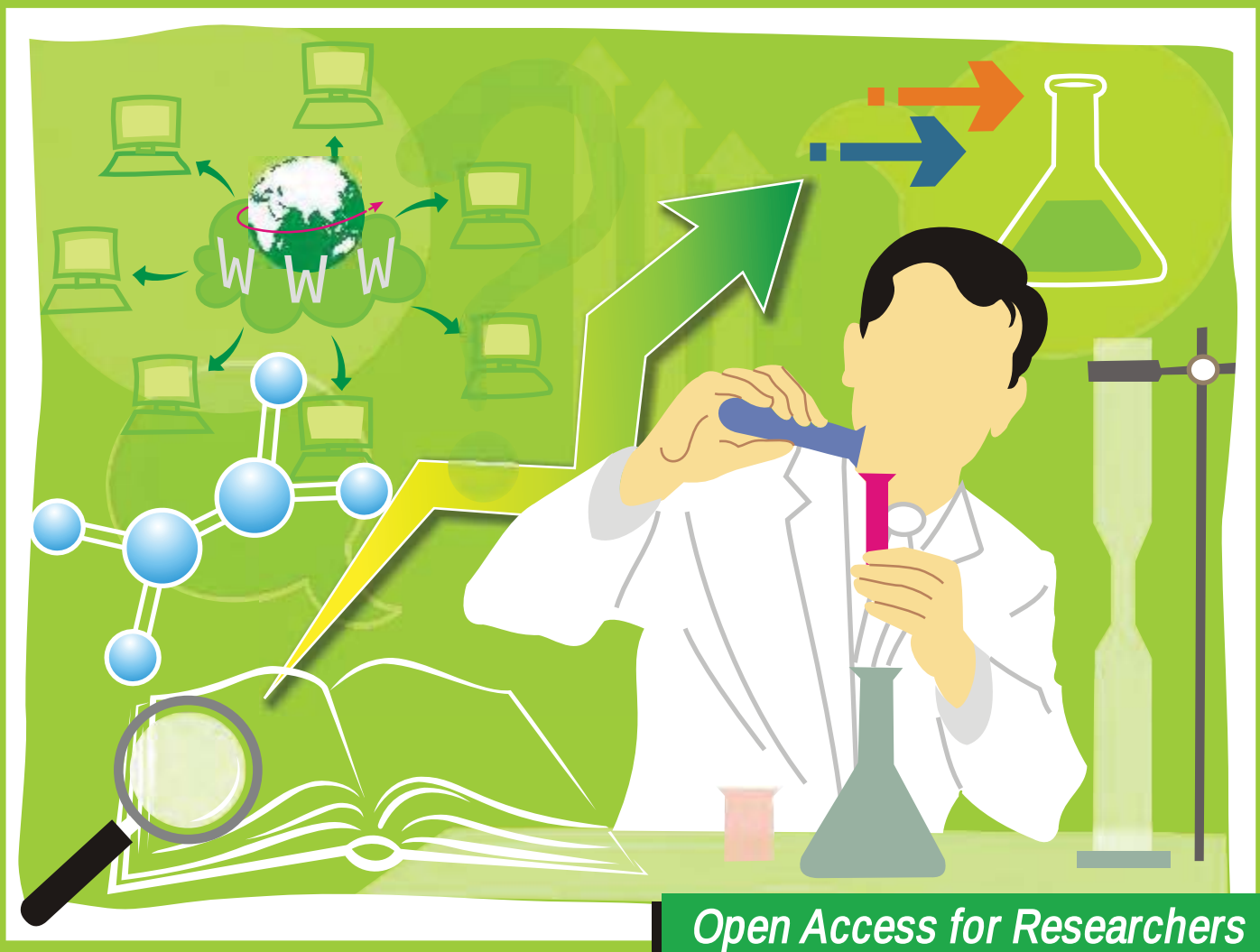
United Nations
Educational, Scientific and
Cultural Organization

4

Research
Evaluation Metrics



Open Access for Researchers

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

ISBN 978-92-3-100082-9

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
UNESCO, Paris, France

Bojan Macan
Ruder Boškovif Institute Library, Croatia

Dominique Babini
CLACSO, Argentina

Ina Smith
Stellenbosch University, South Africa

Iskra Panevska
UNESCO New Delhi, India

Jayalakshmi Chittoor Parameswaran
Independent Consultant, India

M Madhan
ICRISAT, India

Parthasarathi Mukhopadhyay
Kalyani University, India

Ramesh C Gaur
Jawaharlal Nehru University, India

Sanjaya Mishra
CEMCA, New Delhi, India

Shalini Urs
University of Mysore, India

Sridhar Gutam
Central Institute for Subtropical Horticulture, India

Susan Veldsman
Academy of Science of South Africa, South Africa

Uma Kanjilal
Indira Gandhi National Open University, India

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 1 INTRODUCTION TO RESEARCH EVALUATION METRICS AND RELATED INDICATORS

Structure

1.0 INTRODUCTION

In an open access world, much importance has been given in using open source tools, open access resources and open solutions to engage authors and researchers in collaborative research, peer-to-peer sharing of scholarly information and collaborative evaluation of scholars' works.

On the other hand, exponential growth of scientific literature also has led to rapid disappearance of produced literature before it actually gets noticed by the scientific communities. No single database can capture this over-grown scientific literature. Several data mining tools are probably required to keep abreast with quantum of produced literature. The social webs, available to the researchers' communities in addition to any other groups of citizens, help the researchers in disseminating their produced or contributed knowledge to global communities. The more you are active in social media, the more you have chances to get noticed by fellow researchers and possible research collaborators. Many personalized web-based services are now increasingly made available targeting global researchers' communities, helping them to enhance their social media presence and visibility.

Thus, research evaluation of a researcher or a research institution or a research group looks into detailed analysis of many aspects of this entity. Figure 1 depicts four important dimensions of research evaluation. These aspects are extremely interrelated and interdependent. Weakness in one aspect will lead to lowering value to other aspect. Research evaluation should be carried out to determine strengths and weaknesses in productivity, visibility, reputation, and impact of scientific researchers or institutions.

