

# DEFINING CHEMICAL SCIENCE RESEARCH: CONCLUSIONS FROM A CRITICAL REVIEW OF THE LITERATURE

Chaman Sab M.\*, Dharani Kumar P.\*\*, B. S. Biradar\*\*\*

**Abstract** *Objective:* To summarize findings from a systematic exploration of existing literature and views regarding chemical science, to discuss themes and components of such work, and to propose a theoretically based definition of chemical science research.

**Data Sources/Study Setting:** The major data sources were used: Google search with researchers from various disciplines, and a systematic review of the scientometrics literature.

**Study Design:** Systematic review of literature, Data Collection/Extraction Methods. We reviewed 18 definitions of scientometrics literature in the fields of study, that definition was then field tested by 18 individuals with scientometrics research experience, and their research responses proposed in this paper.

**Principal Findings:** Three key definitional characteristics were identified: Without constant pressure for theory building, the field would surely slide to its natural resting place in dust-bowl empiricism.

**Conclusion:** Existing literature from several fields did not provide a definition for scientometrics research of sufficient specificity to facilitate activities.

**Keywords:** Chemical Science, Review of Literature, Collaboration, Research, Definition

## INTRODUCTION

The review of literature is an important component of any research study. It helps the researcher frame the research study on the chosen topic by providing new ideas, concepts, methods, techniques and approaches. The review of relevant literature covers the key sources, relevant to the present research topic. The review of literature is unique and it aims to provide an overview of the sources. The purpose of review is to identify relevant information and to outline the existing information, to identify the gaps in the current field of study and to position the present work, to evaluate and synthesize the information. This is to provide justification for the study undertaken.

For this purpose, a retrospective search of literature was carried out by using SCOPUS Database, Web of Science database (Science Citation Index), Social Science Citation Index, JCCC@infonet, Emerald, Springer e-journals full-text database. Attempts were also made to trace and collect the relevant research papers and related documents such as journal articles, conference papers, books, etc. Attempts

were also made to trace and collect the original articles and the same have been used for review.

The research publications gathered from various sources have been documented and the information so collected was used for evaluation.

The summary of the papers has been written. In this study an attempt has been made to review the published literature under the following sub-headings:

- Growth and Development of research Productivity;
- Scientometric Analysis of different Subjects and Sources; Scientific Productivity of Institutions or Organizations;
- Author Productivity and Collaboration; Ranking of Journals and Institutions;
- Citation Analysis of Individual Scientists; Collaborative works (Individual level, Institutional level and Country level);
- Application of Bibliometric Laws;
- Obsolescence of Literature and
- Recent Trends in Scientometrics/Bibliometrics.

\* Research Scholar, Dept. of Studies in Library and Information Science, Kuvempu University, Shankarghatta, Shimoga, Karnataka, India. Email: chamansabm@gmail.com

\*\* Asst. Professor, Dept. of Studies in Library and Information Science, Kuvempu University, Shankarghatta, Shimoga, Karnataka, India. Email: dr.dharanikumarp@gmail.com

\*\*\* Dept. of Studies in Library and Information Science, Kuvempu University, Shankarghatta, Shimoga, Karnataka, India. Email: bsbiradar53@rediffmail.com

