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Research Excellence of IITs in Business, Management and Accounting: A bibliometric study

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Abstract

The present study assesses business research in Indian Institute of Technologies (IITs). The publications of IITs in business, Management and Accounting recorded in Scopus database dates back to 1963. The study analyzed top performing nine IITs and found 5000 publications during 1963 to 2019. Bibliometric analysis is implemented on data retrieved from Scopus database. The study identifies annual growth, prolific authors, authorship trend, leading journals and Bradford's Law is tested on the collected data of Scattering in different sources.

Keywords - Business Research; Bibliometric study; h-Index; Bradford's Law; IIT

1. Introduction

The mapping and analysis of research materials, is to comprehend and analyze scientific domains[1] together with the development and fine tuning of new techniques and tools to facilitate decision-making in areas of scientific policy and it reflects the "state of the art" of research at a given time. These processes, necessary for the evaluation of science [2, 3] are a responsibility that no country can elude [4] given the evident connections between advancement through research activity, economic growth and progress, and the enhanced well-being of society.[5] The number of scientific disciplines interrelated by Business research lends it an interesting yet complicated character. Its inter disciplinary[6] nature presents a great challenge when delimiting and analyzing its thematic composition, demanding a very precise analysis. Precisely to face this challenge, bibliometrics has complementary tools that more recently include social network analysis[7] and the visualization of scientific domains[8, 9, 10].

Bibliometrics[11] is a type of research method frequently used and an emerging thrust area of research in the field of LIS. It[12] has become a standard tool to explore scientific communication process in any subject area by measuring and analyzing various aspects of written documents. Bibliometrics is also used to evaluate impact of research papers, researchers, institutions, and

journals. The present study is an attempt to analyse research excellence of IITs in the area of Business, Management and Accounting. IITs performance is well known in technical education. These institutes have also prominent productivity and acquired leading positions in Business, Management and Accounting literature output. Top productive nine IITs found to contribute about 10% of the total research output of India in Business, Management and Accounting (51628) which led the researcher to concentrate on the topic.

2. Literature Review

We are living in the world of business[13]. Business provides goods and services to the society. Business growth increases national income, which contributes to social development. Business studies help us in best utilizing the available resources. Bibliometric methods have been used to measure scientific progress in many disciplines of science and engineering and are a common research instrument for systematic analysis[14]. As Narin[15] first proposed the concept of 'evaluative bibliometrics', many scientists have tried to evaluate the research trend in the publication outputs of geographic areas, research organizations, academic institutions, journals and different subjects[16,17] the citation analysis[18] and the peak year citation per publication[19,20]. Fu et al.[21] retrieved data from Science Citation Index database for their study. They analyzed the data in many steps like: Publication output, types of document, subject category etc. Jena *et al.*[22] gathered 417 articles for their study. They analyzed the parameter like types of article, geographical distribution of contributors and ranking of journals with Bradford's Law of Scattering. Jeevan and Gupta[23] have said about the contribution and impact of Indian Institute of Technology, Kharagpur and suggested some methods about the quantitative profile of a research-cum-teaching institute, with a view to get knowledge on its performance and importance. Accordingly, Singh *et al.*[24] analyzed the research outputs and weight age of Indian Institute of Technology, Roorkee during 1993 to 2001. Employment of bibliometric methods, including publication and citation analyses, Bonnevie[25] studied a multifaceted portrait of the Journal of Information Science, focused on the last quarter of the twentieth century.

Ratha, Joshi, and Naidu[26] analyzed the design and structure of IITs library websites. The study conducts a detailed study about 15 library websites of IITs in India. Some differences are noticed with regard to user services, number of hyperlinks provided, number and location of images, inactive links etc. Khanchandani and Hasan[27] carried out a study specially to know the marketing resources, services and products of IIT, Delhi. The study provides a widespread outline on marketing strategies implemented by Central Library of IIT, Delhi for user services. Hulagabali[28] put forward a study on initiation of Institutional Repositories (IRs) by IIT and IIM. Use of IR as a medium of sharing institution's content, started by IITs and IIMs, the study discusses software used for IRs, type and number of documents archived, accessibility options and link provided by IRs. Singh[29] discuss about IIT Bombay and the library services. The study focuses on methods of information collection, acquisition, library collection. It examines user's awareness about services and use of library. Vijayakumar, Kannappanavar and Mestri[30] conducted a study on IIT

libraries web portals. Having common goals they can develop unique library website/portal with links of individual IIT libraries and provide library resources and services. The study also suggests creating educational network among libraries of IITs. Khobragade and Lihitkar[31] attempted to evaluate virtual reference service provided by IIT libraries. It is the same reference service with a new face that is getting through online using library websites from remote place. The study finds that in IIT libraries there is greater progress in electronic access to information.

