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Summer 4-1-2020

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# Scientometric Study of Publications of ‘Journal of Indian Society of Remote Sensing’

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## **Abstract**

The study attempts to analyse 1008 research publications of ‘Journal of Indian Society of Remote Sensing’ during the period 2010-2019. The present study focused on growth of research output, collaborations trends, citations patterns, contributing countries and organizations. Bibliometrix an R package used for scientometric analysis to achieve the research activities. The study shows that India, China and Iran are the top collaborating countries. The study also shows that the research output of the journal has increased over the years, a significant jump has recorded after 2012. VOSviewer was used to build network maps to know the collaborative zones with respect to Insitute and keyword distributions. The finding of the study shows that Lotka’s law is valid for the present study.

Keywords: Bibliometrix Package, Scientometrics, Journal of Indian Society of Remote Sensing, VOSviewer, Lotka’s Law.

**1.Introduction:-** The 20<sup>th</sup> century may be described as the century of the development of metric sciences like librametrics, bibliometrics, scientometrics, cybermetrics or webmetrics and lastly informatics<sup>1</sup>. Worldwide scientometrics is becoming a more powerful instrument to evaluation of the research performance of country, a regine, research and academic institutions, journals. Nalimov and malchenico(1969) of the USSR define scientometric as quantitative methods that deal with the analysis of science viewed as information processing. Scientometrics is the study and measurement of all forms of published knowledge and it deals with the quantification of written communication. Scientometrics is “The study of measurement of scientific and technological progress (Garfield, 1979)”. It is deals with the study of quantifying analysis of science and technology performance by applying mathematical and statistical methods to evaluate the scientific productivity. Journals are the primary communications channel to disseminating scholarly information and act as the important source for understanding research and development activites.

Several studies have revealed the role of R and its packages in vast scientific fields. It encompasses statistical algorithms, arthematical functionality and visualization capabilities, which makes it a good candidate for bibliometric and scientometric study. Aria & Cuccurullo (2017) stated that R an open-source software with its rich statistical capabilities is an excellent choice for scientific computing. Bibliometrix is an R statistical package for analyzing and visualizing the bibliographic data from WoS and Scopus databases (Aria & Cuccurullo, 2017). It read file in R language (<https://www.r-project.org/>), which operates under GNU operating system and archived and distributed by CRAN network project (<https://cran.r-project.org/>), operates under Windows and Linux operating system environment with a graphical user interface (RStudio), which makes it user-friendly.

## **Journal of Indian Society of Remote Sensing**

Indian Society of Remote Sensing was established in 1969. It started its journal titled as Photonirvachak in 1973. In 2008, the journal was changed to Journal of Indian Society of Remote Sensing with quarterly frequency, available in both print and electronic formats. The main objective of the journal is advancement and dissemination of remote sensing technology in the fields of mapping, planning, management of natural resources and environment. The editorial board contains experts from India and many other countries such as Russia, Japan, Germany, China, Thailand, USA, UK and The Netherlands. Indian Society of Remote Sensing has a membership of 5402 members. It is indexed in the host of indexing services such as Science Citation Index Expanded (SCI-E), Journal Citation Reports/Science Edition, SCOPUS, INSPEC, and Indian Science Abstracts and many other agencies.

### **2.Objectives of the study**

- To study the growth of research productivity of the journal.
- To find out the most productive Authors and Authorship.
- To analyze the highly cited papers in the JISRS.
- To study the country-wise distribution of research publications.
- To examine the publication density through mapping of Institutions and keyword co-occurrences based on the research papers.

### **3.Methods and Data:-**

A total of 1008 publications were published in journal of Indian society of remote sensing during the period. The data for the present study was downloaded from the online WoS database using the string IS=0255-660X. The data pertaining to each publication namely type of publications, publication author(s), institutions of author(s), publication keywords, number of citations received by each publication was retrieved on 15 Jan 2020. Bibliometrix package (latest version 1.442 of RStudio) is used to analyze the data pertaining to the growth of research, productive authors and country wise distributions. Finally, use respective functions in Bibliometrix to plot the research output. In connection with data visualization of institutions and keywords VOSviewer was used.