In this Module, various tools and techniques are discussed in details to help the researchers in strengthening their efforts in enhancing scientific productivity, visibility, reputation, and impact of their research works.

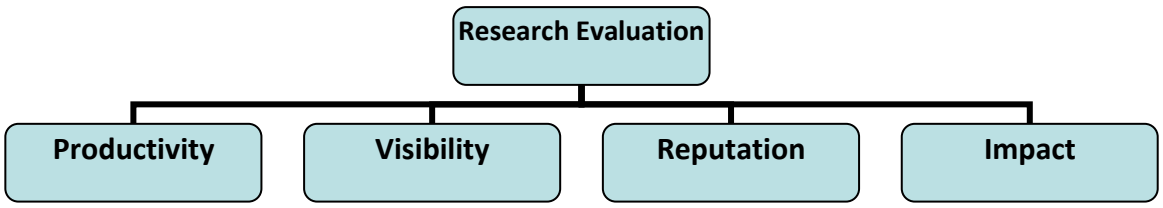


Figure 1: Dimensions of Research Evaluation

1.1 LEARNING OUTCOMES

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

- Describe basic tools used for measurement of scientific productivity and evaluation of research;
- Explain the features of different research evaluation metrics;
- Understand citation analysis, and importance of citations in academic research; and
- Discuss transition from citation-based indicators to author level and article level metrics for research evaluation.

1.2 USE OF CITATION-BASED INDICATORS FOR RESEARCH EVALUATION

After World War II, the measurement or evaluation of research emerged as a key policymaking tool to justify investments in scientific research across the world. This time the world also saw the emergence of cross-border research collaborations, and bilateral, multilateral as well as South-South, North-South, North-North scientific cooperation. International as well as national research collaborations need to assess impact of scientific literature produced by their prospective research collaborators. Measurement of scholarly communications got a new impetus when Eugene Garfield[1] established the Institute for Scientific Information (ISI) in the United States in 1960. Garfield started the first ever citation indexing service for papers published in academic journals. The *Science Citation Index (SCI)* was officially launched in 1964. As defined in the *Glossary of Thomson Scientific Terminology*, "a Citation Index is a bibliographic tool in print or electronic format that lists all referenced or cited source items published in a given time span. … What distinguishes it from other indexes is that it includes all the cited references (footnotes or bibliographies) published with each article it covers". Subsequently, the ISI published *Social Sciences Citation Index (SSCI)* from 1972 and *Arts & Humanities Citation Index (AHCI)* from 1978.

[1] http://en.wikipedia.org/wiki/Eugene_Garfield

Based on wealth of resources available in SCI database, the ISI introduced another tool for ranking academic journals analysing citations they received and impact they percolated into scientific communities. The annual *SCI Journal Citation Reports* was officially launched in 1975. Here, ISI introduced two basic indicators, namely Impact Factor and Immediacy Index. As defined in the *Glossary of Thomson Scientific Terminology*, Impact Factor is "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", whereas Immediacy Index is defined as "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". Nonetheless, the Impact Factor is actually Journal Impact Factor (JIF), not exactly measuring contributions of individual scientists. JIF is a collective indicator for a journal, not its authors. Similarly, Immediacy Index is "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".

From its beginning, the SCI database included details of affiliation of all authors of a journal article. This facilitates analysing research collaborations while publishing journal articles, not only for the sake of paper writing but also in laboratory experimentations. ISI silently observed globalization of scientific research, as recorded in SCI database.

The citation products and analytical tools of ISI facilitated formation of a scientific discipline called Scientometrics and related areas such as Bibliometrics, Informetrics, Webometrics, Patentometrics, and Librametrics. Bibliometrics started in early 20th century also received a tremendous boost. A journal titled *Scientometrics* was launched in 1978, followed by other journals such as *Research Evaluation* (f. 1991), *Cybermetrics: International Journal of Scientometrics, Informetrics and Bibliometrics* (f. 1997), *Journal of Informetrics* (f. 2007), *Collnet Journal of Scientometrics and Information Management* (f. 2007), *Journal of Scientometric Research* (f. 2012), besides a few other multidisciplinary journals covering scientometrics and related subject areas.

In the first era of scientometric studies, citation analysis was the predominant method for analysing scientific productivity of individual scientists or research institutions or countries. Research performance of an individual was measured in terms of citations an author's works received, journal's rank or journal impact factor wherein an author's works appeared ~~in~~, and collaboration matrix of collaborating authors. An institution or a country was similarly measured.

In an era of electronic publishing of academic journals (e-journals) as well as online social networking, things have changed very dynamically. Many dimensions of scientist's contributions, influence and impact of research are looked into, as scientific communities are now matured enough to go beyond the conventional bibliometric indicators such as citations count, journal impact factor, immediacy index, etc. Influence of an individual within scientific

communities can be measured in various ways. Recently in 2012, the San Francisco Declaration on Research Assessment (DORA[2]) elaborated some provisions of research evaluation for individual researchers, transition from counting citations based on journals impact factor to counting influence an individual scientist made. A number of research funding agencies have already supported this declaration and they are going to use alternative metrics (or altmetrics) more conclusively.

In the following Sections we shall learn basics of conventional research measurement tools and their applications in evaluation of scientific research.

1.2.1 Citation Analysis

Harrod's Librarians' Glossary defines citation as "a reference to a text or part of a text identifying the document in which it may be found". Citations are usually found in the list of references mostly with full bibliographic details and generally placed at the end of an article or chapter or as footnotes.

Authors cite other authors for different reasons, such as, (a) giving credit (i.e. identifying antecedents and original publications in which a fact, idea, concept or principle was first published); (b) previous work (i.e. identifying general documents related to the topic; presenting previous results; announcing future work; commenting, correcting or criticizing previous work; identifying methodology, equipment, etc.); (c) authority (i.e. substantiating claims and persuading readers; authenticating data and other results, or identifying the results by others supporting the author's work); and (d) social factors (i.e. citing prestigious researchers; citing work by the author's graduate students, fellows and co-workers to increase their visibility; 'perfunctory' citations) (Campanario, 2003).

