United Nations
Educational, Scientific and
Cultural Organization

Research Evaluation Metrics

Module

4

Research Evaluation Metrics

Published in 2015 by the United Nations Educational, Scientific and Cultural Organization, 7, place de Fontenoy, 75352 Paris 07 SP, France

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ISBN 978-92-3-100082-9

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Cover design by The Commonwealth Educational Media Centre for Asia (CEMCA)
Printed in PDF

CURRICULUM DESIGN COMMITTEE

Anirban Sarma
UNESCO New Delhi, India

Anup Kumar Das
Jawaharlal Nehru University, India

Barnali Roy Choudhury
CEMCA, New Delhi

Bhanu Neupane
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Upali Amarasiri
University of Colombo, Sri Lanka

Žibutė Petrauskiene
Vilnius University Library, Lithuania

MODULE ADVISORS

Ramesh C Gaur
Jawaharlal Nehru University, India

Uma Kanjilal
Indira Gandhi National Open University, India

Project Coordinator

Sanjaya Mishra
CEMCA, New Delhi, India

MODULE PREPARATION TEAM

Writer
Anup Kumar Das
Jawaharlal Nehru University, India

Editor
Prof. Bimal Kanti Sen
Formerly at University of Malay, Malaysia

Chief Editor
Sanjaya Mishra
CEMCA, New Delhi

MODULE INTRODUCTION

At present**,** research is going on all over the world practically in all subjects and generating millions of research articles and other documents. In some cases, the research works are generating very good results, in most cases mediocre, and in some cases negative results. Basing research results, awards, fellowships, promotion, selection for a job, etc are decided. For all these, evaluation of research output becomes sine qua non.

Centuries ago when the number of researchers were less, peers used to evaluate research. With the passage of time, the number of researchers increased, research areas proliferated, research output multiplied. The trend continued and after World War II the research workers and their outputs started growing exponentially. Today even on a moderate estimate there are around or more than one million researchers and they produce more than two million research papers and other documents per year.

In such a mind-boggling situation, research evaluation is continuously proving to be a tough job. For any award and fellowship there may be scores or hundreds of nominees. From among these, how to select the best candidate has turned out to be a big question. Peer reviews in many cases are proving to be subjective. As a result decisions are getting biased.

In 1963 *Science Citation Index (SCI)* appeared on the scene covering the literature of 1961. A few years hence, Eugene Garfield, the founder of *SCI*, prepared a list of 50 most cited scientists basing first author citation of 1967 *SCI*. The paper titled 'Can Nobel Prize Winners be Predicted?' was presented in 1968 (Garfield & Malin, 1968). In the very next year i.e. 1969, two scientists figuring in the list, e.g. Derek H R Barton and Murray Gell-Mann received the coveted Prize. This vindicated the usefulness of citation analysis. Every year several scientists belonging to the field of Physics, Chemistry, Physiology & Medicine receive the Nobel Prize. If out of a list of 50, two get the award it is no mean achievement for a prediction.

This prediction opened the floodgate of citation analysis as it was free from subjectivity. Even for peers, citation analysis became a useful tool. However, citation analysis was not free from faults. Even Garfield remarked – 'Using citation analysis for evaluation papers is a tricky business. It is fraught with opportunities for error' (Garfiled, 1983).

For research evaluation, some other indicators were needed. Citation analysis along with peer review ensured better judgment in innumerable cases. Something more was needed to make the judgment foolproof to a great extent. The advent of World Wide Web (WWW) provided the opportunity. Quite a number of indicators have come up based on the data available in WWW.

This module dwells on a number of methods (including old and new) available for research evaluation. The module comprises the following four units:

- Unit 1. Introduction to Research Evaluation Metrics and Related Indicators.
- Unit 2. Innovations in Measuring Science and Scholarship: Analytical Tools and Indicators in Evaluation Scholarship Communications.
- Unit 3. Article and Author Level Measurements, and
- Unit 4. Online Citation and Reference Management Tools.

Brief overviews of the units are presented below.

Unit 1 encompassed and discussed citation analysis, use of citation-based indicators for research evaluation, common bibliometric indicators, classical bibliometric laws, author level indicators using authors' public profiles, article level metrics using altmetric tools. It is to be noted that author level indicators and article level metrics are new tools for research evaluation. Author level indicators encompasses h index, citations count, i10 index, g index, articles with citation, average citations per article, Eigenfactor® score, impact points, and RG score. Article level metrics or altmetrics are based on Twitter, Facebook, Mendeley, CiteULike, and Delicious which have been discussed. All technical terms used in the Unit have been defined.

Unit 2 deals with analytical tools and indicators used in evaluating scholarly communications. The tools covered are The Web of Science, *Scopus*, *Indian Citation Index* (*ICI*), CiteSeerX, Google Scholar and Google Scholar Citations. Among these all the tools except *Indian Citation Index* (*ICI*) are international in scope. *ICI* is not very much known outside India. It is a powerful tool as far Indian scholarly literature is concerned. As Indian journals publish a sizable amount of foreign literature, the tool will be useful for foreign countries as well. The analytical products with journal performance metrics *Journal Citation Reports* (*JCR*®) has also been described. In the chapter titled New Platforms for Evaluating Scholarly Communications three websites i.e. SCImago Journal & Country Rank (SJR) [ScimagoJR.com], eigenFACTOR.org, JournalMetrics.com and one software called Publish or Perish (POP) Software have been discussed.

Article and author level measurements have been discussed in **Unit 3**. Author and researcher identifiers are absolutely essential for searching databases in the WWW because a name like D Singh can harbour a number of names such as Dan Singh, Dhan Singh, Dhyan Singh, Darbara Singh, Daulat Singh, Durlabh Singh and more. The ResearcherID.com, launched by Thomson Reuters, is a web-based global registry of authors and researchers that individualises each and every name. Open Researcher and Contributor ID (ORCID) is also a registry that uniquely identifies an author or researcher. Both have been discussed in this Unit. Article Level Metrics (Altmetrics) has been treated in this Unit with the discussion as to how altmetrics can be measured with Altmetric.com and ImpactStory.org. Altmetrics for Online Journals has also been touched. There are a number of academic social networks of which ResearchGate.net, Academia.edu, GetCited.org, etc. have been discussed. Regional journal networks with bibliometric indicators are also in existence. Two networks of this type such as SciELO – Scientific Electronic Library Online, and Redalyc have been dealt with.

The last unit (**Unit 4**) is on online citation and reference management tools. The tools discussed are Mendeley, CiteULike, Zotero, Google Scholar Library, and EndNote Basic. The features of all the management tools have been discussed with figures, tables, and text boxes.

Written by B K Sen

UNIT 2 INNOVATIONS IN MEASURING SCIENCE AND SCHOLARSHIP

Structure

2.0 INTRODUCTION

As mentioned in the previous Unit, citation indexing helps in examining growth of scientific literature, contributions of individual scientists, journals, institutions and countries in production of knowledge. For effective citation analysis, we require comprehensive tools that have recorded newly produced scientific literature contributed by scientists and researchers located around the world in all subject areas. Commercially available citation indexing databases had become very comprehensive tools for citation analysis, mapping of science, mapping of internationally collaborative research and trend analysis in emerging fields of science. The *Science Citation Index*, introduced in 1964 by the Institute for Scientific Information (ISI), has been widely used for citation analysis and measurement of research.

In the beginning of the twenty-first century, we see emergence of new tools and new techniques for measurement of science, scientific journals, institutions and individuals. Some of the tools are also freely available to scientific communities to help them in understanding exponential growth of scientific literature.

The knowledge explosion has become inevitable to the scientific communities, as we see some online scientific journals are even publishing more than one

thousand articles in a year. Thus, the entire literature needs to be tracked and indexed for the benefit of the society. -Innovative tools and indicators now measure influence and impact of each peer-reviewed scientific publication. Measurement has now re-focused on article level, as journal level measurement through conventional citation-based indicators has been debated as inadequate, biased or skewed.

This Unit highlights conventional citation databases, new tools and indicators for performance measurement and freely available resources so that worldwide researcher communities can equally participate in the process of knowledge production and knowledge utilization.

2.1 LEARNING OUTCOMES

At the end of this unit, you are expected to be able to

- Understand measurement of research using citation databases and more particularly *Web of Science* (*WoS*[13]), *Scopus*[14], and other citation-based products available;
- Use different metrics and indicators derived from citation databases;
- Use online citation databases, and more particularly freely available citation databases and search engines;
- Describe about various online analytical tools for measuring impact, influence and cost effectiveness of scientific journals and more particularly open access journals; and
- Use freely available online analytics such as ScimagoJR[15].

2.2 CITATION DATABASES

While ScimagoJR has become trendsetter as a comprehensive tool for evaluating research performance and for measuring impact of scientific communications using the techniques of citation analysis, there are many others before this. A number of citation databases were launched by different organizations. With the emergence of high speed internet technologies and launching of many electronic journals, a number of bibliographic-cum-citation databases were launched for providing seamless access to recorded human knowledge online to scientific communities around the world.

Table 4 shows an indicative list of presently available citation databases which are used by millions of researchers across the world. These citation databases primarily help in bibliographic search of published literature. Citation databases index literature published by peer-reviewed academic journals and

[13] http://wokinfo.com/
[14] http://www.elsevier.com/online-tools/scopus
[15] http://www.scimagojr.com/

other channels of academic communications, such as books, conference proceedings, theses and dissertations.

Table 4: Major Citation Databases

Name of Citation Database	Launched	Scope	Owned by	Terms of Availability
Science Citation Index (*SCI*)	1964	Global	Thomson Reuter	Subscription-based with Web of Science
Social Science Citation Index (*SSCI)*	1972	Global	Thomson Reuter	Subscription-based with Web of Science
Arts & Humanities Citation Index (A&HCI)	1978	Global	Thomson Reuter	Subscription-based with Web of Science
Scopus	2004	Global	Elsevier B.V.	Subscription-based
Google Scholar Citations	2004	Global	Google Inc.	Freely Available Online
Microsoft Academic Search	2003	Global	Microsoft Research	Freely Available Online
CiteSeerX (CiteSeerX.ist.psu.edu)	1997	Global; Subject specific	Pennsylvania State University, USA	Freely Available Online
Indian Citation Index (IndianCitationIndex.com)	2009	India/ South Asia	Knowledge Foundation and Diva Enterprises	Subscription-based

2.2.1 The Web of Science

The Institute for Scientific Information (ISI) produced highly respected citation databases in all major subject areas, viz. *SCI, SSCI* and *A&HCI*. ISI produced them in print format as well CD-ROM format in a regular interval as periodicals. In print format, there had been a three-part index for each volume of *SCI* or *SSCI*, namely Source Index, Subject Index and Citation Index. In the Source Index, full bibliographic information for the citing author and citing work is given. In the Citation Index, works cited during a given year are listed alphabetically by the name of the author cited, followed by the names of the citing authors. In the Subject Index called Permuterm Subject Index, significant words in the title of an article are listed.

In 1992, ISI was acquired by Thomson Scientific & Healthcare and became a new entity called Thomson ISI. Later, Thomson ISI became a part of the Healthcare & Science business of Thomson Reuters. Thomson ISI introduced a new web-based product called *Web of Science (WoS*), which offered indexing and abstracting (I&A) services to the global researcher communities. *WoS* included all its citation databases namely, *SCI*, *SSCI* and *A&HCI* to make *WoS* more comprehensive and competitive over other similar products in this

segment. All its citation databases *SCI*, *SSCI* and *A&HCI* were made accessible from a single gateway. For *WoS*, an extended version of *SCI* called *Science Citation Index Expanded* was introduced to cover more peer-reviewed academic journals from around the world. Table 5 indicates source items included in citation databases and available with *WoS*. In addition to citation databases *SCI*, *SSCI* and *A&HCI*, *WoS* also includes *Book Citation Index* and *Conference Proceedings Citation Index*. However, few more citation databases are not part of *WoS* but included in another comprehensive product of Thomson Reuters, namely, *Web of Knowledge* (*WoK*). Table 3 shows a list of citation databases included in *WoS* as well as *WoK* products. It can also be observed that with introduction of *WoK*, *WoS* has become a subset of the comprehensive product *WoK*.

Recently, *WoS* has enhanced its coverage of journals published from different regions of the world, including Latin America, Asia and Africa. It has also enhanced coverage of open access peer-reviewed journals to make this product more competitive. With representation of global South and emerging economies, the *WoS* is striving to reach out to new markets. Table 6 indicates its diversity of coverage and more focused acquisition of regional contents.

Table 5: Web of Science Coverage

Product Included	**Years Coverage**	**Titles Coverage**
Science Citation Index Expanded	1900 to present	Over 8,500 major journals from across 150 disciplines.
Social Sciences Citation Index	1900 to present	Over 3,000 social sciences journals, covering the most significant social sciences discoveries from all of the 20th century.
Arts & Humanities Citation Index	1975 to present	over 1,700 arts and humanities journals, as well as selected items from over 250 scientific and social sciences journals.
Book Citation Index	2005 to present	Over 30,000 editorially selected books with 10,000 new books added each year.
Conference Proceedings Citation Index	1900 to present	Over 148,000 conference titles in the Sciences and Social Sciences with 12,000 conferences added annually.

Source: Web of Science Fact Sheet 2013, available at http://thomsonreuters.com/products/ip-science/04_064/web-of-science-fs-en.pdf

Table 6: Citation Databases Included in Web of Science vis-à-vis Web of Knowledge

Product Included	Web of Science	Web of Knowledge
Science Citation Index Expanded	√	√
Social Sciences Citation Index	√	√
Arts & Humanities Citation Index	√	√
Book Citation Index	√	√
Conference Proceedings Citation Index	√	√
Data Citation Index	X	√
BIOSIS Citation Index	X	√
Chinese Science Citation Database	X	√
SciELO Citation Index	X	√
Derwent Patents Citation Index (DPCI) (also included in Derwent World Patents Index)	X	√

Using Web of Science for Citation Analysis

The *WoS* is suitable for bibliographic search of published literature in all subject areas including science, technology, medicine, social sciences and humanities. *WoS* also provides various functionalities for visualization of retrieved data. Searched data can also be downloaded for importing to a reference manager software, such as EndNote, Mendeley and Zotero.

Figure 5 shows the homepage of *WoS* with basic search interface. *WoS* databases can be searched using topic, name of an author, publication name, article title, name of an institution, name of a city, name of a country, and other metadata. In this search interface you can also limit your search to a specific database, say *SCI* or *SSCI* or both. *WoS* also has option of 'cited reference search' to retrieve bibliographic details of papers citing a particular document.

Figure 6 shows retrieved result of a basic search. It retrieved documents matching search criteria and with listing items sorted by number of times cited – highest to lowest. For each reference, data shows number of times this item was cited. On the left panel of this Figure, it indicates major *WoS* categories, document types, major authors, major research areas, etc. When clicked on a particular item, full bibliographic details of that paper, abstract and external link to e-journal will be shown. From this page, a user can also generate a citation report or analyse results in charts or spreadsheet.

Figure 7 shows retrieved result of a cited reference search. It retrieved documents matching search criteria and with listing items sorted by publication date– newest to oldest. For each reference, data shows number of times this item was cited. Here, search result shows that works of Nobel laureate C.V. Raman published between 1901 and 1950 are still relevant and continually getting cited in papers written by the researchers of present time.

The *Web of Science* has been a data source for deriving many bibliometric indicators, including Journal Impact Factor (JIF) and Immediacy Index (JII), that help in evaluation of performance of journals, contributing authors, affiliating institutions of contributors, etc. Most important analytical product derived from *WoS* is the annual *Journal Citation Reports* (*JCR*). Thomson Reuters produces two editions of *JCR*, one for Science edition and other one for Social Sciences edition. Both are subscription-based. Other important analytical product is eigenFACTOR.org. We shall discuss more about *JCR* and eigenFACTOR.org in Section 2.4.2 of this Unit.