### **4.Review of Literature:-**

Batcha, M. Jahina, S. Ahmad, M (2018)<sup>2</sup> has examined DESIDOC Journal and analyzed the growth patterns, authorship patterns, subjects covered to the papers over the period 2013-2017. 227 papers were published during the period and maximum numbers of articles were collaborative in nature. The maximum numbers of articles (65%) have ranged their thought contents between 6 and 10 pages. Sadik Batcha & Muneer Ahmad, (2017)<sup>3</sup> analyzed scientometric analysis on the Indian Journal of Information Sources and Services (IJISS), studied authorship pattern & author productivity, citations, length of articles, keywords and collaborative papers were analyzed and degree of collaboration was 0.73 during this period. The study concluded that the author's productivity was 0.53 and dominated by Indian authors. Batcha, M (2017)<sup>4</sup> analyzed the field of robotic technology, increasing the publications over the years during the period from 1990 to 2016. USA, UK, and Germany give the most output on robotic technology-related research and a major proportion of contribution (36.30%) is from the USA. English is the most preferred for the research amounting (87.70%) followed by German, Bloss R is appreciable and author from Japan, Dario P competes with more number of publications in the study. Ahmad, *et al.* (2017)<sup>5</sup> explored the scientometric analysis of the Webology Journal, analyzed the pattern of growth, pattern of authorship, author productivity, and subjects covered. It was found that 62 papers were published during (2013-2017), maximum numbers of articles were collaborative nature. Social Networking/Web 2.0/Library 2.0 and Scientometrics or Bibliometrics were mainly covered under the journal subject. Iranian researchers contributed to maximum articles (37.10%). The study applied the standard formula and statistical tools to bring out the factual results.

Biljecki (2016)<sup>6</sup> examined 20 GIScience journals from 2000-2014 and studied growth patterns, trends and comprehensive scientometric study focuses on output volume, citations, national output and efficiency, collaboration, altmetrics, authorship, and length of articles. The study found that 5% of countries contribute 76% global GIScience output, a paper published 15 years before received a median of 12 citations. It found that global collaborations in GIScience have more than tripled from the year 2000 onwards. Khan, I(2001)<sup>7</sup> attained DESIDOC Journal of Library and Information Technology from 2010 to 2014, covers mainly the number of articles, authorship patterns, geographical distribution and types of documents cited. 119 (38.76%) are contributed by single authors reputation while the remaining 188 (61.24%) have joint authors. Furthermore, the research finds that maximum contributions are from India.

**5. Analysis and Presentation:-**

**The data is analyse and presented in the following paragraph**

**Table 1. Year Wise Growth Distribution**

Year	Articles	Percentage	Cumulative	AGR
2010	64	6.35	6.35%	0.00%
2011	60	5.95	12.30%	-6.25%
2012	65	6.45	18.75%	8.33%
2013	92	9.13	27.88%	41.54%
2014	87	8.63	36.51%	-5.43%
2015	80	7.94	44.44%	-8.05%
2016	99	9.82	54.27%	23.75%
2017	101	10.02	64.29%	2.02%
2018	196	19.44	83.73%	94.06%
2019	164	16.27	100.00%	-16.33%
Total	1008	100.00		13.36%

Table 1 shows the year-wise distribution of the publication during the period of 2010-2019. A total of 1008 research publications recorded during this period. The maximum number of papers published in the year 2018 with 196 publications followed by the year 2019 with 164 publications, 2017 with 101 papers published. It clearly shows that there is a quantum jump observed in the growth of publications after the year 2012. The annual growth rate shows that the growth of publications is found to be positive in 2012,2013,2016,2017,2018 and the remaining years indicate negative growth. In 2018(94.06%) growth rate occupied top position, followed by 2013(41.54%) occupied second position, followed by 2016 (23.75%), overall years an average of 13.36 % annual growth rate recorded. The following mathematical representation is used to derive annual growth rate of articles over a specific period.

$$AGR = \frac{\text{EndValue} - \text{FirstValue}}{\text{FirstValue}} \times 100$$

