

Performance of India and China in Business Research: A Research

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Abstract:-The study analyses research activity of India and China in business using Elsevier's Scopus database for 2008-2017. Bibliometric methods are applied to extract the results. The study reveals that world productivity in business research is 36,192 during the period. And United States and United Kingdom are highly productive countries. China ranks three with 2281 and India ranks six with 1353 papers. China in earlier period of 2008-2011 has a rapid growth and from 2012 there is fall of publication, world share and Activity Index. Where as in India a gradual growth of publication, world share and Activity Index is found. The average impact and Exergy (X) of India is higher than China. Article, conference paper and book chapter are the major carrier of business research in both the nation. The author's collaborative trend of both countries is upward and higher in China than India. India published 343 (25.35%) papers abroad collaborated with 63 countries where as China published 990 (43.40%) papers abroad collaborated with 62 countries. India and China jointly published 10 papers in business. Global, Indian and China's business literature is disseminated in collaboration with 23, 20 and 16 subjects respectively. The estimation of future growth of publication indicate that India may become a stronger nation where as China may lose its identity in global business research.

Keywords: Business research; Indian business research; China's business research; Degree of collaboration; Bibliometrics; Activity Index; Research impact

I. INTRODUCTION

Business aims to satisfy needs of the society which includes trade, commerce and each activity involved in production and distribution of goods and services. Business brings economic, social and national development in society. It enhances advancement and prosperity of society. Research in business¹ helps to lead among competitors. It gives knowledge about how to put value in same product and services that could distinguish them from their competitors can raise market value of the company. It increases revenue and finance of a country. Many business, science and engineering industries like manufacturing, healthcare, agriculture, pharmaceuticals, information and communication technology etc have high expenditure on Research and Development (R&D) for improving their services. Evaluating business research is hence important to emphasize major areas of research and to manage investments. Bibliometric methods are applied to quantify both quantity and quality of research performance. It enables us to know trend and development of a scientific field

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during a period which leads emergence of various strategies of investment.

Earlier studies witness the demand of bibliometric assessment of country's performance in different subject areas. India and China cover 40% of the world population. World's largest market is represented by them. Instead of diverse national and political strategies, they have acknowledged the role of business in national development. High priorities are given by Indian and Chinese government to studies on business. It is imperative to uncover their position in World environment of business. No earlier bibliometric study is available on comparison of Indian and Chinese business research. It led the researcher to focus on this area. The present study makes an assessment of the performance of two countries in business research by analysing papers indexed in Scopus database.

II. OBJECTIVES

The comparative study of India and china is based on the following objectives:

- To uncover research activity
- To demark research impact
- To know document type preference
- To find out Collaborative trends
- To estimate future growths

III. REVIEW OF LITERATURE

Few previous studies on scientometrics comparing the two nations are available. Like, Garg² analyses 1223 research papers of India and China on laser published in journals and conferences for the period of 1993 and 1997. China's publication found to be twice of India. Both the county's Activity Indices were more or less same in 1993 and 1997. Chinese scientists choose domestic journals, where as Indian scientists choose foreign journals to publish. Impact per paper and citations received by India are more than China's. Arunachalam and Gunasekran³ attempted to map research on diabetes in India and China for 1990-1999. The study suggests to these two countries to increase research, investment, international collaboration and multi disciplinary research between life science and medical research. Dhawan⁴ examined research on physics in India and China using INSPEC Physics for the years 1990 and 1995. Publication output of China is far ahead of India. In spite, India's average impact per paper is higher than China. Chatterjee and Sahasranamam⁵ examined 162 technological innovation articles of China and India during 1991 to 2015.

