

# Uncitedness of Indian scientific output

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*An analysis of 35,640 papers published by Indian scientists as journal articles and reviews in journals indexed by Science Citation Index-Expanded (SCI-E) in 2008 revealed that 6231 (17.5%) papers remained uncited during 2008–2013. Most of the uncited papers were published by State Agricultural Universities and the Indian Council of Agricultural Research. The highest proportion of uncited papers was in the discipline of agricultural sciences followed by multidisciplinary and mathematical sciences. These uncited papers appeared in journals published from India, Singapore, Romania and Japan with low impact factor (IF). Lowest number of uncited papers was published by the Department of Biotechnology. It was also found that a small fraction of papers published in journals with IF more than 5 also remained uncited.*

**Keywords:** Citation analysis, scientific output, scientometrics, uncitedness.

NUMEROUS bibliometric studies examining India's contribution to the scientific literature based on the journals indexed by *Science Citation Index-Expanded (SCI-E)* and *Scopus* databases have been published in the literature<sup>1–5</sup>. These studies focused on the scientific output and impact of the Indian research output published during different periods. But, to date, no study has examined the uncitedness of the Indian scientific contributions indexed by *SCI-E* or *Scopus* database. Uncitedness is an important aspect of citation analysis and needs a separate investigation. This motivated the authors of the present communication to take stock of the quantum of uncited papers published by Indian scientists in 2008 that remained uncited during 2008–2013 (six years) in journals indexed by *SCI-E*. However, these papers might have been cited in the literature not indexed by *SCI-E*. Garfield<sup>6</sup> has mentioned that some papers might be cited implicitly and has termed it as uncitedness III.

In the past, several authors have examined the issue of uncitedness of journals as well as disciplines. For instance, Ghosh and Neufeld<sup>7</sup> examined the uncitedness of 222 articles published in the *Journal of the American Chemical Society* during January–February 1965 and found that about 0.45% of the articles remained uncited during the entire period 1965–1970. In another study, Ghosh<sup>8</sup> examined uncitedness of 327 articles and letters published in *Nature* in five issues of January 1965 and found that 34 (10.4%) papers remained uncited during the first five years (1965–1969) of publication. However, 10 of these were cited in the subsequent three years (1970–1972). Schwartz<sup>9</sup>, in a study of papers published in the discipline of library and information science, found that

the rate of uncitedness was 72%. Based on the data compiled by the Institute for Scientific Information (ISI; now Thomson Reuters), USA, Hamilton<sup>10</sup> showed that 55% of the papers published between 1981 and 1985 in journals indexed by *SCI* received no citations at all in the five years after they were published. Further analysis of the data indicates that uncited average for all sciences was 47.4%. Among all the disciplines, physics and chemistry had the lowest rates of uncitedness, 36.7% and 38.8% respectively, followed by biological sciences (41.3%), geosciences (43.6%) and medicine (46.4%) in the four years following publication. However, in engineering sciences, more than 72% of all papers published had no citations at all. There was a wide variation among individual sub-disciplines. For instance, atomic, molecular and chemical physics had only 9.2% of articles uncited followed by virology (14.0%). Among fields that did not fare so well were electrochemistry (64.6%), developmental biology (61.5%), optics (49.1%) and acoustics (40.1%). As for engineering, every sub-field showed high rates of uncitedness ranging between 59% for biomedical engineering and 78% for civil engineering<sup>11</sup>. Pendlebury<sup>12</sup> later explained that the statistics provided by Hamilton<sup>10,11</sup> included all types of records that appeared in journals indexed by ISI in its *SCI*. If only articles included in ISI database are examined, the extent of uncited articles decreased significantly and only 22.4% of 1984 science articles remained uncited by the end of 1988. The extent of uncited articles by the US authors alone was only 14.7% and that by non-US authors was 28%. These studies did not explore the journals where these uncited articles were published.