Citation analysis is a very important method in measuring impact of scientific publications, and more particularly citation analysis helps in identifying role of highly cited papers in expanding universe of knowledge, formation of new scientific disciplines and strengthening scientific communities.

Self Citation

In scientific communication, authors not only cite others' works but also cite their own works earlier authored by themselves. This phenomenon is known as self citation. Author self-citation occurs when an author cites his earlier published works in his forthcoming paper. Whereas, journal self-citation occurs while an author of a journal paper cites other articles from the same journal. In the articles published in the journal A, if there are references to the same journal, then they are all journal self citations.

Both author self citations and journal self citations are valid in scientific discourses, with a threshold limit. Beyond a point it may raise undesirable attention of paper reviewers, information analysts and others from the research evaluation perspectives.

[2] http://am.ascb.org/dora/files/sfdeclarationfinal.pdf

Cited Half-Life and Citing Half-Life

All references cited by an author in an article are not of the same year. If you scan a paper from a journal of humanities or social sciences, you may find some references published even decades ago. The cited half life of an article is the median age of the items cited in that article. Half (i.e., 50%) of the citations to the article are to items published within the cited half-life. Similarly, the cited half-life of a journal is the median age of its items cited in that journal. Half (i.e., 50%) of the citations to the journal are to items published within the cited half-life. It should be noted that the half life is always calculated from the latest year backwards.

Similarly, the citing half-life of a journal is the median age of articles cited by the journal in a calendar year. For example, in the 2012 *Journal Citation Reports (JCR*), the journal *Annual Review of Psychology* has a citing half-life of 9.0. That means 50% of the items cited in *Annual Review of Psychology* in 2012 were published between 2004 and 2012 (both years inclusive).

There are many terms commonly used in citation analysis and related techniques. Some of citation-related terms, popularly used for measurement of science and evaluation of scientific research, are listed in Table 1.

Table 1: Citation Related Terms

Term	Short Definition
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.
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.
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.
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.
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.
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. Self-citation can be of two kinds: journal self-citation or author self-citation.

1.2.2 Concepts of Bibliometrics, Scientometrics Webometrics, etc.

A number of terms are commonly used in defining different approaches of research evaluation and measurement of scientific productivity. Many of the terms are ~~cor~~related as each one addresses a typical aspect of scholarly communications. Table 2 shows an indicative list of terms frequently used as research evaluation metrics. Each term defines a set of methods for a particular type of resources or applications. Some of the terms are used interchangeably to broadening or narrowing scope of research evaluation.

Table 2: Frequently Used Terms Used as Research Evaluation Metrics

Term	Short Definition
Bibliometrics	Bibliometrics is a set of methods to quantitatively analyse academic literature and scholarly communications.
Informetrics	Informetrics is the study of quantitative aspects of information. This includes the production, dissemination, and use of all forms of information, regardless of its form or origin.
Scientometrics	Scientometrics is the study of quantitative features and characteristics of science, scientific research and scholarly communications.
Webometrics	Webometrics is the study of quantitative features, characteristics, structure and usage patterns of the world wide web, its hyperlinks and internet resources.
Cybermetrics	Cybermetrics is an alternative term for Webometrics.
Librametrics	Librametrics is a set of methods to quantitatively analyse availability of documents in libraries, their usage and impact of library services to its user community.
Patentometrics	Patentometrics is a set of methods to quantitatively analyse patent databases, patent citations and their usage patterns.
Altmetrics	Altmetrics is new metrics proposed as an alternative to the widely used journal impact factor and personal citation indices like the 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 Level Metrics (ALM)	Article level metrics is an alternative term for Altmetrics.

Applications of Scientometrics and Bibliometrics in Research Evaluation

In the last sixty years, evaluation of public funded research has been carried out globally on a regular basis for performance measurement of different actors of scientific research. Most of the citation databases and citation analysis tools available in today's world have functionalities to instantly generate reports and scientometric profile of a scientist, an institution, a collaborative research group, a country, or a journal. Some of the popular applications of scientometrics and bibliometrics listed below can use report generator tools available with citation-based products and services discussed in Unit 2 of this Module.

- **For Institution/ Collaborative Research Group**: Mapping of collaborations, top collaborating institutions, top collaborating countries,

collaborating with public vs. private institutions, highly cited papers, highly cited authors, top contributing scientists, top publishing journals, scientists with top h-index, top subject categories or research domains, percentage of cited vs. uncited papers, percentage of self-citations, publishing in open access vs. subscription-based journals, comparative study of two or more institutions in a region/ country.

- **For a scientist**: Mapping of collaborations, collaborating institutions, collaborating countries, co-authors, highly cited papers, top publishing journals, percentage of cited vs. uncited papers, percentage of self-citations, author-level indicators such as h-index, i10-index, etc.
- **For a country**: Top contributing institutions, top contributing cities, top contributing states, top research funding agencies, top affiliating apex bodies, mapping of collaborations, top collaborating countries, top collaborating institutions, top contributing scientists, top publishing journals, top subject categories or research domains, percentage of cited vs. uncited papers, percentage of self-citations, highly cited papers, highly cited authors, top scientists with h-index, publishing by public vs. private institutions, publishing in open access vs. subscription-based journals, comparative study of two or more countries in a region or globally.
- **For a journal**: highly cited papers, highly cited authors, percentage of cited vs. uncited papers, percentage of self-citations, top research domains, cited half-life vs. citing half-life, top contributing institutions, top contributing cities, top contributing countries, most downloaded papers, most shared papers, and highly ranked journals based on citation-based indicators.

1.2.3 Common Bibliometric Indicators

There are a number of bibliometric indicators used for research evaluation and performance measurement of journals, institutions, countries and collaborative research groups. These bibliometric indicators are mostly citation-based indicators, traditionally drawn from the citation databases such as *Science Citation Index (SCI), Social Science Citation Index (SSCI) and Journal Citation Reports (JCR)*. Later, from the beginning of the twenty-first century, web-based citation databases such as Scopus and Web of Science, and citation search engines such as Google Scholar, Microsoft Academic Search and CiteSeer^{X} are frequently used for deriving citation-based indicators. Figure 2 depicts various citation-based indicators, mostly derived from citation databases and citation search engines. Some of the indicators help in analysing co-authors, collaborative institutions and collaborative countries commonly found from affiliation search in any citation database. These indicators are discussed in details with suitable examples in Unit 2 of this Module.