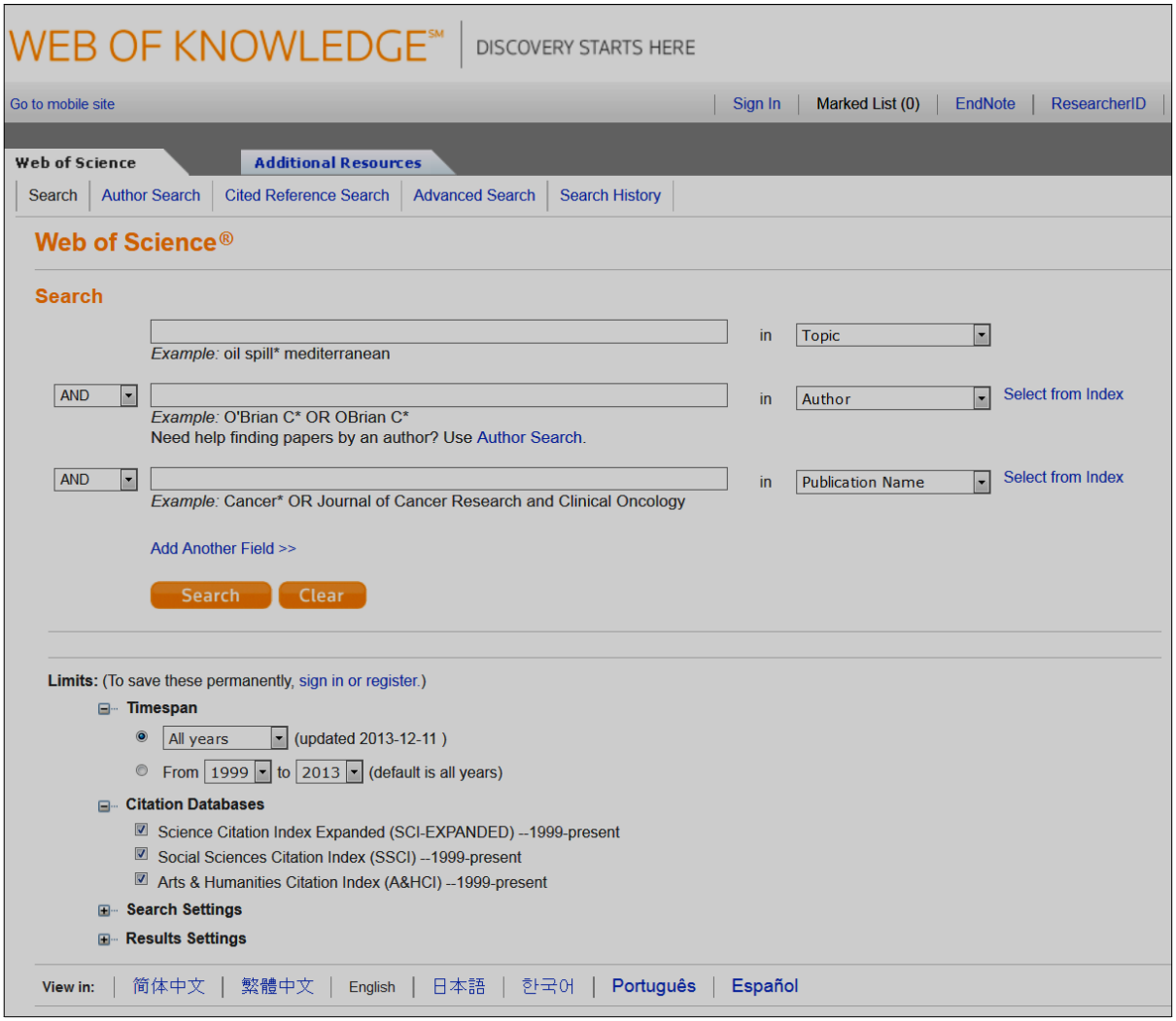


Figure 5: Basic Search Interface of Web of Science

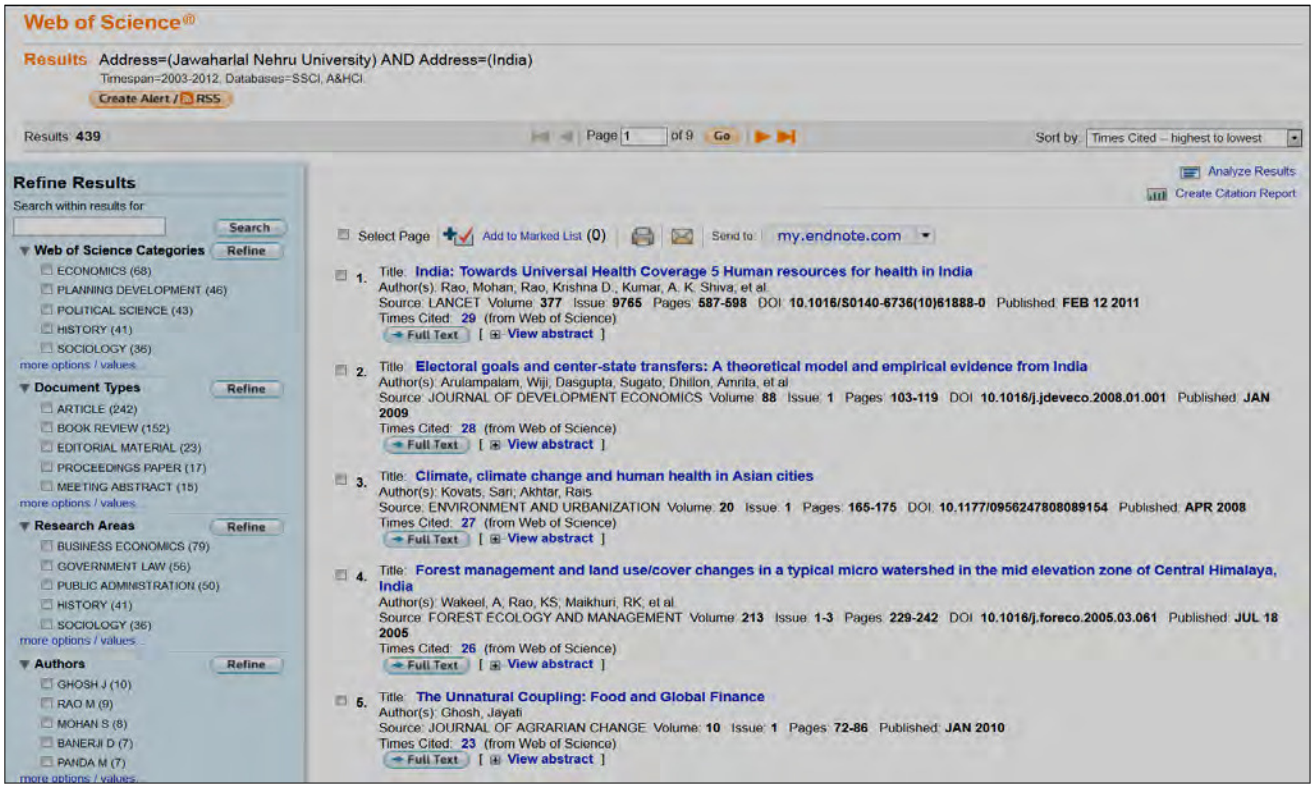


Figure 6: A Search Result from Web of Science

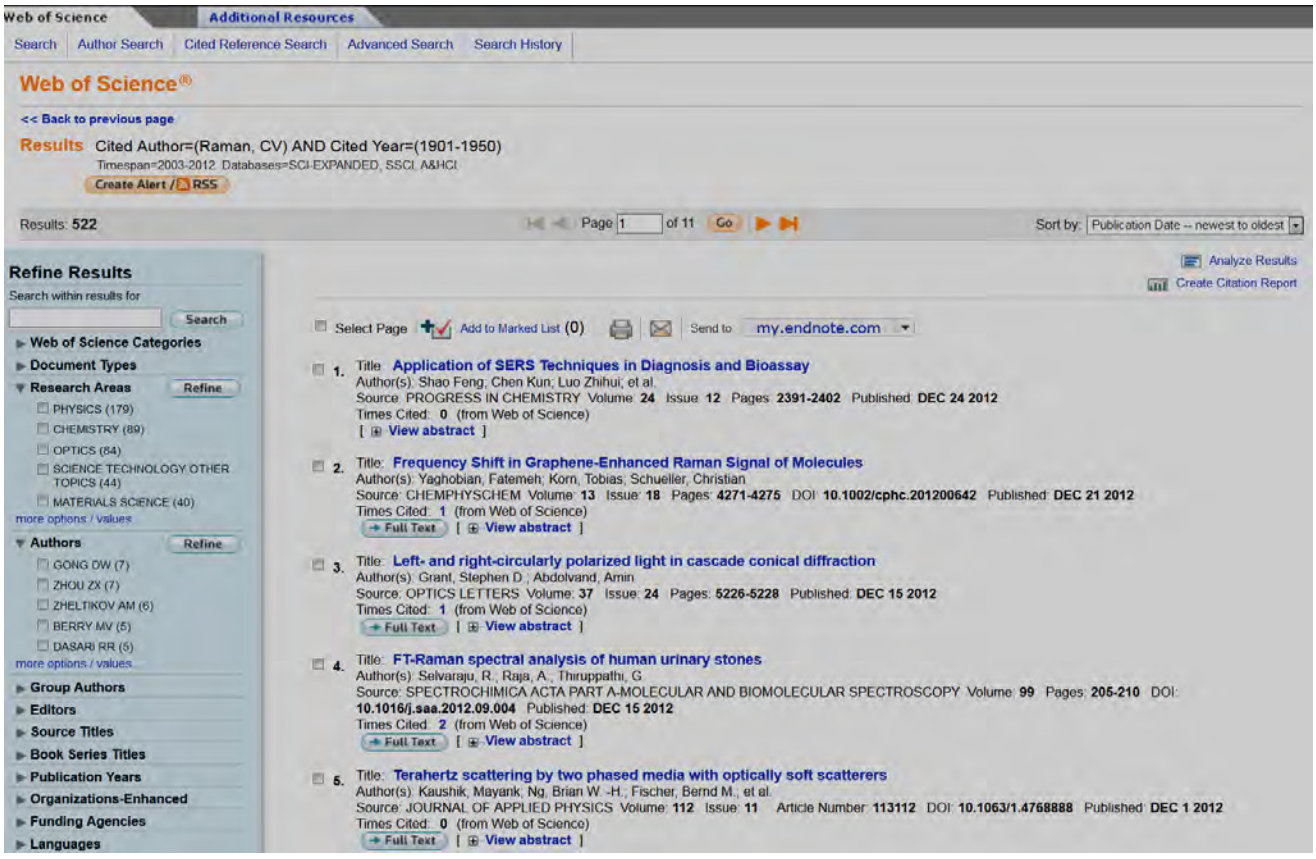


Figure 7: A Result from Cited Reference Search in *WoS*

2.2.2 Scopus

Scopus is one of the largest abstracting, indexing and citation databases of peer-reviewed literature. As indicated earlier in Table 4, *Scopus* is a subscription-based proprietary database produced by Elsevier B.V. As in December 2013, *Scopus* covered over 20,000 peer-reviewed journals, including about 2,600 open access journals, 390 trade journals, 370 book series, and 5.5 million conference papers. It also covers "Articles-in-Press" from more than 3,850 journals, with forthcoming papers in different journals. *Scopus* has larger coverage of peer-reviewed journals than its competitor *Web of Science*. Similar to *WoS*, *Scopus* also covers all subject areas of science, technology, medicine, social sciences and humanities. Recently, *Scopus* has enhanced its coverage of journals published from emerging economies and global South such as BRICS countries, viz., Brazil, Russia, India, China, South Africa and Republic of Korea.

Using Scopus for Citation Analysis

Similar to *WoS*, *Scopus* document search interface facilitates searching by many key bibliographic elements or metadata such as article title, keywords, author, affiliation and country. You can also limit your search to a particular subject area such as life sciences or physical sciences or both, as shown in Figure 8. Figure 9 shows retrieved result of a document search. It retrieved documents matching search criteria and with listing items sorted by number of times cited – highest to lowest. For each reference, data shows number of times this item was cited. On the left panel of this Figure, it indicates year-wise distribution, names of major contributors, major collaborating countries, etc. When clicked on a particular item, full bibliographic details of that paper, abstract and external link to e-journal will be shown. From this page, a user can analyse results in charts or spreadsheet, and generate a citation report.

Scopus has been a data source for deriving many bibliometric indicators and related analytical tools for measuring performance of journals, institutions and countries. Most prolific ones are SCImago Journal & Country Rank (SJR), SCImago Institution Ranking (SIR) and JournalMetrics.com. We shall discuss more about SJR, SIR and JournalMetrics in Section 2.4 of this Unit.

In the first decade of its existence, *Scopus* and its derivative works has become useful tool to researchers for analysing their published works, knowing research trends and retrieving documents of their interests. Its analytical tools and map or chart generators help in generating good visualization effects for objective analysis. *Scopus*, thus, has become useful resources for information analysts, journal editors and research administrators.

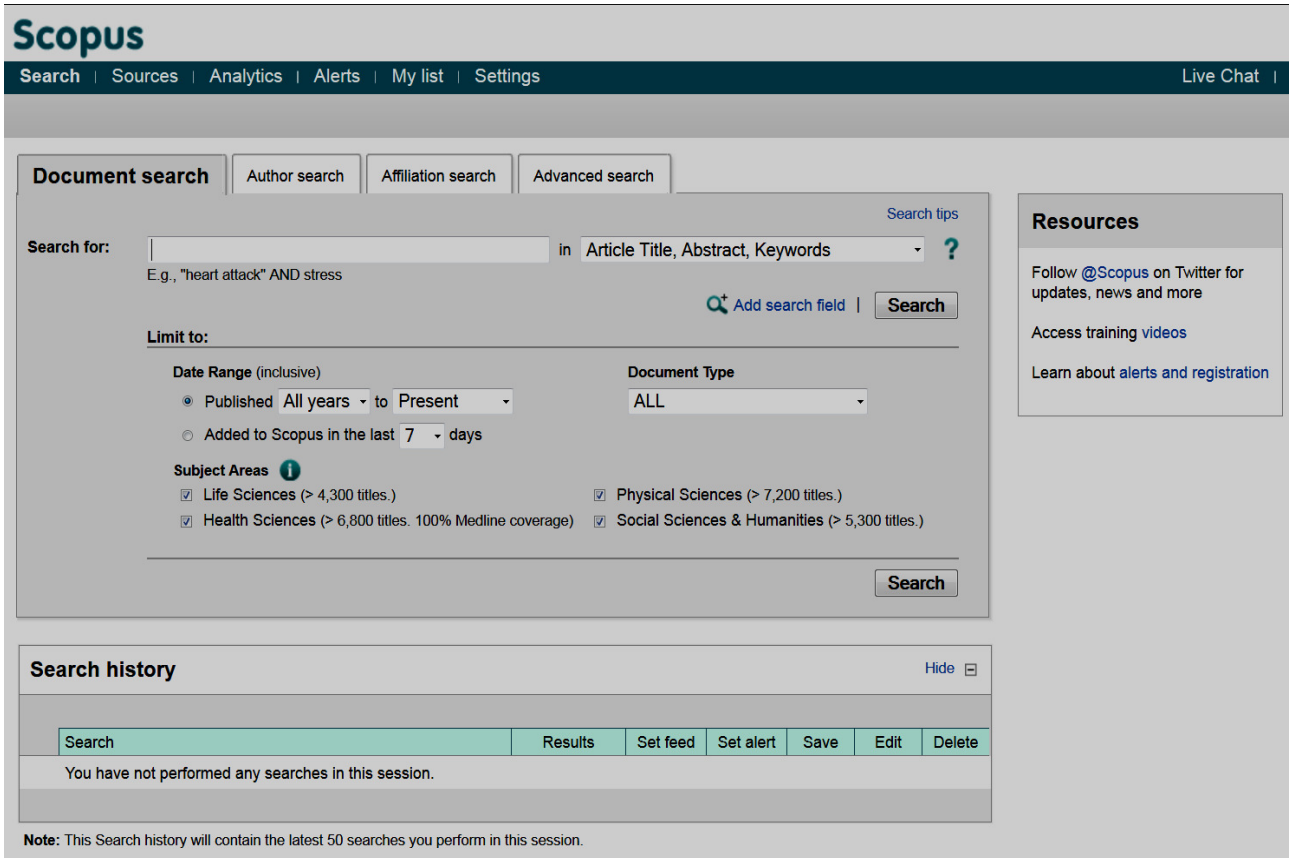


Figure 8: *Scopus* Homepage with Document Search Interface

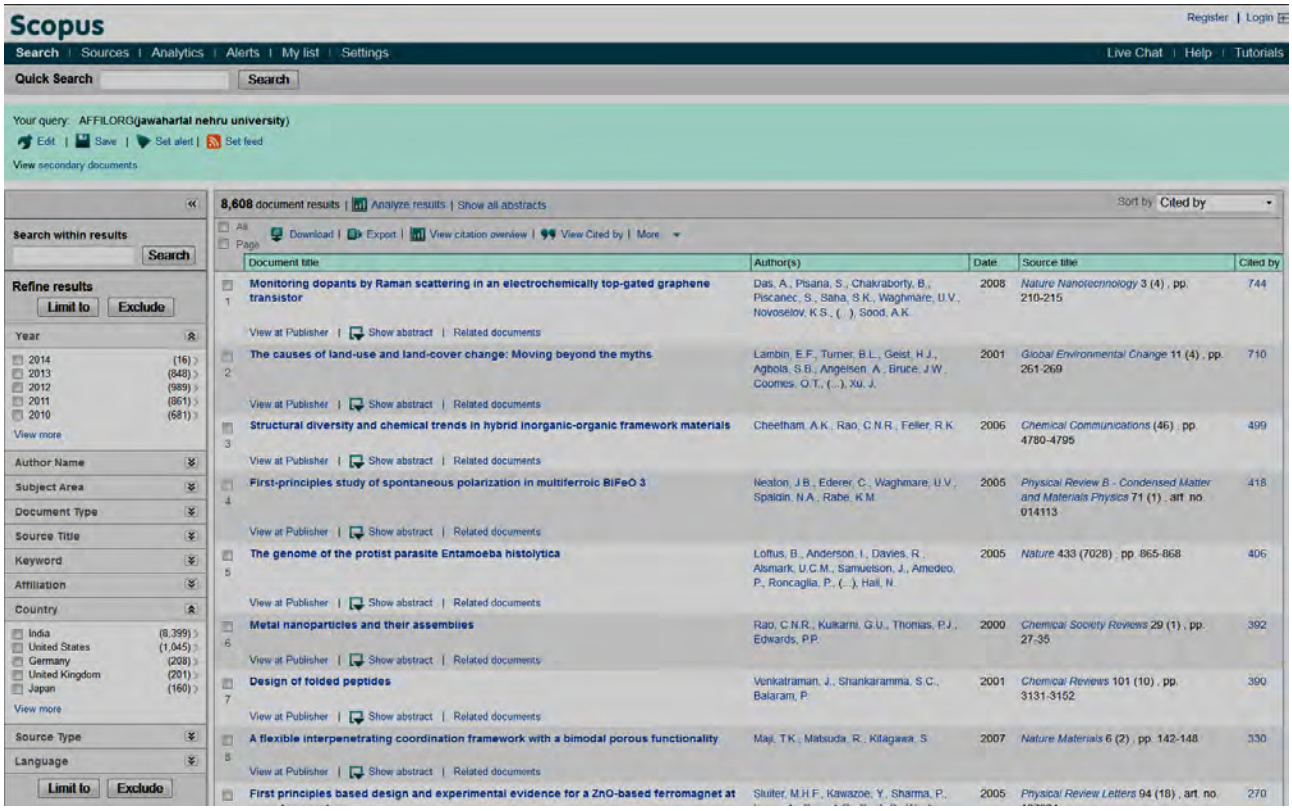


Figure 9: A Search Result from *Scopus*

2.2.3 Indian Citation Index (ICI)

The *Indian Citation Index* (IndianCitationIndex.com) is an online collection of multidisciplinary citation-cum-bibliographic databases covering about 800 multidisciplinary academic journals, published from South Asia and more particularly from India. As global citation databases such as *Web of Science* and *Scopus* cover only a handful of Indian academic journals, there has always been a demand for home-grown online citation databases for bibliographic control of scientific literature emanating from India.

The *ICI*, launched in October 2009 by the Knowledge Foundation (a registered society) and Diva Enterprises Pvt. Ltd. (a registered company) as a subscription-based proprietary knowledge portal, covers retrospective citation data since 2004 onwards from about 800 academic journals pertaining to all major subject areas including STM (science, technology and medicine) and HSS (humanities and social sciences). It also includes about 220 open access journals published from India.

The scope of *ICI*, as mentioned in its website, is: "Indian R&D literature across all disciplines i.e. science, technology, medicine, agriculture, social science and humanities get published in 1000 plus journals/ serials or in other documents emanating from India". It attempts to achieve the following objectives: (i) to ensure access to articles published in local Indian R&D literature at national & global level; (ii) to reflect and represent true picture of locally published Indian scholarly contribution at national and global level; and (iii) to have an authentic tool/ground for effective and rigorous evaluation of Indian scholarly works.

