

SCIENTOMETRIC HIGHLIGHTS ON SCIENCE AND TECHNOLOGY REVIEW ARTICLES AFFILIATED TO INDIA

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Abstract

Garfield^[9] stated that review articles often serve as surrogates for earlier literature, thus avoiding extensive bibliographies. The present study has focused on the review articles written by researchers in India and included in *Science Citation Index* during the period 2000-2005. The study has aimed at analysing chronological growth of these review articles; authorship pattern and author productivity; authors' affiliations and collaborations; journals publishing review articles; subject contents of the review articles; keywords associated with the review articles; and synchronous references in the review articles.

Keywords: Review Articles; Scientometrics; Bibliometrics; Publication Productivity; Author Productivity; Institutional Productivity; Country Collaboration; Synchronous References; Content Analysis; keyword Analysis

1. INTRODUCTION

Review Articles synthesize and evaluate recent progress in an area. Good Review Articles are explicit accounts of what the vast majority of experienced scientists in a field consider to be the acceptable facts and the significant relationships among these facts. Comprehensive Review Articles precisely identify, but do not necessarily exclude, that which is still regarded as speculation and may provide other experienced researchers in the field with strong indications of what is ripe for scientific inquiry. Review Articles are an essential part of the continuous reassessment of the current stage of scientific knowledge in a field, and such reassessment is not simply a matter of retrieving and synthesizing piecemeal, discrete facts^[1].

A complete and concise Review Article of an area can be of great help to a researcher new to that field. Review Articles in a particular area help in bypassing the compilation of bulk bibliographies in that field, and that way saves the time of the researcher. In this regard, Garfield^[9] stated that Review Articles often serve as surrogates for earlier literature, thus avoiding extensive bibliographies. A good Review Article should present the controversial data, and perhaps that will stimulate ideas for other experiments to resolve the controversy^[2]. Given the increasing volume of literature and the limited time for reading that, busy researchers have, reliance on Review Articles is likely to increase, even though concerns have been raised that narrative and nonsystematic Review Articles may produce biased conclusions^[3]. Systematic Review Articles are cited more often than narrative Review Articles, an indirect endorsement of the 'hierarchy of evidence'^[4]. Review Articles constitute a form of original research, albeit done in the library rather than in the laboratory^[5]. Review Articles are of primary importance as a scholarly output. Review Articles also become a secondary source in order to access older primary literature. The author(s) of Review Articles provides a major service by agreeing to carryout a more or less

comprehensive literature search from some particular self-selected vantage point. A good Review Article accomplishes much more than merely collecting facts otherwise widely dispersed across a host of primary sources. The principal objective is to establish some degree of order among the facts. To the extent that this entails passing judgments, the reviewer(s) actually becomes something of a “trend setter” with respect to future research. In an age suffering under increasing fragmentation of knowledge, Review Articles assume its important role. Thus, Review Articles present information drawn from a large number of (selected) original papers, organized and analyzed for the purpose of educating the reader regarding the current status of some narrow field of specialization.

Review Articles are viewed as a transitional phase between primary research literature on one hand and books on the other. Editor(s) of serials solicit commissioned Review Articles. Hence, an invitation to write a Review Article should be cherished as compelling evidence that one’s expertise has been recognized^[6] for higher-level of publication. Editors play an especially important role in the enforcement of standards governing communication, with indispensable support from a host of dedicated and conscientious Review Articles.

Modern science & technology is heavily dependent upon the notion that reported results will always be verifiable. Publications in reputable serials implies that reported findings and observations are capable of surviving in every way the potential test of replication by one’s peers within the discipline.

Present study attempts to do quantitative documentation of ‘Review Articles’ published during 2000-2005 and having India in the affiliation of authors. The target of the present study are: journal editors of science publications; publication policy makers; quality controllers of R&D; scientometricians; documentalists; knowledge managers; information scientists; historians of science etc.

2. MATERIALS, METHODS AND LIMITATIONS

Science Citation Index (SCI) © CD-ROM version is serviced by the Thomson Corporation (earlier Institute for Scientific Information (ISI), Philadelphia). Any article having 100 or more synchronous references are considered as ‘review’ by *SCI*, besides all articles categorised as ‘review article’ by the sources/channels of communications. Records with ‘Review’ in Document type field are extracted out from the results of the search ‘India’ in the ‘Address word’ field for the publication period between 2000-2005.

Numerical ‘Impact Factors (IF)’ and ‘Immediacy Index (II)’, are revised annually and published as *Journal Citation Reports (JCR)-2004*, a companion volume to *SCI*^[7-8], was consulted as per requirement of documentation. The classification of the journals given in *Journal Citation Reports (JCR)-2004*, is made use of for the broad classification of the Review Articles. The well Known bibliometric/informetric/scientometric methods are followed consistently in the present exploratory study.

The term Synchronous References refers to the references at the end of each and every Review Articles under study.

3. RESULTS AND DISCUSSION

The search resulted in a total of 2042 records and these records are analysed as per the objective of the study. The results and discussions based on these are briefly explained as follows:

3.1 Chronological growth of Review Articles

The publication years of the 2042 records are analysed and the results are presented graphically in Figure 1. It has observed a nominal growth in number of published Review Articles during the 2000-2005 as per *Science Citation Index*. The average yearly growth rate has also been calculated from the data and found as 11.04.