## **6.Top Twenty Prolific Authors:-**

**Table 2: Top Twenty Prolific Authors**

Authors	Articles	TC	h_index	g_index	m_index
DADHWAL VK	36	172	7	10	0.6363636
KUMAR A	25	113	6	9	0.5454546
PANIGRAHY S	21	125	7	9	0.6363636
KUMAR AS	14	46	3	6	0.375
PARIHAR JS	13	83	5	8	0.4545455
NAGAMANI PV	11	25	3	4	0.3
PRADHAN B	11	295	7	11	0.6363636
DAS S	9	26	4	5	0.4
JHA CS	9	40	4	6	0.3636364
KUMAR KV	9	36	4	6	0.5
RAY SS	9	56	4	7	0.3636364
REDDY CS	9	23	3	4	0.2727273
SHARMA JR	9	40	4	5	0.5
CHOUDHURY SB	8	21	3	4	0.375
LI Y	8	16	3	3	0.375
MISHRA AK	8	19	3	4	0.3
RAJAWAT AS	8	27	3	5	0.2727273
RAO KH	8	27	3	4	0.375
SEHGAL VK	8	37	4	6	0.3636364
SINGH M	8	49	4	7	0.3636364

**TC=Total Citations,h-Index=H-Index, g-index=G-Index, m-index=M-Index**

The analysis of Table 2 shows that 2561 unique authors contributed to the 1008 articles. The study revealed that “Dadhwal VK” and “Kumar A” from Indian Institute of Remote Sensing, Dehradun, Uttar Pradesh, India ranked first and second with the contributions of 36 papers, 25 papers, followed by “Panigrahy S” from ISRO, Space Application Center, Ahmadabad, Gujarat, India has the third-highest with contributions research output of 21 papers. It could be found from this analysis, ‘Dadhwal VK’, ‘Kumar A, ‘Panigrahy S’ were identified as the most prolific authors among top twenty authors.

### **H-Index, G-Index and M-Index**

The table 2 also shows that author level indexes with respective total citations. H-Index is an author level index introduced by Hirsch, defined as the number of articles h that each article receives a least h citations. Another popular indicator is g-index developed by Leo Egg, it is the unique largest number such that top g papers together receive g<sup>2</sup> or more citations. The m-index is defined as h-index/n, where n is the number of years since the first published paper of the scientist. It has revealed that Dadhwal VK(7) followed by Panigrahy S(7) and Pradhan B(7) has prominent H-Index among the top twenty authors. Pradhan B(11), followed by Dadhwal VK(10), followed by Kumar A(9), Panigrahy S(9) has productive G-Index authors. With respective M-Index Dadhwal VK, Pradhan B, Panigrahy S indentified as prominent authors with equal scores of 0.6363636.

### **7.Verification of Lotka’s Law:-**

Lotka’s law describes the relationship between the authors and publications. The number of authors against their publications was plotted on a logarithmic scale.

The general form of Lotka’s law is  $Y=C/X^n$  ;X = number of publications; Y = relative frequency of authors with X publications; C & n = constant; By using this function R Programming Lotka’s Law is tested; L=lotka(results) function.

**Table:3 No of articles published by a number of corresponding authors**

No. of Research Publications	N. of Authors	Proportion of Authors
1	2012	0.785630613
2	334	0.130417806
3	99	0.038656775
4	51	0.019914096
5	22	0.008590394
6	12	0.00468567
7	9	0.003514252
8	9	0.003514252
9	6	0.002342835
11	2	0.000780945
13	1	0.000390472
14	1	0.000390472
21	1	0.000390472
25	1	0.000390472
36	1	0.000390472

For the given data set, the  $\beta = 2.506367$ ,  $C=0.4942513$ ,  $R^2= 0.9264645$  and  $p = 0.3337843$ . Normally, there is an inverse relationship between  $R^2$  and P-value. The higher R-value and lower P-value indicate a significant relationship between the variable that data lies on a straight line. R-square value reflects on how much variation is explained by the model. The Lotka's law was also found to be a good fit for the present study(See Tabel 3).