They analysed trends of and sub areas of research on technological innovation. The study found very few papers relating to indigenous features of innovation. There is lack of research on technological innovation management in India. Kumar and Garg⁶ analysed research of India and China in computer science for 1971-2000. India's publication is considerably more than Chinese publication. Researchers of China select domestic journals, where as researchers of India Select international journals especially of West. Mittal and Pillania⁷ measured Indian business research collecting data from ISI Web of Knowledge databases. Literature growth is found to be remarkable. The study concentrates on authors, key journals, disciplines and institutions. It is revealed that few of them are influencing the environment of researches on business in India. Zhu et al⁸ studied research performance of universities in China for which data is collected from Scopus database. Comparisons are made with US and Europe. To know the strengths and weakness of universities of China quantity, quality, citation and international collaboration of research papers are studied.

IV. METHODOLOGY

Data is collected from Scopus database on 15th November 2018. In document search title-Abs-Key "business management" is searched and limited for subject area "Business, Management and Accounting" and the years 2008-2017. This is the global bibliographical data. To get data for India and China the query is limited again to the country/territory name. The query is further refined using document type, subject area, country/territory to extract data about that particular type. Bibliometric methods are applied on the data collected and analysed in MS Excel.

V. DATA ANALYSIS AND DISCUSSION& RESULTS

Productive countries

Table 1 displays top 10 productive countries in business research. Total global productivity is 36192. These top 10 performing countries contribute 67.54% of the total global output. United States and United Kingdom have not only highest productivity with 7749 (21.41%) and 3977 (10.99%) contributions but also have highest h-index of 130 and 91 respectively. China ranks three which accounts for 2281 (6.30%) and India ranks six with 1353 (3.74%) publications. India and China together account for 10.04% of the world output on business research. China's publication productivity and h-index is higher than India.

Table 1. Top 10 Productive Countries in Business Research

S N	Country	Papers	%age	h-index
1	United States	7749	21.41	130
2	United Kingdom	3977	10.99	91
3	China	2281	6.30	54
4	Germany	2204	6.09	67
5	Australia	2151	5.94	68
6	India	1353	3.74	44
7	Spain	1300	3.59	54
8	Canada	1270	3.51	72
9	Italy	1210	3.34	51
10	France	950	2.62	52
	Total	36192	67.54	

Research Activity of India vs. china

Annual Publication trend

The Figure 1 displays annual publication trend of India and China. It is observed that total Indian output in business research during the period is 1353 and 3.74% of the world output. China's contribution in business is almost twice of India with 2281 and 6.30% of world publication. Indian growth is consistent and similar with growth pattern of World. Whereas China has a rapid growth in earlier period that is from 2008-2011 and from 2012 it has a publication fall.

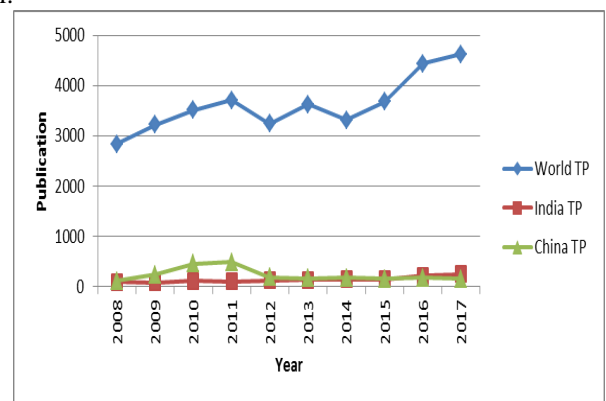


Fig. 1-- Annual publication trend of India and China

World share

Figure 2 shows World share of India and China in Business Research. Indian share of world business literature has increased from 3.03% in 2008 to 5.23% in 2017 and for the whole study period it has 3.74% publication share of world research. In 2017, there is highest 5.23% share of India with world. On the other hand, China's world share increase from 3.88% in 2008 to 3.31% in 2017 and it has 6.30% world share for the total study period. In spite of greater share than India, China's publication share with world reached its peak in 2011 and started to decrease from 2012 parallel with publication fall.

