

Mapping of Computer Communication Research Output among Indian Scientists (1976-2009): A Scientometric Study

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Abstract

This study has analyzed the findings of a scientometric analysis of Computer Communication research publications in India during the period 1976–2009. The sample data was downloaded from the database of SCI, SSCI and AHCI from Web of Science. The search key term used for getting data is computer communication; the total number of records is 176. The methodology chosen for this paper is the scientometric method by way of growth rate, areas of research concentration, author productivity and authorship pattern. The study shows the growth rate has been varied during the selected periods. It is showed from this analyses that majority of papers are multi-authored. The ranking of authors based on their publications shows that 'Aggarwal KK' in first place with 12 records with 157 Global Citation Scores. The journals articles occupied the predominant place among the other sources of publication.

Keywords: Authorship Pattern, Computer Communication, Prolific Author, Research Productivity, Scientometric Study

1. INTRODUCTION

The term Scientometrics originated as a Russian term for the application of quantitative methods to the history of science [1], but its scope and objectives have widened considerably. Scientometrics studies characterize the disciplines using the growth pattern and other attributes [2]. These studies have potential particularly in assessing the emerging disciplines. In the present study, we studied the Scientometrics study of the research performance on computer communication, a significantly growing area in the knowledge-driven world [3].

2. OBJECTIVES OF THE STUDY

The main objectives framed for the present study are:

- a) To identify the year-wise growth rate of Computer Communication literature;
- b) To find the prolific authors and analyses the authorship pattern and examine the research Collaboration;
- c) To assess the Institution-wise research concentration in Computer Communication;

- d) Test the applicability of scientometric indicator tools of Lotka's law and Bradford's law.

3. METHODOLOGY

The study entitled "Mapping of Computer Communication Literatures research output among Indian Scientists: A Scientometric Study" is a case study encompassing records output on Science from Science Citation Index (SCI), Social Science Citation Index (SSCI) and Arts and Humanities Citation Index available on online (Web of Science) [4]. The present study aims to analyse the research output of researchers in the field of Computer Communication. The growth rates of output in terms of both at absolute level and relative level are analysed from 1976 to 2009. The authorship pattern and author productivity are examined to identify the pattern of research contribution in the field of computer communication [5]. The area-wise research performance is analysed to identify the emerging area of research. Further, an attempt is made to measure the performance of researchers and their research concentration in the field of computer communication and it is also analytical in nature in

strengthening the empirical validity due to application of suitable statistical tools [6].

4. DATA ANALYSIS AND INTERPRETATION

4.1 Growth of Publications

To analyse the year-wise publication of research on computer communication, the data has been presented in Table 1. The table depicts the research output in the Indian

level. From the below table, we could clearly see that during the period 1976-2009 a total of 176 publications were published. The highest publication is 14 in 1996 and 2009 with 11 and 4 Global Citation Scores followed by 13 papers in 1994 with 15 Global Citation Scores (GCS) and 11 papers in 1993, 2007 and 2008 with 49, 23 and 5 Global Citation Scores. The lowest publication is each one in 1976, 1977, 1986, 1987 and 1988.

Table 1 Year - Wise Distribution of Computer Communication Literatures 1976 - 2009)

S.No	Year	R.o/p	%	TLCS	TGCS
1	1976	1	0.6	0	0
2	1977	1	0.6	0	0
3	1981	3	1.7	2	64
4	1982	3	1.7	2	61
5	1983	3	1.7	0	0
6	1984	1	0.6	0	15
7	1985	2	1.1	0	6
8	1986	1	0.6	0	1
9	1987	1	0.6	0	1
10	1988	1	0.6	0	34
11	1990	5	2.8	0	8
12	1991	5	2.8	0	23
13	1992	3	1.7	1	54
14	1993	11	6.3	0	49
15	1994	13	7.4	2	15
16	1995	7	4.0	2	31
17	1996	14	8.0	0	11
18	1997	6	3.4	0	26
19	1998	7	4.0	0	4
20	1999	8	4.5	1	23
21	2000	5	2.8	0	38
22	2001	5	2.8	0	10
23	2002	8	4.5	0	47
24	2003	6	3.4	0	34
25	2004	7	4.0	0	28
26	2005	8	4.5	0	30
27	2006	5	2.8	2	8
28	2007	11	6.3	0	23
29	2008	11	6.3	0	5
30	2009	14	8.0	0	4

4.2 Authorship Pattern

The Authorship Pattern of Computer Communication Research in Indian level is analysed and the results in the Table 2 depicts that majority of papers are multi-authored. Articles having single authors constitute only 17.05 % of the total paper, followed by 82.95% multiple authors. It clearly brings out that collaborative research in the field dominates. Authors are ranked by number of publications. By clicking on the all-author hotlink, the most-published author in computer communication displayed and is presented in the Table 2. Hotlinks also permit display of the authors by Global or Local Citation Score. Thus the most-cited authors are distinguished from the most-published ones. The individual citation frequencies for these papers are totaled. The table shows that among the author, Aggarwal KK in first place with 12 records followed by others.