## Methodology

The source of data for the present bibliometric study was Thomson Reuters *SCI-E*, which annually indexes articles

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**Table 1.** Distribution of total output and uncited papers by different performing sectors

Performing sector	TP (1)	TP% (2)	TUP (3)	TUP% (4)	RUI (4)/(2)
Academic institutions	18,967	53.2	2,518	40.4	0.76
Indian Institutes of Technology	5,644	15.8	412	6.6	0.41
Engineering colleges	4,739	13.3	551	8.8	0.66
Medical colleges and hospitals	5,083	14.3	673	10.8	0.75
Council of Scientific and Industrial Research	3,865	10.8	296	4.8	0.45
Department of Atomic Energy	2,228	6.3	206	3.3	0.52
State Agricultural Universities and colleges	1,951	5.5	955	15.3	2.82
Indian Council of Agricultural Research	1,599	4.5	509	8.2	1.82
Private institutions	1,455	4.1	181	2.9	0.70
Department of Science and Technology	1,409	3.9	93	1.5	0.38
Defence Research and Development Organisation	673	1.9	74	1.2	0.63
Indian Council of Medical Research	434	1.2	20	0.3	0.25
Department of Space	427	1.2	43	0.7	0.58
R&D institutions under Central Government	385	1.1	59	0.9	0.82
Department of Biotechnology	222	0.6	3	0.05	0.08
Foundations/Associations	195	0.5	21	0.4	0.80
R&D institutions under State Governments	184	0.5	39	0.6	1.20
Others	799	2.2	135	2.2	1.00
Total	35,640	100.00*	6,231	100.00	1.00

\*Percentage is more than 100, as several papers have been published in collaboration.

TP, Total papers; TUP, Total uncited papers; RUI, Relative uncited index.

available in more than 8000 science and technology journals published from different parts of the world. We downloaded all articles published by Indian authors from *SCI-E* for the year 2008 and the citations of these papers during 2008–2013, the data for which were available in the first week of January 2014. From these records, we culled out the data for papers that remained uncited during 2008–2013. The rationale for choosing the year 2008 was that for an article not cited within five years of its publication, it may be presumed that it will not be cited in future<sup>13</sup>. The downloaded data included name of all authors with their affiliations, name of the journal with its place of publication, sub-discipline of the paper and type of publications. The data were later enriched with the impact factor (IF) of the journals and the performing sector to which the institution belonged (academic, research agency or private). The data thus downloaded were converted into Fox-Pro database for ease of analysis. We have used the method of complete count in which a paper in collaboration is credited to all the performing sectors or institutes or disciplines, etc., so the actual total is more than used in the article.

### Objectives of the study

The focus of the present study was to evaluate the quantum of uncited papers by different performing sectors, different institutions, disciplines, publishing country and IF of journals of the uncited papers where such uncited papers were published and to provide a listing of these journals.

### Results and discussion

#### *Type of documents used for publishing research results*

*SCI-E* indexed 47,630 items published by the Indian scientists in 2008. Based on the type of documents, it was observed that highest number was journal articles (34,384) followed by conference proceedings (6,704). These constituted about 86% of the total items. Rest 14% records were scattered among meeting abstracts (2,776), letters (1,384), reviews (1,256), editorial material (838), corrections (144), news items (59), biographical items (51), book reviews (30), reprints (2), book chapters (1) and software reviews (1). Among all these document types, journal articles and reviews constituted the most important channel of communication. Hence we analysed the journal articles and reviews which remained uncited during 2008–2013. Of the total 34,384 items published as journal articles, 18% remained uncited and among 1,256 reviews, 91 (7%) did not get any citation.

#### *Uncited papers by performing sectors*

Scientific research in India is performed by different sectors like academic institutions, Indian Institutes of Technology (IITs), engineering colleges, medical colleges and hospitals, and different scientific agencies funded by the Government of India. Table 1 presents data on the total output and quantum of uncited papers of each performing sector.