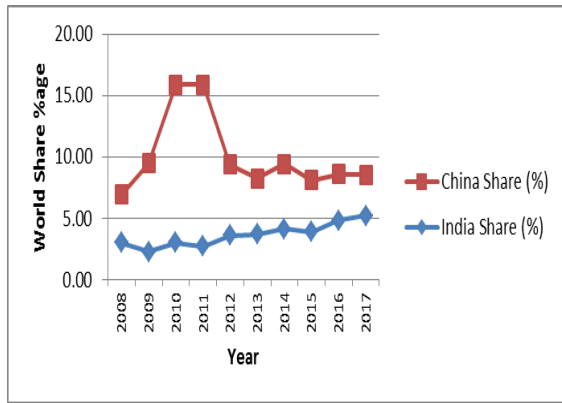


Fig. 2-- World share of India and China

Activity Index (AI)

In table 2 an attempt has been made to compare research activity of India and China using Activity Index (AI). It measures quantitative aspect considering publication output. First it was suggested by Frame⁹ and then by Schubert, Braun¹⁰, Garg, Padhi¹¹, Varaprasad and Ramesh¹². It

Table 2. Activity Index of India and China in Business Research

Year	World	Indian output	India (AI)	Chinese output	China (AI)	Total
2008	2836	86	81.12	110	61.54	196
2009	3224	74	61.40	231	113.69	305
2010	3513	105	79.95	452	204.15	557
2011	3706	101	72.90	487	208.50	588
2012	3236	117	96.71	186	91.20	303
2013	3623	134	98.94	165	72.26	299
2014	3317	137	110.48	175	83.71	312
2015	3674	143	104.11	155	66.94	298
2016	4439	214	128.96	167	59.69	381
2017	4624	242	139.99	153	52.50	395
Total	36192	1353	97.46	2281	101.42	3634

Research Impact of India vs. China

Citation Pattern

Citation count is used to measure quality, usage and impact of researches. It is applicable for papers, researchers, journals, institutions, subject area, and countries. Citation analysis also helps in evaluating the quality of research in macroscale and microscale comparisons (Aksnes and Rip 2009, Radicchi and Castellano 2012). Table 3 displays

determines whether an element of study is more or less active within a selected sub domain. The formula works out as: $AI = (n_{ij} / n_{io}) / (n_{oj} / n_{oo}) * 100$. Where n_{ij} = the output of country i , in the particular Year j ; n_{io} = the output of country i , for all study period; n_{oj} = world output in the particular Year j ; and n_{oo} = the output of world in all study period. $AI=100$ means country's effort corresponds to the world average. When $AI > 100$, it indicates country's higher activity than world average, and $AI < 100$ means country's effort is lower than world average. AI of India and China for different years are calculated to demark the periodic variations. India's activity for 2008-2012 is less than world average. From 2013-2017, it crossed the world average and reaches its peak as 139.99 in 2017. From 2012 onwards research activity regularly consistently increases. Where as China's activity is not consistent as it has higher world average during 2009-2011 and rest of the years it has lower activity than world average.

citation pattern of India and China. As we see total 1353 papers of India received 10484 citations where as 2281 papers of China received 14083 citations during the period. India's 484 (35.77%) papers remained uncited where as China's 1164 (51.03%). Citation per paper of India is 7.75 and of China is 6.17 for the study period. Among the list, papers having one citation is more in both India and China. Instead of higher citations of China, India's uncited papers are less and citation per paper is higher than China.