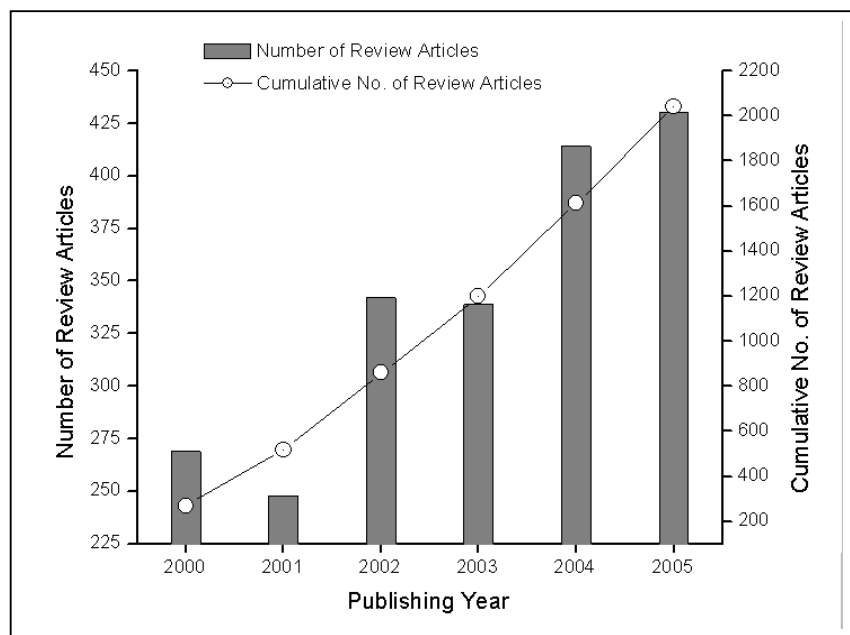


Figure 1.: Chronological growth in number of published Review Articles in *Science Citation Index* (2000-2005)

3.2 Authorship pattern and Author productivity

The extent of collaboration in writing Review Articles is analysed and it has been found that 85.16 per cent of the total Review Articles are written in collaboration. Among these collaborated Review Articles, collaboration of two, three and four authors constitute more than 70 per cent. Table 1 shows year-wise collaboration pattern observed in the Review Articles taken into consideration. On the extreme end, 255 different authors have collaborated for writing a Review Article.

Table 1: Publication year-wise number of authorships observed in the Review Articles in *Science Citation Index* (2000-2005)

Number of author(s)	Publications Year						2000-2005		
	2000	2001	2002	2003	2004	2005	Total Review	Percentage	Cumulative Percentage
1	34	40	51	55	68	55	303	14.84	14.84
2	105	85	122	98	128	141	679	33.25	48.09
3	68	67	83	86	113	103	520	25.47	73.56
4	35	28	44	40	60	55	262	12.83	86.39
5	15	12	11	31	17	32	118	5.78	92.16
6	8	7	15	13	10	18	71	3.48	95.64
7		2	2	2	9	8	23	1.13	96.77
8	2	2	5	2	1	4	16	0.78	97.55
9		2	5	3	2	3	15	0.73	98.29
10				1		4	5	0.24	98.53
11		1				1	2	0.10	98.63
12					1	1	2	0.10	98.73
13				1		1	2	0.10	98.82
15		1	1			1	3	0.15	98.97
16		1		1			2	0.10	99.07
17				2	1		3	0.15	99.22
18			1				1	0.05	99.27
19				1			1	0.05	99.31
22					1		1	0.05	99.36
23	1						1	0.05	99.41
25				1	1	1	3	0.15	99.56
26				1	1		2	0.10	99.66
32				1			1	0.05	99.71
36			1				1	0.05	99.76
53					1		1	0.05	99.80
140			1				1	0.05	99.85
166						1	1	0.05	99.90
225						1	1	0.05	99.95
255	1						1	0.05	100.00
Total no. of collaborated Review Articles	235	208	291	284	346	375	235	85.16	-
Total no. of Review Articles	269	248	342	339	414	430	2042	100.00	-

The 2042 Review Articles under study is the collective work of 5135 individual authors and the study has identified those authors. The top thirty authors with their latest affiliation and the number of internationally collaborated Review Articles is given in Table 2. Authors from Bhabha Atomic Research Centre, Mumbai, India are in the forefront among the most productive review writers.

Table 2: Top 30 authors in descending order of authorship credits observed in the Review Articles in *Science Citation Index* (2000-2005)

Rank	Author	Affiliation	Number of authorship credits	ICR*
1	Mukherjee-T	Bhabha Atomic Research Centre-Mumbai	20	2
2	Mohan-H	Bhabha Atomic Research Centre-Mumbai	10	0
3	Kishore-K	Bhabha Atomic Research Centre-Mumbai	9	0
3	Kapoor-S	Bhabha Atomic Research Centre-Mumbai	9	1
3	Rao-CNR	Indian Institute of Science-Bangalore	9	4
3	Padmanabhan-T	Inter Univ Ctr for Astron & Astrophys-Pune	9	2
3	Banerjee-UC	Natl-Inst-Pharmaceut-Educ-&-Res-Mohali	9	3
3	Sinha-VR	Punjab University-Chandigarh	9	0
3	Sehgal-VN	Sehgal Nursing Home-New Delhi	9	0
4	Naik-DB	Bhabha Atomic Research Centre-Mumbai	8	1
4	Nair-V	CSIR, Reg Res Lab-Trivandrum	8	0
4	Jain-RK	Inst Microbial Technol-Chandigarh	8	1
4	Tuteja-N	Int Ctr Genet Engr & Biotechnol-New Delhi	8	1
4	Mohan-V	Madras Diabet Res Fdn-Chennai	8	1
4	Garg-S	Natl-Inst-Pharmaceut-Educ-&-Res-Mohali	8	1
4	Panchagnula-R	Natl-Inst-Pharmaceut-Educ-&-Res-Mohali	8	0
5	Dey-GR	Bhabha Atomic Research Centre-Mumbai	7	0
5	Ravishankar-GA	Cent Food Technol Res Inst-Mysore	7	1
5	Surolia-N	Indian Institute of Science-Bangalore	7	2
5	Tuteja-R	Int Ctr Genet Engr & Biotechnol-New Delhi	7	1
5	Ahmad-S	Jamia Millia Islamia-New Delhi	7	0
5	Singla-AK	Panjab University-Chandigarh	7	1
5	Gupta-R	University of Delhi-New Delhi	7	2