In the coming years, *ICI* proposes to produce following online services as subsets or by-products of main *ICI* databases:

- *Indian Science Citation Index* (ISCI)
- *Indian Health Science Citation Index (IHSCI)*
- *Indian Agriculture Citation Index (IACI)*
- *Indian Social Science & Humanities Citation Index (ISSHCI)*
- *Indian Journals Citation Report (IJCR)*
- *Indian Science & Technology Abstracts (ISTA)*
- *Directory of Indian R&D Journals (DoIJ)*

Using *ICI* for Citation Analysis

ICI's online citation database can be seached using different metadata and search terms. Its homepage provides a basic search interface for entering a search query in combination with two or three different search terms, such as the name of the author and the name of the institution. Figure 10 shows its homepage and basic search interface. Figure 11 shows search results of a search query given by a user. For this search query a combination of names of two authors was given and a year range selected from the timespan slider.

This search result of retrieved papers was sorted by number of times cited. This search result also provides external link to documents so that the user can directly open or download the paper in another browser window. If your search result obtains a large number of documents, you can refine your search within the retrieved data to retrieve more specific documents you are looking for. Left-side panel of this page, as shown in Figure 11, is used for refining search.

From this search result you can also generate analytical reports and charts using *Analyze Result* and *View Citation Report* options as shown in Figure 11. While you click on a score of TimesCited as seen in Figure 11, a new page will appear as shown in Figure 12. This Figure shows a new window that retrieved a detailed list of the citing articles of a paper.

Figure 10: *ICI* Homepage and Search Interface

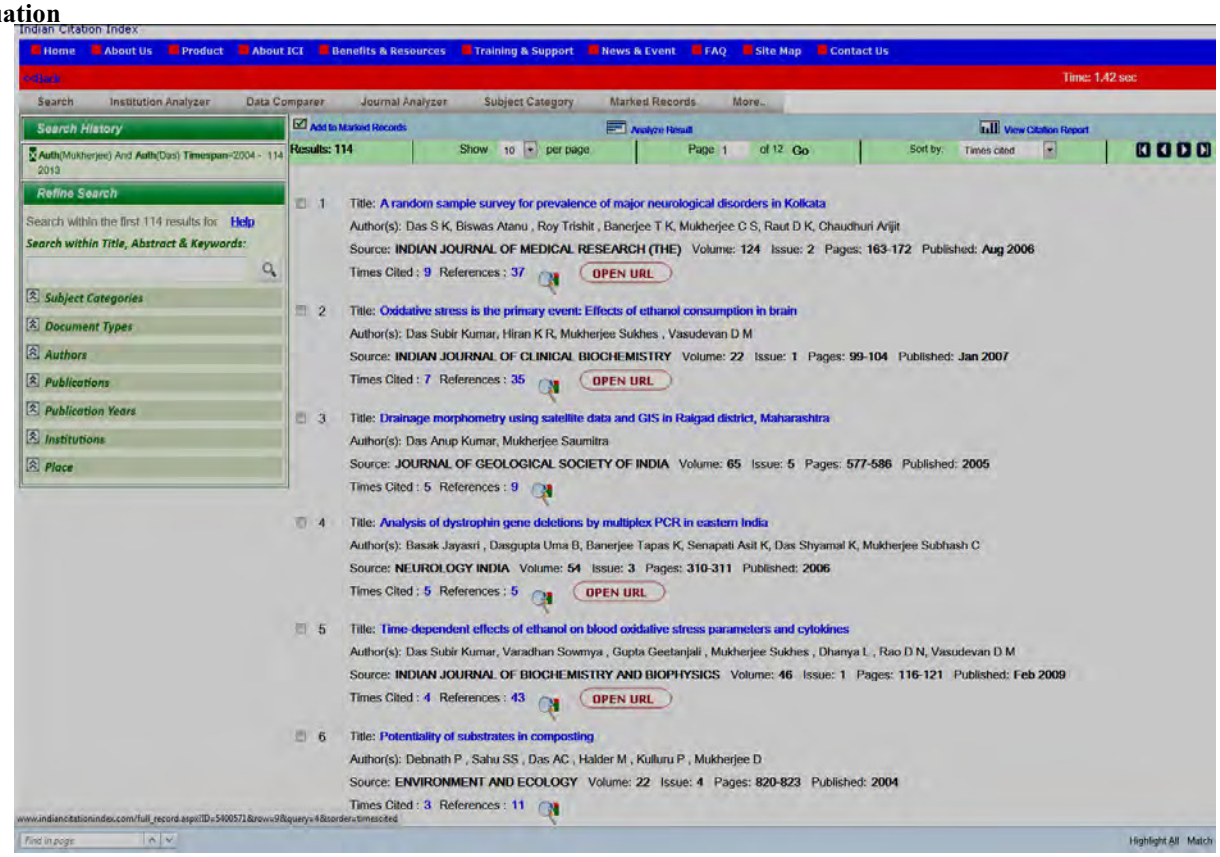


Figure 11: A Search Result, sorted by TimesCited

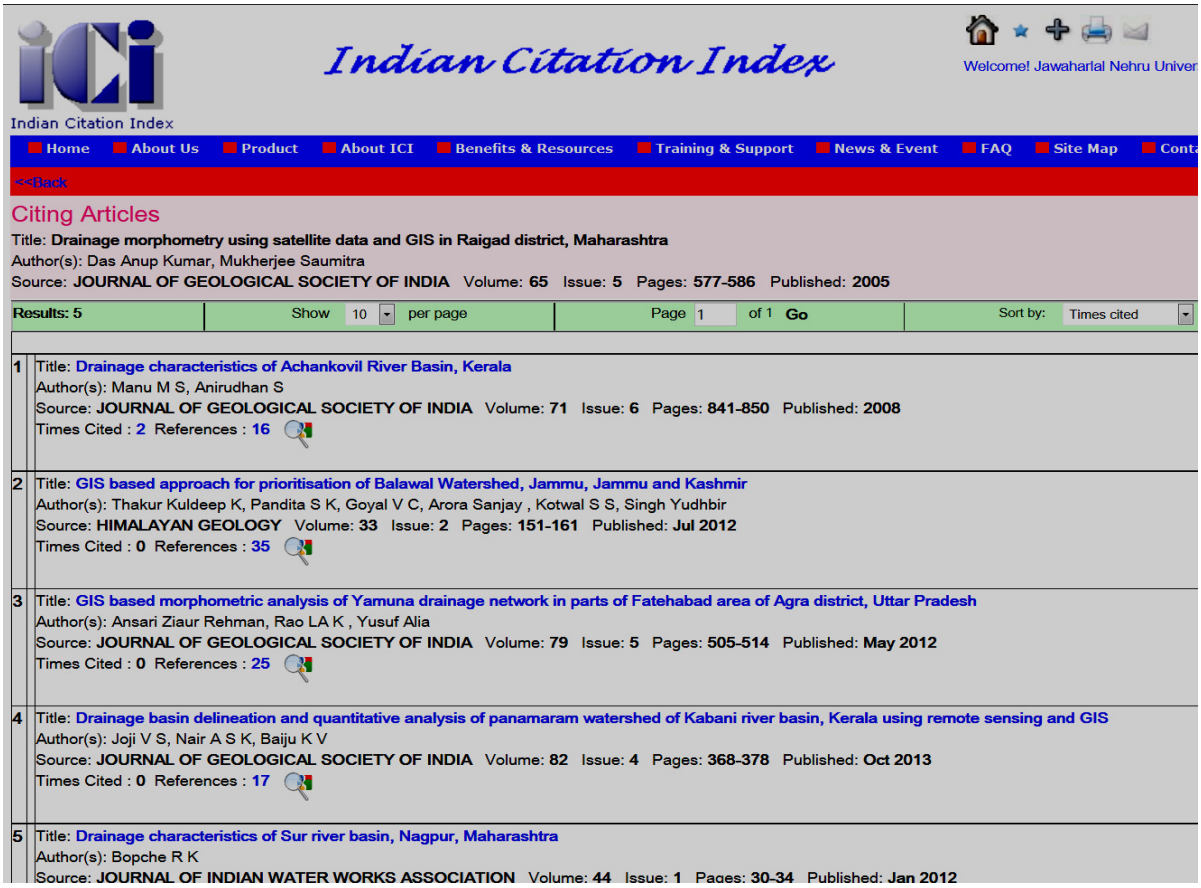


Figure 12: A Detail List of Citing Items of an Article

Analytical Tools in *ICI*

The *ICI* provides online tools such as Journal Analyzer, Institution Analyzer and Data Comparer, for retrieving data related to performance measurement of journals, institutions, and contributing authors. *ICI* also produces different data visualization effects online for helping users to understand retrieved indicators.

ICI's Journal Analyzer is a tool that offers various indicators for journal evaluation and comparison such as citations count, articles count, self-citations, uncited articles, JCI (Journal Current Index, similar to ISI's journal immediacy index) score, and RII (Journal Research Impact Indicator, similar to ISI's JIF) score. A representative data obtained from *ICI* Journal Analyzer is shown in Table 7.

Table 7: Comparison of Five Indian Scientific Journals in Different Disciplines

Sl. No.	Journal Title	Type	Founded	Articles (2004-2013)	Citations	Self-Citations	Uncited	for a Year (e.g. 2011)	
								JCI	RII
1	*Indian Journal of Medical Research*	OA	1913	2176	3458	1065	52.11%	0.22	0.311
2	*Journal of the Indian Chemical Society*	Non OA	1924	2344	1960	853	64.33%	0.017	0.249
3	*Current Science*	OA	1932	5811	6657	2015	58.61%	0.139	0.247
4	*Journal of Scientific & Industrial Research*	OA	1942	1209	553	199	73.78%	0.02	0.138
5	*Vikalpa: Journal for Decision Makers*	OA	1976	200	43	8	89%	-	0.053

ICI's Institution Analyzer is a tool which presents a comprehensive analytical details of an institution, in terms of articles published, citations received, and details of journals in which articles were published (top 15 journal titles),

details of the authors (e.g., top 15 authors with maximum articles count or citations count), distribution of papers in different subject categories, and distribution of papers in different document types. Figure 13 shows an auto-generated visualization effect using *ICI*'s Institution Analyzer functionality for a reputed research institute in India.

ICI's Data Comparer is a tool which offers comparative analysis of institutions and places. This functionality can show how two or more institutions vary in the kind of work they do or compare contribution made in a certain field from two more places. Table 8 shows a comparative data generated from Data Comparer functionality of the *ICI*.

Table 8: Comparable Data retrieved using ICI Data Comparer

Sl. No.	Institution	Articles	Citations	Citation Density (Citations/ Articles)	Articles/ Citation	Doc Types	
						Research Articles	Other Type Docs
1	Jawaharlal Nehru University (JNU)	246	62	0.252	3.968	208	38
2	Banaras Hindu University (BHU)	597	197	0.330	3.030	488	109
3	University of Hyderabad (UH)	170	18	0.106	9.444	146	24
4	Visva Bharati University (VBU)	241	66	0.274	3.652	218	23
5	Aligarh Muslim University (AMU)	499	128	0.257	3.898	425	74

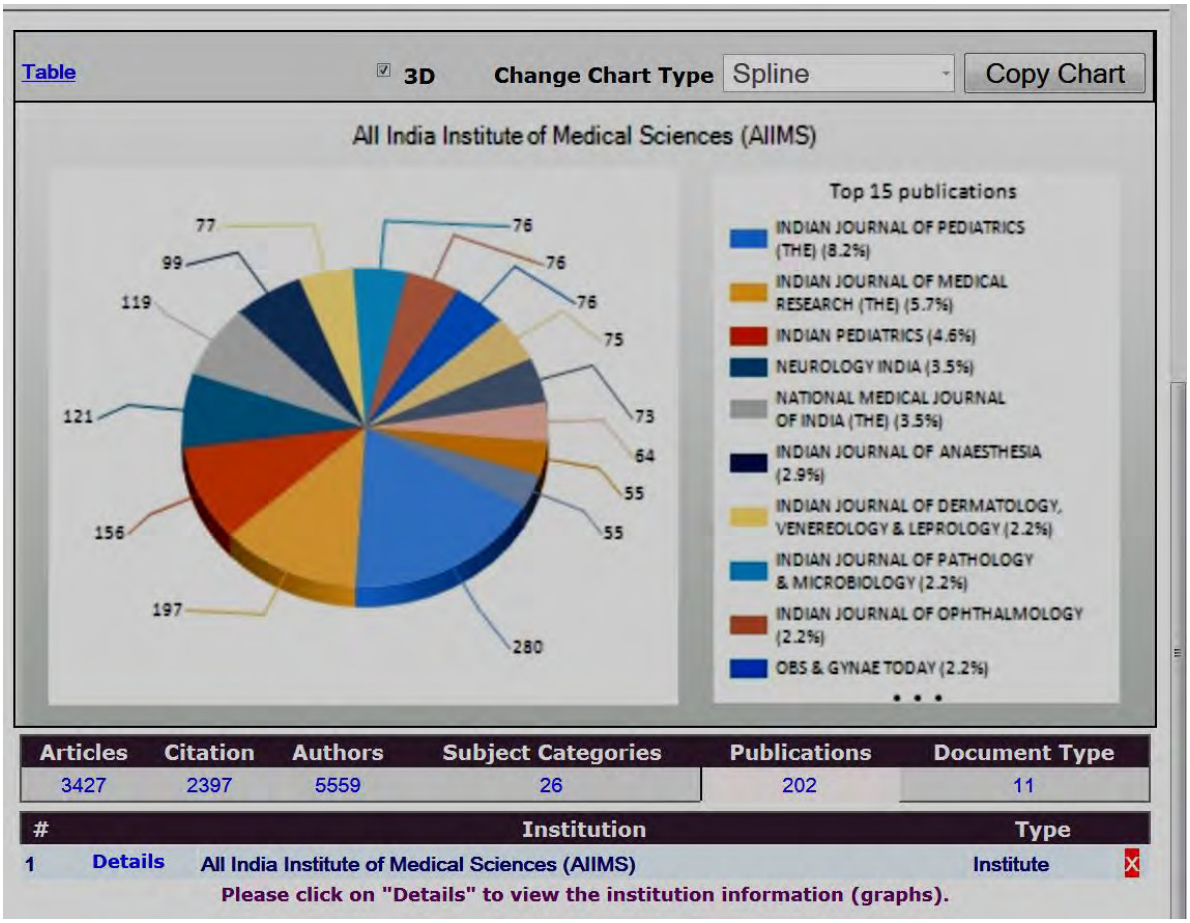


Figure 13: Data Visualization using *ICI* Institution Analyzer

2.2.4 CiteSeer^X (http://citeseerx.ist.psu.ede)

CiteSeer^X is an online citation and reference search engine, similar to Google Search. It is primarily focused on the literature ~~in~~ computer and information science. It is developed and hosted by the College of Information Sciences and Technology, in the Pennsylvania State University (PSU), with support from the U.S. National Science Foundation. The earlier version of the search engine, known as CiteSeer, was developed in 1997 at the NEC Research Institute, United States. CiteSeer was the first digital library and search engine to provide automated citation indexing and citation linking. Later, a new architecture and data model was developed for the Next Generation CiteSeer, or CiteSeer^X, in order to meet exponential growth of scholarly literature in early years of the 21st century. CiteSeer^X continues the CiteSeer legacy and is prepared to meet the challenges of the foreseeable future.

CiteSeer^X uses autonomous citation indexing technique to automatically extract citations and create a citation index that can be used for literature search and evaluation. It automatically extracts author, title and other related metadata for analysis and document search. CiteSeer^X website facilitates a user to search for documents, authors, data tables (as appeared within a research paper), and algorithms. Its approach to search data tables is very unique. Figure 14 shows the search result out of a query for retrieving data tables from

full-text documents. This result also indicates number of times the document containing this retrieved data table was cited. Its *Authors Search* feature retrieves publication records of a scientist and indicates citation count for each paper. It also indicates H-index for the respective author. Figure 15 shows an author's profile based on *Authors Search* option.

Over the years, CiteSeer^X has become useful citation search and analysis platform for a specific area of computer science and information science. However, its functionality as citation metrics is very limited. It is not comprehensive enough to fit for evaluating research or researchers. It does not provide any online analytical tool for analysing retrieved data from a search query.

