A Bibliometric Study of Journal of the Indian Society of Remote Sensing for the Period 1973-2014

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Abstract

The bibliometric portrait of Journal of the Indian Society of Remote Sensing concentrates on four decades publication trends from 1973-2014. The study analyzed 1310 research articles published in 140 issues of the journal. An attempt has been made to study various bibliometric indicators such as year-wise distribution of articles, authorship pattern & productivity, distribution of cited references, different forms of resources used and cited by authors in their research work, ranked list of prolific authors, journals & institutions. Efforts have also been made to test Lotka's law of scientific productivity.

Keywords

Bibliometrics, Remote Sensing, Authorship Pattern, Citation study, Lotka's Law.

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1. Introduction

Remote sensing can be defined as obtaining information about an object by observing it from a distance and without coming into actual contact with it (Narayan, 1999). Schowengerdt (1997) defined remote sensing as the measurement of object properties on the earth's surface using data acquired from aircraft and satellites. The applications of remote sensing include environmental assessment and monitoring; global change detection and monitoring; agriculture; nonrenewable resource exploration; renewal natural resources; meteorology; mapping and military surveillance, reconnaissance and many more. With the advent of earth observation satellites and advanced instruments with the capability to monitor closely the land-air-ocean interactions, the field has expanded dramatically covering almost all the areas, say, from cartography to climate (Panda, 2005). Enormous research is carried out all over the world in the field of remote sensing and its applications in every walk of life. India is one of the major space-faring nations which has made its mark with the largest fleet of remote sensing satellites.

The research results and applications have been brought out in the form of research articles, reports, books, conference papers, webpages and in many other formats of communicating the research. Journals have been the most important form of primary source for communicating research results. There are many journals published around the world in the field of remote sensing. In this study, Journal of the Indian Society of Remote Sensing which is a very important and popular journal in the field of remote sensing published in India is chosen. An attempt is made to study different bibliometric indicators and laws to the data gathered from the journal.

2. Source Journal

Started as Photonirvachak: Journal of the Indian Society of Remote Sensing in 1973, changed the title to Journal of the Indian Society of Remote Sensing in 2008. It is the official publication of Indian Society of Remote Sensing founded in 1969 and the only Indian journal exclusively publishing remote sensing and related research. In 1988, the frequency of this journal is changed to Quarterly from Half Yearly. The aims and scope of the journal are well documented in the print and electronic versions. The editorial board contains experts from India and many

other countries such as Russia, Japan, Germany, China, Thailand, USA, UK and The Netherlands. The society has now collaborated with Springer for publishing the journal. The journal is available in both print and electronic formats.
It is indexed in the host of indexing services such as Science Citation Index Expanded (SciSearch), Journal Citation Reports/Science Edition, SCOPUS, INSPEC, and Indian Science Abstracts to name a few.

2. Objectives of the Study

The objectives of the study are as follows:

- To map year-wise distribution of articles
- To examine the authorship pattern of the contributions
- To study author productivity
- To study the range and percentage of references per article
- To analyze the use of various types of resources used and cited by the authors
- To identify and prepare ranked list of prolific authors, journals and organisations/institutions
- To study Lotka's law of scientific productivity

4. Methodology

The data required for the study was collected from both print and electronic versions of the journal for the period 1973-2014. Only the research articles are considered for this study. The references appended to each article were carefully scanned and tabulated in respective tables using Microsoft Excel. The details regarding number of articles published, author names, affiliations and cited references are recorded for each article. Citation analysis technique and required bibliometric measures are applied to explore the objectives of the study.

5. Analysis of Data:

The following section discusses the analysis of the data collected and presented under different table headings as per the objectives of the study.
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5.1 Distribution of Contribution:

Table 1 presents the volume & year-wise distribution (distributed in blocks of 10 years for first three blocks and the fourth block contains 12 years) of published articles of Journal of the Indian Society of Remote Sensing. In 42 volumes containing 140 issues, 1310 articles have been published during the period 1973-2014. The study revealed that the highest number of 683 articles (52.14%) are published in the block 2003-2014 and lowest number of 128 articles (9.77%) are published in the block 1973-1982. The average number of articles published per year is 31.19 and the average articles per issue is 9.36. In 1988, the frequency of the journal is changed to Quarterly and from then on it is being published regularly with varying number of articles. It is also clear from Table 1 that publication of articles is continuously increasing from one block to the other.