Table 3. Citation Pattern of India and China - A Comparison

Citation Extent	India			China		
	Papers	%age	Cit	Papers	%age	Cit
0	484	35.77	0	1164	51.03	0
1	195	14.41	195	304	13.33	304
2	97	7.17	194	143	6.27	286

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3	80	5.91	240	82	3.59	246	
4	61	4.51	244	73	3.20	292	
5	48	3.55	240	41	1.80	205	
6	40	2.96	240	55	2.41	330	
7	43	3.18	301	32	1.40	224	
8	20	1.48	160	31	1.36	248	
9	16	1.18	144	25	1.10	225	
10	25	1.85	250	27	1.18	270	
11	20	115	8.50	1659	130	5.70	1890
21	30	50	3.70	1271	71	3.11	1792
31	40	30	2.22	1068	26	1.14	946
41	50	11	0.81	485	18	0.79	822
51	100	28	2.07	1868	48	2.10	3355
100<	10	0.74	1925	11	0.48	2648	
Total	1353	100.00	10484	2281	100.00	14083	

Research Impact (i) and Exergy Indicator (X)

H-index is commented of having biasness towards older articles as it counts citations received during whole life span of an author. Prathap¹³ suggested a robust performance indicator called as Exergy indicator (X). $X = iC = i^2 P$. $i = C/P$. He called it as a better indicator to measure impact than

citation (C) itself. In table 4 research impact and Energy Indicator of India and China is displayed. It is observed that during 2008-2011 the impact and Exergy (X) of India supersedes China and then opposite is the case during 2012-2017.

Table 4. Research Impact and Energy Indicator of India vs. China

Year	India output (%)	India Impact (i)	China output (%)	China Impact (i)	Exergy (X) India	Exergy (X) China
2008	6.36	26.64	4.82	12.46	61031.17	17087.65
2009	5.47	11.72	10.13	5.46	10157.96	6883.64
2010	7.76	13.69	19.82	5.3	19666.37	12711.52
2011	7.46	11.16	21.35	3.96	12575.53	7632.82
2012	8.65	11.48	8.15	13.94	15415.8	36148.65
2013	9.9	7.43	7.23	9.38	7403.1	14523.05
2014	10.13	5.89	7.67	5.22	4753.64	4773.69
2015	10.57	3.87	6.8	6.12	2138.52	5798.09
2016	15.82	3.1	7.32	4.79	2060.26	3832.34
2017	17.89	1.65	6.71	2.11	657.86	681.89
Average		9.66		6.87		

Document Types

The distribution of research outputs of India and China in different document types is discussed in table 5. Total nine document types are used by Indian researchers and ten by Chinese researchers to disseminate the business research. Indian research in business is greatly distributed in article

(72.06%), then conference paper, while China's most preferred document type is conference paper (60.41%) and then article. However article, conference paper and book chapter are the major carrier of business research in India as well as China during the period.



Table 5. Research Output of India and China by Document Type

Doc Type	India		China	
	Out Put	%age	Out Put	%age
Article	975	72.06	777	34.06
Book	51	3.77	34	1.49
Book Chapter	117	8.65	47	2.06
Conference Paper	139	10.27	1378	60.41
Review	61	4.51	26	1.14
Others	10	0.74	19	0.83
Total	1353	100.00	2281	100.00

Collaborative Research

Authorship Pattern/ Degree of Author Collaborations

Any research paper carried out by more than one author is considered as collaborative research. The period when first journal was published witnessed the interest among scientific researchers for collaboration. Different factors like rising cost of instruments, rapid development of telecommunication etc led the researchers for collaborative efforts. Collaboration brings visibility of research. The degree of collaboration varies among different disciplines and was found to be high in technical publications. In present days collaborative efforts are preferred in many other disciplines as discussed by Khaparde and Pawar¹⁴ in IT, Zafrunnisha and Pullareddy¹⁵ in Psychology, Mishra and Ramesh¹⁶ in business, Thavamani¹⁷ in Librarianship. Earlier studies show that there is strong association between collaborative effort and productivity and between collaborative effort and research funding. Collaborations may be among authors, institutions, subjects and nations.

Bibliometric methods offer various ways to determine the extent of collaboration. Annual degree of collaboration of authors in India as well as China in business research is displayed in table 6. Through multi authored papers extent of collaborative research of author's can be known. Subramanyam's¹⁸ formula is applied to determine the ratio of collaboration among authors. The formula is $C = Nm / (Nm + Ns)$, Where C= Degree of Collaboration in a subject, Nm= Number of papers with multi authors, Ns= Number of papers with Single authors. Out of 1353 papers of India single authored papers are 349 and multi authored papers are 1004. Collaboration reached it peak in 2015. For the total study period the degree of collaboration is 0.74.