**Table 2.** Distribution of output and uncited papers by institutions

Institution	TP (1)	TP% (2)	TUP (3)	TUP% (4)	RUI (4)/(2)
Indian Institute of Science, Bangalore	1,373	3.9	0	0.0	0.0
Indian Institute of Technology, Kharagpur	1,221	3.4	0	0.0	0.0
Indian Institute of Technology, Chennai	938	2.6	0	0.0	0.0
Bhabha Atomic Research Centre, Mumbai	934	2.6	0	0.0	0.0
Indian Institute of Technology, Delhi	910	2.6	0	0.0	0.0
Indian Institute of Technology, Kanpur	853	2.4	0	0.0	0.0
Indian Institute of Technology, Mumbai	785	2.2	0	0.0	0.0
All India Institute of Medical Sciences, New Delhi	830	2.3	72	1.2	0.5
Banaras Hindu University, Varanasi	756	2.1	91	1.5	0.7
University of Delhi, Delhi	746	2.1	66	1.1	0.6
Jadavpur University, Jadavpur	670	1.9	79	1.3	0.7
Indian Institute of Technology, Roorkee	604	1.7	48	0.8	0.5
Anna University, Chennai	561	1.6	59	1.0	0.6
Tata Institute of Fundamental Research, Mumbai	518	1.5	52	0.8	0.6
Indian Institute of Chemical Technology, Hyderabad	516	1.4	30	0.5	0.3
Panjab University, Chandigarh	510	1.4	36	0.6	0.4
PGIMER, Chandigarh	462	1.3	58	0.9	0.7
Annamalai University, Chidambaram	417	1.2	74	1.2	1.0
Aligarh Muslim University, Aligarh	401	1.1	69	1.1	1.0
Indian Association for the Cultivation of Science, Kolkata	387	1.1	20	0.3	0.3
National Chemical Laboratory, Pune	386	1.1	20	0.3	0.3
Indian Institute of Technology, Guwahati	383	1.1	29	0.5	0.4
University of Calcutta, Kolkata	379	1.1	39	0.6	0.6
University of Madras, Chennai	313	0.9	39	0.6	0.7
Indira Gandhi Agricultural University, Raipur	308	0.9	38	0.6	0.7
University of Mumbai, Mumbai	306	0.9	28	0.5	0.5
National Physical Laboratory, New Delhi	297	0.8	25	0.4	0.5
University of Hyderabad, Hyderabad	287	0.8	21	0.3	0.4
Cochin University of Science and Technology, Cochin	256	0.7	30	0.5	0.7
Central Drug Research Institute, Lucknow	255	0.7	15	0.2	0.3
University of Pune, Pune	249	0.7	25	0.4	0.6
Saha Institute of Nuclear Physics, Kolkata	245	0.7	11	0.2	0.3
SGPGIMS, Lucknow	240	0.7	22	0.4	0.5
Indira Gandhi Centre for Atomic Research, Kalpakkam	239	0.7	25	0.4	0.6
NIIST, Thiruvananthapuram	237	0.7	14	0.2	0.3
Indian Veterinary Research Institute, Izatnagar	232	0.7	81	1.3	2.0
Christian Medical College and Hospital, Vellore	230	0.6	22	0.4	0.5
University of Allahabad, Allahabad	229	0.6	34	0.6	0.9
Indian Agricultural Research Institute, New Delhi	223	0.6	44	0.7	1.1
Jawaharlal Nehru University, New Delhi	223	0.6	11	0.2	0.3
University of Rajasthan, Jaipur	222	0.6	32	0.5	0.8
National Institute Technology, Tiruchirappalli	216	0.6	23	0.4	0.6
JNCASR, Bangalore	216	0.6	6	0.1	0.2
Guru Nanak Dev University, Amritsar	213	0.6	13	0.2	0.4
Sri Venkateswara University, Tirupati	204	0.6	23	0.4	0.6
Others	14,660	41.1	4,807	77.1	1.9
Total	35,640	100	6,231	100	1.00

PGIMER, Postgraduate Institute of Medical Education and Research; SGPGIMS, Sanjay Gandhi Postgraduate Institute of Medical Sciences; NIIST, National Institute of Interdisciplinary Sciences and Technology; JNCASR, Jawaharlal Nehru Centre for Advance Scientific Research.