3. Objectives

The objective of the study is to find out –

1. Top Performing IITs
2. Annual Growth
3. Prolific Authors and Authorship Trend
4. Leading Journals
5. Testing of Bradford's Law

4. Methodology

Data is extracted from Elsevier's Scopus database which is a multidisciplinary bibliographic database containing abstracts and citations of peer-reviewed literature which may be journals, books and conference proceedings. The query that is put in document search of Scopus comprises of "(AFFILCOUNTRY(India) AND (LIMIT-TO (SUBJAREA,"BUSI")) AND (LIMIT-TO (AF-ID,"Indian Institute of Technology Delhi" 60032730) OR LIMIT-TO (AF-ID,"Indian Institute of Technology Kharagpur" 60004750) OR LIMIT-TO (AF-ID,"Indian Institute of Technology Roorkee" 60031818) OR LIMIT-TO (AF-ID,"Indian Institute of Technology Madras" 60025757) OR LIMIT-TO (AF-ID,"Indian Institute of Technology, Bombay" 60014153) OR LIMIT-TO (AF-ID,"Indian Institute of Technology Kanpur" 60021988) OR LIMIT-TO (AF-ID,"Indian Institute of Technology Indian School of Mines, Dhanbad" 60008898) OR LIMIT-TO (AF-ID,"Indian Institute of Technology Guwahati" 60010126) OR LIMIT-TO (AF-ID,"Indian Institute of Technology Banaras Hindu University" 60019106)) AND (EXCLUDE (PUBYEAR,2020)))". Total number of publication is 5000. There may exist relevant publications in this field that is not covered by Scopus database due to certain reason. No attempt has been made to collect and include such scholastic publications in this study.

5. Data Analysis and Discussion

5.1 Top Performing IITs

Whenever we think of technical education in India, IIT is the first choice that comes to our mind. The Indian Institutes of Technology (IIT) [32] are autonomous national institutes opened for public. They are managed by Institutes of Technology Act, 1961. The first Indian Institute of

Technology was established in Kharagpur. Apart from various facilities, IIT libraries are enriched with print and electronic resources (have online access). IITs have started making availability of online free actual videos of class rooms. The elected senate of IITs manages the academic activities like: courses, curriculum, and examination. IITs provide B Tech, M Tech, Dual degrees of B Tech, M Tech and Ph D degrees. IITs provide best teaching and learning platform and quality research outputs also. There are valuable business research publications in IITs.

Table 1: Top Performing IITs in Business Research

Institutions	State	Papers	Percentage
Indian Institute of Technology Delhi	Delhi	1420	2.75
Indian Institute of Technology Kharagpur	West Bengal	867	1.68
Indian Institute of Technology Roorkee	Uttarkhand	752	1.46
Indian Institute of Technology Madras	Tamil Nadu	597	1.16
Indian Institute of Technology, Bombay	Maharashtra	591	1.14
Indian Institute of Technology Kanpur	Uttar Pradesh	469	0.91
Indian Institute of Technology Indian School of Mines, Dhanbad	Jharkhand	246	0.48
Indian Institute of Technology Guwahati	Assam	103	0.20
Indian Institute of Technology Banaras Hindu University	Uttar Pradesh	85	0.16

Table 1 displays productive nine IITs with their paper publications. Among these Indian Institute of Technology, Delhi leads with 1420 publications, followed by Indian Institute of Technology, Kharagpur with 867 publications, and Indian Institute of Technology, Roorkee with 752 publications. Top five affiliating institutions cover 85% of total publications.