## REVIEW OF LITERATURE

### Growth and Development of Research Productivity

1. **Sangam and Keshava (2003)** have conducted a study on the growth pattern of literature in the field of social science. For the study the data was derived from CD-ROM version of Wilson Social Science Abstracts for the period 1983-1998. The six disciplines viz, Anthropology, Economics, History, Political Science, Psychology and Sociology were chosen. The calculation of relative growth rates and doubling time for publication has been done in order to determine the rate of growth of social science literature. Further, the study is extended to identify the criteria on which the growth models are to be selected for the appropriate application in the above said six disciplines.
2. **Sangam and Kadi (2003)** have studied the growth of research and priorities of demography research in different countries of the world, i.e., USA, UK, India and China for the period 1986 to 2000. For the study they have employed appropriate growth model to fit the time series data in order to study the trend of growth of subject for each country. The results show that over a period of time there is an increase in publication of literature.
3. **Sangam, Meera and Megeri (2008)** have analyzed the growth pattern of chemical science literature in India in eight branches. And also measures the growth by calculating relative growth rate and doubling time for chemical literature. Further identify parameters and fit statistical branch for modeling the growth.
4. **Bala and Gupta (2010)** have analyzed the research output in India in neurosciences during the period 1999-2008 and the analyses includes research growth, rank, global publications share, citation impact, share of international collaborative papers and major collaborative partner countries and patterns of research communication in most productive journals. It also analyses the characteristics of most productive institutions, authors and high-cited papers. The paper compares the publication output and impact of India with China, Brazil and South Korea.

### Scientific Productivity of Institutions or Organizations

1. **Sangam & Bagalkoti (2012)** undertook a study of research output of top eight Asian countries under various indicators. To determine the ranks, the total

articles, citations, subject areas, authors, institutional collaborations, international collaboration and H-index are taken into account. In this article, all the indicators which measure quantifiable aspects of the application of science and technology. For this, data has been collected from the SCOPUS international multidisciplinary bibliographical database.

### Author Productivity and Collaboration

1. **Sangam and Meera (2009)** have examined the collaboration in research that is affected by various socioeconomic and other environmental factors prevailing to the society. The collaborative outputs of different subject areas are science, social ill science and humanities. The investigation of such nature may be found useful in understanding the research and communication patterns for Indian chemical science.
2. **Biradar and Rajashekhar (2010)** present a study based on references appended to the articles published in open access e-journal AgBioForum for the year 1998-2009. The study highlights the authorship trend, average citations per article, collaborative research and use of web references. The study found that team research is preferred than solo research in the field of Biotechnology and maximum number of articles are contributed from USA.
3. **Hadagali et al. (2010)** present paper on authorship pattern, degree of collaboration and collaborative index in the field of Library and information science on Information Literacy, Knowledge management and Knowledge organization.

### Ranking of Journals and Institutions

1. **Kaur and Gupta (2010)** have examined India's performance based on its publication output in dental sciences during 1999-2008, based on several parameters, including the country annual average growth rate, global publication share and rank among 25 most productive countries of the world, national publication output and impact in terms of average citations per paper, international collaboration output and share and contribution of major collaborative partners, contribution and impact of selected top 25 Indian institutions and selected top 15 most productive authors, patterns of communication in national and international journals and characteristics of its 45 high cited papers.
2. **Sangam and Meera (2011)** have pointed out the periodicals as the best tool for scientific information communication. The data on chemical science journals

has been collected using SCI Finder Scholar-online Chemical Abstract database. The study reveals five most productive journals. Out of 120 journals, 13 are basically from medical sciences, 17 physics and 8 belong to environmental sciences showing the interdisciplinary and multidisciplinary character of Chemical Science Literature. The distribution pattern of the articles in chemical science journals has followed the Bradford's distribution which shows that Bradford's law of scattering goes well with the Chemical Science literature.

3. **Sangam & Bagalkoti (2012)** examines India's performance on the basis of its publication output in Science and Technology during 2001-2010. Also identifies the international collaboration, h-index and the National Assessment and Accreditation Council grade (NAAC) of top 50 productive universities. The study uses 10 years publications data from Scopus international multidisciplinary bibliographical database. 50 universities contributed 1, 08,666 papers and received 3, 36,027 citations during 2001-10, with the average citation per paper as 3.09. The study also indicates various criteria for ranking universities.

### Citation Analysis of Individual Scientists

1. **Garfield (1984)** conducted the Citation Analysis study on Lester R Aronson during the Anti-visection Controversy. in his series of two essays in Current Contents dedicated to Dr. S. R. Ranganathan, the Father of Indian Library Science highlighted in detail life and works in the first part and his contribution to Indian and International library science in the second part of the essay.