Here we introduce an indicator called as Relative Uncitedness Index (RUI) which is calculated in a way similar to Relative Citation Impact (RCI) used by Kumari<sup>14</sup> in a study on synthetic organic chemistry research. RCI measures both the influence and visibility of a nation's research in global perspective and was standardized by ISI to calculate Science and Engineering Indicators. RCI is defined as 'a country's share of world citations in the subspecialty/country's share of world publications in the

subspecialty'.  $RCI = 1$  denotes a country's citation rate equal to world citation rate;  $RCI < 1$  indicates a country's citation rate less than world citation rate and also implies that the research efforts are higher than its impact and  $RCI > 1$  indicates a country's higher citation rate than the world citation rate and also implies high impact research in that country.

The interpretation of RUI used by us is different from RCI. In case of RCI, higher values indicate higher impact,

while in case of RUI, higher values indicate less impact. RUI is the ratio of the share of uncited papers to the share of total papers by an agency or institution. The value of RUI can be zero or more. Higher RUI value indicates less impact and higher proportion of uncited papers and vice versa for a performing sector or an institution. Zero RUI value for a performing sector or an institution implies that all its papers have been cited, i.e. it has no uncited papers.

Data presented in Table 1 reveal that of the 35,640 papers published by the Indian scientists, 6,231 (17.5%) papers remained uncited. It also shows that among all the performing sectors, the highest value of RUI was for State Agricultural Universities (SAUs) and colleges, followed by Indian Council of Agricultural Research (ICAR). This implies that the share of uncited papers for these two agencies was higher than all other performing sectors listed in Table 1. Also, the share of uncited papers for these two agencies of their total output was 49% and 32% respectively. The value of RUI was also more than 1 for R&D institutions under the state governments, which implied that the share of uncited paper for these performing sectors was higher than the Indian average. The value of RUI was lowest for the Department of Biotechnology (DBT), implying that the share of uncited papers was lowest for DBT. This was also reflected by the absolute number of uncited papers, which was only three papers.

#### Uncited papers by institutions

All the uncited papers were scattered among 2,524 institutions. Table 2 lists 45 institutions which published 200 or more papers during 2008 along with their number of uncited papers during 2008–2013 and RUI values. These 45 institutions published 20,980 (59%) papers, of which 1,424 (7%) did not get any citation. All papers published by the Indian Institute of Science (IISc), Bangalore; Bhabha Atomic Research Centre (BARC), Mumbai and IITs at Kharagpur, Chennai, Delhi, Kanpur and Mumbai, were cited and these institutes did not have any uncited papers. Hence, the value of RUI for these institutes was zero. For the remaining institutions listed in Table 2, the value of RUI was less than 1, except for Indian Agricultural Research Institute (IARI) and Indian Veterinary Research Institute (IVRI). This implies that the proportion of uncited papers for these two institutes was higher than the Indian average; the highest being for IVRI. Proportion of uncited papers of their published papers for these institutes was 20% and 44% respectively. The value of RUI for Annamalai University and Aligarh Muslim University was 1, which implies that the proportion of uncited papers for these two institutions was equal to the Indian average. The share of uncited papers for these two institutes was 18% and 17% respectively, of their total publication output.

#### Uncited papers by discipline

Table 3 presents data on uncited papers by discipline. It indicates that among all the disciplines, highest value of RUI was for agricultural sciences (2.2), followed by multidisciplinary and mathematical sciences. This implies that the proportion of uncited papers for these disciplines was more than the Indian average of uncited papers. This is also reflected by a large share of uncited papers for these disciplines. The share of uncited papers for agriculture sciences was ~38% of the total output in agricultural sciences. One of the possible reasons for this might be that the agricultural scientists publish their findings in domestic journals, which are not cited in the international literature. Similar observation has been made by Garg *et al.*<sup>15</sup> in an earlier study on the scientific output in agricultural sciences during 1993–2001, where 57% papers remained uncited. For multidisciplinary and mathematical sciences, the share of uncited papers was 27% and 24% respectively, of their total output. *SCI-E* has classified the journals indexed by it into several sub-disciplines. Analysis of raw data for different sub-disciplines indicates that highest share of uncited papers was for 'chemistry multidisciplinary' (8.3%) followed by