5.2 Annual Growth

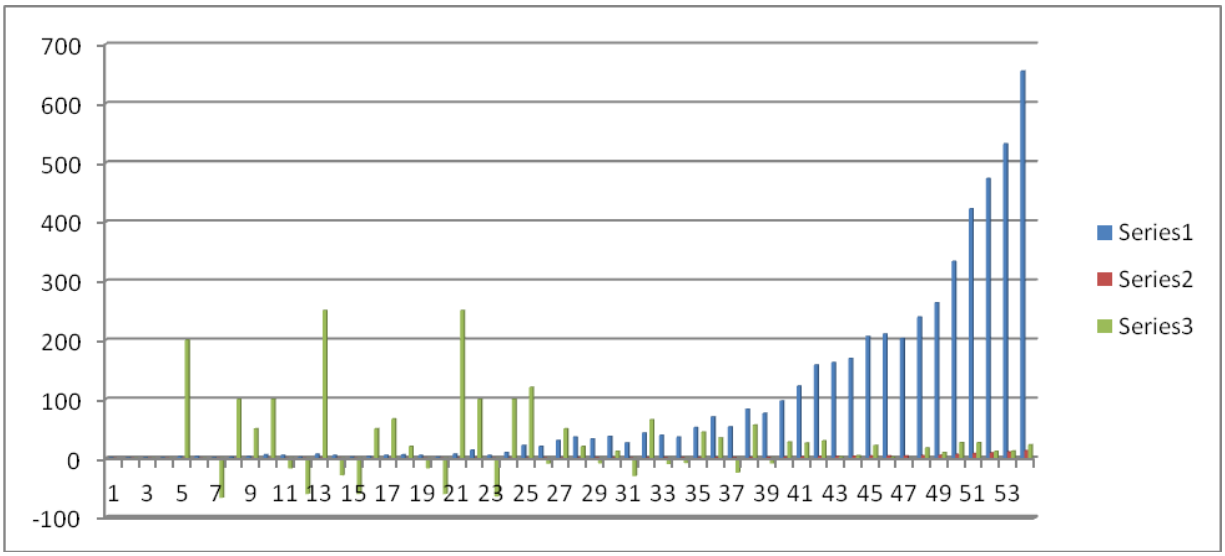
Research activity is encouraged in academic institutions by the competent investigating authorities. The interested researchers involve themselves in different research activities and publish their research finding in different sources in a regular interval. Academic research output helps the affiliated institutions to bring their reputation in national and international level. Such activities of IITs are listed (table 2) with annual growth within studied period.

Table 2: Annual Growth of Business Research in IITs

Year	Paper	Cum Papers	%age	Cum %	Growth Rate (%)
1963	1	1	0.02	0.02	
1964	1	2	0.02	0.04	0.00
1965	1	3	0.02	0.06	0.00
1966	1	4	0.02	0.08	0.00

1967	3	7	0.06	0.14	200.00
1970	3	10	0.06	0.20	0.00
1971	1	11	0.02	0.22	-66.67
1972	2	13	0.04	0.26	100.00
1974	3	16	0.06	0.32	50.00
1975	6	22	0.12	0.44	100.00
1976	5	27	0.10	0.54	-16.67
1977	2	29	0.04	0.58	-60.00
1978	7	36	0.14	0.72	250.00
1979	5	41	0.10	0.82	-28.57
1980	2	43	0.04	0.86	-60.00
1981	3	46	0.06	0.92	50.00
1982	5	51	0.10	1.02	66.67
1983	6	57	0.12	1.14	20.00
1984	5	62	0.10	1.24	-16.67
1985	2	64	0.04	1.28	-60.00
1986	7	71	0.14	1.42	250.00
1987	14	85	0.28	1.70	100.00
1988	5	90	0.10	1.80	-64.29
1989	10	100	0.20	2.00	100.00
1990	22	122	0.44	2.44	120.00
1991	20	142	0.40	2.84	-9.09
1992	30	172	0.60	3.44	50.00
1993	36	208	0.72	4.16	20.00
1994	33	241	0.66	4.82	-8.33
1995	37	278	0.74	5.56	12.12
1996	26	304	0.52	6.08	-29.73
1997	43	347	0.86	6.94	65.38
1998	39	386	0.78	7.72	-9.30
1999	36	422	0.72	8.44	-7.69
2000	52	474	1.04	9.48	44.44
2001	70	544	1.40	10.88	34.62
2002	53	597	1.06	11.94	-24.29
2003	83	680	1.66	13.60	56.60
2004	76	756	1.52	15.12	-8.43
2005	97	853	1.94	17.06	27.63
2006	122	975	2.44	19.50	25.77
2007	158	1133	3.16	22.66	29.51
2008	162	1295	3.24	25.90	2.53