Table 1: Year-wise Distribution

Years	Vol.	Issues	No. of Articles	Percentage
1973-1982	1-10	21	128	9.77
1983-1992	11-20	31	244	18.63
1993-2002	21-30	40	255	19.46
2003-2014	31-42	48	683	52.14
42	42	140	1310	100.00

5.2 Authorship Pattern:

The authorship pattern is analysed to determine the percentage of single and multiple authored contributions. Table 2 depicts the results of authorship pattern which reveals that two authored articles 364 (27.78%) are maximum in number and closely followed by 356 (27.17%) three authored article and 219 (16.72%) four authored articles. Single authored contributions accounts for 189 (14.43%) articles. There are 182 (13.89%) articles with more than or equal to five authors published during the study period

Table 2: Authorship Pattern

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	20	Total
1973-1982	52	43	25	6	2	-	-	-	-	-	-	-	-	-	128
1983-1992	60	71	64	30	12	-	-	1	2	-	-	-	-	-	244
1993-2002	43	75	62	34	25	10	1	1	1	1	-	2	-	1	255
2003-2014	34	175	205	149	66	25	13	8	3	-	2	-	-	1	683
Total	189	364	356	219	105	38	15	11	4	3	2	2	1	1	1310
%	14.43	27.78	27.17	16.72	8.01	2.90	1.14	0.84	0.30	0.23	0.15	0.15	0.08	0.08	100.00

5.3 Author Productivity

In order to calculate Average Author Per Paper (AAPP) and Productivity Per Author (PPA), Yoshikane et al (2009) have provided a formula which is mathematically represented as below:

Average Author Per Paper = No. of Authors/No. of Papers
Productivity Per Author = No. of Papers/No. of Authors

Table 3 reveals the block-wise author productivity of the articles. In all 3952 authors (each author is given one count for each published paper) have contributed 1310 articles during the study period. The average author per paper is 3.02 for 1310 articles. The average productivity per author is 0.33. The average author per paper is increasing and the productivity per paper is decreasing from one block to other.

Table 3: Author productivity

Years	No. of papers	No. of Authors	AAPP	Productivity per author
1973-1982	128	247	1.93	0.52
1983-1992	244	635	2.60	0.38
1993-2002	255	758	2.97	0.34
2003-2014	683	2312	3.38	0.29
Average	1310	3952	3.02	0.33

5.4 Year-wise Appearance of Citations

Table 4 depict that the 1310 articles published during the study period have received 19044 cited references. The block 2003-2014 has recorded the highest number of references with 13552 (71.16%) citations followed by 1993-2002 block with 2784 (14.62%). The block 1973-1982 which is the initial phase of publication of journal has recorded least number of citations i.e. 740 (3.88%) for 128 articles published. The average number of citations per articles is 14.54.

Table 4 : Year-wise appearance of citations

Years	No. of Citations	%
1973-1982	740	3.88
1983-1992	1968	10.34
1993-2002	2784	14.62
2003-2014	13552	71.16
Total	19044	100.00

5.5 Distribution of Citations

Table 5 analyzes the data on the range and percentage of references per block. It is clear that the articles having references ranging from 6-10 were highest with 339 (25.88%) articles followed by 11-15 range with 244 (18.63%) articles. There are 31 (2.37%) articles published without any cited references. It is also noted that 77 (5.88%) articles were having more than or equal to 36 cited references.

Table 5: Study of citations

Years	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	>=36	Total
1973-1982	10	66	32	14	5	-	-	1	-	128
1983-1992	15	84	77	43	15	4	4	-	1	244
1993-2002	5	41	105	51	30	9	9	5	-	255
2003-2014	1	22	125	136	117	90	71	44	76	683
Total	31	213	339	244	168	103	85	50	77	1310
%	2.37	16.26	25.88	18.63	12.82	7.86	6.49	3.82	5.88	100.00

5.6 Form-wise Distribution of Citations

Table 6 gives the details of different forms of sources used and cited by the authors in their research work. It shows that most of the authors have preferred "Journals" as the primary source of information for their research work with 11405 (59.89%) citations followed by books 3279 (17.22%), conference proceedings 1811 (9.51%), reports 1534 (8.06%) and webpages 290 (1.52%). The other forms of reference materials (3.8%) such encyclopedias, handbooks, directories, glossaries, news items, atlases, personal communications, thesis, manuals, standards, pamphlets, patents and monographs have also been used by the authors in their research work

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Table 6: Form-wise distribution of citations