**Table 3.** Distribution of uncited papers by discipline

Subject	TP	TP%	TUP	TUP%	RUI
Chemical sciences	9,493	26.6	1,152	18.4	0.69
Physical sciences	7,463	20.9	833	13.4	0.64
Medical sciences	6,322	17.7	854	13.7	0.77
Engineering sciences	6,000	16.8	865	13.9	0.82
Agricultural sciences	4,965	13.9	1,910	30.6	2.20
Materials science	4,411	12.4	754	12.1	0.97
Life sciences	4,003	11.2	399	6.4	0.57
Environmental sciences	2,213	6.2	201	3.2	0.52
Mathematical sciences	1,066	3.0	258	4.1	1.37
Multidisciplinary	703	1.9	194	3.1	1.63
Total	35,640	100	6,231	100	1.00

**Table 4.** Distribution of uncited papers by publishing country of journals

Journal publishing country	TP	TP%	TUP	TUP%	RUI
USA	10,527	29.5	1,107	17.7	0.6
England	7,533	21.1	637	10.2	0.5
India	6,889	19.3	3,145	50.5	2.6
The Netherlands	4,333	12.2	247	3.9	0.3
Switzerland	1,149	3.2	66	1.1	0.3
Germany	1,060	2.9	97	1.6	0.5
Japan	380	1.1	83	1.3	1.2
France	366	1.0	24	0.4	0.4
Singapore	339	0.95	92	1.5	1.5
Romania	216	0.60	69	1.1	1.8
Poland	207	0.58	34	0.5	0.9
Others	2,641	7.4	449	7.2	0.97
Total	35,640	100	6,231	100.00	1.0

**Table 5.** Journals in descending order of RUI

Journal with the publishing country	TP	TP%	TUP	TUP%	RUI
<i>Indian Veterinary Journal</i> (India)	409	1.1	369	5.9	5.4
<i>Journal of Agrometeorology</i> (India)	154	0.4	121	1.9	4.7
<i>Research on Crops</i> (India)	165	0.5	142	2.3	4.6
<i>Plant Archives</i> (India)	135	0.4	115	1.8	4.5
<i>Asian Journal of Chemistry</i> (India)	392	1.1	256	4.1	3.7
<i>Indian Journal of Animal Sciences</i> (India)	341	1.0	229	3.7	3.7
<i>Indian Journal of Agricultural Sciences</i> (India)	261	0.7	165	2.6	3.7
<i>Indian Journal of Heterocyclic Chemistry</i> (India)	123	0.3	63	1.0	3.3
<i>Pramana – Journal of Physics</i> (India)	120	0.3	50	0.8	2.7
<i>Indian Journal of Traditional Knowledge</i> (India)	106	0.3	42	0.7	2.3
<i>Indian Journal of Pediatrics</i> (India)	174	0.5	66	1.1	2.2
<i>Acta Crystallographica Section E, online</i> (USA)	314	0.9	111	1.8	2.0
<i>Journal of the Indian Chemical Society</i> (India)	209	0.6	76	1.2	2.0
<i>Journal of the Geological Society of India</i> (India)	128	0.4	50	0.8	2.0
<i>Journal of Food Science and Technology – Mysore</i> (India)	107	0.3	38	0.6	2.0
<i>Indian Journal of Pure and Applied Physics</i> (India)	105	0.3	35	0.6	2.0
<i>Current Science</i> (India)	346	1.0	91	1.5	1.5
<i>Indian Journal of Pharmaceutical Sciences</i> (India)	178	0.5	38	0.6	1.2
<i>Indian Journal of Pathology and Microbiology</i> (India)	155	0.4	32	0.5	1.2
<i>Indian Journal of Chemistry, Section B</i> (India)	153	0.4	30	0.5	1.2
<i>E-Journal of Chemistry</i> (India)	151	0.4	33	0.5	1.2
<i>Indian Journal of Chemistry, Section A</i> (India)	114	0.3	19	0.3	1.0
<i>Indian Journal of Dermatology Venereology and Leprology</i> (India)	105	0.3	21	0.3	1.0
Others	31,195	87.6	4039	64.9	0.7
Total	35,640	100	6231	100	1.0