*ICR = No. of internationally collaborated Review Articles

3.3 Author affiliations and collaborations

The Affiliations of the authors, who wrote the 2042 review Articles are segregated and the most occurred affiliations (occurred more than 25 times) are listed in Table 3 with the number of times occurred. The table also gives an idea about the number of times collaborated with authors of affiliation outside India. Indian Institute of Science, Bangalore; All India Institute of Medical Sciences, New Delhi; Bhabha Atomic Research Centre, Mumbai; Indian Institute of Technology, New Delhi; and Delhi University, New Delhi are the most occurred five affiliations. When the collaborated Review Articles of these 22 affiliations are considered, on an average 22.9 percentage are written in collaboration with authors from outside India.

Table 3: Affiliation of authors (occurred more than 25 times) who wrote Review Articles in *Science Citation Index* (2000-2005)

Rank	Affiliation	TA	TR	% of TR	ICR	% of ICR
1	Indian Inst Sci-Bangalore	116	102	5.00	17	16.67
2	All India Inst Med Sci-New Delhi	98	84	4.11	10	11.90
3	Bhabha Atomic Research Centre-Mumbai	82	76	3.72	14	18.42

4	Indian Inst Technol-New Delhi	68	59	2.89	11	18.64
5	Delhi Univ-New Delhi	60	56	2.74	18	32.14
6	Panjab Univ-Patiala	54	49	2.40	7	14.29
7	Tata Inst Fundamental Res-Mumbai	48	47	2.30	22	46.81
8	Indian Inst Technol-Mumbai	49	44	2.15	17	38.64
9	Natl Inst Pharmaceut Educ & Res-Mohali	45	43	2.11	7	16.28
10	Banaras Hindu Univ-Varanasi	40	38	1.86	10	26.32
11	Postgrad Inst Med Educ & Res-Chandigarh	47	36	1.76	3	8.33
12	Indian Inst Chem Technol-Hyderabad	36	34	1.67	4	11.76
13	Jawaharlal Nehru Ctr Adv Sci Res-Bangalore	41	33	1.62	5	15.15
14	Cent Food Technol Res Inst-Mysore	34	33	1.62	9	27.27
15	Indian Inst Technol-Kanpur	33	33	1.62	13	39.39
15	CSIR-Reg Res Lab -Trivandrum	33	33	1.62	7	21.21
16	Natl Chem Lab-Pune	32	32	1.57	7	21.88
17	Indian Inst Technol-Kharagpur	28	28	1.37	6	21.43
18	Univ Hyderabad-Hyderabad	27	26	1.27	5	19.23
19	Sanjay Gandhi Postgrad Inst Med Sci-Lucknow	32	24	1.18	7	29.17
20	Jadavpur Univ-Kolkata	26	24	1.18	6	25.00
20	Christian Med Coll & Hosp-Vellore	26	21	1.03	5	23.81

(TA = No. of times occurred; TR = Total number of Reviews; and ICR = No. of collaborated Review Articles)

The countries in the affiliation of authors of the internationally collaborated Review Articles are analysed and the results of the top ten countries other than India are presented in Table 4. It has been observed collaboration of Indian authors with authors from 78 different countries. USA has comparatively good number of Review Articles with Indian authors followed by GERMANY; JAPAN; ENGLAND; FRANCE etc.

Table 4: Countries other than India in the affiliation of the collaborated Review Articles in *Science Citation Index* (2000-2005)

Country	Publication Year-wise Number of Review(s) and Affiliations												Total	
	2000		2001		2002		2003		2004		2005			
	R*	A	R	A	R	A	R	A	R	A	R	A	R	A
USA	20	32	19	27	32	96	42	124	38	97	44	112	195	488
GERMANY	12	16	10	11	8	13	12	21	14	27	23	31	79	119
JAPAN	6	8	3	3	5	9	11	24	14	21	5	16	44	81
ENGLAND	9	11	2	3	5	14	4	10	12	16	9	10	41	64
FRANCE	7	15	4	6	2	2	9	18	3	6	9	17	34	64
CANADA	3	3	2	2	3	5	9	14	4	6	11	16	32	46
PEOPLES-R-CHINA	2	3	1	1	2	2	7	8	9	14	6	9	27	37
ITALY	3	19	3	3	7	16	2	8	6	26	3	3	24	75
AUSTRALIA	2	2	3	3	4	5	4	8	4	5	4	5	21	28
NETHERLANDS	2	7	2	2	5	6	5	7	5	9	2	4	21	35

(truncated)

*(R = Number of Review Articles; and A = Number of Affiliations)

Table 5 is the list of most occurred affiliations of authors from countries other than India and collaborated with Indian Review Writers. Even though, The United States of America has appeared at the top among the countries of affiliations of the

internationally collaborated Review Articles, IST-NAZL-FIS-NUCL, ITALY and CERN, SWITZERLAND are on the top of the affiliations to which Indian Review writers are most associated with.