4.3 Document-Wise Distribution

The highest number of publications were 148(84.1%) in journals articles with six Total Local Citation Scores and 557 Total Global Citation Scores and other publications were 15(8.5%) in conference proceedings, eight (4.5%) in Reviews, four (2.3%) in Notes, one (0.6%) in Letter. In the context of Indian level 84% papers were published in journal articles and other publication followed by other forms.

Table 2 Ranking of Prolific Authors by Number of Publication (Top 50 Authors)

S.No*	Author/s	R.o/p	TLCS	TGCS
1	AGGARWAL KK	12	4	157
2	SOI IM	7	1	19
3	GUPTA UC	5	0	22
4	SINHA BP	5	1	30
5	MUKHERJEE A	4	4	12
6	PATNAIK LM	4	1	51
7	RANA VS	4	0	1
8	SAHA D	4	4	15
9	CHAKRAVARTI AK	3	0	1
10	CHOPRA YC	3	2	76
11	DAS S	3	0	1
12	MAHESHWARI RP	3	2	8
13	PANDA G	3	0	5
14	SHARMA AK	3	0	3
15	ANVEKAR DK	2	0	0
16	BAJWA JS	2	2	61
17	BANDYOPADHYAY AK	2	0	3
18	BHALJA B	2	2	4
19	BHATTACHARYA M	2	0	6
20	BHUNIA CT	2	0	7
21	DAS D	2	1	16
22	DASGUPTA S	2	0	2
23	GUPTA M	2	0	0
24	GUPTA R	2	0	1
25	KAMAL TS	2	0	2

Sl.No.	Author/s	R.o/p	TLCS	TGCS
26	Kekre HB	2	0	1
27	KORIE SM	2	0	0
28	KUMAR A	2	0	34
29	KUMAR JM	2	1	51
30	KUMAR S	2	0	0
31	KUMAR V	2	0	10
32	MAJUMDER A	2	0	1
33	MURTHY CSR	2	0	32
34	PAL S	2	0	6
35	PATHAK SS	2	0	11
36	RAI S	2	1	86
37	RAO TSSS	2	0	6
38	SARNOT SL	2	0	4
39	SHARMA V	2	0	1
40	SINGH IV	2	0	6
41	SINGH P	2	0	5
42	TIWARI GN	2	0	13
43	TOYAMA K	2	0	2
44	VENKATARAM P	2	0	19
45	ABRAHAM A	1	0	1
46	ADYA M	1	0	0
47	AGARWALA RA	1	0	1
48	AGNIHOTRI RK	1	0	0
49	AGRAWAL DP	1	0	34
50	ANAND S	1	0	2

Table 3 Document-Wise Distribution of the Computer Communication Output

S.No.	Document Type	R.o/p	%	TLCS	TGCS
1	Article	148	84.1	6	557
2	Proceedings Paper	15	8.5	1	34
3	Review	8	4.5	2	31
4	Note	4	2.3	3	27
5	Letter	1	0.6	0	4
	Total	176	100	12	653

4.4 Scattering of Journals

The articles of computer communication, which appears in various journals, have been ranked and the top 10 journals are displayed in Table 4. The results are self-explanatory by stating that the journal of "Microelectronics and Reliability" is stands in rank one followed by the journal of "Computer Communications" is rank two followed by the other journals having lesser publication contributions.

4.5 Distribution of Institution-Wise Research Productivity

Table 5 indicates Institution-wise research productivity. It is noted that Indian Institute of Technology ranks first in order by contributing 39(22.2%) with 138 Global Citation Scores of total research output. The second place in order is recorded by Regional Engineering College, which shares 15(8.5%) with 104 Global Citation Scores, Indian Institute of Science 13(7.4%) with 71 Global Citation Scores and other Institutions have contributed less than 10 Publications.

Table 4 Scattering of Articles in Different Journals (Top 10)

S.No .	Journal Name	R.o/p	%	TLCS	TGCS
1	Microelectronics and Reliability	14	1.290	2	93
2	Computer Communications	11	0.884	4	33
3	IETE Technical Review	10	0.025	0	10
4	Electronics Information & Planning	9	0.024	0	5
5	IETE Journal of Research	6	0.059	0	2
6	Current Science	5	0.973	0	17
7	Defence Science Journal	4	0.118	0	0
8	Journal of the Institution of Electronics and Telecommunication Engineers	4	0.031	0	5
9	Computers & Electrical Engineering	3	0.443	0	0
10	Electric Power Components and Systems	3	0.376	2	4

Table 5 Institution-Wise Distribution of Computer Communication Literatures (Top 10)