TP% and TUP% have been rounded off to the nearest whole number.

‘veterinary sciences’ (7.1%), ‘agronomy’ (5.8%), ‘agriculture dairy and animal sciences’ (5.2%) and ‘plant sciences’ (4.6%). Other sub-disciplines where the share of uncited papers was more than 3% were multidisciplinary materials science, multidisciplinary engineering, electrical and electronics, and physics multidisciplinary. For the remaining sub-disciplines, the share of uncited papers was less than 3%.

#### Uncited papers by journal publishing countries

The Indian scientists publish their research findings in journals published from both the advanced countries as well as from India. In 2008, about half of the total papers published by the Indian scientists appeared in journals originating from USA (30%) and England (21%). Rest appeared in journals published from other Western countries and India. Data presented in Table 4 show that the value of RUI was highest (2.6) for papers published in the Indian journals, followed by those published in journals originating from Romania, Singapore and Japan. Of the 6,889 papers published in Indian journals, 3,145 (45.6%) remained uncited. Similarly, the proportion of uncited papers published in journals from Romania, Singapore and Japan was 32%, 27% and 22% respectively. The low value of RUI indicates that lesser number of papers that remained uncited appeared in journals originating from The Netherlands and Switzerland.

Table 5 lists 23 journals with  $RUI \geq 1$ . Of these journals, all were published from India, except one *Acta Crystallographica Section E*, which was published from USA.

#### Uncited papers by journal impact factor

IF is an indicator of the prestige of the journal and depends upon the average rate of citations received by the articles published in it. Papers published in journals with high IF by and large indicate more credit than those published in journals with low IF. Papers published in high IF journals also indicate mainstream connectivity and readership. A raw analysis of data on the uncited papers indicates that of the 6,231 uncited papers, 2,258 (36%) were published in 298 journals with  $IF = 0$ , 3,086 (49.5%) in journals with  $IF \leq 1$  and the rest 14.5% in journals with  $IF > 1$ . Further analysis of data reveals that of the 2,258 uncited papers in journals with  $IF = 0$ , 1,468 (65%) were published in Indian journals followed by 253 (10%) in journals originating from USA and 127 (5.6%) from England. There were 17 papers which remained uncited despite being published in journals with  $IF > 5$ .

#### Implications of the study

The present study on uncitedness of Indian scientific output has implications for Indian science policy makers in

general and for agricultural scientists in particular, because a large proportion of uncited papers are in the discipline of agriculture and veterinary sciences. Major share of uncited papers are also published in Indian journals. Journal editors have to enhance the quality of the papers they publish. Further investigation is needed to identify the type (theoretical or methodological) of the uncited papers as well the subjects discussed in these papers. Similar studies may be undertaken for other countries like China and South Korea and a comparison can be made with India. However, one should not interpret that uncited papers are not being read, or do not contribute to scientific progress. Also, according to Garfield<sup>6</sup>, 'a certain level of uncitedness in the journal literature is probably more an expression of the process of knowledge creation and dissemination than any sort of measure of performance'.