2009	169	1464	3.38	29.28	4.32
2010	206	1670	4.12	33.40	21.89
2011	210	1880	4.20	37.60	1.94
2012	203	2083	4.06	41.66	-3.33
2013	239	2322	4.78	46.44	17.73
2014	263	2585	5.26	51.70	10.04
2015	333	2918	6.66	58.36	26.62
2016	422	3340	8.44	66.80	26.73
2017	473	3813	9.46	76.26	12.09
2018	532	4345	10.64	86.90	12.47
2019	655	5000	13.10	100.00	23.12
Total	**5000**		**100.00**		**Average Growth Rate= 27.02**
CAGR Growth Rate			**12.76%**		



Graph 1 – Annual Growth rate of Business literature

Table 2 and graph 1reflects year wise publication of IITs on business management in chronological order. It is found that not a single document is recorded in the years of 1968, 1969 and 1973 within the period of study i.e. 1963 to 2019. There may not be any publications in those years for any other reason. A total number of 5000 record is retrieved and analyzed during this period of study. Average publication per year is 92.59 in whole period of study. It is also found that there is no regularity in increasing number of publication with the increase of years. In The Compound Annual Growth Rate (CAGR) is 12.76% which is calculated through the web

page (http://www.investopedia.com/calculator/cagr.aspx) and the average growth rate of the studied period is 27.02.

5.3 Prolific Authors and Authorship Trend

An author, who publishes his / her research paper, is solely responsible for his / her work. Individual appearance counts the number of publication in different sources. Such activities are listed (table 3) to identify the top most authors in this field.

Table 3: Top 10 Prolific Authors

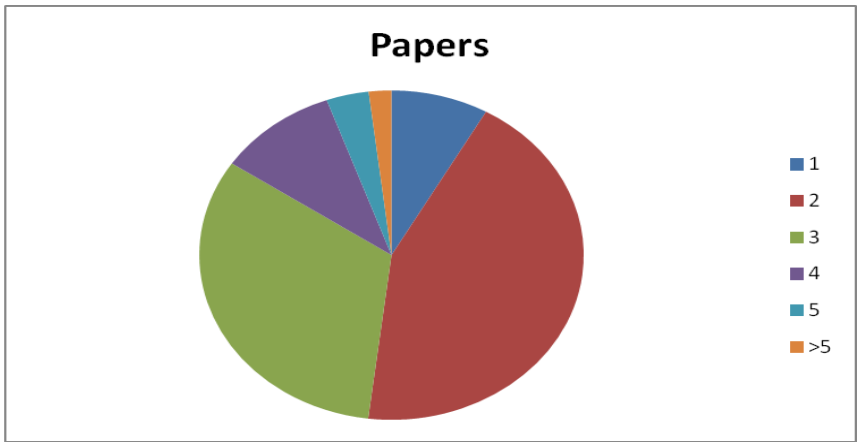
Rank	Authors	Affiliations	Department	Papers N=5000	h-index
1	Shankar, R.	IIT, Delhi	Management Studies	169	36
2	Deshmukh, S.G.	IIT, Delhi	Mechanical Engineering	114	38
3	Sushil	IIT, Delhi	Management Studies	110	24
4	Rahman, Z.	IIT, Roorkee	Management Studies	97	26
5	Tiwari, M.K.	IIT, Kharagpur	Industrial Engineering and Management	92	23
6	Sharma, R.R.K.	IIT, Kanpur	Industrial and Management Engineering	75	6
7	Rajendran, C.	IIT, Madras	Management Studies	73	33
8	Vankar, P.S.	IIT, Kanpur	Chemistry	60	9
9	Kumar, P.	IIT, Roorkee	Civil Engineering	57	22
9	Yadav, S.S.	IIT, Delhi	Management Studies	57	9

Table 3 reflects top 10 authors on the basis of their number of publications. These ten authors contribute 18.08% of the total publication. R. Shankar, S. G. Deshmukh and Sushil from IIT, Delhi occupied first three places with 169, 114 and 110 publications respectively and it is also observed that 4 authors from IIT, Delhi contribute 9% of the total publication. Authors from Management department contribute 10.12% of the total publications.