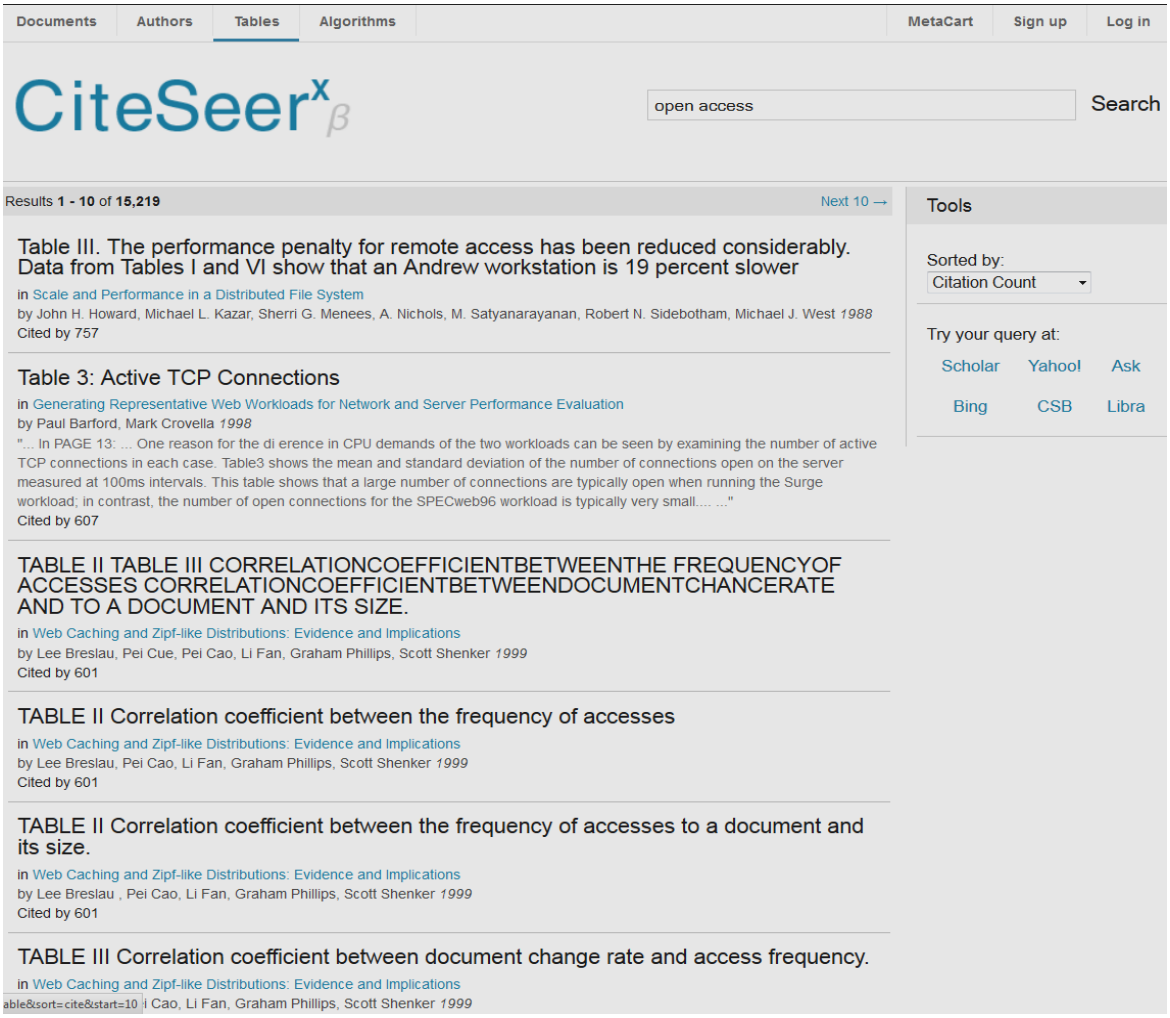


Figure 14: A Search Result retrieved by Citeseer^x Search Engine

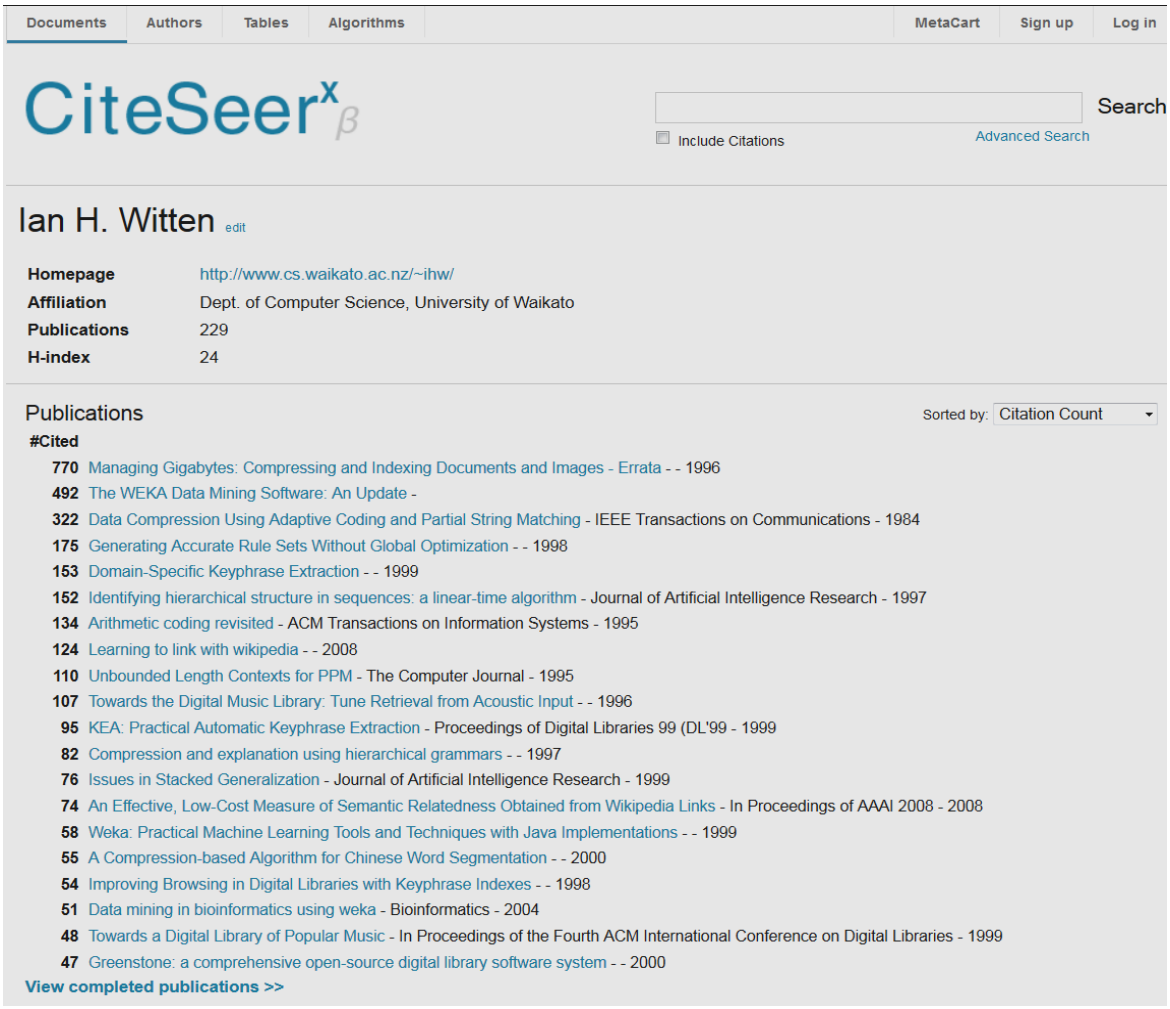


Figure 15: An Author's Profile, retrieved using Authors Search function of Citeseer^{x}

2.2.5 Google Scholar and Google Scholar Citations

The Google Scholar, launched in 2004 by Google Inc., appears to be the world's largest indexing and citation database of peer-reviewed scholarly literature, covering more academic journals and other scholarly materials than similar other citation databases such as *Scopus*, *Web of Science* and *Microsoft Academic Search*. It has become world's largest search engine for academic literature. It provides a simple way to broadly search for scholarly literature across many disciplines and sources. Its sources include articles, theses, books, abstracts and court opinions from academic publishers, professional societies, online repositories, universities, subject gateways and other web sites.

Google Scholar indicates availability of following features to the end users:

- Search all scholarly literature from one convenient place;
- Explore related works, citations, authors, and publications;
- Locate the complete document through your library or ~~on~~ the web;
- Keep up with recent developments in any area of research;
- Check who's citing your publications, create a public author profile.

Google Scholar Citations (GSC)

GSC is a personalized source of information for authors to keep track of citations to their published articles. As an author, you can check who is citing your publications, graph citations over time, and compute several citation metrics. You can also make your profile public, so that it may appear in Google Scholar results when people search for your name, e.g., Richard Feynman as shown in Figure 16.

In a public profile, information displayed include: name of the scholar, current affiliation, broad areas of research interests, bibliographic details of all papers, number of citations received by each paper, names of co-authors, number of the followers of this profile, etc. This profile also includes a few performance indicators and citation metrics, such as overall total citations, h-index, i-10 index; and total citations for the last five years, as shown in Figure 17. When you register with GSC as an author, these citation metrics are computed and updated automatically as Google Scholar finds new citations to your work on the web. You can choose to have your list of articles updated automatically or review the updates yourself, or to manually update your articles at any time.

GSC provides following details on how to create your author profile in GSC, as shown in the Text Box below:

You can sign up for a *Google Scholar Citations* profile. It's quick and free.

1. First, sign ~~to~~ your Google account, or create one if you don't yet have one. We recommend that you use a personal account, not an account at your employer, so that you can keep your profile for as long as you wish.
2. Once you have signed your Google account, the Citations sign up form will ask you to confirm the spelling of your name, and to enter your affiliation, interests, etc. We recommend that you also enter your university email address which would make your profile eligible for inclusion in Google Scholar search results.
3. On the next page, you'll see groups of articles written by people with names similar to yours. Click "Add all articles" next to each article group that is yours, or "See all articles" to add specific articles from that group. If you don't see your articles in these groups, click "Search articles" to do a regular Google Scholar search, and then add your articles one at a time. Feel free to do as many searches as you like.
4. Once you're done with adding articles, it will ask you what to do when the article data changes in Google Scholar. You can either have the updates applied to your profile automatically, or you can choose to review them beforehand. In either case, you can always go to your profile and make changes by hand.
5. Finally, you will see your profile. This is a good time to add a few finishing touches - upload your professional looking photo, visit your university email inbox and click on the verification link, double check the list of articles, and, once you're completely satisfied, make your profile public. Voila - it's now eligible to appear in Google Scholar when someone searches for your name!

Source: www.google.com/intl/en/scholar/citations.htm

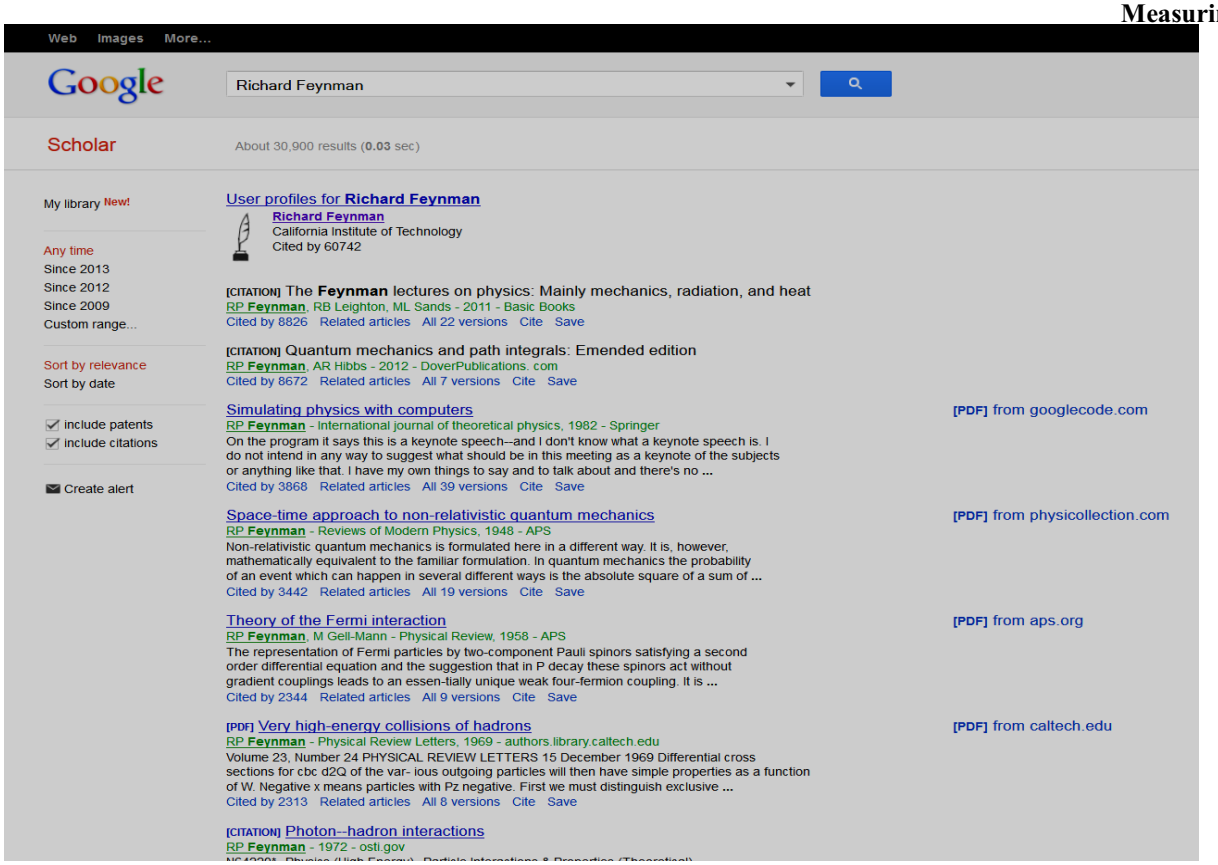


Figure 16: Display of a Google Scholar Search Result, publications by Richard Feynman

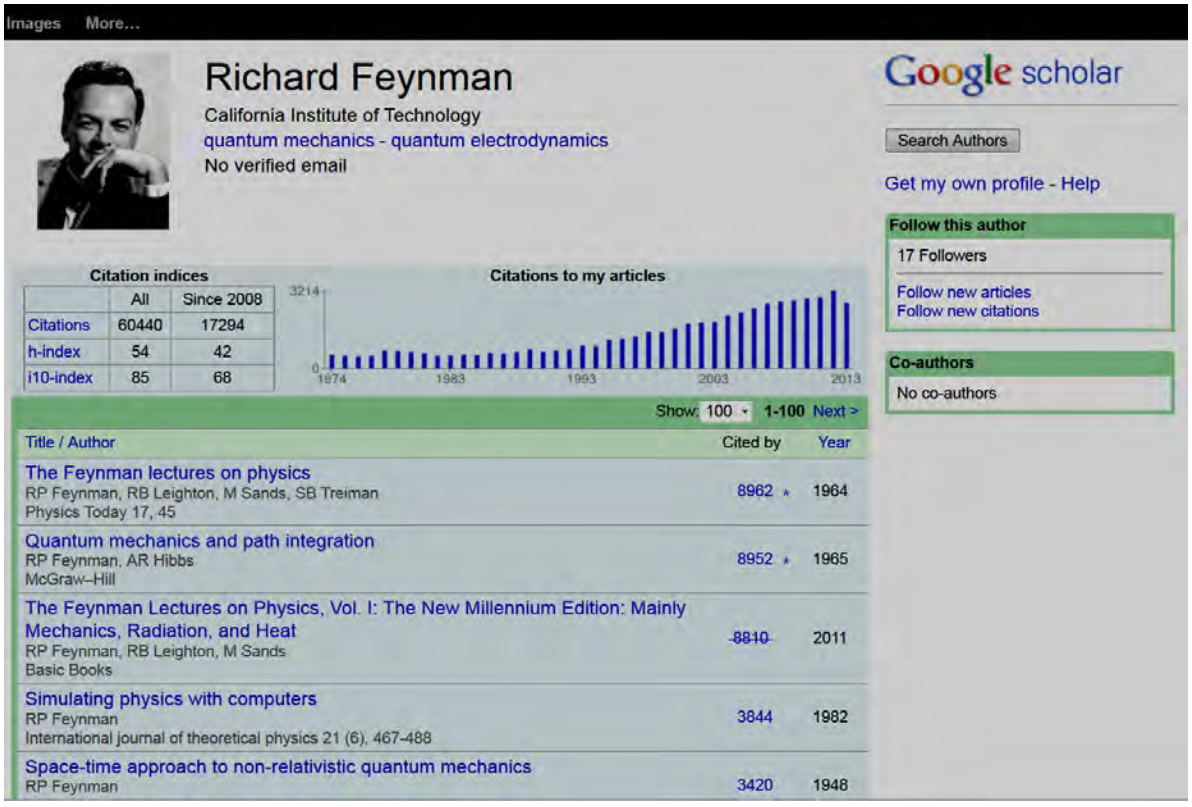
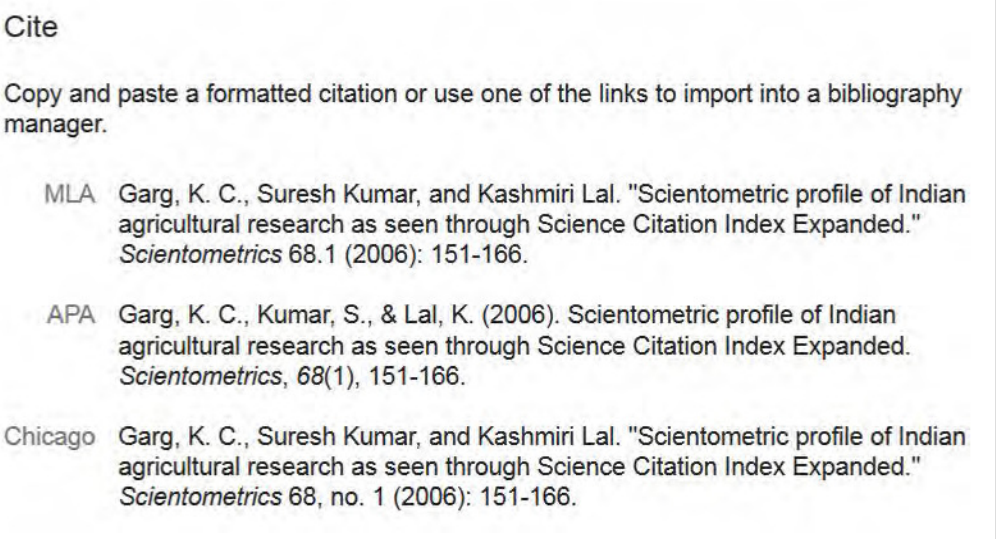


Figure 17: Display of Public Profile of Prof. Richard Feynman in Google Scholar Citations

Research Evaluation Metrics

Google Scholar (GS) not only provides citation metrics for authors, it also provides citation metrics for academic journals as well. It also displays ranked lists of journals in different subject categories as well as sub-categories based on its Google Scholar's own citation indicators h5-index and h5-median. These indicators of a journal are, respectively, the h-index and h-median of only those of its articles that were published in the last five complete calendar years. The ranked list for a subject category or a subcategory is available for top twenty journals. However, you can also search any journal title to know citation indicators h5-index and h5-median of that respective journal. Figure 18 shows a ranked list for subcategory 'Entrepreneurship & Innovation' under the category 'Business, Economics & Management'. Table 9 shows ranked list of a few journals derived from GS for mixed categories and subcategories. You may generate your own Tables for searched journals, as and when you require.

Google Scholar also added a new feature called My Library for saving papers and building your own reference collections for your ongoing as well as past research works. If you find a new useful bibliographic reference of document retrieved from a Google Scholar search result, you can *Save* it to your online reference list in My Library. This feature helps you in saving an article in My Library where you can read or cite it later. Similarly you can get formatted citation of a document, while you click on *Cite*.

To add a searched document to My Library, click on *Save*.	
To get formatted citation of a searched document, click on *Cite* (as shown in earlier row). You will get citation in a reference style MLA, APA and Chicago.	