### Collaborative Works (Individual Level, Institutional Level and Country Level)

1. **Gupta, Suresh Kumar & Karisiddappa (1997)** examine collaborative pattern by using different collaborative measures. About 72% of authors have collaborated, and it is observed that the average author per paper is 1.86, and there is consistent increase in collaborative coefficient, and the productivity and collaboration count is found to be 2.34 and 2.08, using normal count and straight count method. Correlation between the number of publication/papers and average number of collaboration per author as 0.6944 ( $r=0.002$ ) seems to be strong.
2. **Mueen & Gupta (2013)** examined the India's performance on antioxidants using several quantitative

measures such as India's global publication share, rank, growth rate and citation quality, its publication share in various sub-fields in terms of national share utilizing last 10 year's (2001-10) publications data obtained from the Scopus database. They have also determined Indian share with international collaborative papers at the national level as well as is major international collaborative partners, besides analyzing the characteristics of its high productivity institutions, authors and high-cited papers, etc.

### Application of Bibliometric Laws

1. **Neelamma and Anandhalli (2016)** have studied the research output performance of Crystallography literature, which is covered in Web of Science on-line version database for the period of 1989-2013. A total of 1387195 references cited in 45320 articles in 2043 journals. The study elaborates on various bibliometric components such as distribution of citations by documents type, Country wise publication of citations, further the study also list out the most productivity journals in the field of crystallography. The analysis of the study reveals that out of 1387195 citations which (83.835%) Research articles contribute the highest number of citations and it is the most preferred sources of information used by researchers in the field of crystallography. Further journal of Molecular Biology is the most cited journal in the field of crystallography. The USA is most cited country in the world. Bradford's law well fitted in to the given data set for the present study. Finally it can be concluded that, the significant research activity is being taking place in the field of Crystallography. And it is one of the emerging research fields in the applied science.

### Obsolescence of Literature

2. **Sangam and Biradar (1990)** discussed the pattern of information use by researchers in the field of surgery as indicated by citations in the M. S. Dissertations submitted to the Gulbarga University, Kalburgi during 1982-1989. They identified the use of different sources of information, their languages, countries of origin and subjects, also states the obsolescence of literature and lastly applies Bradford's Law of Scattering. Finally they found that, implications for the development of need based collection in library and information centres in the field of surgery.
3. **Sangam and Meera (2012)** have conducted a study on obsolescence factors and pattern of citation distribution

in the field of chemical science. The study is based on citation received by two journals viz. *Indian Journal of Experimental Biology* and *Asian Journal of Chemistry*. These two journals have received 30,142 references for 3,027 articles at the rate of 9.95 references per article for 5 year data.

## Recent Trends in Scientometrics/ Bibliometrics

1. **Wildgaard, Schneider & Larsen (2014)** opines that an increasing demand for bibliometric assessment of individuals has led to a growth of new bibliometric indicators as well as new variants or combinations of established ones. The authors reviewed the 108 indicators that can potentially be used to measure performance on individual author-level and examines the complexity of their calculations in relation to what they are supposed to reflect and ease of end-user application.
2. **Jaric et al. (2012)** has applied a bibliometric approach to identify recent patterns and trends in the methods, subjects, and authorships in the literature published in fisheries science.

## FINDINGS

Motivates the research topic and explains the review's contributions \* describes the key concepts \* delineates the boundaries of the research \* reviews relevant prior literature in chemical science and related areas \* develops a model to guide future research \* justifies propositions by presenting theoretical explanations, past empirical findings, and practical examples \* presents concluding implications for researchers.