### Salient findings

The present article studied the uncitedness of Indian scientific papers indexed by *SCI-E* in 2008 and their citations during 2008–2013, and estimated the quantum of uncited papers, their disciplines and journals where these papers were published. The study indicates the following:

- Only a small portion (17.5%) of the total Indian papers remained uncited. Based on the data of uncited papers indexed by ISI during 1984–1988, the share of uncited papers for the US authors was 14.7% and for non-US authors it was 28%.
- Most of the uncited papers were published by SAUs and ICAR. DBT had only three uncited papers.
- IISc, BARC and the IITs at Kharagpur, Chennai, Delhi, Kanpur and Mumbai did not have any uncited papers.
- Proportion of uncited papers for Annamalai University, Aligarh Muslim University, IARI and IVRI was 18%, 17%, 20% and 44% respectively, of their published papers.
- The highest share of uncited papers was for agriculture sciences (38%) followed by multidisciplinary (27%) and mathematical sciences (24%) of their total output.

- Of the 6,889 papers published in Indian journals, 3,145 (45.6%) remained uncited, followed by papers published in journals from Romania (32%), Singapore (27%) and Japan (22%).
- Of the 6,231 uncited papers, 2,258 (36%) were published in 298 journals with IF = 0 and 3,086 (49.5%) in journals with IF ≤ 1.

1. Garg, K. C. and Dutt, B., Bibliometrics of Indian science as reflected through *Science Citation Index. J. Sci. Ind. Res.*, 1992, **51**, 329–340.
2. Arunachalam, S., Srinivasan, R. and Raman, V., Science in India – a profile based on India's publications as covered by *Science Citation Index 1989–1992. Curr. Sci.*, 1998, **74**, 433–441.
3. Garg, K. C., Dutt, B. and Kumar, S., Scientometric profile of Indian science as seen through *Science Citation Index. Ann. Libr. Inf. Stud.*, 2006, **53**, 114–125.
4. Gupta, B. M. and Dhawan, S. M., Status of India in science and technology as reflected in its publications output in the *Scopus* database – 1996–2006. *Scientometrics*, 2009, **80**, 473–490.
5. Garg, K. C. and Kumar, S., Scientometric profile of Indian science as seen through *Science Citation Index Expanded 2010–2011. SRELS J. Inf. Manage.*, 2013, **50**, 529–542.
6. Garfield, E., Uncitedness III – the importance of not being cited. *Curr. Contents*, February 1973, **8**, 5–6; <http://www.garfield.library.upenn.edu/essays/V1p413v1962-73.pdf> (accessed on 19 July 2014).
7. Ghosh, J. S. and Neufeld, M. L., Uncitedness of articles in the *Journal of the American Chemical Society. Inf. Storage Retrieval*, 1974, **10**, 365–369.
8. Ghosh, J. S., Uncitedness of articles in *Nature*, a multidisciplinary scientific journal. *Inf. Process. Manage.*, 1975, **11**, 165–169.
9. Schwartz, C. A., The rise and fall of uncitedness. *Coll. Res. Libr.*, 1997, **58**, 19–29.
10. Hamilton, D. P., Publishing by – and for? – the numbers. *Science*, 1990, **250**, 1331–1332; [http://www.garfield.library.upenn.edu/commentaries/tsv12\(14\)p10v19980706.pdf](http://www.garfield.library.upenn.edu/commentaries/tsv12(14)p10v19980706.pdf) (accessed on 19 July 2014).
11. Hamilton, D. P., Research papers: who's is uncited now? *Science*, 1991, **251**, 25; [http://www.garfield.library.upenn.edu/commentaries/tsv12\(14\)p10v19980706.pdf](http://www.garfield.library.upenn.edu/commentaries/tsv12(14)p10v19980706.pdf) (accessed on 19 July 2014).
12. Pendlebury, D. A., Science, citation and funding. *Science*, 1991, **251**, 1410–1411.
13. Kessler, M. M. and Heart, F. E., Concerning the probability that a given paper will be cited. MIT, Cambridge, (TIP-TM-005), 1962.
14. Kumari, G. L., Synthetic organic chemistry research: analysis by scientometric indicators. *Scientometrics*, 2009, **80**(3), 559–570.
15. Garg, K. C., Kumar, S. and Lal, K., Scientometric profile of Indian agricultural research as seen through *Science Citation Index-Expanded. Scientometrics*, 2006, **68**, 151–160.

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