Years	Journals	Books	Conf. Procs.	Reports	Webpages	Others	Total
1973-1982	227	216	107	144	0	49	740
1983-1992	785	452	293	311	0	127	1968
1993-2002	1441	537	367	308	12	119	2784
2003-2014	8992	2074	1047	771	278	430	13552
Total	11405	3279	1811	1534	290	725	19044
%	59.89	17.22	9.51	8.06	1.52	3.80	100.00

5.7 Ranked List of Prolific Authors

Table 7 presents the list of top 5 prolific authors during the study period. In all, 2362 authors (each author is given one count irrespective of number of articles published) contributed 1310 articles during the years 1973-2014. It is found that Dadhwal, V. K. is the top author with 36 articles followed by Panigrahy, Sushma 30 articles, Roy, P. S. 23 articles and Sharma, P. K. 22 articles. The other prominent authors are Parihar, Jai Singh with 19 articles, Manchanda, M. L. with 17 articles, Patel, N. K. with 15 articles, Badarinath, K. V. S with 14 articles and Singh, Raghavendra Pratap with 13 articles. There are 1745 authors who have contributed only once to this journal either single or in collaboration.

Table 7 - List of Prolific Authors

Sl. No.	Name	No. of Papers authored /co-authored
1	Dadhwal, V. K.	36
2	Panigrahy, Sushma	30
3	Roy, P. S.	23
4	Sharma, P. K.	22
5	Parihar, Jai Singh	19

5.8 Lotka's Law of Scientific Productivity:

Lotka's (1926) Inverse Square Law of Scientific Productivity states that the number of authors producing 'n' contributions is approximately equal to $1/n^2$ of the number of authors that produce only one contribution. For example, in a given subject about 60% authors out of One Hundred will contribute one

article each, 15% will contribute two articles each, 7% will contribute 3 articles each and so on. Lotka's Law is mathematically expressed as:

$$Y_x = \frac{C}{X^n}$$

Where, Y is the number of authors credited with X (1, 2, 3, 4, 5, 6, 7, 8, 9……) papers
C is the number of authors contributing one paper
And n is rate

$X^n * Y_x = C$ **(Where X = 1)**

i.e., 1 * 1745 = C , (C = 1745, number of authors contributing one paper)
When X=2
$2^n * 313 = C$ (C = 1745)
$2^n = 1745/313 = 5.57$ (by applying log)
n log(2) = log(5.57)
n = log(5.57) / log(2) (Where log(5.57) = 0.746 & log(2) = 0.301)

Therefore n = 2.48
Where, Y is the number of authors credited with X (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 19, 22, 23, 30 & 35) papers, C are the number of authors contributing one paper.

Table 8: Lotka's Law of Scientific Productivity

No. of Articles, X	No. of Authors (Observed) 2362	Observed %	No. of Authors (Expected) 2339	Expected %
1	1745	73.90	1745	74.60
2	313	13.25	314	13.42
3	121	5.12	114	4.80
4	66	2.80	56	2.40
5	36	1.52	34	1.32
6	20	0.85	20	0.85
7	15	0.63	14	0.60
8	8	0.34	10	0.43
9	9	0.38	7	0.30
10	6	0.25	6	0.25
11	9	0.38	4	0.17
12	5	0.21	4	0.17
13	1	0.04	3	0.13
14	1	0.04	2	0.08
15	1	0.04	2	0.08
17	1	0.04	1	0.04
19	1	0.04	1	0.04
22	1	0.04	1	0.04
23	1	0.04	1	0.04
30	1	0.04	0	0.00
36	1	0.04	0	0.00

In the present study 2362 authors have contributed 1310 articles published during the publication phase of 1973-2014. There are 1745 (73.90%) authors contributing only once, 313 (13.25%) authors contributing two times, 121 (5.12%) authors contributing 3 times, 66 (2.80%) authors contributing 4 times and so on. It is clear from Table 8 that the observed and expected authors are almost equal and the difference is also very negligible for n=2.48. Hence, author productivity pattern of Journal of the Indian Society of Remote Sensing partially complies with Lotka's Law for n=2.48.

5.9 Ranked list of prolific Institutions/Organizations

Table 9 shows the top 10 institutions that have contributed to this journal. All the top 10 institutions are from India. The Space Applications Centre, Ahmedabad has contributed 503 (12.73%) articles followed by Indian Institute of Remote Sensing, Dehra Dun 392 (9.92%) articles and National Remote Sensing Centre, Hyderabad 273 (6.91%) articles. In all authors affiliated with 685 institutions have contributed to this journal. It is also observed that many of the authors are affiliated with different institutions due to transfers or change from one institution to other. Such authors have been counted under the affiliation in the published version of the articles.