### **8.The Highly Cited Papers:-**

**Figure 1: Ten Highly Cited Paper in JISRS**

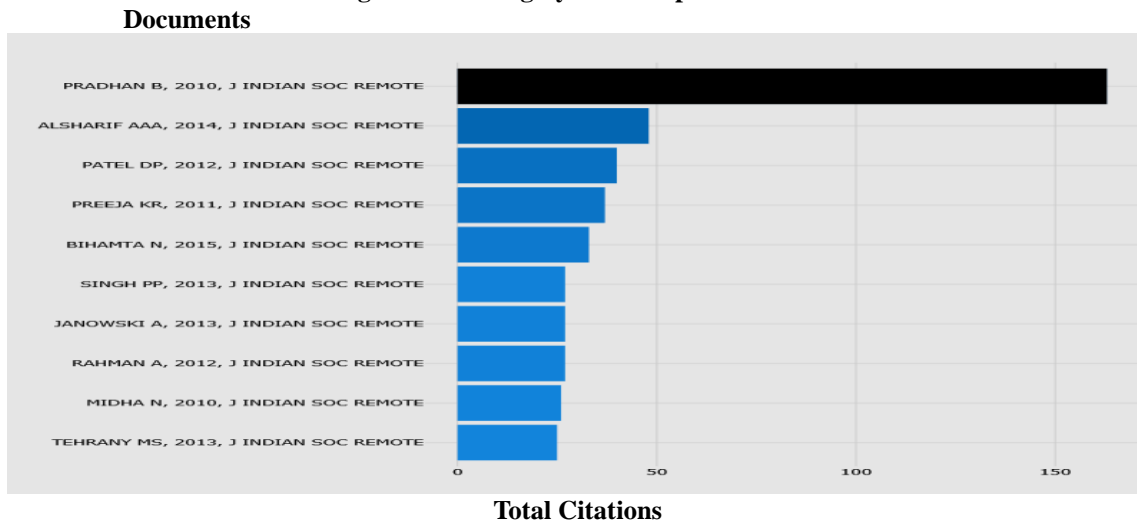


Fig 1 shows that Among the top ten highly cited papers the publications titled **“Landslide Susceptibility mapping of a catchment area using frequency ratio, fuzzy logic and multivariate logistic regression approaches”** by PRADHAN B(2010) gets first rank by receiving of 163(14.81%) total citations, followed by **“Urban Sprawl Analysis of Tripoli Metropolitan City (Libya) Using Remote Sensing Data and Multivariate Logistic Regression Model”** by ALSHARIF AAA(2014) gets second rank with an average of 48(6.85%) citations, followed by **“Water Harvesting Structure Positioning by Using Geo-Visualization Concept and Prioritization of Mini-Watersheds Through Morphometric Analysis in the Lower Tapi”** by

PATEL DP(2012) gets third rank with an average of 40(4.44%) citations, it is evident from figure 1

that out of 10 papers, 9 papers published in 01-50 citation range. It shows that highly cited papers out of ten papers, 6 papers from India followed by Germany(1), Malaysia(2) and Poland(1) published during this tenure.

### **9.The Country Collaborations:-**

**Table 4: Country collaboration**

Country	Articles	Freq	SCP	MCP	MCP_Ratio
INDIA	537	0.533797	504	33	0.0615
CHINA	217	0.215706	193	24	0.1106
IRAN	98	0.097416	83	15	0.1531
TURKEY	47	0.04672	43	4	0.0851
ALGERIA	15	0.014911	12	3	0.2
MALAYSIA	15	0.014911	9	6	0.4
SAUDI ARABIA	10	0.00994	4	6	0.6
TAIWAN	6	0.005964	6	0	0
EGYPT	5	0.00497	4	1	0.2
JAPAN	4	0.003976	1	3	0.75
PAKISTAN	4	0.003976	1	3	0.75
ETHIOPIA	3	0.002982	3	0	0
GERMANY	3	0.002982	2	1	0.3333
KOREA	3	0.002982	0	3	1
TUNISIA	3	0.002982	2	1	0.3333
USA	3	0.002982	3	0	0
AUSTRALIA	2	0.001988	2	0	0
BANGLADESH	2	0.001988	2	0	0
CAMEROON	2	0.001988	1	1	0.5
CANADA	2	0.001988	1	1	0.5

