	10.72	90093	23.61	331034	11.82

Table 4. Most preferred source type of research publications

Source Type	IISc		IISER		IIT		NIT		Combined (IISc+IISERs+IITs+NITs)	
	Pub	%	Pub	%	Pub	%	Pub	%	Pub	%
Journal	40001	78.96	11701	93.54	185889	72.79	59991	62.55	287280	71.61
Conference proceeding	8644	17.06	517	4.13	53904	21.11	27770	28.95	88587	22.08
Book series	1295	2.56	146	1.17	10292	4.03	6195	6.46	17405	4.34
Book	658	1.30	143	1.14	4193	1.64	1591	1.66	6421	1.60
Trade journal	56	0.11	2	0.02	1075	0.42	359	0.37	1436	0.36
Report	0	0.00	0	0.00	1	0.00	0	0.00	1	0.00

which existed before the INDEST-AICTE Consortium. There is a positive correlation between access to scholarly publications and research output. The combined data for all institutions show a significant increase in research publications and CAGR for both periods, indicating the importance of access to scholarly e-resources in facilitating research output. The average number of publications per year of IISc, IITs and NITs grew to 2.63 times, 8.09 times, and 55.57 times, respectively in 2002-2020 compared to 1991-2001. The CAGR of IISc is slightly lower, whereas the number of publications has increased. The CAGR and publications grew substantially in the case of IITs and NITs. It expressed that the increased growth of publications in IITs and NITs is relatively affected due to the scholarly access of publications through the e-resources consortium.

6.4. Most Preferred Source Type of Research Publications

Table 4 provides the most preferred source type for publishing the research papers by the researchers of CFTIs in India. The percentage of conference proceedings in engineering and technology institutes, IITs and NITs is higher than IISc and IISERs, whose research concentrates more on basic science. It can be interpreted that the publications of conference proceedings are equally vital for researchers working in the engineering and technology field.

6.5. Preferred Medium of Language for Research Publications by CFTIs

The breakdown of publications in different languages shows that English is the most common language for publications of CFTIs, with 99.98 % of publications in IISc, 99.98 % in IISERs, 99.97 % in IITs and 99.98 % in NITs and 99.97 % in combined total. French, German, Polish, and Spanish are the most common languages, but with very low percentages compared to English. Many other languages have only one or two publications. The portions are rounded to the nearest hundredth, so the number of publications in each language could differ slightly. Scientific and technical publications are more predominantly published in English, and access to global scholarly publications through consortium impact research productivity.

7. FINDING AND DISCUSSION

- The increase in the number of institutes from 1991 to 2020 is 1.9 times, whereas the growth in the contribution is 14 times.
- The growth of publications has steadily increased from 2004 onwards.
- The contribution of CFTIs in 1991-1995 (3.31 %) and 2016-2020 (46.57 %) trend is identical to the study of Arora et al. in 2013.
- The CAGR of CFTIs from 1991-2001 (4.38 %) and 2002-2020 (11.82 %) indicated almost double the

CAGR growth. Whereas, in the case of IISc there is slightly less and very high jump in NIT. It is closely aligned with the study of Sahoo and Agarwal in 2012.

- There is a positive correlation between access to scholarly publications and research output.

8. CONCLUSION

Library e-resources consortia have been around for decades, beginning in the late 20th century, when electronic resources first became widely available for libraries. The access of e-resources to CFTIs through INDEST-AICTE Consortium was started in 2002, and in 2015 e-ShodhSindhu was formed by merging three consortia, i.e., INDEST-AICTE Consortium, UGC-Infonet Digital Library and N-LIST. The study provided the foundation for factors influencing the research productivity of the institutes. There are several factors behind the research productivity and ranking of the institutes. The study presented a research analysis of the CFTIs research output before and during the consortium period. This quantitative approach compares the impact by analysing the number of research publications.

English is the most preferred language of scholarly publications for scientific and technical publications. Comparing research publications and Compound Annual Growth Rate, the decade-wise analysis showed a positive increase in each decade. CFTIs increased 1.9 times in three decades, whereas publications are 14 times more. There is a positive correlation between the accessibility of scholarly journals and the research output of CFTIs after the INDEST-AICTE Consortium.

The increase in publications of IISc, IITs and NITs are 2.63 times, 8.09 times, and 55.57 times, respectively. The CAGR of IISc is slightly lower, whereas the number of publications has increased. The CAGR and publications have risen substantially in the case of IITs and NITs. The library committee and administrator understand that the subscription of electronic resources through the consortium is worthy. It adds value and increases the number of e-resources for access through combined negotiation.

REFERENCES

1. Braun, T.; Schubert, A. & Glanzel, W. Scientometric indicators: A 32 country comparative evaluation of publishing performance and citation impact. World Scientific Publishing, Philadelphia, Penn, 1985.
2. Zhang, H. & Zhang, Y. Scientometric study on research performance in China. *Information Processing and Management*, 1997, **33**(1), 81-89. doi: 10.1016/s0306-4573(96)00018-0.
3. Sandström, U. Research quality and diversity of funding: a model for relating research money to output of research. *Scientometrics*, 2009, **79**(2), 341-349. doi: 10.1007/s11192-009-0422-2.
4. Prathap, G. Making scientometric and econometric sense out

- of NIRF 2017 data. *Current Science*, 2017, **113**(7), 1420-1423. doi: 10.18520/cs/v113/i07/1420-1423.
5. Inglesi-Lotz, R. & Pouris, A. Scientometric impact assessment of a research policy instrument: the case of rating researchers on scientific outputs in South Africa. *Scientometrics*, 2011, **88**(3), 747-760. doi: 10.1007/s11192-011-0440-8.
 6. Sahoo, B.B. & Agarwal, G.P. INDEST-AICTE consortium: a decade of service for engineering, science and technology community of the country. *Annals of Library and Information Studies*, 2012, **59**(3), 170-180. <https://nopr.niscair.res.in/handle/123456789/14975> (accessed on 12/02/2023)
 7. Yadav, Roshni & Gadhavi, Geeta G. Measuring Impact of 'E-Shodh Sindhu' in Scholarly Publications. *Library Philosophy and Practice (e-journal)*, 2021, 5422. url: <https://digitalcommons.unl.edu/libphilprac/5422/> (accessed on 12/02/2023).
 8. Arora, J.; Trivedi, K.J. & Kembhavi, A. Impact of access to e-resources through the UGC-INFONET digital library consortium on research output of member universities. *Current Sci.*, 2013, **104**(3), 307-315. <https://www.currentscience.ac.in/Volumes/104/03/0307.pdf> (accessed on 12/02/2023)
 9. <https://icolc.net/> (accessed on 12/02/2023).
 10. <https://ess.inflibnet.ac.in/> (accessed on 12/02/2023).

CONTRIBUTORS

Mr Shankar B. Chavan is a Research Scholar at Department of Studies & Research in Library Information Science, Tumkur University, Tumkur & Assistant Librarian at Indian Institute of Technology Delhi. His research interests include: Scientometrics, Information systems, Data analytics and technology trend analysis. He has contributed to the data collection, computational analysis and writing of the article.

Prof Keshava is a Professor & Chairman, Department of Studies & Research in Library Information Science, Tumkur University, Tumkur. His research interests include: Scientometrics, Information systems, Knowledge organisation, User study and Research methodology.

He has contributed to conceptualisation of the study, the design of the analytical framework and the writing and review of the article.