Table 5: Most occurred (more than six times) affiliations of authors, who had written Review Articles with Indian authors in *Science Citation Index* (2000-2005)

Affiliation	No. of occurrence
IST-NAZL-FIS-NUCL-ITALY	24
CERN-SWITZERLAND	12
UNIV-CALIF-BERKELEY-USA	12
UNIV-TEXAS-USA	11
COLUMBIA-UNIV-USA	9
UNIV-CALIF-RIVERSIDE-USA	9
NORTHEASTERN-UNIV-USA	8
UNIV-TOKYO-JAPAN	8
CALTECH-USA	7
HEBREW-UNIV-JERUSALEM-ISRAEL	7
LUND-UNIV-SWEDEN	7
MICHIGAN-STATE-UNIV-USA	7
MIT-USA	7
PRINCETON-UNIV-USA	7
TEXAS-A&M-UNIV-USA	7
TOHOKU-UNIV-JAPAN	7
UNIV-BIRMINGHAM-ENGLAND	7
BROOKHAVEN-NATL-LAB-USA	6
CTR-DIS-CONTROL-&-PREVENT-USA	6
DESY-GERMANY	6

3.4 Published journals

The 2042 Review Articles considered for the present study are published over 640 individual journals. A truncated list (those journals which have occurred more than ten or more than ten times) is given in Table 6. Current Science; Research on Chemical Intermediates; Indian Journal of Medical Research; National Medical Journal of India; Progress in Organic Coatings are the leading journals which publish Review Articles of Indian origin.

Table 6.: Most occurred journals in which Review Articles in Science Citation Index (2000-2005) are published with their Impact Factors (IF-2004)

Rank	Serial Publication	Country	Review Articles	%	IF-2004
1	<i>CURRENT SCIENCE</i>	India	201	9.84	0.688
2	<i>RESEARCH ON CHEMICAL INTERMEDIATES</i>	The	69	3.38	0.446
3	<i>INDIAN JOURNAL OF MEDICAL RESEARCH</i>	India	59	2.89	0.600
4	<i>NATIONAL MEDICAL JOURNAL OF INDIA</i>	India	36	1.76	0.626
5	<i>PROGRESS IN ORGANIC COATINGS</i>	Switzerland	34	1.67	1.214
6	<i>PROG IN CRYSTAL GROW AND CHARACT OF MAT</i>	England	26	1.27	0.531
7	<i>APPLIED MICROBIOLOGY AND BIOTECHNOLOGY</i>	United States	25	1.22	2.358
8	<i>JOURNAL OF MACROMOLECULAR SCIENCE-POLY</i>	United States	24	1.18	0.609
9	<i>CHEMICAL REVIEWS</i>	United States	21	1.03	20.233
9	<i>CURRENT MEDICINAL CHEMISTRY</i>	Netherlands	21	1.03	4.382
10	<i>ACCOUNTS OF CHEMICAL RESEARCH</i>	United States	20	0.98	13.154

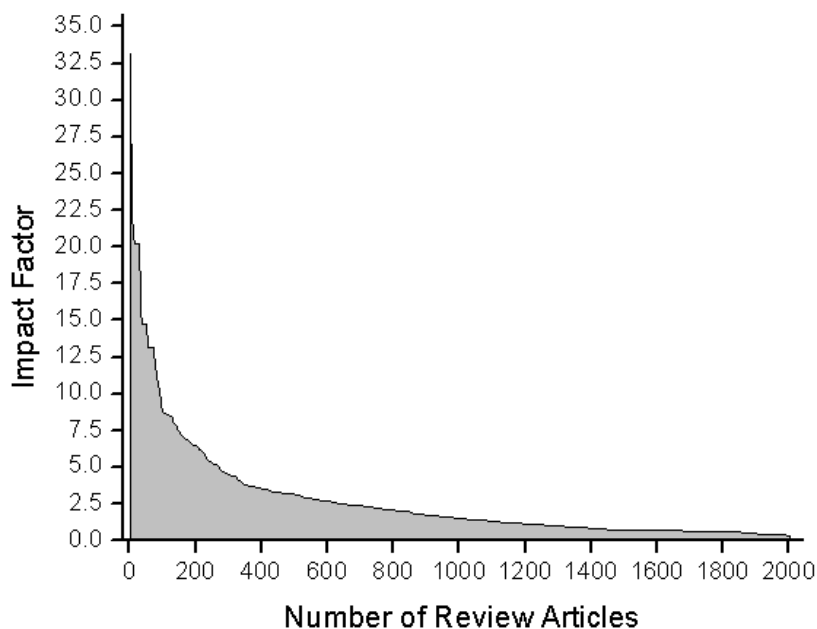
11	<i>BIOTECHNOLOGY ADVANCES</i>	England	18	0.88	2.468
12	<i>CRITICAL REVIEWS IN BIOTECHNOLOGY</i>	United States	17	0.83	3.227
12	<i>PHYSICS REPORTS-REVIEW SECTION OF PHYSICS</i>	The	17	0.83	14.742
12	<i>POSTGRADUATE MEDICAL JOURNAL</i>	England	17	0.83	0.807
13	<i>JOURNAL OF GASTROENTEROLOGY AND</i>	Australia	16	0.78	1.796
13	<i>PHYSICAL REVIEW D</i>	United States	16	0.78	5.156
13	<i>TETRAHEDRON</i>	England	16	0.78	2.643
14	<i>COORDINATION CHEMISTRY REVIEWS</i>	The	15	0.73	6.446
14	<i>RENEWABLE & SUSTAINABLE ENERGY REVIEWS</i>	United States	15	0.73	1.614
15	<i>INTERNATIONAL JOURNAL OF DERMATOLOGY</i>	United States	14	0.69	0.884
15	<i>JOURNAL OF BIOSCIENCES</i>	India	14	0.69	1.102
16	<i>PROGRESS IN POLYMER SCIENCE</i>	United States	13	0.64	8.482
17	<i>SURVEY OF OPHTHALMOLOGY</i>	United States	12	0.59	3.221
18	<i>METHODS IN ENZYMOLOGY</i>	United States	11	0.54	1.392
19	<i>ADVANCES IN AGRONOMY</i>	United States	10	0.49	3.212
19	<i>BRITISH MEDICAL JOURNAL</i>	England	10	0.49	7.038
19	<i>CRITICAL REVIEWS IN BIOCHEMISTRY AND MOL</i>	United States	10	0.49	6.115
19	<i>CRITICAL REVIEWS IN PLANT SCIENCES</i>	United States	10	0.49	3.525
19	<i>HETEROCYCLES</i>	Japan	10	0.49	1.064
19	<i>PHARMAZIE</i>	Germany	10	0.49	0.587