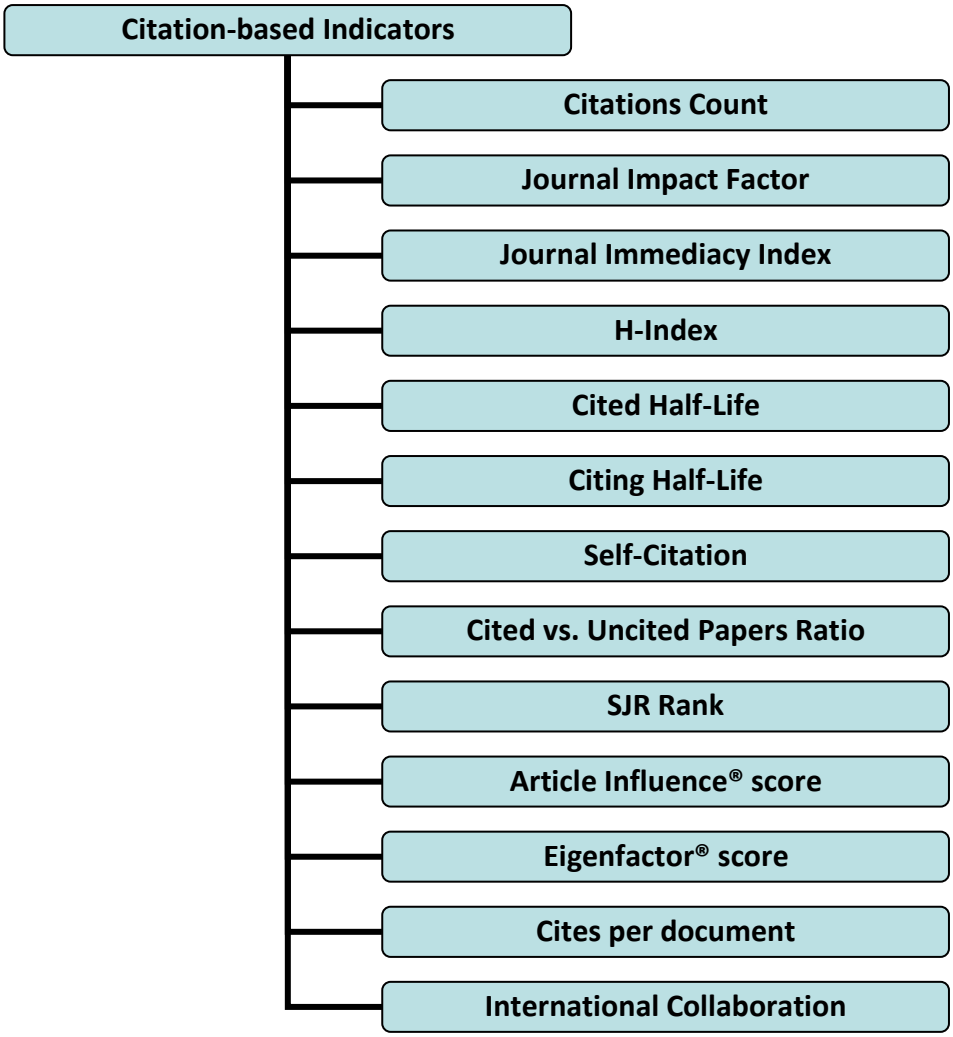


Figure 2: Most Useful Citation-based Indicators, derived from Citation Databases

1.2.4 Classical Bibliometric Laws

Three classical bibliometric laws are widely accepted by the bibliometricians and information scientists in establishing theoretical framework and understanding growth of universe of knowledge or formation of emerging subject areas, as recorded in citation databases. Figure 3 depicts these three classical bibliometric laws. These laws are discussed in details with suitable examples in literature listed in Further Readings at the end of this Unit.

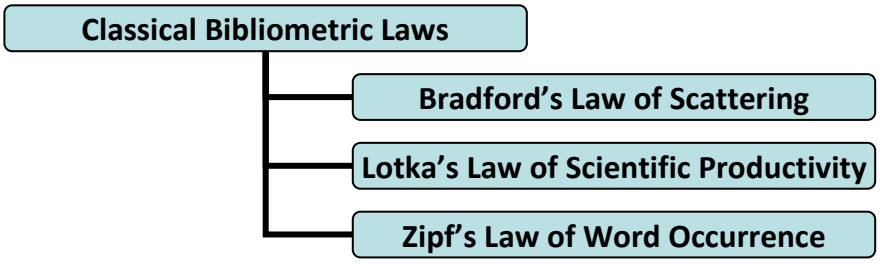


Figure 3: Classical Bibliometric Laws

Bradford's Law of Scattering: Samuel C. Bradford in 1934 found that a few core journals harbour 1/3 of the articles on a given subject, a moderate number of less-than-core journals harbour a further 1/3 of the articles on the subject, and a large number peripheral journals harbour the remaining 1/3 of the articles. He proposed the formula $1:n:n^2$ to describe the phenomenon. However, this distribution is not statistically accurate and it may vary subject-to-subject. But it is still commonly used as a general rule of thumb.

Lotka's Law of Scientific Productivity: Alfred J. Lotka in 1926 in his paper "the Frequency Distribution of Scientific Productivity" found that " … the number (of authors) making n contributions is about $1/n^2$ of those making one; and the proportion of all contributors, that make a single contribution, is about 60 percent". This means that out of all the authors in a given field, 60 percent will produce just one publication, and 15 percent will produce two publications, 7 percent of authors will produce three publications, and so on. According to Lotka's Law of scientific productivity, only six percent of the authors in a field will produce more than 10 articles. However, this distribution is not statistically accurate and it may vary subject to subject. But it is still commonly used as a general rule of thumb.

Zipf's Law of Word Occurrence: Harvard linguist George Kingsley Zipf suggested an equation popularly known as Zipf's law that is often used to predict the frequency of words within a relatively lengthy text. Zipf found that the rank of the word multiplied by the frequency of the word equals a constant. Zipf's law, again, is not statistically accurate, but it is very useful for indexers and indexing databases even during the internet era.