In China greater collaboration is found in 2008 and 2015. For the whole study period the degree of collaboration is 0.81. Though productivity of China started to decrease from 2012 onwards, its collaborative trend is not affected. However the collaborative trend of both countries is found to be upward and greater in China than India.

Table 6. Degree of Collaborations of India and China

Year	India			Degree of Coll (C)	China			Degree of Coll (C)
	Single Auth Papers (Ns)	Multi Auth Papers (Nm)	Total		Single Auth Papers (Ns)	Multi Auth Papers (Nm)	Total	
2008	26	60	86	0.70	10	100	110	0.91
2009	29	45	74	0.61	40	191	231	0.83
2010	26	79	105	0.75	108	344	452	0.76
2011	25	76	101	0.75	130	357	487	0.73
2012	36	81	117	0.69	21	165	186	0.89
2013	34	100	134	0.75	31	134	165	0.81
2014	31	106	137	0.77	34	141	175	0.81
2015	32	111	143	0.78	14	141	155	0.91
2016	52	162	214	0.76	18	149	167	0.89
2017	58	184	242	0.76	16	137	153	0.90
Total	349	1004	1353	0.74	422	1859	2281	0.81

International Collaboration

The culture of international research collaboration is constantly increasing. Now a day's research is becoming more international. It enhances knowledge, attract funding, increase productivity, impact and creativity. Researchers are easily reaching to their global colleagues and community. Today's digital environment is making international collaboration easier. The table 7 represents international collaboration of India and china. Out of 1353 papers, India

published 343 papers abroad collaborated with 63 countries where as out of 2281 papers, China published 990 papers abroad collaborated with 62 countries. United States and United Kingdom are the common highly collaborated countries of both India and China. India and China jointly published 10 papers in business. China is the 6th collaborating country of India and India is the 17th collaborating country of China.

Table 7. International Collaboration of India vs. China in Business research

Country	India		China	
	Coll Papers	%age	Coll Papers	%age
United States	85	24.78	283	28.59
United Kingdom	39	11.37	106	10.71
Germany	9	2.62	24	2.424
Australia	18	5.25	86	8.687
Spain	5	1.46	9	0.909
Others	187	54.52	482	48.69
Total	343	100.00	990	100

Subject Scattering

Table 8 shows Subject Scattering of Business Research in India and china. For the purpose of study, Business Management and Accounting subject area of Scopus database is selected and found 36192 papers. Due to multi disciplinary nature of research, business research is also disseminated in collaboration with various other subjects.

Global and Indian business research is Scattered in 23 and 20 collaborating subjects respectively and greatly in Economics, Econometrics and Finance, following Decision Sciences, Social Sciences and Computer Sciences. Where as China's research is scattered in 16 subjects namely Computer Science, Decision Sciences, Economics, Econometrics and Finance, and Social Sciences.

Table 8. Subject Collaboration of Business Research in India and china

Subjects	World		India			China		
	TP	%age	TP	TC	CP	TP	TC	CP
Economics, Econometrics and Finance	7998	22.10	304	1105	3.63	406	2872	7.07
Decision Sciences	7825	21.62	295	3769	12.78	588	3872	6.59
Social Sciences	5963	16.48	159	1032	6.49	342	2246	6.57
Computer Science	5634	15.57	154	1056	6.86	696	1901	2.73
Engineering	5576	15.41	180	2470	13.72	460	3211	6.98
Mathematics	1630	4.50	24	359	14.96	30	388	12.93
Arts and Humanities	1548	4.28	40	92	2.30	69	744	10.78
Environmental Science	934	2.58	47	357	7.60	45	718	15.96
Psychology	547	1.51	22	160	7.27	19	222	11.68
Energy	494	1.36	20	161	8.05	25	578	23.12
Medicine	357	0.99	7	30	4.29	13	21	1.62
Materials Science	264	0.73	10	0	0.00	5	2	0.40
Agricultural and Biological Sciences	260	0.72	10	50	5.00	1	2	2.00
Total	36192		1353	10484	7.75	2281	14083	6.17

Here average citation per paper (CP) of China is 8.34 where as India's CP is 7.15 for these subjects. Instead of

this, for total subjects India's research impact is higher as its citation per paper is 7.75 and higher than China.