The 640 journals, which have published Review Articles affiliated to India, are published from 27 various countries as listed in Table 7. Among them, USA publishes 36.41 percentage of journals followed by England (25.63 %); Netherlands (15.16 %); Germany (6.72 %); Switzerland (2.34%) etc. The Impact Factors of the journals are analysed and the trend is shown in Figure 2.

Table 7: Countries of the journals publishing Indian Review Articles in *Science Citation Index* (2000-2005)

Publishing countries	No. of Journals	% of Total	No. of Review Articles	% of Total	Average Impact Factor (2004)
USA	233	36.41	657	32.17	3.17
England	164	25.63	403	19.74	2.85
Netherlands	97	15.16	323	15.82	2.60
Germany	43	6.72	87	4.26	2.41
Switzerland	15	2.34	55	2.69	1.74
Japan	11	1.72	26	1.27	1.36
Australia	9	1.41	24	1.18	1.07
Denmark	9	1.41	10	0.49	2.79
India	9	1.41	332	16.26	0.60
France	7	1.09	20	0.98	2.15
Singapore	7	1.09	31	1.52	1.01
Ireland	5	0.78	19	0.93	1.77
Scotland	4	0.63	4	0.20	1.19
Austria	3	0.47	4	0.20	1.24
Canada	3	0.47	3	0.15	0.74
Czech Republic	3	0.47	8	0.39	0.54
Italy	3	0.47	8	0.39	3.32
Peoples R China	3	0.47	6	0.29	0.79
New Zealand	2	0.31	2	0.10	4.28
Russia	2	0.31	2	0.10	0.61
South Korea	2	0.31	2	0.10	1.62
Hungary	1	0.16	1	0.05	0.46
Israel	1	0.16	1	0.05	0.68

Norway	1	0.16	2	0.10	1.88
Spain	1	0.16	9	0.44	0.61
Sweden	1	0.16	2	0.10	1.18



Taiwan	1	0.16	1	0.05	1.57
Total	640	100.00	2042	100.00	

Figure 2.: Impact factors of the journals published Indian Review Articles in *Science Citation Index* (2000-2005)

The 2042 Review Articles are broadly classified as seen in Table 8 and correlated with the Impact Factors (2004) of the journals in which they are published. One third of the Review Articles are published in journals having Impact Factors ranges between zero to one. When the Review Articles of Multidisciplinary and Agricultural nature are considered, majority of them are published in journals having less impact factors.

Table 8.: Broad subject-wise categorization and the Impact Factors of the journals published the Review Articles in *Science Citation Index* (2000-2005)

Impact Factor	Chemical Sciences	Medical Sciences	Biological Sciences	Physical Sciences	Multidiscipl. Sciences	Agricultural Sciences	No. of Review Articles	% of total
0 - 1	193	198	67	52	203	28	741	36.29
>1 - 2	101	131	108	74	10	40	464	22.72
>2 - 3	88	91	100	25	5	7	316	15.48
>3 - 4	48	39	54	19	0	24	184	9.01
>4 - 5	29	8	26	2	0	1	66	3.23
>5 - 6	8	12	8	20	0	0	48	2.35
>6 - 7	22	8	14	13	0	0	57	2.79
>7 - 8	6	16	4	3	0	0	29	1.42
>8 - 9	20	3	16	0	0	0	39	1.91
>9 - 10	4	1	0	0	0	0	5	0.24
>10	51	10	5	24	0	3	93	4.55
0-33.17	570	517	402	232	218	103	2042	100

3.5 Subject contents

The Review Articles under consideration are classified as per the subject contents and presented in Table 9. Review Articles of Multidisciplinary Sciences; Chemistry in General; General and Internal Medicine; Biochemistry and Molecular Biology; and Pharmacology & Pharmacy come on top of the list.

Table 9.: Subject categorization of the Review Articles in *Science Citation Index* (2000-2005)

Subject	No. of Review Articles	Subject	No. of Review Articles
Multidisciplinary Sciences	209	Pediatrics	10
Chemistry, Multidisciplinary	179	Agricultural Engineering	9
Medicine, General & Internal	139	Biochemical Research Methods	9
Biochemistry & Molecular Biology	108	Developmental biology	8
Pharmacology & Pharmacy	99	Immunology	8
Biotechnology & Applied Microbiology	92	Physics, Atomic, Molecular & Chemical	8
Chemistry, Organic	75	Public, Environmental & Occupational	8
Polymer Science	62	Surgery	8
Plant Sciences	55	Toxicology	8
Chemistry, Physical	46	Anesthesiology	7
Chemistry, Applied	39	Marine & Freshwater Biology	7
Microbiology	39	Physics, Applied	7
Chemistry, Inorganic & Nuclear	37	Urology & Nephrology	7
Environmental Sciences	35	Biophysics	6
Materials Science, Multidisciplinary	34	Dentistry, Oral Surgery & Medicine	6
Physics, Multidisciplinary	32	Electrochemistry	6
Cell Biology	31	Endocrinology & Metabolism	6
Food Science & Technology	30	Instruments & Instrumentation	6
Astronomy & Astrophysics	27	Medicine, Research & Experimental	6
Materials Science, Characterization	26	Nutrition & Dietetics	6
Chemistry, Medicinal	25	Agriculture, Soil Science	5
Energy & Fuels	25	Geochemistry & Geophysics	5
Gastroenterology & Hepatology	25	Geology	5
Physics, Particles & Fields	25	Hematology	5
Agronomy	23	Virology	5
Biology	22	Agriculture, Multidisciplinary	4
Engineering, Chemical	22	Crystallography	4
Geosciences, Multidisciplinary	21	Infectious Disease	4
Dermatology	20	Mechanics	4
Ophthalmology	20	Obstetrics & Gynecology	4
Chemistry, Analytical	18	Parasitology	4
Neurosciences	17	Psychiatry	4
Genetics & Heredity	16	Veterinary Sciences	4
Radiology, Nuclear Medicine & Medical	14	Agriculture, Dairy & Animal Science	3
Physics, Condensed Matter	13	Ecology	3
Oncology	12	Engineering, Aerospace	3
Physics, Mathematical	12	Engineering, Biomedical	3
Cardiac & Cardiovascular Systems	11	Engineering, Mechanical	3
Clinical, Neurology	11	Entomology	3
Engineering, Electrical & Electronics	11	Horticulture	3
Physics, Nuclear	11	Medical Laboratory Technology	3
Computer Science	10	Optics	3