Applications of these bibliometric laws are very often found in the early period of scientometric literature and bibliometric studies. However, their applications in web 2.0 or social media-enabled scholarly communications have not been tested adequately, as scientometric research has now moved into different domains and in different directions.

1.3 TRANSITION FROM CITATION-BASED INDICATORS TO AUTHOR-LEVEL METRICS AND ARTICLE-LEVEL METRICS FOR RESEARCH EVALUATION

Emergence of new web-based services as well as new service providers facilitates the new-age researchers with new tools of social networking and collaborative research. Web 2.0 or social media-based products became a boom for researchers across the world reducing dependence on subscription-based services, and increasing dependence on open access or open source-based services. Many commercial academic database companies are now venturing into offering free web services to the researchers. On the other hand, non-profit ventures as well as web services supported by philanthropic foundations are on the rise. They also offer free web services to the researchers. While authors or researchers have access to many value-added

personalized web services, authors-level metrics are on the rise to help researchers to determine their potentials as well as asserting potentials of research collaborators. Now, the innovative value-added personalized web services are helping in transition from citation-based indicators to author-level metrics and article-level metrics for research evaluation. We shall learn more about author-level metrics and article-level metrics in Unit 3 of this Module.

1.3.1 Author Level Indicators Using Authors' Public Profiles

The personalized web-based researchers' profiles help in deriving many performance indicators of researchers, their collaborators and institutions. Innovative new indicators are now extensively focusing on author's works rather than journal's performance, visibility or prestige. Some commonly available author-level indicators are shown in Figure 4. Table 3 shows most useful author level indicators, derived from online researchers' profiles offered by innovative academic social networks and new age web service providers for researchers communities. We learn more about author level metrics in Unit 3 of this Module.

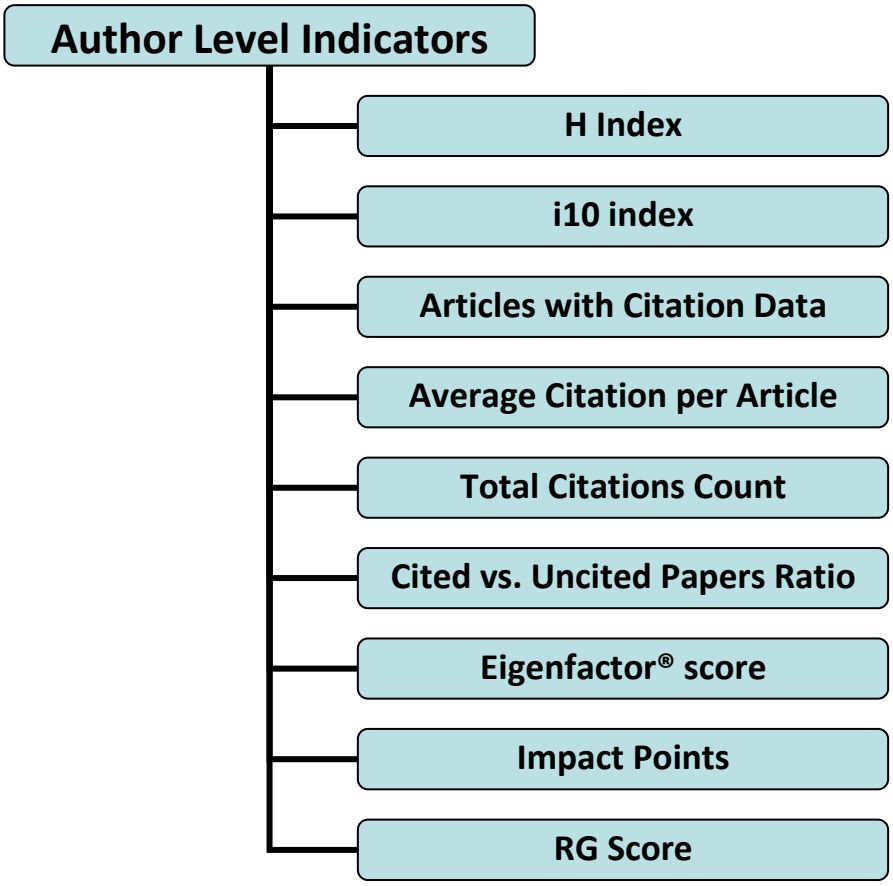


Figure 4: Useful Author Level Indicators, derived from Online Researchers' Profiles

Table 3: Useful Author-Level Indicators, derived from Online Researchers' Profiles

Name of the Indicator	Data Source	Researchers' Profiles/ Tools Used
H Index	Google Scholar, Web of Science, Scopus	Google Scholar Citations, ResearcherID
Citations Count	Google Scholar, Web of Science, Scopus	Google Scholar Citations, ResearchGate
i10 Index	Google Scholar	Google Scholar Citations
g Index	Google Scholar	PoP Software
Articles with citation	Web of Science	ResearcherID
Average citations per article	Web of Science, Google Scholar	ResearcherID, PoP Software
Eigenfactor® score	Web of Science	Social Science Research Network (SSRN)
Impact Points	ResearchGate	ResearchGate
RG Score	ResearchGate	ResearchGate

1.3.2 Article Level Metrics Using Altmetric Tools

Although, many scholarly journals are indexed in world's renowned citation databases such as *Web of Science* or *Scopus*, not every paper published by these journals is lucky enough to get cited by other scholarly papers in successive years. Attracting citations for a published paper is not easy, if not impossible. The online journals and open access journals have liberty to track its online usage through statistics of downloads and HTML views. Thus, they have means to track an alternative measure of article usage.

Innovative new age online journal publishers got interested in deriving article metrics for every published article in their portals. They make these download and usage statistics public in the respective page of article to indicate popularity or acceptance of said article. Some journals started tracking of articles' 'share' in popular social media and social bookmarking websites such as Twitter, Facebook, Mendeley, CiteULike, and Delicious, to mark the articles' popularity or acceptance. This led to the development of article level metrics or altmetrics as an indicator of scholarly communications.