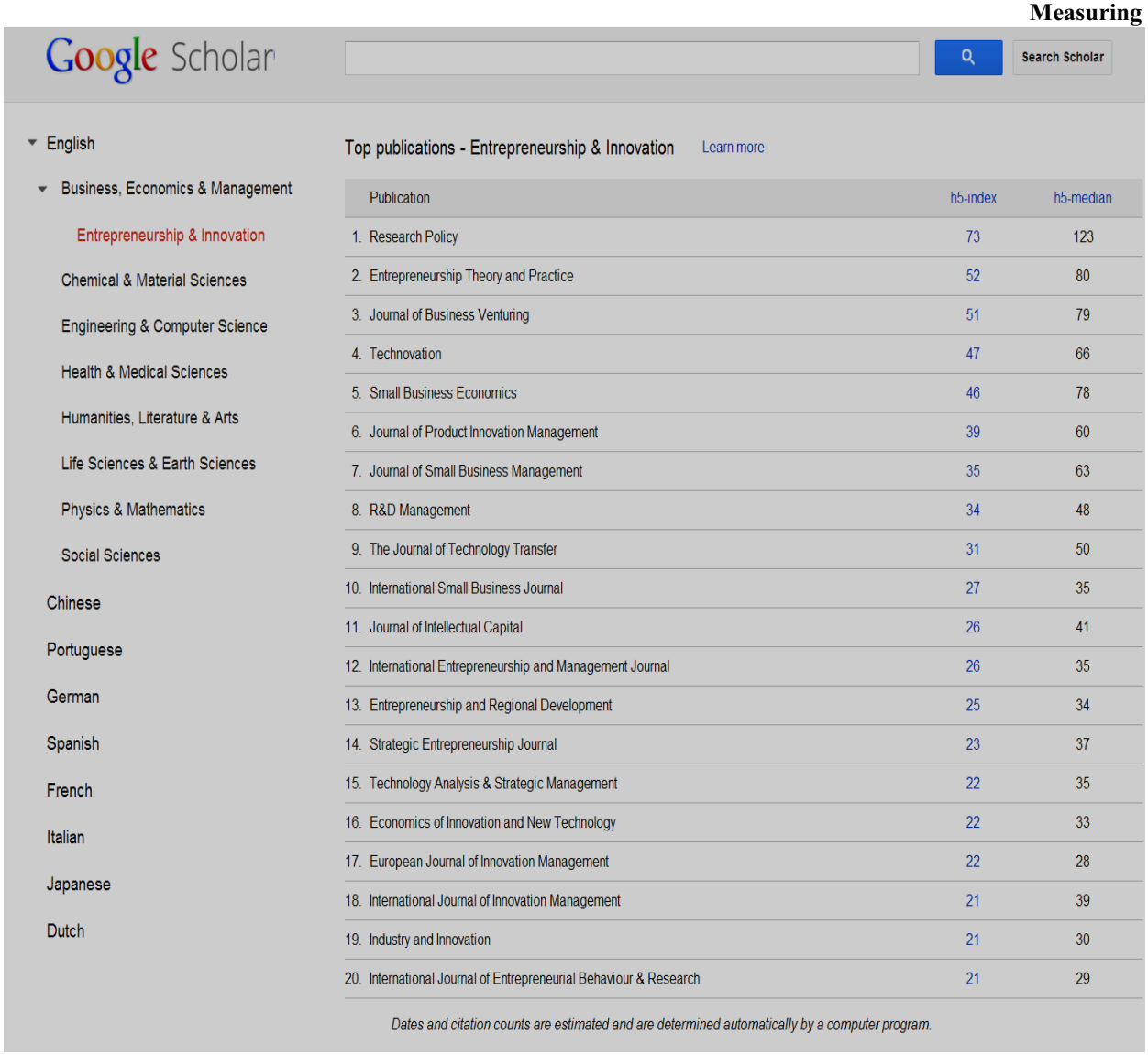


Figure 18: Rank List of Top Journals in a Sub-category

Table 9: Journals' Citation Metrics as Measured in Google Scholar (Journals of Mixed Categories)

Journal Name	h5-index	h5-median
PLoS One	131	168
BMC Bioinformatics	75	111
Journal of Econometrics	62	97
Journal of the American Society for Information Science and Technology (JASIST)	53	74
Scientometrics	42	54
Journal of Applied Econometrics	37	58
Journal of Informetrics	34	49
Current Science	25	34
Journal of Visualized Experiments: JoVE	23	28
Collnet Journal of Scientometrics and Information Management	7	8

2.3 ANALYTICAL PRODUCTS WITH JOURNAL PERFORMANCE METRICS

2.3.1 Journal Citation Reports (JCR®)

JCR offers a systematic, objective means to critically evaluate the world's leading journals, with quantifiable, statistical information based on citation data. *JCR* comes with two editions, namely, *JCR Science Edition* that contains data from over 8,000 journals in 171 subject categories, and *JCR Social Sciences Edition* that contains data from over 2,900 journals in the 55 subject categories. Together *JCR* citation data comes from over 10,500 journals, representing over 2,500 publishers worldwide in over 230 disciplines. Each annual edition contains the previous year's publication data and shows the relationship between citing and cited journals in an easy-to-use and easy-to-understand structure. This means 2013 *JCR* provides analytics from 2012 *Web of Science* data, more precisely from the *Social Sciences Citation Index* (*SSCI*) and *Science Citation Index Expanded* (*SCI-Expanded*).

Figure 19 shows the result of search query, where retrieved data shows various indicators for each journal for the particular year 2012, such as, Total Cites, Journal Impact Factor, 5-Year Impact Factor, Immediacy Index, Number of Articles, Cited Half-Life, Eigenfactor Score, and Article Influence Score. The search result is sorted here by impact factor score. The search query was given to search by a journal publishing country 'India'. If you click on any abbreviated journal title, you will get more information about the journal, and calculations for different indicators.

For example, *Indian Journal of Medical Research* (IJMR) is shown in Figure 20 with 3rd rank, calculations for journal impact factor, journal cited half-life, journal citing half-life and journal self cites are given below for your understanding. Table 10 shows various indicators of a few social science journals covered in *WoS*.

Journal Impact Factor (JIF)

Cites in 2012 to items published in:	2011 =	232	Number of items published in:	2011 =	146
	2010 =	411		2010 =	166
	Sum:	643		Sum:	312

Calculation: $\frac{\text{Cites to recent items}}{\text{Number of recent items}} = \frac{643}{312} = \mathbf{2.061}$

So, JIF for IJMR for 2012 is 2.061.

Journal Immediacy Index

Cites in 2012 to items published in 2012 = 65
Number of items published in 2012 = 198

Calculation: Cites to current items 65 = **0.328**
Number of current items 198

So, JII for IJMR for 2012 is 0.328.

Journal Cited Half-Life

The cited half-life is calculated based on citations to the journal by the cumulative percent of 2012 cites, until achieving 50%, to items published in the following years. Here, 50% cites achieved between 2006-2007, and more precisely in 6.5 years.

Year of Publication	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	Pre-2003
# Cites from 2012	65	232	411	402	391	328	358	263	257	77	1232
Cumulative %	1.62	7.40	17.63	27.64	37.38	45.54	54.46	61.01	67.41	69.32	100

So, cited half-life for IJMR for 2012 is roughly 6.5 years.

Journal Citing Half-Life

The citing half-life for the journal is calculated based on citations from the journal by the cumulative percent of 2012 cites, until achieving 50%, to items published in the following years. Here, 50% cites achieved between 2003-2004, and more precisely in 9.5 years.

Year of Publication	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	Pre-2003
Cites from 2012	117	317	498	543	526	508	488	458	387	383	3839
Cumulative %	1.45	5.38	11.56	18.29	24.81	31.11	37.17	42.84	47.64	52.39	100

So, citing half-life for IJMR for 2012 is roughly 9.5 years.

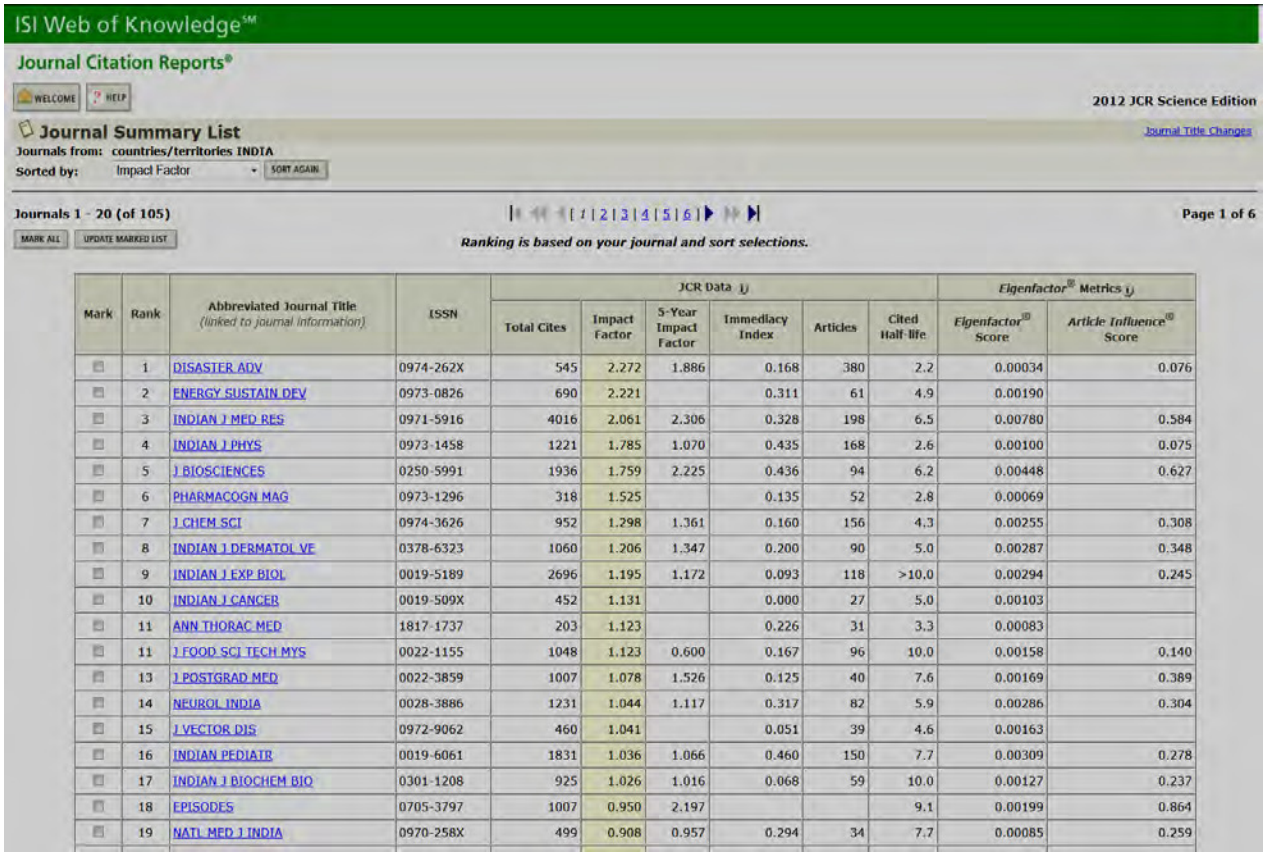
Journal Self Cites

Here, Journal Self Cites for IJMR for 2012 is 6%.

Total Cites	4016	**Self Cites**	280 (6% of 4016)
Cites to Years Used in Impact Factor Calculation	643	Self Cites to Years Used in Impact Factor Calculation	42 (6% of 643)
Impact Factor	2.061	**Impact Factor without Self Cites**	**1.926**

Table 10: A Sample Table Comparing Different Randomly Selected Social Science Journals

Rank	Journal Title	*JCR* Data					*Eigenfactor*® *Metrics*	
		Articles	Journal Impact Factor	5-Year Impact Factor	Im-mediacy Index	Cited Half-life	Eigenfactor® Score	*Article Influence*® Score
1	*Annual Review of Psychology*	22	15.265	26.624	4.818	9.5	0.02810	12.870
2	*Quarterly Journal of Economics*	41	5.278	8.147	1.000	>10.0	0.04647	12.205
3	*Behavioral and Brain Sciences*	14	18.571	23.173	2.286	>10.0	0.00996	10.969
4	*Journal of Economic Literature*	24	6.667	10.160	1.083	>10.0	0.01745	10.628
5	*Econometrica*	77	3.823	5.702	0.740	>10.0	0.04571	9.622
Based on 2012 *JCR* Social Science Edition; Rank based on *Article Influence*® Score.								



Mark	Rank	Abbreviated Journal Title (linked to journal information)	ISSN	JCR Data						Eigenfactor® Metrics	
				Total Cites	Impact Factor	5-Year Impact Factor	Immediacy Index	Articles	Cited Half-life	Eigenfactor® Score	Article Influence® Score
	1	DISASTER ADV	0974-262X	545	2.272	1.886	0.168	380	2.2	0.00034	0.076
	2	ENERGY SUSTAIN DEV	0973-0826	690	2.221		0.311	61	4.9	0.00190	
	3	INDIAN J MED RES	0971-5916	4016	2.061	2.306	0.328	198	6.5	0.00780	0.584
	4	INDIAN J PHYS	0973-1458	1221	1.785	1.070	0.435	168	2.6	0.00100	0.075
	5	J BIOSCIENCES	0250-5991	1936	1.759	2.225	0.436	94	6.2	0.00448	0.627
	6	PHARMACOGN MAG	0973-1296	318	1.525		0.135	52	2.8	0.00069	
	7	J CHEM SCI	0974-3626	952	1.298	1.361	0.160	156	4.3	0.00255	0.308
	8	INDIAN J DERMATOL VE	0378-6323	1060	1.206	1.347	0.200	90	5.0	0.00287	0.348
	9	INDIAN J EXP BIOL	0019-5189	2696	1.195	1.172	0.093	118	>10.0	0.00294	0.245
	10	INDIAN J CANCER	0019-509X	452	1.131		0.000	27	5.0	0.00103	
	11	ANN THORAC MED	1817-1737	203	1.123		0.226	31	3.3	0.00083	
	11	J FOOD SCI TECH MYS	0022-1155	1048	1.123	0.600	0.167	96	10.0	0.00158	0.140
	13	J POSTGRAD MED	0022-3859	1007	1.078	1.526	0.125	40	7.6	0.00169	0.389
	14	NEUROL INDIA	0028-3886	1231	1.044	1.117	0.317	82	5.9	0.00286	0.304
	15	J VECTOR DIS	0972-9062	460	1.041		0.051	39	4.6	0.00163	
	16	INDIAN PEDIATR	0019-6061	1831	1.036	1.066	0.460	150	7.7	0.00309	0.278
	17	INDIAN J BIOCHEM BIO	0301-1208	925	1.026	1.016	0.068	59	10.0	0.00127	0.237
	18	EPISODES	0705-3797	1007	0.950	2.197			9.1	0.00199	0.864
	19	NATL MED J INDIA	0970-258X	499	0.908	0.957	0.294	34	7.7	0.00085	0.259

Figure 20: *JCR* Web's Journal Summary List showing journals published from India

Limitations of *JCR* in Evaluating Research

Until the entry of *Scopus* and Google Scholar in the citation databases business in 2004, the *JCR* was sole information source to information analysts, bibliometricians, journal editors and decision makers for evaluating quality and performance of journals through various indicators such as journal impact factor, immediacy index, citations count, cited half-life, and citing half-life. *JCR* is based on mainly *SCI* Expanded and *SSCI* databases. Their coverage prior to 2004 was much skewed, covering only handful of journal titles from global South and developing nations. A study published by Thomson Reuters in 2011, titled "The Globalization of Web of Science^{SM}: 2005-2010" indicated how *Web of Science* was strategically expanding its coverage from around the world to make it globally representative. Now *WoS* has much better and balanced collections of journals in all disciplines.

Until very recently, *JCR* citation indicators, particularly, journal impact factor (JIF) along with few other indicators were widely used for evaluating research and performance appraisal of individual scientists for their career advancement or awarding research grants. Some of the indicators are also used for evaluating research and performance appraisal of a country or an institution. However, JIF gives equal weightage to all papers, but not all papers published in that particular journal have equal weightage to the researchers' communities. Many papers in a journal remain unnoticed, uncited or are self-cited. Thus, non-performing or non-influential papers of a journal also get equal weightage, although they have no role in increasing JIF and other indicators of that journal.

Recently, *the San Francisco Declaration on Research Assessment (DORA)* of 2012 has strongly opposed the use of JIF to assess an individual scientist's contributions, for hiring, promotion or funding decisions.

The quest for alternative metrics for evaluating research and researchers has continued and will be continued as we see a changing nature of global scholarships. Online social platforms have become very attractive to new age researchers for sharing research results and research publications, and ultimately get noticed by the fellow researchers and peer groups around the world. In the next section, we shall learn more about new indicators of scholarly communications and new platforms for sharing and retrieving those indicators.

2.4 NEW PLATFORMS FOR EVALUATING SCHOLARLY COMMUNICATIONS

As shown in Table 11, a number of platforms have been emerged in recent times to disseminate various kinds of citation-related indicators for journals, authors, institutions and countries. These are analytical platforms with data drawn from different citation databases or data sources. Four online platforms, namely, ScimagoJR.org, eigenFACTOR.org, Publish or Perish (POP) Software, and JournalMetrics.com are all freely available to worldwide scientific communities, in contrast to *JCR* which is a subscription-based

product. Information given in Table 11 is self-explanatory. If you want to know the definition of any indicator mentioned in this Table, you may consult glossary of terms at the end of this Unit. It may be mentioned here that the value of any particular citation indicator for a particular year may differ depending upon the coverage of source database. For example, if you compare JIF of a journal in two databases e.g. ScimagoJR and *JCR*, you may obtain two different values as their journal coverage is different from one to another, so are their citation records.

Distinct features of each platform are described in the sections following Table 11.

Table 11: Features of Scimagojr (SJR), eigenFACTOR.org, POP Software and JournalMetrics.com

	ScimagoJR (SJR)	**eigenFACTOR.org**	**POP Software**	**JournalMetrics.com**
Data source	*Scopus* database, a proprietary product of Elsevier B.V.	*Journal Citation Reports* (*JCR*) and *Web of Science*, proprietary products of Thomson Reuter.	Google Scholar, a proprietary product of Google Inc.; Microsoft Academic Search of Microsoft Inc.	*Scopus* database, a proprietary product of Elsevier B.V.
Developer	Scimago Lab.	Bergstrom Lab at University of Washington, USA.	Anne-Wil Harzing of Harzing.com	Scimago Lab and Leiden University
Coverage	Global	Global	Global	Global
Titles covered	It covers larger data source (in terms of no. of distinct titles of journals and other publications), about 17,000 distinct titles.	It covers large data source (in terms of no. of journals and other publications), about 12,300 distinct titles.	It covers largest data source (in terms of no. of distinct titles of journals and other publications).	It covers larger data source (in terms of no. of distinct titles of journals and other publications), about 17,000 distinct titles.
Terms of Access	Freely accessible.	Freely accessible.	Freely accessible.	Freely accessible.
User registration	Not required.	Not required.	Not required.	Not required.
Online or Desktop	Online	Online	Desktop (free software)	Online
Graphics and Charts	Equipped with chart and map generators.	Equipped with chart and map generators.	No graphical application.	Equipped with chart and map generators.

Visualization	Many visualization apps exist.	Many visualization apps exist.	No visualization apps exist.	Many visualization apps exist.
Indicators (Journals)	SJR (Scimago Journal Rank indicator), h-index, Cites per doc. (2yr), Journal's cited vs. uncited docs, etc.	eigenFACTOR score, Article Influence score, and Cost Effectiveness score	Journal Impact (h-index, g-index, hc-index, hI norm, hI annual, cites/paper, cites/author/year)	SJR (Scimago Journal Rank indicator), Source Normalized Impact per Paper (SNIP)
Indicators (Authors)	Not available (N.A.)	N.A.	Journal Impact (h-index, g-index, hc-index, hI norm, hI annual, cites/paper, cites/author/year)	N.A.