Future Growths

Table 9. Business Research - A Time Series Analysis

Year	Y _{World}	Y _{India}	Y _{China}	X (Year Code)	X ²	XY _{World}	XY _{India}	XY _{China}
2008	2836	86	110	-9	81	-25524	-774	-990
2009	3224	74	231	-7	49	-22568	-518	-1617
2010	3513	105	452	-5	25	-17565	-525	-2260
2011	3706	101	487	-3	9	-11118	-303	-1461
2012	3236	117	186	-1	1	-3236	-117	-186
2013	3623	134	165	1	1	3623	134	165
2014	3317	137	175	3	9	9951	411	525
2015	3674	143	155	5	25	18370	715	775
2016	4439	214	167	7	49	31073	1498	1169
2017	4624	242	153	9	81	41616	2178	1377
Total	36192	1353	2281	0	330	24622	2699	-2503

The table 9 tries to predict future growth of business research of World, India and China in 2025 applying time series analysis. Time series¹⁹ is a technique used in statistics, pattern recognition, mathematical finance, earthquake prediction, weather forecasting, astronomy, engineering, science etc. It is a method of application of a model to predict or statistically infer or forecast future values which rely on earlier observed values. It is applied on time series data means data series of a particular time period or a particular time interval.

The model is $Y = a + bx$. $a = \sum Y / N$, $b = \sum XY / \sum X^2$ and Here $X = 25$.

Estimated World publication in Business for 2025 is:

$$a = 36192 / 10 = 3619.2, \quad b = 24622 / 330 = 74.61, \quad a + bx = 3619.2 + (74.61 * 25) = 5484.45.$$

Estimated Indian publication in Business for 2025 is

$$a = 1353 / 10 = 135.3, \quad b = 2699 / 330 = 8.18, \quad a + bx = 135.3 + (8.18 * 25) = 339.80.$$

Estimated China's publication in Business for 2025 is

$$a = 2281 / 10 = 228.1, \quad b = -2503 / 330 = -7.58, \quad a + bx = 228.1 + (-7.58 * 25) = 38.60.$$

Depending on the existing publication pattern the formula works out business literature in 2025 of world will be 5484.45, of India will be 339.80 and of China will be 38.60. Here we can notice in case of world and India there will be positive growths, where as China is predicted to have negative growths. If we see existing publications pattern, publication of world and India will increase where as China will decrease.

If the publication rate will continue in this way, in near future India may grow to a stronger nation in business research and at the same time China may lose its identity in global market.

CONCLUSION

The comparative study of India and China in business research finds out that there are 36,192 global publications. United States and United Kingdom have highest productivity. China ranks three with 2281 and India ranks six with 1353 papers. But if we see its annual publication trend, in earlier period of 2008-2011 it has a rapid growth and from 2012 there is publication fall which also affects its world share and Activity Index. In case of India, a consistent and regular growth of publication, world share and Activity Index is found. During the period, India received 10484 citations where as China received 14083. Instead, the average impact and Exergy (X) of India is higher than China. We can say during 2012-2017 China published quality papers than the earlier period. Article, conference paper and book chapter are the major carrier of business research in India as well as China during the period. The author collaborative trend of both the countries is upward and higher in China (0.81) than India (0.74).