Subject	No. of Review Articles
Paleontology	3
Transplantation	3
Geography, Physical	2
Materials Science, Ceramics	2
Metallurgy & Metallurgical Engineering	2
Microscopy	2
Mineralogy	2
Mining & Mineral Processing	2
Mycology	2
Nuclear Science & Technology	2
Spectroscopy	2

Subject	No. of Review Articles
Water Resources	2
Emergency Medicine	1
Operations Research & Management	1
Orthopedics	1
Otorhinolaryngology	1
Peripheral Vascular Disease	1
Reproductive Biology	1
Respiratory System	1

The study has also analysed the ten affiliations of the authors, which produced highest number of Review Articles in broad subjects and the results are provided in Table 10. Indian Institute of Science, Bangalore has occurred in all fields except Medical Sciences and Agricultural Sciences.

Table 10.: Affiliations of authors, which produced highest number of Review Articles in *Science Citation Index (2000-2005)*

Subject	Affiliations
Chemical Sciences	BHABHA ATOM RESEARCH CENTRE-Mumbai; INDIAN INST SCI-BANGALORE-Bangalore; INDIAN INST TECHNOL BOMBAY-Mumbai; CSIR-Trivandrum; INDIAN INST CHEM TECHNOL-Hyderabad; NATL CHEM LAB-Pune; INDIAN INST TECHNOL DELHI-New Delhi; INDIAN INST TECHNOL-Kanpur; INDIAN ASSOC CULTIVAT SCI-Kolkata; INDIAN INST TECHNOL-Kharagpur
Medical Sciences	ALL INDIA INST MED SCI-New Delhi; POST GRAD INST MED EDUC & RES-Chandigarh; PANJAB UNIV-Chandigarh; SANJAY GANDHI POST INST MED SCI-Lucknow; CHRISTIAN MED COLL & HOSP-Vellore-Tamil Nadu; NATL INST PHARM EDUC & RES-Sas Nagar-Punjab; NATL INST MENTAL HLTH & NEUROSCI-Bangalore; TATA MEM HOSP-Mumbai; SEHGAL NURSING HOME-New Delhi; LV PRASAD EYE INST-Hyderabad
Biological Sciences	CENT FOOD TECHNOL RES INST-Mysore; INDIAN INST SCI-Bangalore; UNIV DELHI-New Delhi; INST MICROBIAL TECHNOL-Chandigarh; INDIAN INST TECHNOL-New Delhi; NATL INST PHARMACEUT EDUC & RES-Mohali-Punjab; CTR CELLULAR & MOL BIOL-Hyderabad; JAWAHARLAL NEHRU CTR ADV SCI RES-Bangalore; NATL INST OCEANOLOG-Panaji-Goa; INDIAN INST CHEM BIOL-Kolkata

Subject	Affiliations
Physical Sciences	TATA INST FUNDAMENTAL RES-Mumbai; INDIAN INST SCI-Bangalore; INDIAN INST TECHNOL-New Delhi; INTER UNIV CTR ASTRON & ASTROPHYS-Pune; BHABHA ATOM RES CTR-Mumbai; PHYS RES LAB-Ahmedabad; INDIAN INST TECHNOL Bombay-Mumbai; BANARAS HINDU UNIV-Varanasi; HARISH CHANDRA RES INST-Allahabad; UNIV BOMBAY-Mumbai
Multidisciplinary Sciences	BANARAS HINDU UNIV-Varanasi; INDIAN INST SCI-Bangalore; INDIAN AGR RES INST-New Delhi; UNIV DELHI-New Delhi; ALL INDIA INST MED SCI-New Delhi; OSMANIA UNIV-Hyderabad; G B PANT UNIV AGR & TECHNOL-Pantnagar; TATA INST FUNDAMENTAL RES-Mumbai; JAWAHARLAL NEHRU CTR ADV SCI RES-Bangalore; JAWAHARLAL NEHRU UNIV-New Delhi
Agricultural Sciences	INDIAN AGR RES INST-New Delhi; INT CROPS RES INST SEMI ARID TROP-Patancheru AP; UNIV DELHI-New Delhi; PUNJAB AGR UNIV-Ludhiana; NATL BOT RES INST-Lucknow; INT CTR GENET ENGN & BIOTECHNOL-New Delhi; UNIV HYDERABAD-Hyderabad; ALL INDIA INST MED SCI-New Delhi; PANJAB UNIV-Chandigarh; CCS HARYANA AGR UNIV-Hisar Haryana

3.6 Keyword analysis

Keywords represent the subject content of the articles. There are a total of 16887 unique keywords, includes both author keywords and KeywrodPlus given by *Science Citation Index*, given to the 2042 Review Articles studied. The keywords, which have occurred more than ten times are listed in Table 11 with the number of times occurred. Escherichia Coli; In Vitro; Crystal Structure; Gene Expression; and Polymerase Chain Reaction are the most occurred five keywords.