The h-index of authors is discussed, which is proposed by Hirsch[33] (2005) is "a numerical indicator to highlight how productive and influential a researcher is. A researcher has index h if h of his/her N_p papers have at least h citations each, and the other $(N_p - h)$ papers have ≤h citations each". This study indicates that S.G. Deshmukh has the highest h-index (38), following R. Shankar with 36, C. Rajendran with 33, Z. Rahman with 26, Sushil with 24, M. K. Tiwari with 23, P. Kumar with 22, P. S. Vankar and S.S Yadav with 9, and R.R.K Sharma with 6 h-index (table 3).

Table 4: Authorship Trend of IITs in Publication of Business Literatures

Authorship Type	Papers	%age	Authorship	%age
1	408	8.16	408	3.08
2	2189	43.78	4378	33.04
3	1624	32.48	4872	36.77
4	506	10.12	2024	15.27
5	178	3.56	890	6.72
6	57	1.14	342	2.58
7	11	0.22	77	0.58
8	13	0.26	104	0.78
9	3	0.06	27	0.20
10	4	0.08	40	0.30
11	1	0.02	11	0.08
12	4	0.08	48	0.36
15	2	0.04	30	0.23
Total	**5000**	**100**	**13251**	**100**
Degree of Collaboration (C)				**0.92**



Graph 2 – Distribution of Authorship

Table 4 and graph 2 displays authorship trend. As the table express, there is 408 (8.16%) single authored papers and 4592 (43.78%) multi authored papers and the degree of collaboration of authors is 0.92. The degree of collaboration recommended by K. Subramanyam[34] in 1983 has been used to find out degree of collaboration in business research. As per the formula, Degree of Collaboration **C =** $N_m / N_m + N_s$. Where, C =degree of collaboration in a subject; Nm = number of multi authored papers in the subject during a period; and N_S = number of single authored

papers in the subject during the same period. The data witness higher collaborative trend of IIT contributors in Business, Management and Accounting subject area. Maximum 15 numbers of authors are found to be combined to publish papers. Individually, if we see two authored research paper have greater share (43.78%), following three authored (32.48%), four authored (10.12%) and single authored (8.16%). More than six authored papers have 0.76% contribution.

5.4 Leading Journals

There are various sources to publish the research outputs. The personal efforts of the authors depend on own view, how to publish and where to publish their intellectual strength. The study found five source type publications. They are Journals, Conference proceedings, Trade Publications, Books and Book series. Out of these, Journals are the major carrier of research communication in IITs which productivity is 4153 (83.06%).

Table 5: Top 10 Leading Journals

Journals	Papers	%age	Citation	CPP	Publisher
International Journal Of Production Research	308	6.16	9024	29.30	Taylor and Francis
Journal Of Cleaner Production	216	4.32	3728	17.26	Elsevier
Global Journal Of Flexible Systems Management	147	2.94	1948	13.25	Global Institute of Flexible Systems Management
Journal Of Manufacturing Processes	118	2.36	1740	14.75	Elsevier
International Journal Of Systems Assurance Engineering And Management	111	2.22	488	4.40	Springer Nature
Journal Of Advances In Management Research	94	1.88	596	6.34	Emerald
Global Business Review	90	1.80	475	5.28	Sage
Benchmarking	88	1.76	1161	13.19	Emerald
International Journal Of Production Economics	80	1.60	3043	38.04	Elsevier
Opsearch	70	1.40	264.00	3.77	Springer Nature

The top ten preferred journals that contribute more than one fourth (26.44%) total papers are displayed in table 5. International Journal of Production Research published by Taylor and Francis is the productive journal, it received highest citation of 9024 and its citation per paper

(CPP) is 29.30. These ten journals are published by 7 publishers out of which Elsevier has 8.28% research output. It is also found that 775 journal papers have remains uncited.

5.5 Testing of Bradford's Law

For testing verbal formulations of Bradford's law[35] three zones are prepared and journals of each zone contribute about 1/3 of the total article. Bradford's multiplier is found by dividing number of journals of a zone by its previous zone. Bradford states zones will form about a geometric pattern in the form 1: n: n2.