## CONCLUSION

With the help of the reviewed articles it is reveals that, many studies have done about scientometric measures. The application of scientometric techniques on scientific literature shows that the bibliometric models are better fitted to the scientific literature. It has been observed that the collaboration is gradually increasing in the scientific publications. Considerable number of the article has been reported on subject and journal productivity. It has been found that a number of scientometric studies have been done in science at the micro level. Indian Chemistry literature has been found to be more investigated research area in world science and technology.

## REFERENCE

- Sangam, S. L., & Keshava. (2003). Growth patterns of literature in the field of social science. *Journal of Information Management*, 40(1), 77-84.
- Sangam, S. L., & Kadi, A. S. (2003). Indicators for Demographic Research: A cross national assessment. Paper presented at 9<sup>th</sup> international Conference on Scientometrics & Informetrics. August 25-29, 2003.
- Sangam, S. L., Meera & Megeri, M. N. (2008). Growth patterns of Indian chemical science literature: A scientometric analysis. *Journal of Information Management and Scientometrics*, 2(1), 99-109.
- Bala, A., & Gupta, B. M. (2010). Mapping of Indian neuroscience research: A Scientometric analysis of research output during 1999-2008. *Neurology India*, 58(1), 35-40.
- Sangam, S. L., & Bagalkoti, V. T. (2012). Science and technology research output of asian countries using science and technology indicators. *Contemporary Research in India*, 2(4), 18-28.
- Biradar, B. S., & Rajashekhar, G. R. (2010, December). *Scientometric analysis of biotechnology literature*. In Sangam and Others (Eds.). Proceedings of National Seminar on Webometrics, Informetrics and scientometrics, DLISc, K. U. Dharwad (pp. 134-145).
- Hadagali, G. S., Kumbar, B. D., & Keshava (2010, December). *Collaboration trends in emerging disciplines of Library and information science*. In Sangam and Others (Eds.). Proceedings of National Seminar on Webometrics, Informetrics and scientometrics, DLISc, K. U. Dharwad (PP. 179-186).
- Kaur, H., & Gupta, B. M. (2010). Mapping of dental science in India: A scientometric analysis of India's research output, 1990-2008. *Scientometrics*, 1-16.
- Sangam, S. L., & Meera. (2011). Scientometric analysis of chemical science journals. *International Journal of Information Research*, 1(2), 1-14.
- Sangam, S. L., & Bagalkoti, V. T. (2012). Ranking of NAAC Accredited Indian Universities. In Sadashivamurthy, P. et al. (Eds.). *Scientometrics Proceedings*, 317-330.
- Garfield, E. (1984). A Tribute to S. R. Ranganathan, the Father of Indian Library Science. Part 1. Life and Works. *Current Contents*, 6, 5-12.
- Gupta, B. M., Kumar, S., & Karisiddappa, C. R. (1997). Collaboration profile of theoretical population genetics specialty. *Scientometrics*, 39(1997), 293-314.
- Mueen, K. K., & Gupta, B. M. (2013). India's contribution on antioxidants: a bibliometric analysis, 2001-10. *Scientometrics*, 94, 741-754.

- Neelamma, G., & Anandahalli, G. (2016). Application of Bradford's law in the field of crystallography: A scientometric study. *International Journal of Information Dissemination and Technology*, 6(2), 77-83.
- Sangam, S. L., & Biradar, B. S. (1990). Pattern of information use by Indian surgical scientists: A citation analysis. *Annals of Library Science and Documentation*, 37(4), 133-142.
- Sangam, S. L., & Meera. (2012). Obsolescence Factors and Pattern of Citation Distribution in the field of Chemical Science. *Journal of Advances in librarianship*, 3(1), 1-8.
- Wildgaard, L., Schneider, J. W., & Larsen, B. (2014). A review of the characteristics of 108 author-level bibliometric indicators. *Scientometrics*, 101, 125-158.
- Jaric, I., Cvijanovic, G., Knezevic-Jaric, J., & Lenhardt, M. (2012). Trends in fisheries science from 2000 to 2009: A bibliometric study. *Reviews in Fisheries Science*, 20(2), 70-79.