A leading online journal publisher – PLOS[3] (Public Library of Science) had shown its interests in article level metrics in 2009 and started showing this metrics in every article. A statement titled "Altmetrics: A Manifesto"[4] was published in 2010 for streamlining development around the article level metrics. We shall learn more about author level metrics in Unit 3 of this Module.

[3] http://www.plos.org/
[4] http://altmetrics.org/manifesto/

1.4 LET US SUM UP

In this Unit, you have learned about different methods and techniques used in evaluating research, measurement of science scientific communities and scientific communications. Some of them are commonly described as research evaluation metrics. Historically, main tools used for research evaluation are citation analysis and citation indexes. Emergence of interactive social network and social media marks arrival of personalized web-based indicators for measuring social impact and outreach of every piece of scholarly work, and its producers – authors and institutions.

When an author shares his 'just published' research paper in social media, personalized researcher's profile and online forums, it comes with much higher possibilities of getting read or noticed by co-researchers working in the same or allied research areas.

Thus, author level metrics and article level metrics are built upon counting social 'share', 'saved', 'discussed' and 'cited' data sources available through different social webs. You will learn more about citation-based analytical tools and indicators for evaluating scholarly communications in Unit 2, article and author level measurements in Unit 3 and how to use online reference managers in Unit 4 of this Module.

1.5 CHECK YOUR PROGRESS

1) Identify five key citation-based indicators for journals.

   ……

   ……

   ……

   ……

2) Identify five key author-level indicators for evaluating author's productivity.

   ……

   ……

   ……

   ……

3) Identify names of three common bibliometric laws.

   ……

   ……

   ……

   ……

4) Where can you find H-Index of an author?

……

……

……

……

5) Where can you find g-Index of an author?

……

……

……

……

6) Choose the correct answer of the following:

a) Which Citation Index was introduced first?
   i) Science Citation Index
   ii) Social Science Citation Index
   iii) Arts & Humanities Citation Index
   iv) Data Citation Index

b) Where can you find Impact Points of an author?
   i) ResearchGate
   ii) ResearcherID
   iii) SSRN
   iv) Scopus

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

d) Which journal publishers did introduce article level metrics?
   i) JoVE
   ii) eLIFE
   iii) PLOS
   v) Biomed Central

e) Where can you find i10-Index of an author?
   i) Google Scholar
   ii) ResearchGate
   iii) Scopus
   vi) Google Scholar Citations

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 learn more about how these products can be used for measurement of articles and contributors.

- *Academic Visibility and the Webometric Future* **Video**[5]
- *Alternate Routes: Journal Metrics Revisited* **Video**[6]
- *Citation Analysis and Bibliographies* **Video**[7]
- *Citation Indexing* **Video**[8]
- *Eugene Garfield on H-indexes and Impact Factors* **Video**[9]
- *Eugene Garfield on Impact Factors* **Video**[10]
- *H-Index: A Measure of a Scientist's Impact* **Video**[11]
- *Impact Factor and other Bibliometric Indicators* **Video**[12]

[5] http://www.youtube.com/watch?v=IRLo_VyBMIo
[6] http://www.youtube.com/watch?v=B7WRbybStps
[7] http://www.youtube.com/watch?v=UK8gEe7y_mk
[8] http://www.youtube.com/watch?v=uYTZouNlxWo
[9] http://www.webofstories.com/play/eugene.garfield/71
[10] http://www.webofstories.com/play/eugene.garfield/38
[11] http://www.youtube.com/watch?v=P47yAH8yz9U
[12] http://www.youtube.com/watch?v=Pmw9KKpuqFU

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.