S.No .	Journal Name	R.o/p	%	TLCS	TGCS
1	Indian Institute of Technology	39	22.2	2	138
2	Regional Engineering College	15	8.5	2	104
3	Indian Inst Science	13	7.4	1	71
4	Jadavpur University	8	4.5	4	20
5	Indian Stat Inst	5	2.8	1	36
6	Anna University	4	2.3	0	10
7	Indian Space Research Org	3	1.7	0	0
8	National Inst Technology	3	1.7	0	1
9	University of Calcutta	3	1.7	0	1
10	Birla Inst Technology & Science	2	1.1	0	6

4.6 Subject-Wise Distribution of Publications

It is evident from the Table 6 that most of the articles (45.45%) covered in the field of Engineering, Electrical and Engineering and followed by Telecommunications (19.89%), Computer Science, Information System (11.36%), Hardware and Architecture (10.80%) and others in various disciplines.

4.7 Collaborative Geographical Research Output

Table 7 identifies the countries with which India collaborates in the field of Computer Communication research. USA and UK appear nine and four times in the addresses of the authors in the database and are in the top of the list. Canada, Germany, Netherlands, Norway, Singapore and Southkorea follow with three and one appearances respectively.

Table 6 Subject-Wise Distribution of Publications

S.No.	Subject	R.o/p	% of 176
1	Engineering, Electrical & Electronic	80	45.45
2	Telecommunications	35	19.89
3	Computer Science, Information Systems	20	11.36
4	Computer Science, Hardware & Architecture	19	10.80
5	Computer Science, Interdisciplinary Applications	16	9.09
6	Computer Science, Theory & Methods	15	8.52
7	Physics, Applied	15	8.52
8	Nanoscience & Nanotechnology	14	7.95
9	Computer Science, Software Engineering	11	6.25
10	Multidisciplinary Sciences	10	5.68
11	Engineering, Multidisciplinary	8	4.55
12	Information Science & Library Science	8	4.55
13	Operations Research & Management Science	8	4.55
14	Engineering, Industrial	7	3.98
15	Mathematics, Applied	7	3.98
16	Computer Science, Artificial Intelligence	5	2.84
17	Management	5	2.84
18	Mechanics	5	2.84
19	Optics	4	2.27
20	Computer Science, Cybernetics	3	1.70
21	Energy & Fuels	3	1.70
22	Thermodynamics	3	1.70
23	Automation & Control Systems	2	1.14
24	Engineering, Aerospace	2	1.14
25	Engineering, Civil	2	1.14
26	Mathematics, Interdisciplinary Applications	2	1.14
27	Physics, Multidisciplinary	2	1.14
28	Physics, Nuclear	2	1.14
29	Agriculture, Multidisciplinary	1	0.57
30	Astronomy & Astrophysics	1	0.57

Calculation of h-index

The h-index is based on a list of publications ranked in descending order by the Times Cited. The value of h is equal to the number of papers (N) in the list that have N or more citations. This metric is useful because it discounts the disproportionate weight of highly cited papers or papers that have not yet been cited.

Table 7 Geographical Distribution of Papers

S.No.	Author/s	R.o/p	%	TLCS	TGCS
1	India	175	99.4	12	651
2	USA	9	5.1	0	40
3	UK	4	2.3	0	8
4	Canada	3	1.7	0	4
5	Germany	3	1.7	0	10
6	Netherlands	1	0.6	0	1
7	Norway	1	0.6	0	1
8	Singapore	1	0.6	0	0
9	South Korea	1	0.6	0	0

Calculating the h-index Value

The h-index factor is based on the depth of the Web of Science subscription and the selected time span. Items that do not appear on the Results page will not be factored into the calculation. If the subscription depth is 10 years, then the h-index value is based on this depth even though a particular author may have published articles more than 10 years ago. Moreover, the calculation only includes items in Web of Science - books and articles in non-covered journals are not included.

Results found	: 176
Sum of the Times Cited	: 653
Average Citations per Item	: 3.71
h-index	: 13

5. FINDINGS AND CONCLUSION

The trend towards collaborative research is gaining currency day-by-day. Every work of researchers depends purely on the library because it contains more sourceable information. The research in the field of Computer Communication has become an important entity wherein more and more researchers help to make it innovative.

The above analysis explicit the following findings and results from the observations:

- The year - wise distribution of research output on Computer Communication brings out the fact that the highest publication is 14 in 1996 and 2009.
- The authorship pattern of Computer Communication research identified that majority of papers are multi-authored.
- The ranking of authors based on their publications shows that Aggarwal KK in first place with 12 records with 157 Global Citation Scores.

- The source-wise distribution of research output brings out the fact that the journals articles occupied the predominant place among the other sources of publication.
- The ranking of source brings out the fact that the highest numbers of publications were 148(84.1%) published in Journal articles with 557 Global Citation Scores.

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