2.4.1 SCImago Journal & Country Rank (SJR) [ScimagoJR.com]

The SCImago Journal & Country Rank (SJR) is an online portal that provides indicators for evaluating scientific research published in academic journals and indexed in Elsevier's *Scopus* database. SJR uses the information contained in the *Scopus* database and derives the journals and country-related indicators. SJR's web analytic environment facilitates analysing, monitoring and evaluating scientific journals on one hand and national science systems on the other. This portal is freely accessible to worldwide community, without being asked for a user registration.

This online platform, developed by SCImago Lab, uses the widely known Google PageRank algorithm. It derives its name from the SCImago Journal Rank (SJR) indicator. SJR provides full scientometric profiles for more than 17,000 *Scopus* journals from year 1996 and 233 countries from all over the world. SJR has online tools for analysing, comparing and visualizing scientometric profiles of journals or countries.

Its primary indicator is called *SJR Indicator* that measures the scientific influence of the average article in a journal; it expresses how central to the global scientific discussion an average article of the journal is. Table 12 gives a full list of SJR indicators available for journals vis-à-vis countries. Many indicators are common for the both types, whereas some indicators are distinct.

SJR website provides following rankings and comparisons:

- Country Rankings
- Journal Rankings
- Compare Countries or Regions
- Compare Journals

SJR website is also useful to obtain:

- Customized rankings of journals (as shown in Table 13 and Table 14)
- Customized rankings of countries (as shown in Table 15, Table 16 and Table 17)
- Full scientometric profiles for over 17,000 *Scopus* journals and 233 countries
- Journals evaluation (as shown in Table 14)
- National-wide Analysis
- Maps of Science: country-wise co-citation networks of subject areas or subject categories for a period; or country-wise bubble-charts for citation indicators.

Figure 21 shows homepage of SJR website, from which you can navigate to obtain country and journal's performance indicators. This screenshot also indicates that you can *Rank*, *Analyse*, *Compare* and *Visualize* available data and obtain useful information for objective analysis as and when you required.

SCImago Institution Ranking (SIR)

Figure 22 shows homepage of SIR website (www.scimagoir.com) that generates SIR reports indicating top ranking or most productive institutions at global-level, regional level or country-level. However, SIR generates regional reports only for Iber American or Latin American region. SIR also uses *Scopus* data for ranking of their institutions based on different parameters.

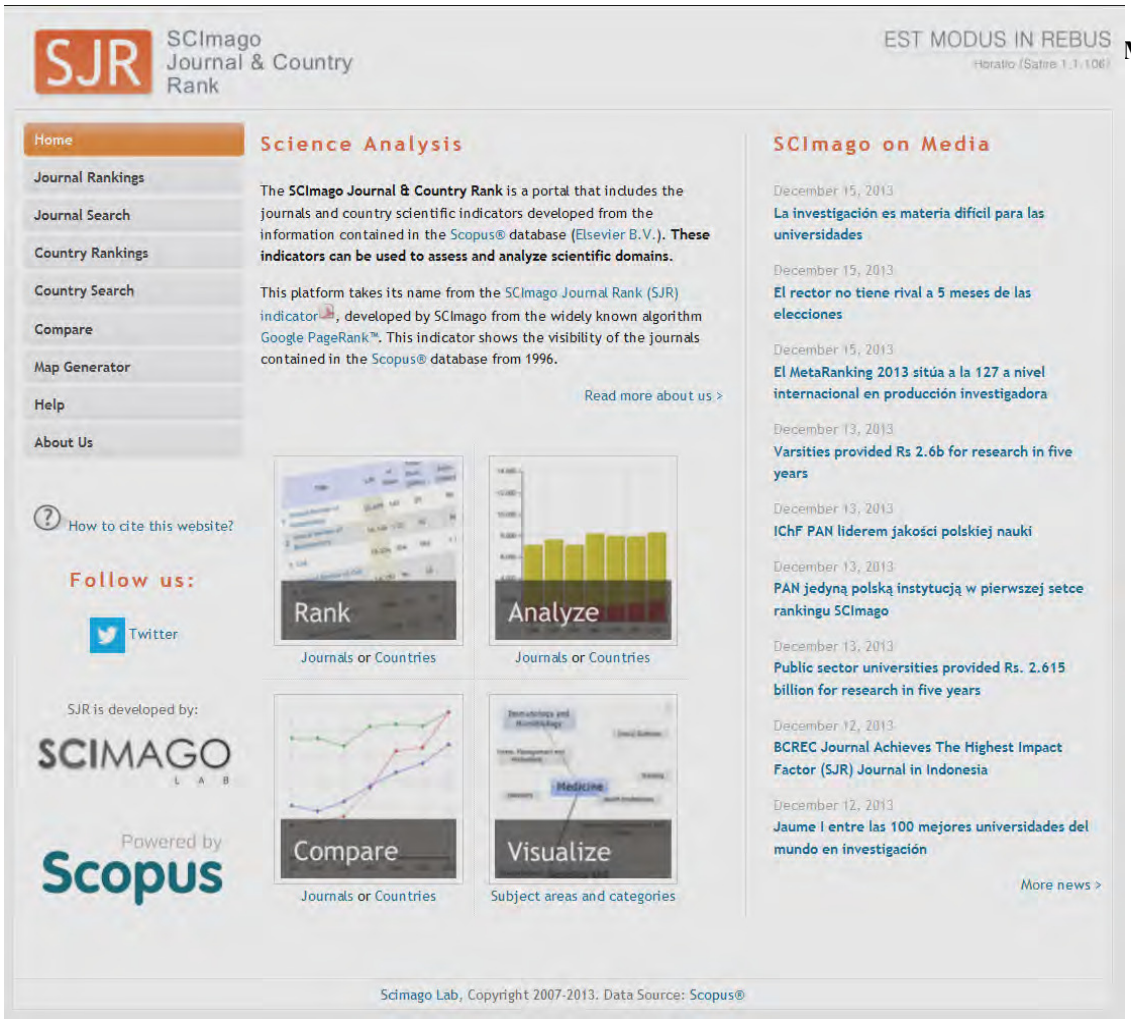


Figure 21: Homepage of SJR Website

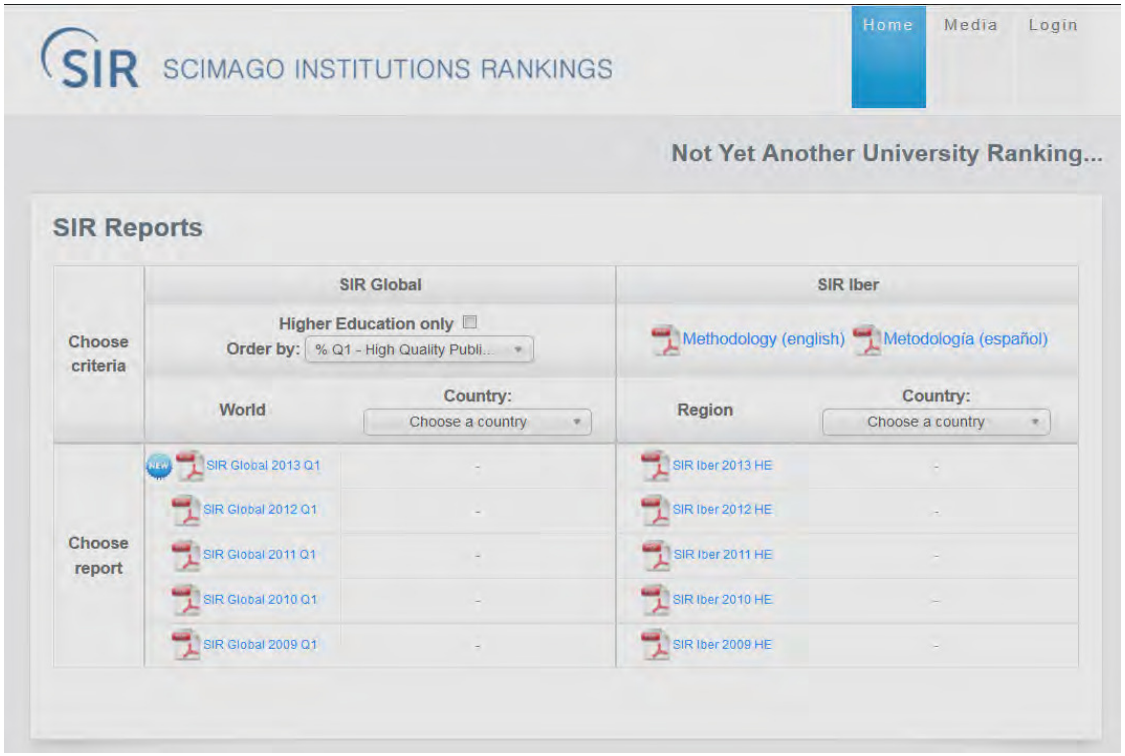


Figure 22: Homepage of The SCImago Institutions Rankings (SIR) Website

Table 12: SCImago Indicators Available for Journals vis-à-vis Countries

For Journals	For Countries
• SJR (Scimago Journal Rank indicator) rank • H-index • Citations per document (2 years) (similar to journal impact factor) • Citation vs. Self-citation • Citations per document vs. External cites per document (excluding self-citation) • Citations per document in 2, 3 and 4 years windows • International collaboration (percentage of docs with more than one country) • Journal's citable vs. Non citable documents • Journal's cited vs. Uncited documents • References per document • Total documents in a particular year • Total documents in 3 years • Total citations in 3 years	• H-index • Total Documents (in a year or range) • Total Citations • Citations per Document • Citable vs. Non Citable Documents • Cited vs. Uncited Documents • Citation vs. Self-Citation • Cites per Document vs. External Cites per Document (excluding self-citation) • Documents by subject areas (27 areas) • International Collaboration (percentage of docs with more than one country) • Relative Production (percentage of the region vs. percentage of the world)

Examples of Analytical Tables Generated using SJR

Some examples of rankings and comparisons, as derived from SJR, are shown in Tables 13, 14, 15, 16 and 17. The portal defines "the SJR is an indicator that expresses the number of connections that a journal receives through the citation of its documents divided between the total of documents published in the year selected by the publication, weighted according to the amount of incoming and outgoing connections of the sources." In Table 14 SJR score is shown for each selected journal. Cites per document for 2 years period is equivalent to journal impact factor (JIF) score provided in the Journal Citation Reports (*JCR*) of the Thomson Reuter.

Table 13 shows publishing pattern of journals with respect to indicator of international collaborative research, i.e., percentage of documents with more than one country, as recorded for the selected journals. For example, *Indian Journal of Medical Research* published 13.75% papers in 2011 with international collaborative authorship. Table 14 shows list of top five journals in all subject areas in year 2012, based on SJR Journal Rankings for all journals. Based on SJR database, Table 15 draws a comparison of countries publishing international collaborative research in all subject areas. Similarly, Table 16 shows list of top ten countries, based on SJR Country Rankings for

all journals. On the other hand, Table 17 shows list of top five countries in all subject areas during years 1996-2012, order by H Index.

Table 13: Comparison of Selected Journals publishing International Collaborative Research Papers

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Indian Journal of Medical Research	5.556	5.556	9.326	7.048	9.132	7.692	9.160	11.673	13.750	10.917
Brazilian Journal of Medical and Biological Research	11.947	14.894	10.965	13.402	12.621	8.989	9.140	19.653	10.227	13.587
South African Medical Journal	7.329	6.467	4.835	7.107	13.388	12.414	19.767	14.786	16.319	13.253
Chinese Medical Journal	9.595	9.466	8.479	6.427	8.415	7.143	7.942	7.650	7.674	7.910

Table 14: Top Five Journal Ranking in all subject areas in year 2012, ordered by SJR Indicator

	Title	SJR	H index	Total Docs. (2012)	Total Docs. (3years)	Total Refs.	Total Cites (3years)	Citable Docs. (3years)	Cites / Doc. (2years)	Ref. / Doc.	Country
1	*Reviews of Modern Physics*	39.439	198	45	170	13,101	8,386	162	43.75	291.13	USA
2	*Annual Review of Immunology*	30.095	218	28	69	4,875	3,629	69	38.80	174.11	USA
3	*Ca-A Cancer Journal for Clinicians*	29.855	92	41	118	3,036	8,072	95	106.13	74.05	USA
4	*Advances in Physics*	24.813	74	7	28	2,922	775	21	38.71	417.43	UK
5	*Annual Review of Biochemistry*	21.509	210	32	105	4,863	3,364	105	28.47	151.97	USA

Docs.= Documents; Ref./ Doc.= References per document; Highlighted score is highest in its respective data series.

Table 15: Comparison of Countries publishing International Collaborative Research Papers (%)

Year	India	Brazil	South Africa	China
2012	16.278	24.558	47.193	15.577
2011	15.999	24.051	44.559	14.507
2010	16.958	24.001	44.117	14.656
2009	17.998	24.584	44.726	14.376
2008	18.550	30.801	44.918	14.819
2007	19.408	29.770	45.607	14.884
2006	18.998	27.491	43.050	14.378
2005	19.121	29.988	43.477	14.314
2004	19.007	30.116	42.685	17.374
2003	18.031	29.785	40.670	19.795

Table 16: Example of SJR Country Rankings for All Journals

	Country	Documents	Citable documents	Citations	Self-Citations	Citations per Document	H index
1	United States	70,63,329	66,72,307	12,95,40,193	6,24,80,425	20.45	1,380
2	China	26,80,395	26,55,272	1,12,53,119	61,27,507	6.17	385
3	United Kingdom	19,18,650	17,63,766	3,13,93,290	75,13,112	18.29	851
4	Germany	17,82,920	17,04,566	2,58,48,738	68,52,785	16.16	740
5	Japan	17,76,473	17,34,289	2,03,47,377	60,73,934	12.11	635
6	France	12,83,370	12,29,376	1,78,70,597	41,51,730	15.6	681
7	Canada	9,93,461	9,46,493	1,56,96,168	30,50,504	18.5	658
8	Italy	9,59,688	9,09,701	1,27,19,572	29,76,533	15.26	588
9	Spain	7,59,811	7,15,452	86,88,942	22,12,008	13.89	476
10	India	7,50,777	7,16,232	45,28,302	15,85,248	7.99	301
Data as on 06/12/2013 (Years 1996-2012)							

Table 17: Top Five Country Ranking in all subject areas during years 1996-2012, order by H Index

	Country	Documents	Citable documents	Citations	Self-Citations	Citations per Document	H index
1	United States	7,063,329	6,672,307	129,540,193	62,480,425	20.45	1,380
2	United Kingdom	1,918,650	1,763,766	31,393,290	7,513,112	18.29	851
3	Germany	1,782,920	1,704,566	25,848,738	6,852,785	16.16	740
4	France	1,283,370	1,229,376	17,870,597	4,151,730	15.60	681
5	Canada	993,461	946,493	15,696,168	3,050,504	18.50	658

2.4.2 eigenFACTOR.org

The eigenFACTOR.org[16] is an academic research project hosted by the Bergstrom Lab at the University of Washington, USA. This web platform aims to use recent advances in network analysis and information theory to develop novel methods for evaluating the influence of scholarly periodicals and for mapping the structure of academic research. It is a freely available, searchable platform for indicators that rank journals based on scores of Eigenfactor®, Article Influence® and Cost Effectiveness. As indicated in Table 11 Eigenfactor.org complements journal indicators available with the *JCR* and assesses influence of a journal based on weightage or significance of citations. If a journal receives citations from high-ranking or highly reputed journals, Eigenfactor score will be higher than another journal that receives most citations from average-ranking journals. Calculation of Eigenfactor score is done using data from *WoS* and *JCR*. The Eigenfactor approach is considered as more robust than the journal impact factor metric, which purely counts incoming citations without considering the significance of those citations. Eigenfactor score is measure of a journal's importance and it can be used in combination with h-index to evaluate the work of individual scientists. Article Influence (AI) score of a journal is a measure of the average influence of each of its articles over the first five years after publication, i.e., if an article published in 2005, AI measures average influence it made during 2006-2010. You can find the methods of calculation of EigenFactor and Article influence scores at www.eigenfactor.org/methods.pdf.

[16] http://www.eigenfactor.org/

Why eigenfactor?

1. Eigenfactor scores and Article Influence scores rank journals as Google ranks websites.
2. Eigenfactor.org reports journal prices as well as citation influence.
3. Eigenfactor scores and Article Influence scores adjust for citation differences across disciplines.
4. Eigenfactor scores and Article Influence scores rely on 5-year citation data.
5. Eigenfactor scores and Article Influence scores are completely free and completely searchable.

Source: www.eigenfactor.org/whyeigenfactor.php

As shown in Figure 23, eigenFACTOR.org generated a list of journals searched by the search term 'Brazil'. It indicates Eigenfactor (EF) scores and Article Influence (AI) scores for each journal in a row. This Figure also shows percentile of each journal's EF and AI scores.