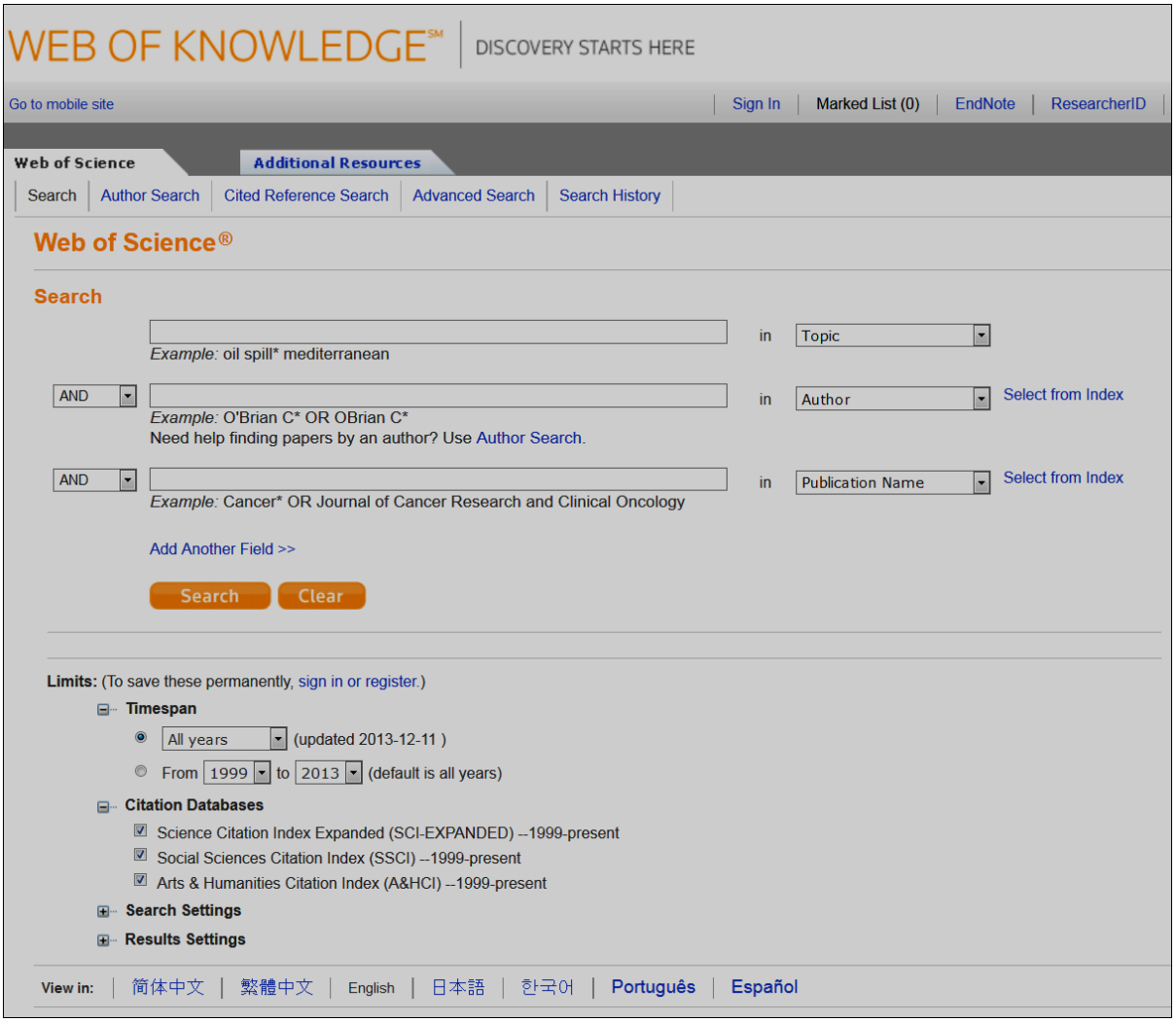


Figure 5: Basic Search Interface of Web of Science

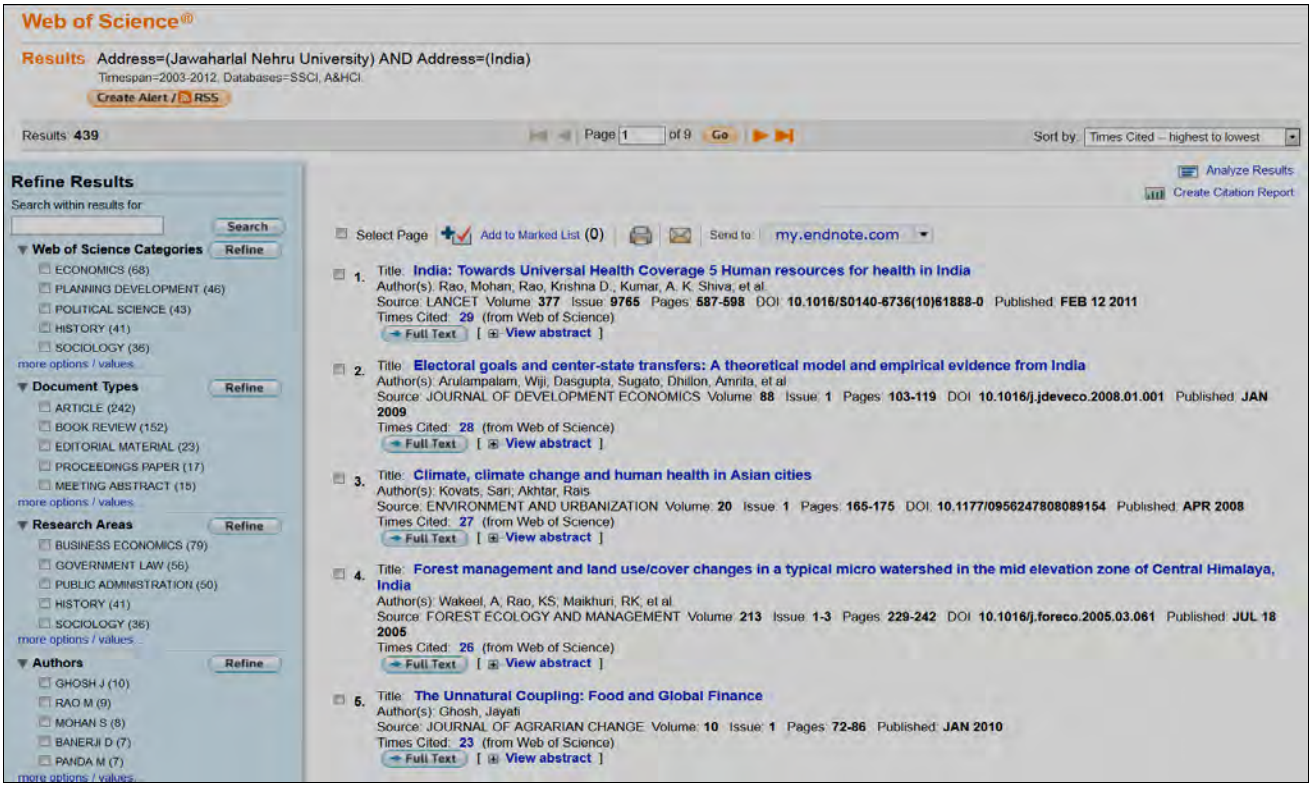


Figure 6: A Search Result from Web of Science

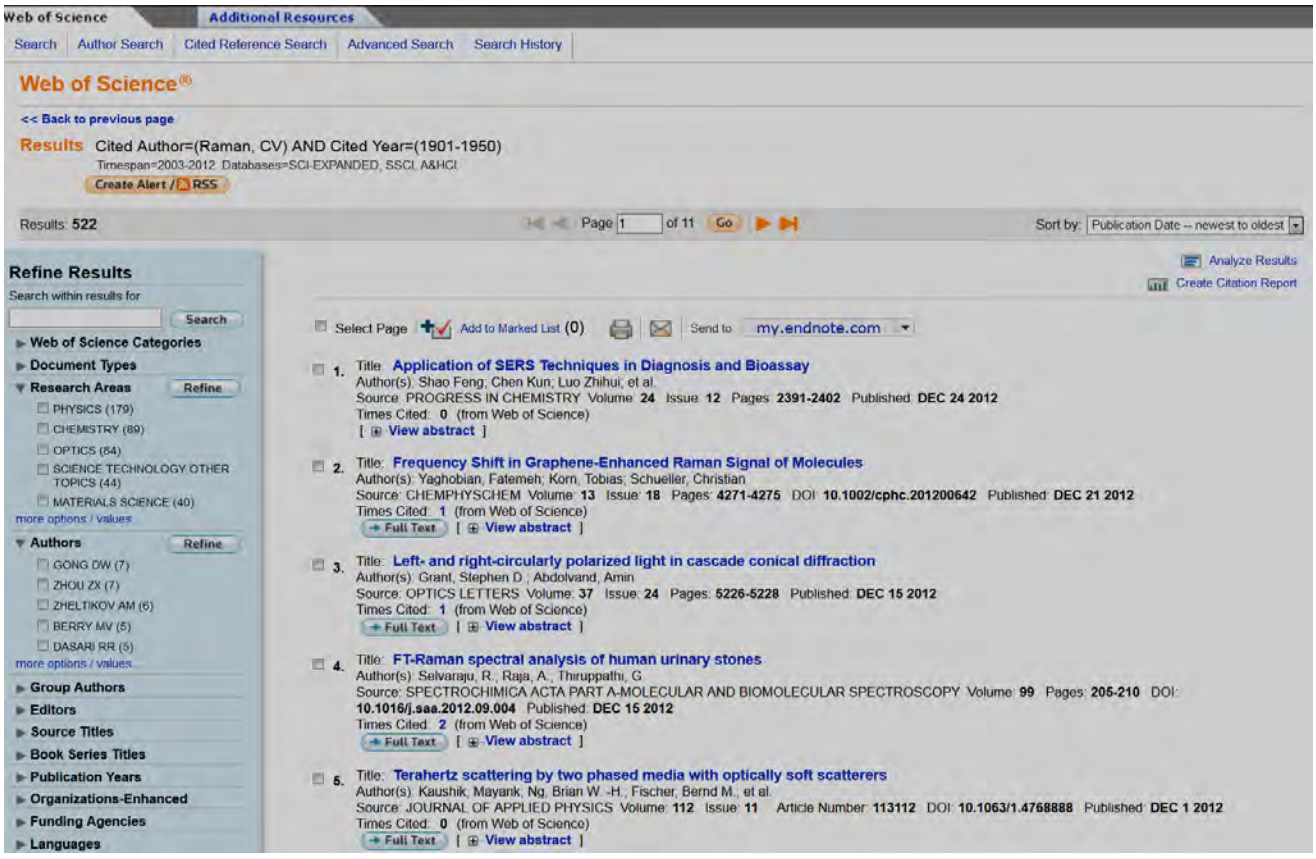