Table 6: Application of Bradford's Law of Scattering

Zones	Articles	%age	Journal	%age	Bradford's Multiplier (n)
I	1387	33.40	11	1.89	
II	1385	33.35	68	11.70	6.18
III	1381	33.25	502	86.40	7.38
Total	**4153**	**100**	**581**	**100**	**6.78**

The relationship of each zone is 11: 68: 502. It is apparent from the table that the number of journals of different zones increased by the multiplier 6.78. Here 11 is periodicals in the nucleus. Hence 1: n: n^2 :: 11: 11*6.78: 11*45.97 :: 11: 74.58: 505.67 >> 591.25
The percentage error is ((581-591.25)/581)*100 = -1.76%. This percentage error is not significant. Therefore keeping 5% degree of significance we can say that Bradford's law of scattering confirms with the observed data of scattering of Business, Management and Accounting literatures in different journals published by IITs.

6. Outlook

Research on business studies is encouraged to enhance the development of the society. Measuring such researches is helpful for the future researchers in the field guiding them in assessing period of growth, prominent authors, key subject areas, top affiliating institutions and so on. Analysis of data also shows geographical collaboration of authors from different parts of the world. The study found 1122 international collaborating papers of IITs with 71 countries. The most collaborating countries are United States, United Kingdom, Australia and Canada. Secondly the scholarly communications have been made in five languages. English language plays a dominant role on business publication in IITs and there is 4988 publication in English language. It can be appreciated if the number of research papers will be more in near future. It is also suggested to provide adequate infrastructure and a well environment to the researchers for better performance of the academic and research organizations. Finally this study will help the future researchers and a better result can also be expected in this same area.

Reference

1. Hjorland B and Albrechtsen H (1995). Toward a new horizon in information science: domain analysis. Journal of the American Society Information Science; 46: 400-425.
2. Cami J, Zulueta M A, Fernandez M I, Bordons M, Gomez I (1997). Spanish scientific production in biomedicine and health sciences during the period 1990-1993 (Science Citation Index and Social Science Citation Index) and comparison to period 1986-1989. Medicinal Clinica; 109: 481-496.
3. Bordons M, Zulueta M A (1999). Evaluation of the scientific activity through bibliometric indices. Revista Española Cardiologia; 52: 780-800.
4. Krauskopf D (2000). La construcción social de la Ciencia y la Tecnología. Booletín SEBBM; 130: 12-16.
5. Chinchilla-Rodríguez Z, Moya-Anegon F (2007). La investigacion científica espanola (1995-2002): una aproximacion metrica. Universidad de Granada, Granada.
6. Zhao D, Strotmann A (2011). Intellectual structure of stem cell research: a comprehensive author co-citation analysis of a highly collaborative and multidisciplinary field. Scientometrics; 87: 115-131.
7. Perianes-Rodríguez A, Olmeda-Gomez C, Ovalle-Perandones M A, Chinchilla-Rodríguez Z, Moya-Anegón F (2011). R&D collaboration in 50 major Spanish companies. Aslib Proceedings; 63: 5-27.
8. Wasserman S, Faust K (1998). Social network analysis: methods and applications. Cambridge University Press Cambridge.
9. Leydesdorff L, Rafols I (2009). A global map of science based on the ISI subject categories. Journal of the American Society for Information Science and Technology; 60: 348- 362.
10. Rafols I, Porter A and Leydesdorff L (2010). Science overlay maps: a new tool for research policy and library management. Journal of the American Society for Information Science and Technology; 61: 1871-1887.
11. https://en.wikipedia.org/wiki/Bibliometrics (accessed on 18 March 2017)
12. http://digitalcommons.unl.edu/libphilprac/945/ (accessed on 18 March 2017)
13. http://worldbusiness24.weebly.com/index.html (accessed on 11 April 2017)
14. Van Raan A F J (2005). For your citations only? Hot topics in bibliometric analysis. *Measurement: Interdisciplinary Research and Perspectives*, Vol. 3, No. 1, pp. 50–62.
15. Narin F, Pinski G and Gee H H (1976). Structure of biomedical literature. *Journal of the American Society for Information Science*, Vol. 27, No. 1, pp. 24–45.
16. Garcia-Rio F, Serrano S, Dorgham A, Alvarez-Sala R, Pena A R, Pino J M, Alvarez-Sala J L and Villamor J (2001). A bibliometric evaluation of European Union research of the respiratory system from 1987 to 1998. *European Respiratory Journal*, Vol. 17, No. 6, pp. 1175–1180.
17. Zhou F, Guo H C, Ho Y S and Wu C Z (2007). Scientometric analysis of geostatistics using multivariate methods. *Scientometrics*, Vol. 73, No. 3, pp. 265–279.