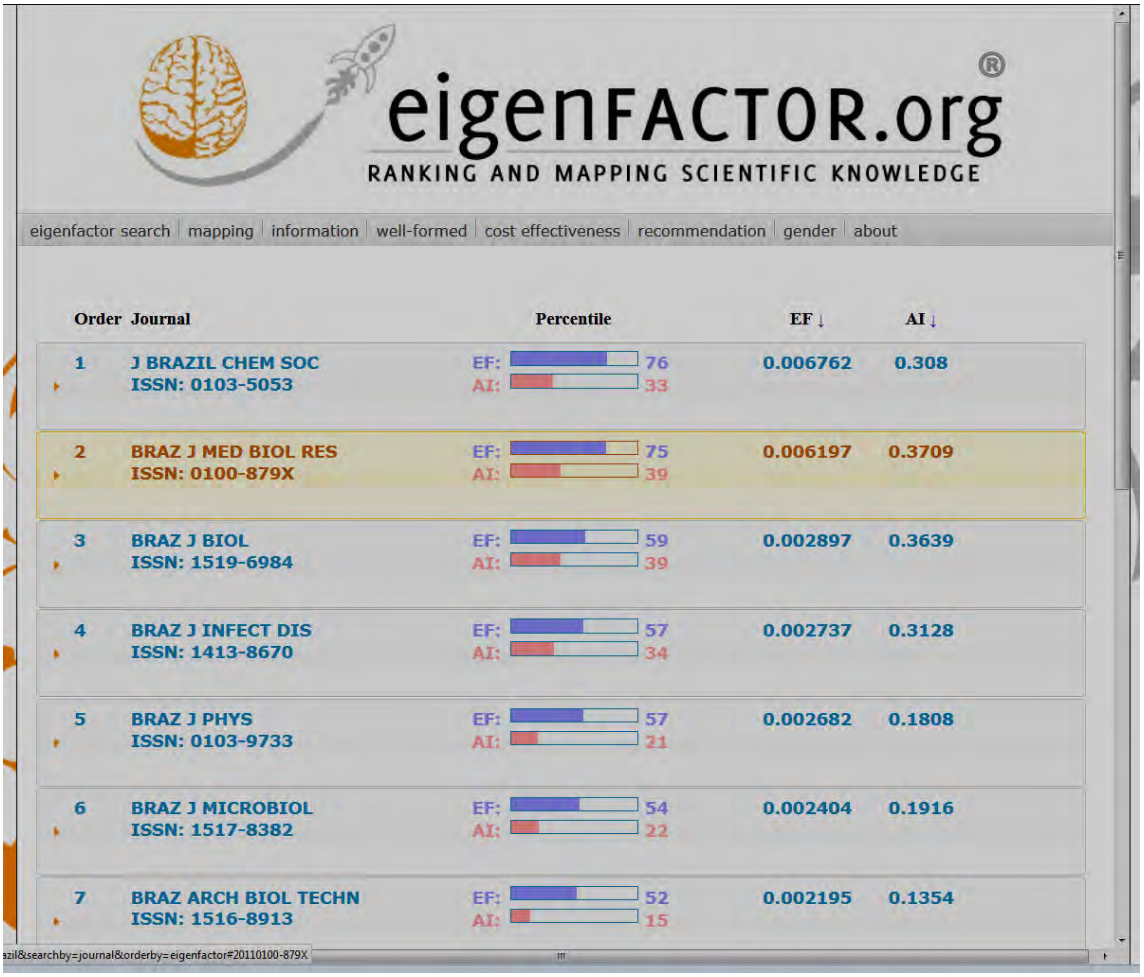


Figure 23: Searching eigenFactor by Journal Name – Brazil*

Cost Effectiveness of Open Access Journals

Eigenfactor.org generates cost effectiveness reports for open access journals, which are covered in *WoS* database. A report can be generated for:

- Fee-based open access journals of a particular subject field;
- No-fee open access journals of a particular subject field;
- Fee-based open access journals in all subject fields (as shown in Figure 24); and
- No-fee open access journals of in all subject fields.

Here, *Cost Effectiveness Score* is calculated based on below-mentioned formula**.** This metric helps authors decide which open access journals provide the most value per price.

- Cost Effectiveness Score = (1000 X Article Influence Score)/ Price

As shown in Figure 24, generated list indicates scores of Cost Effectiveness (CE), Article Influence (AI) and Fee (in US $) for each journal in a row. As it suggests, most cost-effective journal title is *Publications of the Astronomical Society of Japan*.

In addition to generate scorecards for different journals, the website provides various value-added services for the benefits of the scholarly communities. Some of the available useful services among others are:

- ***Gender Browser*****:** The website generates analytical reports on gender composition of scholarly publications between years 1665 and 2011. Its gender browser provides a multiscale view of gender representation across multiple domains of scholarly publishing, i.e., female-male ratio in scientific contributions.
- ***Eigenfactor Recommends*** By uncovering the hierarchical structure of scholarly citation, this website can identify key papers pertaining to any search query. This can use resources from JStore and Microsoft Academic Search. So, it recommends some outstanding papers on your search term.

Fee-based Open Access Journals ordered by CE for ALL FIELDS (full list)

Ranking	Journal	Publisher	CE	AI	Fee
1	PUBL ASTRON SOC JPN 0004-6264	Astronomical Society of Japan	17.336	1.266	$73
2	J PHYSIOL PHARMACOL 1899-1505	Jagiellonian University	7.25	0.464	$64
3	J CLIN INVEST 1558-8238	American Society for Clinical Investigation	4.634	6.951	$1,500*
4	GEOSCI MODEL DEV 1991-9603	European Geosciences Union	4.405	1.388	$315*
5	ASIAN PAC J CANCER P 1513-7368	Asian Pacific Organization for Cancer Prevention	4.155	0.208	$50
6	DNA RES 1756-1663	Oxford University Press	4.114	2.057	$500
7	CLIM PAST 1814-9332	European Geosciences Union	4.092	1.915	$468*
8	BIOGEOSCIENCES 1726-4189	European Geosciences Union	3.804	1.792	$471*
9	CRYOSPHERE 1994-0424	European Geosciences Union	3.573	1.662	$465*
10	J REAL ESTATE RES 0896-5803	American Real Estate Society	3.221	0.435	$135

Figure 24: Rank of Fee-based Open Access Journals, ordered by CE Scores.

2.4.3 Publish or Perish (POP) Software

The Publish or Perish (POP) software, developed by Australian Professor Anne-Wil Harzing in 2006, is a free software for personal non-profit use. This software can be installed in Windows, OS X or GNU/Linux platform. This software program retrieves and analyzes bibliographic information from Google Scholar and Microsoft Academic Search to obtain the raw citations. Then it analyzes and presents these citations in a ranked list order. It has limitation of 1000 citations and thus presents first 1000 citations based on a search query.

Figure 25 shows the homepage of POP software[17] from where this software is downloadable. This page carries information on new version of POP software. You can always revisit this page to know about new release and new features of this software.

[17] http://www.harzing.com/pop.htm

Figure 26 shows screenshot of installed software. Here, it shows the use of POP software for author impact analysis. The software fetched bibliographic information of papers written by specified author and presents different author citations metrics such as h-index, g-index, cites per paper, hc-index, citations count for each paper, cumulative citations count, publishing years (i.e., productive years of a scientist), etc.

Figure 27 shows the use of POP software for journal impact analysis. The software fetched bibliographic information of papers published by a specified journal or a number of journals with a similar title and presents different journal citations metrics such as h-index, g-index, cites per paper, hc-index, citations count for each paper, cumulative citations count, publishing years, etc. This Figure also indicates that the software fetched only first 1000 records from Google Scholar search engine.

POP Software is very useful to researchers residing in developing countries as it instantly generates scores of citations metrics for a journal or an author. It also helps in developing bibliographies and saves selected references in a format usable in a reference manager software or online reference manager.

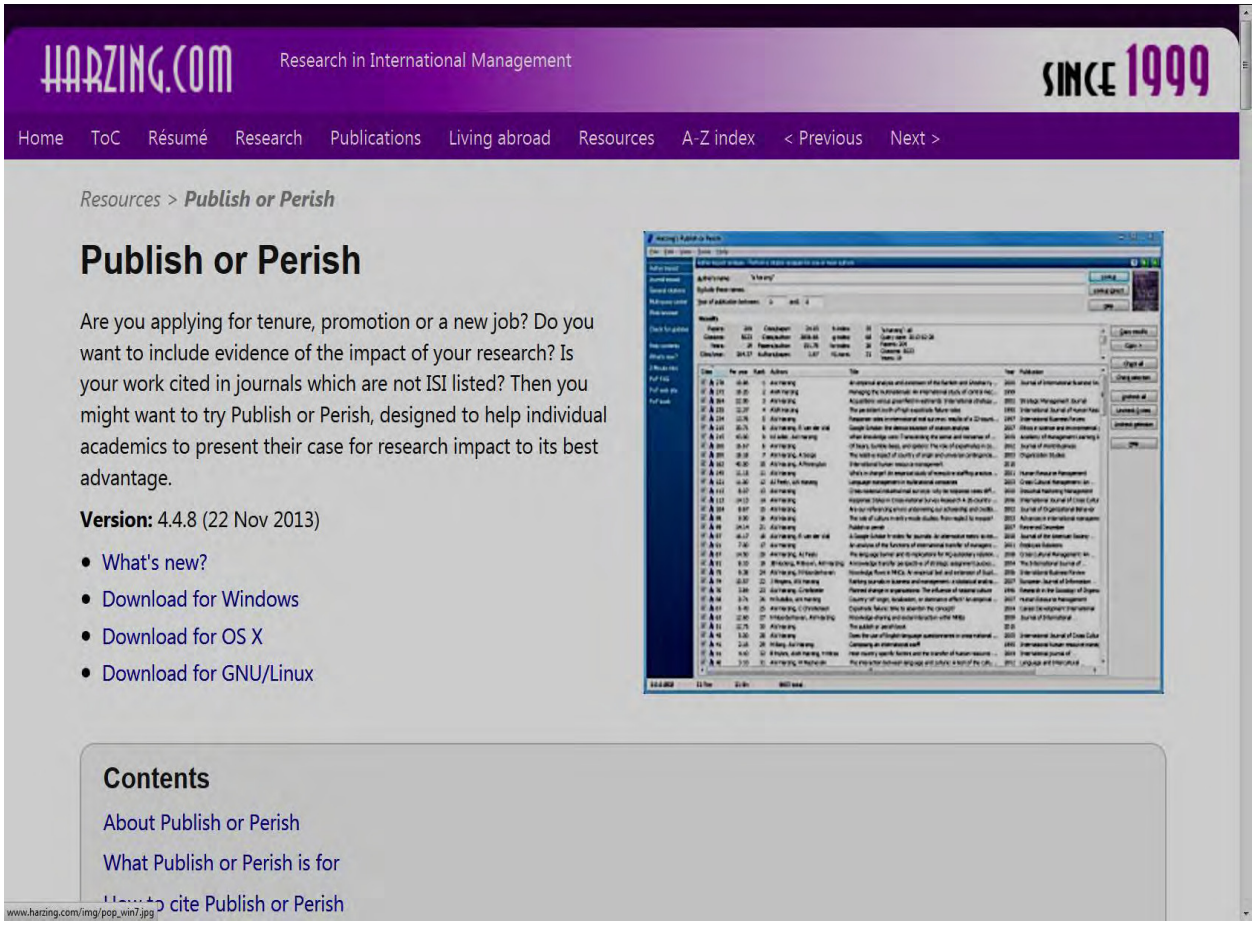


Figure 25: Homepage of POP Software

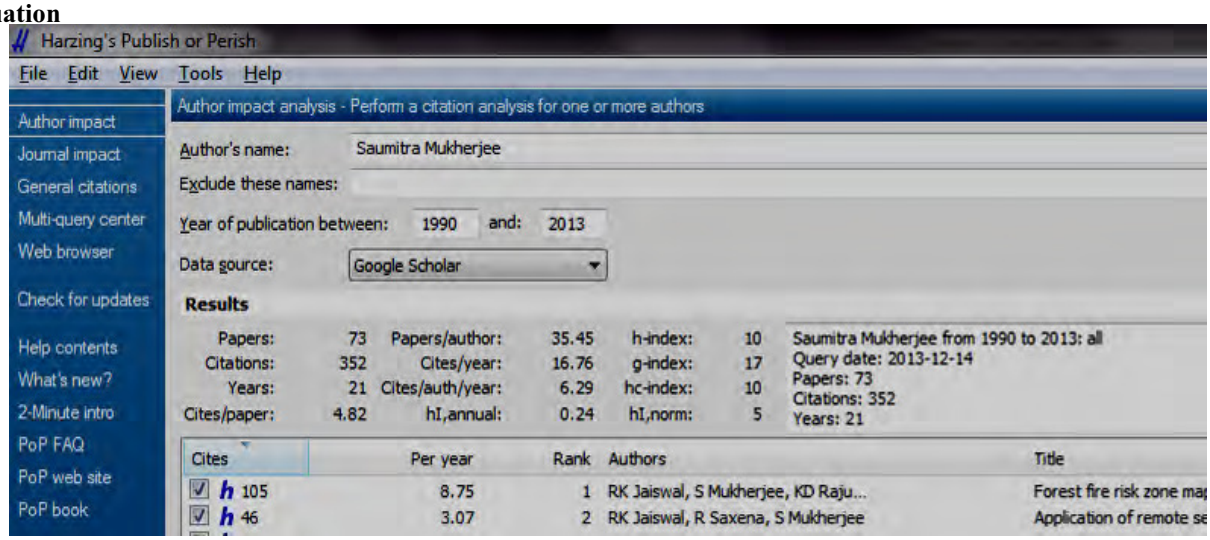


Figure 26: Use of POP Software for Author Impact Analysis

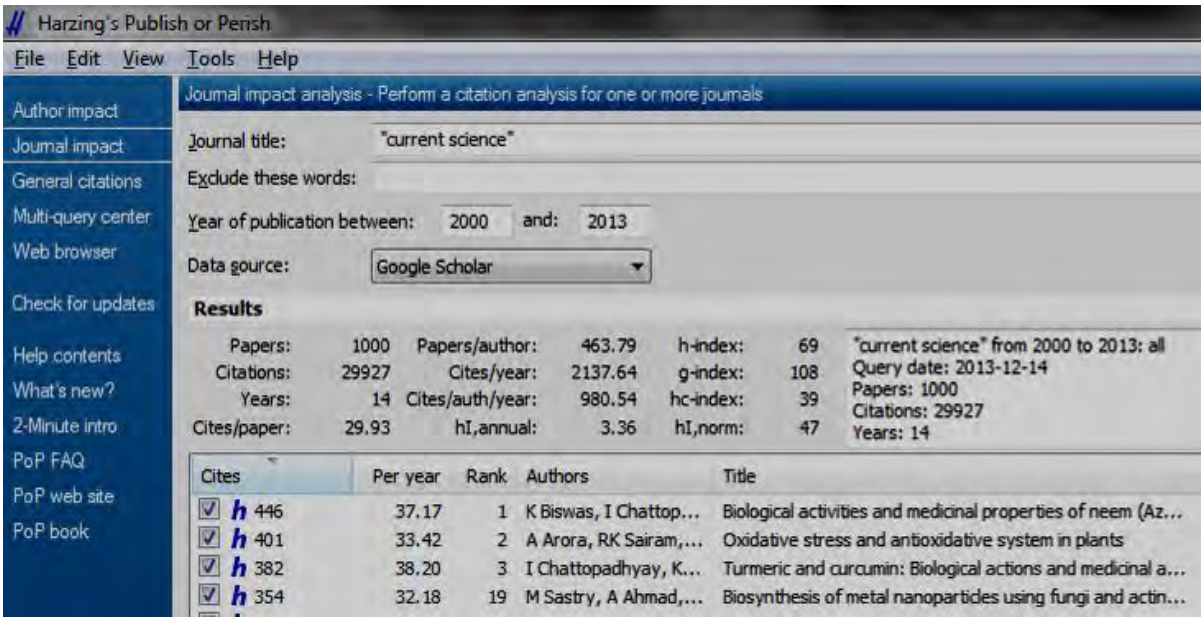


Figure 27: Use of POP Software for Journal Impact Analysis for One or More Journals

2.4.4 JournalMetrics.com

The JournalMetrics.com[18] is a searchable website with data on journal performance scores of all *Scopus*-covered journals, and more particularly newly emerged indicators:- Source-Normalized Impact per Paper (SNIP) and SCImago Journal Rank (SJR). This website is developed collaboratively by the SCImago, Leiden University and Elsevier – the publisher of *Scopus* database.

SNIP is defined as the ratio of a journal's citation count per paper and citation potential in its subject areas. Citation potentials vary between journal subject categories, groupings or disciplines and also within same subject category

[18] http://www.journalmetrics.com/

depending on theoretical or applied nature of the respective journals. SNIP corrects and adjusts for such variations and differences. SNIP scores are updated twice in a year in this website.

SJR is derived using the same algorithm as mentioned earlier in the case of ScimagoJR.com website. In fact, JournalMetrics.com and ScimagoJR.com complements each other. SJR measures scientific influence of scholarly journals that accounts for both the number of citations received by a journal and the importance or prestige of the journals where such citations come from. SJR ranks journals by 'average prestige per article' – similar to Google's PageRank algorithm. SJR rank is frequently used for journal comparisons in research evaluation and measurement process.

Figure 28 shows homepage of JournalMetrics.com website. From its homepage, a user can search a journal by its title or keyword and obtain SNIP and SJR scores for six years period. Figure 29 shows the result of a search query with the term Brazil as appeared in journal titles. This query retrieves data of 34 journals as shown in this Figure.