Table 9: List of Institutions/Organizations

Sl. No.	Institution/Organization	Total	%	Rank
1	Space Applications Centre, Ahmedabad	503	12.73	1
2	Indian Institute of Remote Sensing, Dehra Dun	392	9.92	2
3	National Remote Sensing Centre, Hyderabad	273	6.91	3
4	National Bureau of Soil Survey and Land Use Planning, Nagpur	81	2.05	4
5	Indian Institute of Technology, Roorkee	80	2.02	5

6	Haryana Agricultural University, Hisar	79	2.00	6
7	Andhra University, Visakhapatnam	76	1.92	7
8	Indian Agricultural Research Institute, New Delhi	66	1.67	8
9	Punjab Remote Sensing Centre, Ludhiana	65	1.64	9
10	Anna University, Chennai	63	1.59	10

5.10 Ranked list of Journals

Table 10 shows the top 10 journals preferred by authors during the publication phase of 1973-2014 of Journal of the Indian Society of Remote Sensing. The 11405 citations are scattered in 1636 journals. The top 10 journals accounted for almost 42.41% of total 11405 journal citations. International Journal of Remote Sensing tops as the highly preferred journal among the authors contributing to the source journal with 1110 (9.73%) citations followed by Remote Sensing of Environment 932 (8.17%) citations and Journal of the Indian Society of Remote Sensing 911 (7.99%) citations. There are 4 more Indian journals which occupied the place within top 30 namely "Current Science, Journal of the Geological Society of India, Memoirs of the Geological Survey of India, and Journal of the Indian Society of Soil Science. The journal self citation is 7.99%. There are 949 journals cited only once.

Table 10 :Ranked List of Journals

Sl. No.	Journal Name	Total	%	Rank
1	International Journal of Remote Sensing	1110	9.73	1
2	Remote Sensing of Environment	932	8.17	2
3	Journal of the Indian Society of Remote Sensing	911	7.99	3
4	IEEE Transactions on Geoscience and Remote Sensing	476	4.17	4
5	Photogrammetric Engineering and Remote Sensing	462	4.05	5
6	Current Science	309	2.71	6
7	Journal of Geophysical Research	234	2.05	7
8	Journal of the Geological Society of India	162	1.42	8
9	ISPRS Journal of Photogrammetric and Remote Sensing	124	1.09	9
10	Memoirs of the Geological Survey of India	117	1.03	10

6. Findings and Conclusions

The study provided the publication trend of Journal of the Indian Society of Remote Sensing during 1973-2014. The study reveals that the frequency of publication was inconsistent till 1987 and there after it is regularly being published quarterly. The journal has published 42 volumes with 140 issues containing 1310 articles during the study period. The multi-authored papers have shown an increasing trend with 85.57% contributions. Among the cited references, journals are the most preferred form of sources consulted with 11,405 (59.89%) citations followed by books 3,279 (17.22%). The top three authors are Dadhwal, V. K., Panigrahy, Sushma and Roy, P. S. with 36, 30 and 23 articles respectively. International Journal of Remote Sensing topped the ranked list of journals with 1110 (9.73%). Lotka's law of scientific productivity is also tested and found to partially comply with the present data set. In its 42 years publication phase, this journal has proved itself in terms of quality of contents, editing and has given a platform to the researchers to publish their research. Hence, it can be concluded that, Journal of the Indian Journal Society of Remote Sensing is most ideal journal to communicate and publish the research work in the field of remote sensing and allied areas not only for Indian researchers but also for the researchers around the world.

7. References

[1]. Narayan, L. R. A (1999). *Remote sensing and its applications*. Hyderabad: University Press (India) Limited.

[2]. Schowengerdt, R. A (1997). *Remote sensing: models and methods for image processing*. The Netherlands: Academic Press.

[3]. Panda, B. C (2005). *Remote sensing: principles and applications*. New Delhi: Viva Books Private Limited.

[4]. Yoshikane, F. Nozawa, T. Shibui, S. & Suzuki, T (2009). An analysis of the connection between researchers' productivity and their co-authors' past contributions, including the importance in collaboration networks. *Scientometrics*, 79(2), 435-49.

[5]. Lotka, Alfred T. (1926). The frequency distribution of scientific productivity. *Journal of the Washington Academy of Sciences*, 16(12), 317-23.