**SCP: Single Country Publications; MCP: Multiple Country Publications, MCP\_Ratio=MCP Ratio**

### **10. Geographical Distribution of Citations:-**

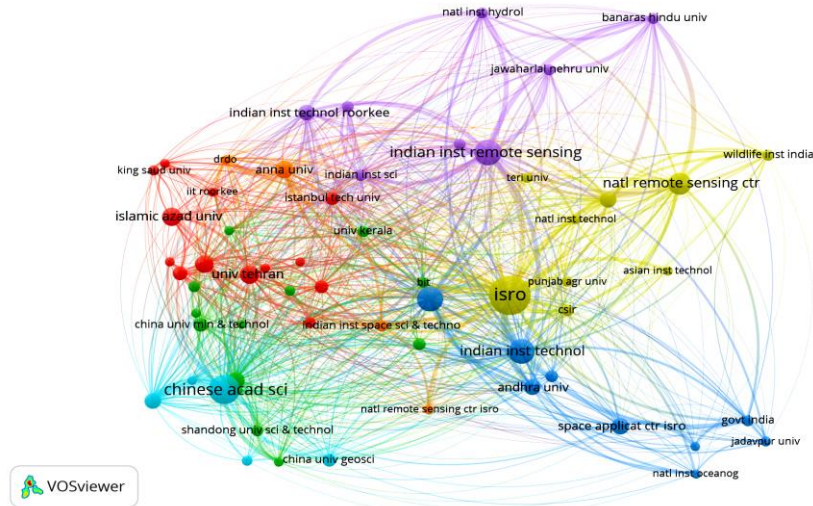
**Table 5: Country wise Citations**

Country	Total Citations	Average Article Citations
INDIA	2046	3.81
CHINA	443	2.04
IRAN	289	2.95
GERMANY	174	58
MALAYSIA	148	9.87
TURKEY	98	2.09
ALGERIA	42	2.8
POLAND	34	17
SAUDI ARABIA	34	3.4
VIETNAM	18	9
JAPAN	13	3.25
SUDAN	13	13
KENYA	11	11
U ARAB EMIRATES	11	5.5
EGYPT	9	1.8
BANGLADESH	8	4
TAIWAN	7	1.17
USA	7	2.33
AUSTRALIA	6	3
KOREA	5	1.67





**Figure 3: Institution Wise Distribution of JISRS Research Output (2014-2018)**



**Research Mapping of Institution Wise Distribution**

Figure 3: shows that the above graph has seven clusters with a total of 61 institutes, cluster-1 having 13 institutes, cluster-2 having 13 institutes, cluster-3 having 9 institutes, cluster-4 having 9 institutes, cluster-5 having 8 institutes, cluster-6 having 5 institutes, cluster-7 having 4 institutes. The keyword analysis was built on a full counting method where a unit of analysis is an organization. The minimum number of documents of organizations should be 5, the minimum number of citations of the organization should be 5, based on this threshold, out of 972 institutes 61 institutes were selected for the study. The higher the number of co-occurrences of two terms, the closer they will be located on the map.

### Conclusion:

The study analyzed quantitatively and graphically from different perspectives based on their publication date, there was a sharp increase in the growth of research publications since 2017. It was established that the research papers published every year by the distinguished scientist are in increasing order. Although The older paper has the advantage of more citations compared to new ones. Author patterns based on Web of Science (WoS) have been focused and found a steady growth, Multi-authored publications outnumbered the single author publications throughout the period. It is evident that Indian, China, and Iran are the leading collaboration countries with respective multi-country contributions. Research organizations occupied leading positions such as National Remote Sensing Center, Hyderabad, followed by the Indian Institute of Remote Sensing, Dehradun and Space Application Center, Ahmadabad. It shows that Lotka's Law is still valid for the present study.

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26. <https://www.isrs-india.org/>

Acknowledgments: - I thank Mr.R Adil Rasheed (Dy Head of LDD) of UR Rao Satellite Center, Bengaluru for great support and encouragement to preparing this Manuscript.