18. Cole S (1989). Citation and the evaluation of individual scientist. *Trends in Biochemical Sciences*, Vol. 14, No. 1, pp. 9–13.
19. Chuang KY, Huang Y L and Ho Y S (2007). A bibliometric and citation analysis of stroke-related research in Taiwan. *Scientometrics*, Vol. 72, No. 2, pp. 201–212.
20. Li Z and Ho Y S (2008). Use of citation per publication as an indicator to evaluate contingent valuation research. *Scientometrics*, Vol. 75, No. 1, pp. 97–110.
21. Fu H Z, Ho Y S, Sui Y M and Li Z S (2010). A bibliometric analysis of solid waste research during the period 1993–2008. *Waste Management*, Vol. 30, pp. 2410–2417.
22. Jena K L, Swain D K, Sahu S (2012). Scholarly communication of the electronic library from 2003 to 2009: A bibliometrics study. *The Electronic Library*, Vol. 30, No. 1, pp. 103–119.
23. Jeevan V K J and Gupta B M (2002). A scientometric profile of research output from IIT, Kharagpur. *Scientrometric*, Vol. 53, No. 1, pp. 165–168.
24. Singh Y, Gupta B M and Kumar S. (2005). Research contributions and impact of research of Indian Institute of Technology, Roorkee, 1993–2001. *Annals of Library and Information Studies*, Vol. 52, No. 1, pp. 8–14.
25. Bonnevie, E (2003). A multifaceted portrait of a library and information science journal: The case of the Journal of Information Science. *Journal of Information Science*, Vol. 29, pp. 11–23.
26. Ratha B, Joshi L & Naidu G H S (2012). Webometric study of IIT libraries Websites. *DESIDOC Journal of Library & Information Technology, 32(3),* 249-254. doi:http://publications.drdo.gov.in/ojs/index.php/djlit/article/view/2382/1273
27. Khanchandani V & Hasan N (2016). Marketing of library resources, services and products: A case study of IIT Delhi. *DESIDOC Journal of Library & Information Technology*, 36(3), 158-163. doi:http://publications.drdo.gov.in/ojs/index.php/djlit/article/view/9813/5601
28. Hulagabali S C (2015). Institutional Repositories initiated by Indian Institutes of Technology and Indian Institutes of Management: A case study. *DESIDOC Journal of Library & Information Technology*, 35(4), 287-292. doi:http://publications.drdo.gov.in/ojs/index.php/djlit/article/view/8215/4981
29. Singh S P (1999). An evaluation of collection development and reader's services at IIT library, Bombay. *DESlDOC Bulletin of Information Technology,* 19(4 & 5), 11-25. doi:http://publications.drdo.gov.in/ojs/index.php/djlit/article/view/3493/1913
30. Vijayakumar M, Kannappanavar B U & Mestri M (2009). Content analysis of Indian Institutes of Technology libraries Web Portals: A study. *DESIDOC Journal of Library & Information Technology*, 29(1), 57-63. doi:http://publications.drdo.gov.in/ojs/index.php/djlit/article/view/231/140
31. Khobragade A D & Lihitkar S R (2016). Evaluation of virtual reference service provided by IIT Libraries: A survey. *DESIDOC Journal of Library & Information Technology*,

36(1), 23-28. doi:http://publications.drdo.gov.in/ojs/index.php/djlit/article/view/9150/5426

32. https://en.wikipedia.org/wiki/Indian_Institutes_of_Technology (accessed on 17 April 2017)
33. Hirsch J. E. (2005). An index to quantify an individual's scientific research output. *Proceedings of the National Academy of Sciences of the United States of America, 102*(46), 16569–16572. doi:10.1073/pnas.0507655102
34. Subramanyan, K. (1983). Bibliometric studies of research collaboration: A review. *Journal of Information Science,* 6 (1): 33-38. Retrieved January 08, 2018
35. Singh, K. P. and Bebi (2014). Application of Bradford's law on journal citations: A study of Ph D theses in social sciences of University of Delhi. *Annals of Library and Information Studies. 61,* 112-120.

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