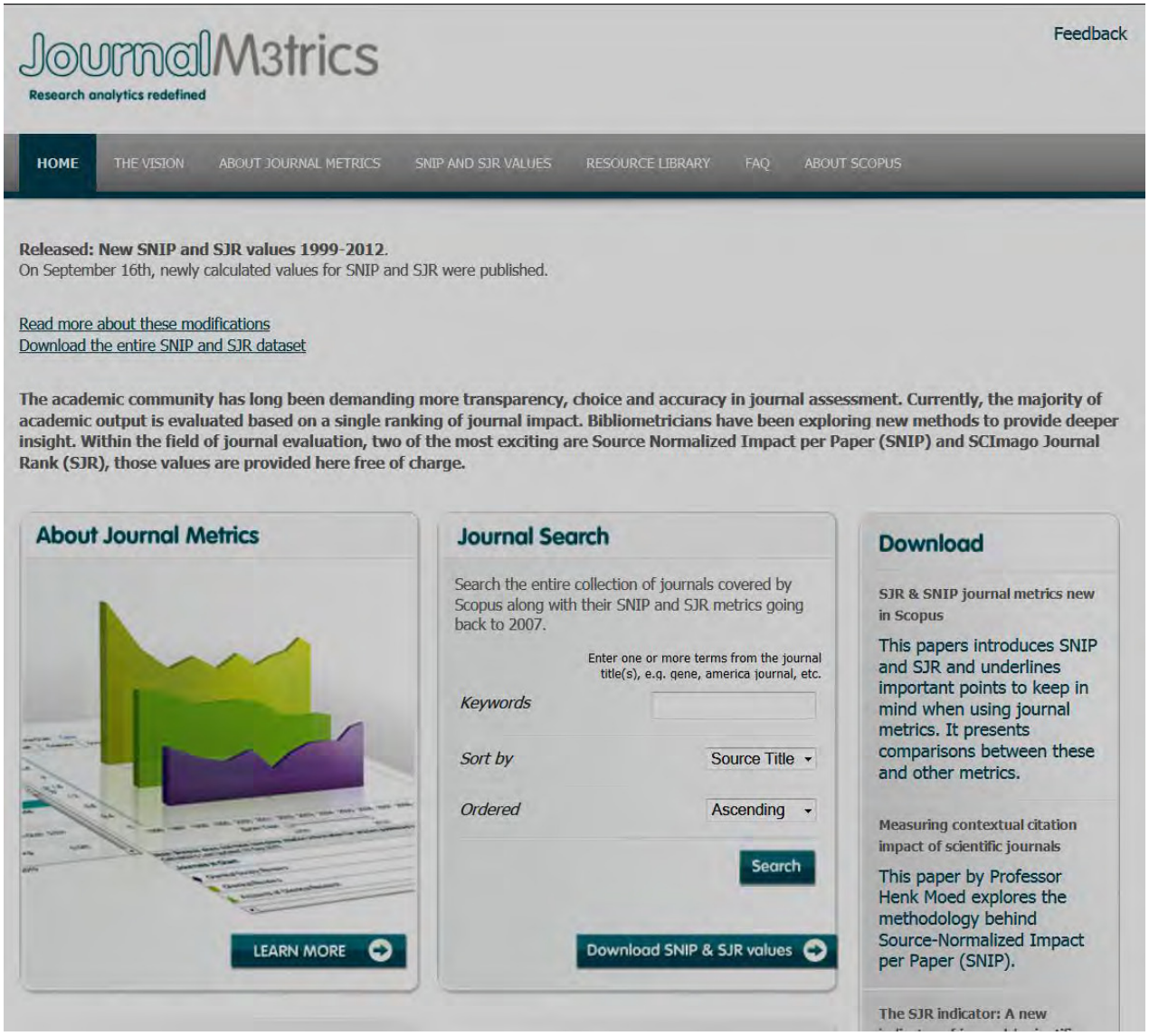


Figure 28: Homepage of JournalMetrics.com

Journal Metrics Values

34 result(s) found

Download the results as a CSV

Glossary: *SNIP*, *SJR*

Nr.	Source ID	Title	SNIP 2007	SJR 2007	SNIP 2008	SJR 2008	SNIP 2009	SJR 2009	SNIP 2010	SJR 2010	SNIP 2011	SJR 2011
1	130174	Brazilian Journal of Plant Physiology	0.791	0.424	0.693	0.466	0.702	0.439	0.912	0.333	0.717	0.31
2	79372	Bulletin of the Brazilian Mathematical Society	0.457	0.454	0.847	0.582	0.857	0.599	0.905	0.741	0.926	0.399
3	24371	Brazilian Dental Journal	0.554	0.304	0.534	0.324	0.613	0.333	0.769	0.37	0.757	0.405
4	5800169372	Revista de Economia Politica/Brazilian Journal of Political Economy	0	0	0	0.103	0.205	0.177	0.755	0.226	1.083	0.121
5	22729	Journal of the Brazilian Chemical Society	0.815	0.367	0.693	0.326	0.724	0.357	0.726	0.386	0.63	0.387
6	19930	International braz j urol : official journal of the Brazilian Society of Urology	0.515	0.231	0.574	0.27	0.611	0.272	0.708	0.364	0.932	0.412
7	52142	Pesquisa odontologica brasileira = Brazilian oral research	0.329	0.264	0.372	0.325	0.638	0.263	0.667	0.352	0.693	0.338
8	16349	Brazilian Journal of Chemical Engineering	0.641	0.275	0.703	0.282	0.631	0.285	0.661	0.324	0.807	0.379
9	28675	Brazilian Journal of Medical and Biological Research	0.719	0.405	0.707	0.414	0.65	0.363	0.645	0.404	0.649	0.335
10	13841	Brazilian journal of biology = Revista brasleira de biologia	0.378	0.266	0.616	0.242	0.679	0.324	0.642	0.353	0.926	0.501
11	145331	Brazilian Archives of Biology and Technology	0.594	0.29	0.641	0.28	0.81	0.294	0.64	0.303	0.652	0.317
12	5400152628	Brazilian Journal of Pharmacognsosy	0	0	0.232	0.267	0.431	0.304	0.64	0.331	0.479	0.261
13	130143	Brazilian Journal of Microbiology	0.462	0.197	0.547	0.246	0.612	0.286	0.636	0.315	0.788	0.354
14	11800154572	Brazilian Journal of Oceanography	0	0	0	0	0.21	0.123	0.632	0.166	0.641	0.208

Figure 29: Journal Metrics Scores as Derived from the Portal

2.5 LET US SUM UP

In this Unit, you have learned use of different citation databases and various indicators for measuring performance of journals, institutions, authors and countries. Emergence of electronic journals and more particularly open access journals have led to higher usage, share and influence of those digital contents easily available to the end users. On the other hand, open access movements have also led to global outreach of scholarly journals, published from the developing countries, emerging nations and countries in global South, to global researchers' communities. Many of these open access journals are now indexed in global citation databases such as *Web of Science* and *Scopus*.

Now, we also have free access to citation-related search engines such as Google Scholar and CiteSeer^{X} and many other derivative as well as innovative bibliometric indicators that help in objective analysis of scientific productivity of journals, authors or institutions. New indicators not only consider citations but also consider weightage of citations based on algorithms for measuring influence of articles or authors in scientific communications and growth of scientific disciplines.

Many open access and online journals now provide real-time statistics on most downloaded or most shared papers in addition to listing most cited papers. Very soon, citations will take a back stage, as many scientific papers will have no citation or few citations although these will be shared, discussed and downloaded widely. Most innovative online journals of today such as *eLIFE*,

Journal of Visualized Experiments (*JoVE*) and *PLoS One*, are now measuring their articles' influence on their respective scientific communities through alternative metrics such as measurement of share, download, discussion and media/ newspaper coverage.

2.6 CHECK YOUR PROGRESS

1) Identify key indicators available with *Journal Citation Reports*.
   ……
   ……
   ……

2) Identify key indicators available with eigenFACTOR.org.
   ……
   ……
   ……

3) Identify key indicators available with JournalMetrics.com.
   ……
   ……
   ……

4) Identify key indicators available with POP Software.
   ……
   ……
   ……

5) Identify key indicators available with Google Scholar.
   ……
   ……
   ……

6) Choose the correct answer:

   a) Who is the creator of *Science Citation Index*?
      i) Anne-Wil Harzing
      ii) Eugene Garfield
      iii) Derek John de Solla Price
      iv) Leo Egghe

   b) Who is the creator of POP Software?
      i) Anne-Wil Harzing
      ii) Eugene Garfield
      iii) Leo Egghe
      iv) Ian H. Witten

c) Which company did introduce *Science Citation Index*?
   i) Institute for Scientific Information
   ii) Indian Statistical Institute
   iii) Elsevier
   v) Springer

d) Identify the name of indicator that is used for journal ranking in *JCR* based on citations count for last two years?
   i) h-index
   ii) Immediacy index
   iii) Impact factor
   iv) g-index

e) Where do you find i10-index?
   i) Google Scholar
   ii) Google Scholar Citations
   iii) *JCR*
   v) JournalMetrics.com

ONLINE VIDEO TUTORIALS

There are a number of video tutorials available on topics discussed in this Unit. Some of the tutorials were developed by the organizations responsible for the respective products or services, while some others were developed by reputed scientists and libraries. Now, you will learn more about how these products can be used for measurement of scholarly communications and for evaluating research or researchers.

- *Alternate Routes: Journal Metrics Revisited* **Video**[19]
- *Beyond Impact Factor An Overview of Citation Metrics* **Video**[20]
- *Calculation of SNIP & SJR powered by Scopus* **Video**[21]
- *eigenFACTOR* **Video**[22]
- *Getting Started with Harzing's Publish or Perish* **Video1**[23]**, Video2**[24]
- *Google Scholar "My Citations" Tutorial* **Video**[25]
- *Henk Moed presents SNIP metric for Journal Evaluation* **Video**[26]
- *Impact Factor and other Bibliometric Indicators* **Video**[27]
- *ISI Web of Science* **Video**[28]
- *SCImago Journal & Country Rank (SJR)* **Video**[29]
- *Using Journal Citation Reports (JCR)* **Video**[30]
- *Using the H-index* **Video**[31]

[19] http://www.youtube.com/watch?v=B7WRbybStps
[20] http://www.youtube.com/watch?v=JihCVmGZgHg
[21] http://www.youtube.com/watch?v=5YarFhyoqeA
[22] http://vimeo.com/20498839
[23] http://www.youtube.com/watch?v=pZpyo7X5YIc
[24] http://www.youtube.com/watch?v=w06iw9NPKaw
[25] http://www.youtube.com/watch?v=cV4N6pl1FgU
[26] http://www.youtube.com/watch?v=SfB9eIYLdhc
[27] http://www.youtube.com/watch?v=Pmw9KKpuqFU
[28] http://www.youtube.com/watch?v=5SPoXnxiNlM
[29] http://vimeo.com/27900894
[30] http://www.youtube.com/watch?v=9qF4PNxs2tY

ANSWERS TO CHECK YOUR PROGRESS

UNIT 1

6-(a) i,
6-(b) i,
6-(c) ii,
6-(d) iii,
6-(2) iv.

UNIT 2

6-(a) ii,
6-(b) i,
6-(c) i,
6-(d) iii,
6-(ej) ii.

UNIT 3

(1) iv,
(2) iii,
(3) ii,
(4) ii,
(5) iv.

UNIT 4

(1) i,
(2) iii,
(3) ii,
(4) i,
(5) iii.

GLOSSARY OF TERMS

Term	Definition
Altmetrics	Altmetrics is a new metrics proposed as an alternative to the widely used journal impact factor and personal citation indices such as h-index. The term altmetrics was proposed in 2010, as a generalization of article level metrics, and has its roots in the twitter #altmetrics hashtag.
Article Influence Score (AI)	It determines the average influence of a journal's articles over the first five years after publication. It is calculated by dividing a journal's Eigenfactor score by the number of articles in the journal, normalized as a fraction of all articles in all publications. The mean AI is 1.00. A score greater than 1.00 indicates that each article in the journal has above-average influence. A score less than 1.00 indicates that each article in the

[58] http://vimeo.com/49328590

	journal has below-average influence. (Source: Thomsonreuters.com)
arXiv	It is an e-print service in the fields of physics, mathematics, computer science, quantitative biology, quantitative finance and statistics.
Author Self-citation	Author self-citation occurs when an author cites his own work published earlier or going to be published in future.
Bibliographic coupling	It is a measure that uses citation analysis to establish a similarity relationship between documents. It links two papers that cite the same article, so that if papers A and B both cite paper C, they may be said to be related, even though they don't directly cite each other. The more papers they both cite, the stronger their relationship is.
Book Citation Index	It allows users to search seamlessly across books, journals and conference proceedings to find the information most relevant to their work within one platform. It details the citations received by a book. (Source: Thomsonreuters.com)
Bookmarklet	It is a small software application stored as a bookmark in a web browser, which typically allows a user to interact with the currently loaded web page in some way.
Chinese Science Citation Database	It contains important research and citation data from China, including research trends, top authors, institutions, journals, and more. (Source: Thomsonreuters.com)
Citation	It is a reference to a text or part of a text identifying the document in which it may be found.
Citation Index	It is a bibliographic tool in print or electronic format that lists all referenced or cited source items published in a given time span.
Citation Network	It is a one-way or two-way network analysing relationship between citing and cited references or authors.
Citations Count	It is a simple method of counting total citations received by an earlier published article, with data obtained from a citation database.
Cited Half Life	It is the number of years, going back from the current year, that account for 50% of the total citations received by the cited journal in the current year.
Cited Half-Life (of a journal)	It is the number of years, going back from the current year, that account for 50% of the total citations received by the cited journal in the current year. ISI developed this calculation to provide an indicator as to the long-term value of source items in a single journal publication. It may be noted that the cited half life of

	the literature of a speciality is different from the cited half life of a journal. (Source: Thomsonreuters.com)
Cites per Document (2 years)	Average citations per document in a 2 year period. It is computed considering the number of citations received by a journal in the current year to the documents published in the two previous years, i.e., citations received in year X to documents published in years X-1 and X-2. (Source: Scimagojr.com)
CiteULike	It is a free service to help you to store, organise and share the scholarly papers you are reading.
CiteULike	It is a free service to help you to store, organise and share the scholarly papers you are reading.
Citing Half-Life	It is the number of journal publication years , going back from the current year that account for 50% of the total citations given by the citing journal in the current year.
Citing Half-Life of a Journal	The number of journal publication years, going back from the current year, that account for 50% of the total citations given by the citing journal in the current year. ISI developed this calculation to provide an indicator of the subtle changes in scope of a publication over the course of time. (Source: Thomsonreuters.com)
Co-citation coupling	It is a method used to establish a subject similarity between two documents. If papers A and B are both cited by paper C, they may be said to be related to one another, even though they don't directly cite each other. The more papers cite A and B, the stronger their relationship is.
Co-citation network	It is a network analysing instances of co-citation coupling.
Conference Proceedings Citation Index	It helps researchers access the published literature from the most significant conferences, symposia, seminars, and more. (Source: Thomsonreuters.com)
Crossref	It is an official Digital Object Identifier (DOI) Registration Agency of the International DOI Foundation.
Data Citation Index (DCI)	It provides digital research that is discoverable, citable and linked to primary research literature. You can discover datasets from multiple repositories in one place. (Source: Thomsonreuters.com)
Delicious	It is an online social bookmarking service. Its website address is Delicious.com.
Desktop application	It is an application software that runs stand alone in a desktop or laptop computer.
Dryad	It is an international repository of data underlying peer-reviewed articles in the basic and applied biology. Its website address is http://datadryad.org.
Eigenfactor Score	Its calculation is based on the number of times articles

(EF)	from the journal published in the past five years have been cited in the *JCR* year, but it also considers which journals have contributed these citations so that highly cited journals will influence the network more than lesser cited journals. References from one article in a journal to another article from the same journal are removed, so that Eigenfactor scores are not influenced by journal self-citation. (Source: Thomsonreuters.com)
Free software	It is a computer software that is available free of charge, however, its source code may or may not be made available.
g-index	An index to quantify an individual's scientific research output, proposed by Leo Egghe. (Source: Harzing.com/pop.htm)
Github	It is a social, online repository for open source software.
h5-index	h5-index is the h-index for articles published in the last 5 complete years. It is the largest number h such that h articles published in 2008-2012 have at least h citations each. (Source: Scholar.google.com)
h5-median	h5-median for a publication is the median number of citations for the articles that make up its h5-index. (Source: Scholar.google.com)
hc-index	Contemporary h-index or hc-index adds an age-related weighting to each cited article, giving (by default; this depends on the parametrization) less weight to older articles. (Source: Harzing.com/pophelp/metrics.htm)
h-index	h-index, proposed by J.E. Hirsch, is the largest number h such that h publications have at least h citations. The second column has the "recent" version of this metric which is the largest number h such that h publications have at least h new citations in the last 5 years. (Source: Scholar.google.com)
i10-index	i10-index is the number of publications with at least 10 citations. The second column has the "recent" version of this metric which is the number of publications that have received at least 10 new citations in the last 5 years. (Source: Scholar.google.com)
Immediacy Index (JII)	The average number of times that an article published in a specific year within a specific journal is cited over the course of that same year. This index, published in the *Journal Citation Reports*, is one developed by ISI as an indicator of the speed with which citations to a specific journal appear in the published literature. Such information is useful in determining which journals are publishing in emerging areas of research. (Source: Thomsonreuters.com)
International	Document ratio (in percent) whose affiliation includes

Collaboration (%)	more than one country address. (Source: Scimagojr.com)
Journal Citation Reports (*JCR*)	*JCR* offers a systematic, objective means to critically evaluate the world's leading journals, with quantifiable, statistical information based on citation data. (Source: Thomsonreuters.com)
Journal Immediacy Index	It is the average number of times articles published in a journal in a specific year are cited within the same year.
Journal Impact Factor (JIF)	The number of current citations to articles published in a specific journal in a two year period divided by the total number of articles published in the same journal in the corresponding two year period. ISI stresses that a journal's impact factor is a meaningful indicator only when considered in the context of similar journals covering a single field of investigation or subject discipline. (Source: Thomsonreuters.com)
Journal self-citation	It is an instance in which an article published in a journal has cited a previously published article in that same journal.
Mendeley	It is a research management tool for desktop and web.
Open source software	It is computer software with its source code made available and licensed with the permissions or rights to study, change and distribute the software to anyone and for any purpose.
Plug-in	It is a software component that adds a specific feature to an existing software application.
PubMed	It comprises more than 21 million citations of biomedical literature.
RG Score	The RG Score is a metric that measures scientific reputation based on how all of your research is received by your peers.
RIS File	The RIS file format is a tagged format for expressing bibliographic citations. RIS File is a plain text file that can contain multiple references. RIS files can be exported from reference software such as EndNote and Reference Manager. Each reference is composed of a variable number of fields; and each field is preceded by a six-character label or "tag." Some tags are specific only to certain reference types. Each tag must be in a specific format, and certain other rules apply to all tags.
SciELO Citation Index	It lets researchers around the world discover new insights from research emanating from Latin America, Spain, Portugal, the Caribbean and South Africa while making connections to the broader research landscape for a more complete global picture. (Source: Thomsonreuters.com)

Scienceseeker.org	It refers to science news from science newsmakers. It offers science news aggregation service.
SCImago Journal Rank (SJR)	SJR is a prestige metric based on the idea that 'all citations are not created equal'. (Source: JournalMetrics.com)
Scopus	It is the world's largest abstract and citation database of peer-reviewed literature.
Self-citation	It can an instance in which an article published in a journal has cited a previously published article in that same journal, or it can be an instance in which an author cites his own work published earlier or forthcoming.
SJR (SCImago Journal Rank) indicator	It expresses the average number of weighted citations received in the selected year by the documents published in the selected journal in the three previous years, i.e., weighted citations received in year X to documents published in the journal in years X-1, X-2 and X-3. (Source: Scimagojr.com)
Source Normalized Impact per Paper (SNIP)	SNIP measures contextual citation impact by weighting citations based on the total number of citations in a subject field. (Source: JournalMetrics.com)
Web of Science® (*WoS*)	*WoS* provides quick, powerful access to authoritative content from the highest impact journals worldwide, including Open Access journals, in the sciences, social sciences, arts and humanities. (Source: Thomsonreuters.com)

LIST OF ABBREVIATIONS

A&HCI	Arts & Humanities Citation Index
AI	Article Influence score
ALM	Article Level Metrics
API	Application Programming Interface
CE	Cost Effectiveness score
DOI	Digital Object Identifier
DORA	San Francisco Declaration on Research Assessment
EF	Eigenfactor score
GB	Gigabytes
HC-Index	Contemporary H-Index
H-Index	Hirsch Index
HSS	Humanities and Social Sciences
HTML	Hypertext Markup Language
ICI	Indian Citation Index

ISI	Institute for Scientific Information
JCI	Journal Current Index
JCR	Journal Citation Reports
JIF	Journal Impact Factor
JII	Journal Immediacy Index
MB	Megabytes
OA	Open Access
ORCID	Open Researcher and Contributor ID
PDF	Portable Document Format
PLOS	Public Library of Science
PLOS ALM	PLOS Article Level Metrics.
PMC	PubMed Central
RII	Journal Research Impact Indicator
RIS	Research Information Systems, Inc.
SCI	Science Citation Index
SciELO	Scientific Electronic Library Online
SJR	SCImago Journal Rank
SNIP	Source Normalized Impact per Paper
SSCI	Social Science Citation Index
SSRN	Social Science Research Network
STM	Science, Technology and Medicine
WoK	Web of Knowledge
WoS	Web of Science
XML	Extensible Markup Language

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This module has been jointly prepared by UNESCO and The Commonwealth Educational Media Centre for Asia (CEMCA), New Delhi.