Table 11.: Keywords (both ‘Author Keywords’ and ‘KeyWord Plus’ fields) occurred more than 10 times along with the Review Articles in *Science Citation Index* (2000-2005)

Keywords	No. of times occurred	Keywords	No. of times occurred
Escherichia Coli	57	Pulse Radiolysis	27
In Vitro	52	Drug Delivery	25
Crystal Structure	51	Nf Kappa B	25
Gene Expression	37	Tuberculosis	25
Polymerase Chain Reaction	36	Derivatives	24
Arabidopsis Thaliana	34	Tumor Necrosis Factor	24
Oxidation	34	Mycobacterium Tuberculosis	23
Performance Liquid Chromatography	30	Saccharomyces Cerevisiae	22
Human Immunodeficiency Virus	29	Nitric Oxide	21
India	29	In Vivo	20
Signal Transduction	28	Growth	19
Kinetics	27	Identification	19
		Nuclear Magnetic Resonance	19

Keywords	No. of times occurred
Behavior	18
Central Nervous System	18
Galaxies	18
Infection	18
Oxidative Stress	18
Therapy	18
Diagnosis	17
Expression	17
Risk Factors	17
Aqueous Solution	16
Children	16
Coronary Heart Disease	16
Disease	16
Model	16
Molecular Structure	16
Resistance	16
Stereoselective Synthesis	16
Temperature	16
Apoptosis	15
Aqueous Solutions	15
Electron Transfer	15
Gene	15
Prevalence	15
Programmed Cell Death	15
Protein	15
South India	15
System	15
Double Blind	14
Epidemiology	14
Hydrogen Peroxide	14
Mechanism	14
Nitric Oxide Synthase	14
Rate Constants	14
Review	14
Toxicity	14
Activation	13
Cancer	13
Cells	13
Developingries	13

Keywords	No. of times occurred
Heavy Metals	13
In Vitro Evaluation	13
Management	13
Mechanical Properties	13
Plants	13
Spectroscopy	13
Water	13
Bacillus Subtilis	12
Biosynthesis	12
Coatings	12
Evolution	12
Insulin Resistance	12
Oryza Sativa L	12
Solid State Fermentation	12
Systems	12
Tissue Culture	12
X Ray Diffraction	12
Acid	11
Binding	11
Brain	11
Breast Cancer	11
Chemistry	11
Degradation	11
Density Functional Theory	11
Diels Alder Reactions	11
Drinking Water	11
Escherichia Coli K 12	11
Free Radicals	11
Inhibition	11
Lipid Peroxidation	11
Low Density Lipoprotein	11
Organic Synthesis	11
Plasma Mass Spectrometry	11
Reduction	11
Ring Opening Polymerization	11
(truncated)	

Table 12 consists of the highly occurred ten keywords from each broad subject categories of the Review Articles.

Table 12.: Most occurred 10 keywords (both 'Author Keywords' and 'KeyWord Plus' fields) in the broad areas of the Review Articles in *Science Citation Index* (2000-2005)

Subject Area	Keywords
Chemical Sciences	Crystal Structure; Oxidation; Pulse Radiolysis; Derivatives; Kinetics; Molecular Structure; Stereoselective Synthesis; Aqueous Solution; Behavior; Electron Transfer
Medical Sciences	Polymerase Chain Reaction; Human Immunodeficiency Virus; In Vitro; Tuberculosis; Mycobacterium Tuberculosis; Drug Delivery; Risk Factors; Children; Diagnosis; Therapy
Biological	Escherichia Coli; Saccharomyces Cerevisiae; Crystal Structure; In

Sciences	Vitro; Aspergillus Niger; Arabidopsis Thaliana; Nf Kappa B; Solid State Fermentation; Activation; Signal Transduction
Physical Sciences	Galaxies; D Branes; Black Holes; Supersymmetric Standard Model; Cosmological Constant; Cosmology; General; Heavy Ion Collisions; Mass Transfer; Stars
Multidisciplinary Sciences	Gene Expression; Arabidopsis Thaliana; Escherichia Coli; Oryza Sativa L; Oxidative Stress; In Vitro; Signal Transduction; Crystal Structure; Insulin Resistance; Nf Kappa B
Agricultural Sciences	Arabidopsis Thaliana; Oryza Sativa; Genetic Transformation; Photosystem 2; Resistance; Agrobacterium Mediated Transformation; Coronary Heart Disease; Escherichia Coli; Chlamydomonas Reinhardtii; Gene Expression

3.6 Synchronous references

Synchronous references show the depth and recency of the subject the Review Article is dealing with. Table 13 presents the descriptive statistics of the Synchronous References observed in the 2042 Review Articles. The table also complements the Review Articles written in collaboration of other highly collaborated countries.