India published 343 (25.35%) papers abroad collaborated with 63 countries where as China published 990 (43.40%) papers abroad collaborated with 62 countries. India and China jointly published 10 papers in business. China is the 6th collaborating country of India and India is the 17th collaborating country of China. Global, Indian and China's business literature is disseminated in collaboration with 23, 20 and 16 subjects respectively. Based on present publication trend it is estimated that India may grow to a stronger nation in business research where as China may lose its identity in global market.

REFERENCE

1. Zarah, L. (2018). 7 reasons why research is important. Retrieved on Dec 04, 2018, from <https://owlcation.com/academia/Why-Research-is-Important-Within-and-Beyond-the-Academe>
2. Garg, K. C. (2002). Scientometrics of laser research in India and China. *Scientometrics*, 55(1), 71-85.
3. Arunachalam, S., & Gunasekran, S. (2002). Diabetes research in India and China today: from literature based mapping to health care policy. *Current Science*, 82(9), 1086-1097.
4. Dhawan, S. M. (1998). Comparative study of physics research in India and China based on INSPEC Physics for 1990 and 1995. *Scientometrics*, 43(3), 423-441.
5. Chatterjee, D., & Sahasranamam, S. (2017). Technological innovation research in China and India: A bibliometric analysis for the period 1991–2015. *Management and Organization Review*. Doi: <http://dx.doi.org/10.1017/mor.2017.46>
6. Kumar, S., & Garg, K. C. (2005). Scientometrics of computer science research in India and China. *Scientometrics*, 64(2), 121-132.
7. Mittal, S. K., & Pillania, R. (2014). Business research in India. *The Journal of Management Development*, 33(2), 68-74. doi: <http://dx.doi.org/10.1108/JMD-12-2013-0156>
8. Zhu, J., Hassan, S., Mirza, H. T., & Xie, Q. (2014). Measuring recent research performance for Chinese universities using bibliometric methods. *Scientometrics*, 101(1), 429-443. Doi: 10.1007/s11192-014-1389-1
9. Frame, J. D. (1977). Mainstream research in Latin America and Caribbean. *Interciencia*, 2(2), 143-147.
10. Schubert, A., & Braun, T. (1986). Relative indicators and relational charts for comparative assessment of publication output and citation impact. *Scientometrics*, 9(5-6), 281-291.
11. Garg, K. C., & Padhi, P. (1999). Scientometrics of laser research literature as viewed through the Journal of Current Laser Abstracts. *Scientometrics*, 45(2), 251-268.
12. Varaprasad, S. J. D., & Ramesh, D. B. (2011). Activity and growth of chemical research in India during 1987-2007. *DESIDOC Journal of Library and Information Technology*, 31(5), 387-394.
13. Prathap, G. (2011). The Energy-Exergy-Entropy (or EEE) sequences in bibliometric assessment. *Scientometrics*, 87(3), 515-524.
14. Khaparde, V., & Pawar, S. (2013). Authorship Pattern and Degree of Collaboration in Information Technology. *Journal of Computer Science & Information Technology*, 1(1), 46-54.
15. Zafrunnisha, N., & Pullareddy, V. (2009). Authorship Pattern and Degree of Collaboration in Psychology. *Annals of Library and Information Studies*, 56, 255-261.
16. Mishra, R., & Ramesh, D. B. (2018). A study of authorship pattern and degree of collaboration in business research during 1998-2017. *International Journal of Information Dissemination and Technology*, 8(3), 150-153.
17. Thavamani, K. (2015). A Study of Authorship Patterns and Collaborative Research in Collaborative Librarianship, 2009-2014. *Collaborative Librarianship*, 7(2), Article 6. doi: <https://digitalcommons.du.edu/collaborativelibrarianship/vol7/iss2/6>
18. Subramanyan, K. (1983). Bibliometric studies of research collaboration: A review. *Journal of Information Science*, 6 (1), 33-38.
19. Time series. (2018). Retrieved on Dec 05, 2018, from https://en.wikipedia.org/wiki/Time_series