Table 13.: Descriptive Statistics of Synchronous References observed in the Review Articles in *Science Citation Index* (2000-2005)

Descriptive statistics	All	India in affiliation	Review Articles written in collaboration with						
			USA	Germany	Japan	England	France	Canada	Peoples-R-China
Mean	112.48	106.41	145.17	174.62	205.34	174.61	233.12	249.06	124.41
Standard Error	2.58	2.36	17.00	39.06	69.98	73.76	87.38	93.63	13.67
Median	99	93	110	115	111.5	105	128	143.5	113
Mode	103	103	103	107	87	34	107	103	NA
Standard Deviation	116.58	93.90	237.41	347.16	464.17	472.27	509.50	529.66	71.02
Sample Variance	13590.58	8816.39	56365.28	120520.08	215452.37	223039.74	259592.11	280538.96	5043.94
Kurtosis	245.35	104.90	124.98	66.34	37.05	39.30	32.95	29.38	-1.04
Skew-ness	11.24	6.33	10.33	7.85	5.91	6.21	5.70	5.33	0.30
Range	3095	1989	3088	3088	3088	3091	3034	3065	246
Minimum	1	1	8	8	8	5	62	31	21
Maximum	3096	1990	3096	3096	3096	3096	3096	3096	267
Sum	229678	168025	28308	13795	9035	7159	7926	7970	3359
Count	2042	1579	195	79	44	41	34	32	27

The number of authors in every Review Articles and Number of Synchronous References are taken into consideration keeping in view that if there are more number of authors there may be a chance of having more Synchronous References. The analysed results between number of authorships and average, minimum and maximum number of Synchronous References is given in Table 14.

Table 14.: Number of author(s) and average, minimum and maximum number of Synchronous References occurred in Review Articles in *Science Citation Index* (2000-2005)

No. of author(s)	No. of articles	Synchronous references		
		Average	Minimum	Maximum
1	303	107.71	1	555
2	679	115.95	2	1990
3	520	114.79	3	665
4	262	98.90	5	503
5	118	100.54	4	728
6	71	105.24	6	475
7	23	116.74	10	529
8	16	81.06	10	222
9	15	116.93	31	270
10	5	163.60	45	372
11	2	169.50	159	180
12	2	98.50	96	101
13	2	61.50	34	89
15	3	135.33	54	195
16	2	61.00	59	63
17	3	109.67	57	159
18	1	111.00	111	111
19	1	210.00	210	210
22	1	197.00	197	197
23	1	107.00	107	107
25	3	191.67	116	267
26	2	168.00	107	229
32	1	108.00	108	108
36	1	130.00	130	130
53	1	8.00	8	8
140	1	3096.00	3096	3096
166	1	65.00	65	65
225	1	239.00	239	239
255	1	117.00	117	117

The numbers of Synchronous References in each and every 2042 Review Articles are observed and it has been found that some numbers are repeating. This phenomenon is presented with the help of a graph as shown in Figure 4. The repeating nature can be seen more on the centre part of the graph. The results are presented in figure 4.

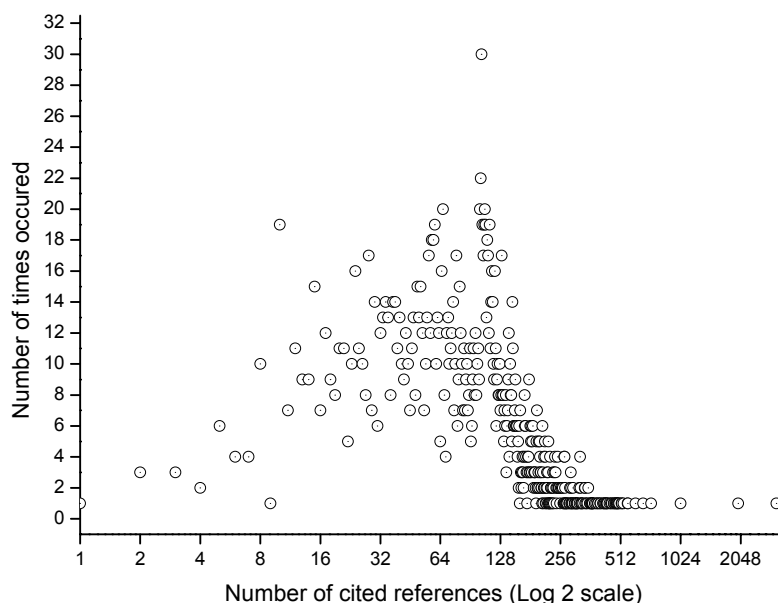


Figure 4.: Correlation of number of Synchronous References and their number of times occurred in the Review Articles in *Science Citation Index* (2000-2005)

4. CONCLUSIONS

Gradual growth is observed in number of Review Article being published in the recent years. More than 85 per cent of the Review Articles are written in collaboration of more than one author. There is a scope for further comparative study of nature of collaboration of normal articles and Review Articles. It is logical that work involved in writing a Review Article is more than writing a normal article. Collecting the available literature in a field, even in a micro field, is a cumbersome work. The collaborative works gets more importance in such situations. Indian Institute of Science, Bangalore; All India Institute of Medical Sciences, New Delhi; Bhabha Atomic Research Centre, Mumbai; Indian Institute of Technology, New Delhi; and Delhi University, New Delhi are the premier institutions which produced more number of Review Articles. Collaboration of Indian reviewers with people from outside India is significant. *Current Science*; *Research on Chemical Intermediates*; *Indian Journal of Medical Research*; *National Medical Journal of India*; and *Progress in Organic Coatings* are the top five journals publishing Review Articles of Indian origin. One third of the Review Articles taken into consideration for the study are published in journals having Impact Factors ranged from zero to one.

Multidisciplinary Sciences; Chemistry in General; General and Internal Medicine; Biochemistry and Molecular Biology; and Pharmacology and Pharmacy are the main fields in which majority of the Review Articles are written. Authors from Indian Institute of Science, Bangalore contributes Review Articles of varied subject areas than any other affiliations of authors. Escherichia Coli; In Vitro; Crystal Structure; Gene Expression; and Polymerase Chain Reaction are the most occurred five keywords. The inter-quartile mean of the number of Synchronous References of the 2042 Review Articles is found as 94.84.

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