Figure 7: A Result from Cited Reference Search in *WoS*

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.

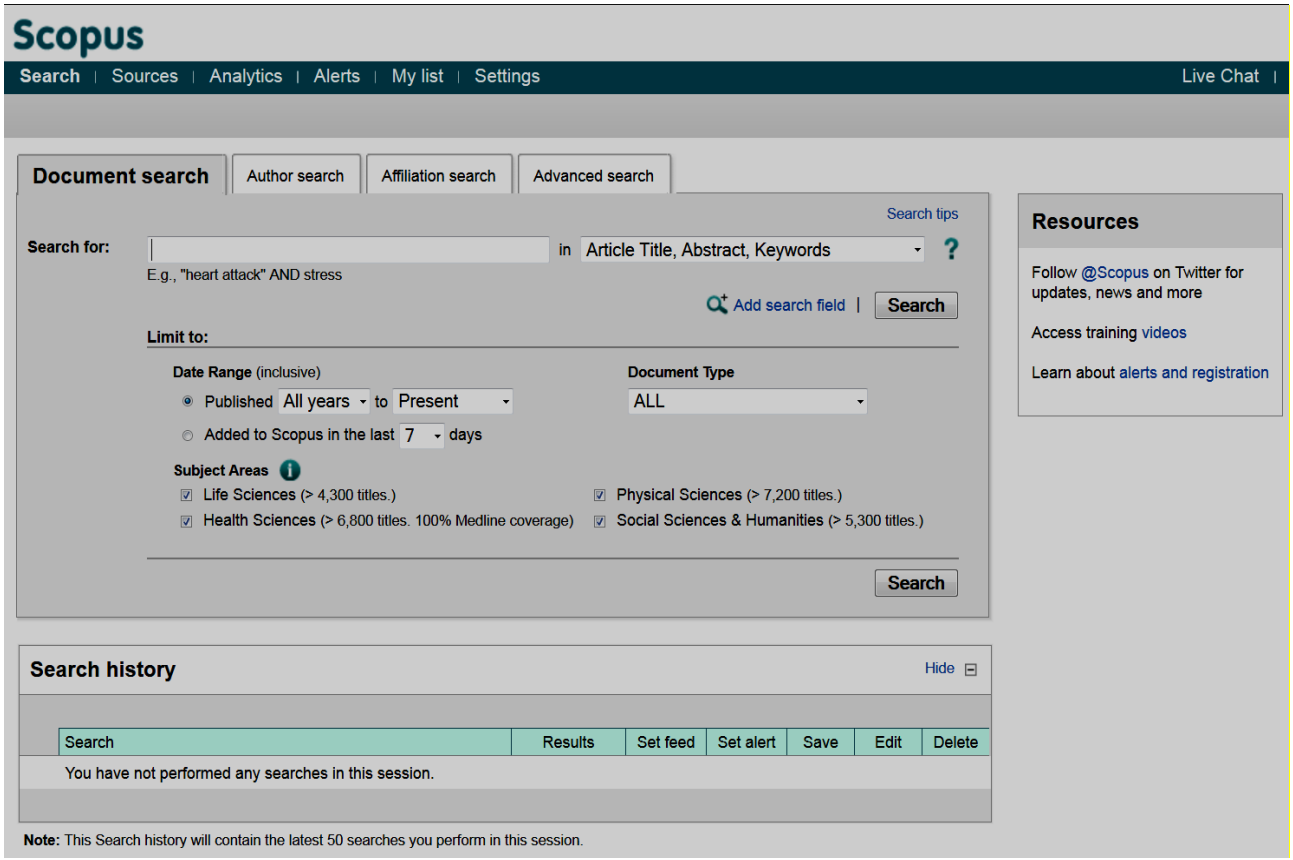


Figure 8: *Scopus* Homepage with Document Search Interface

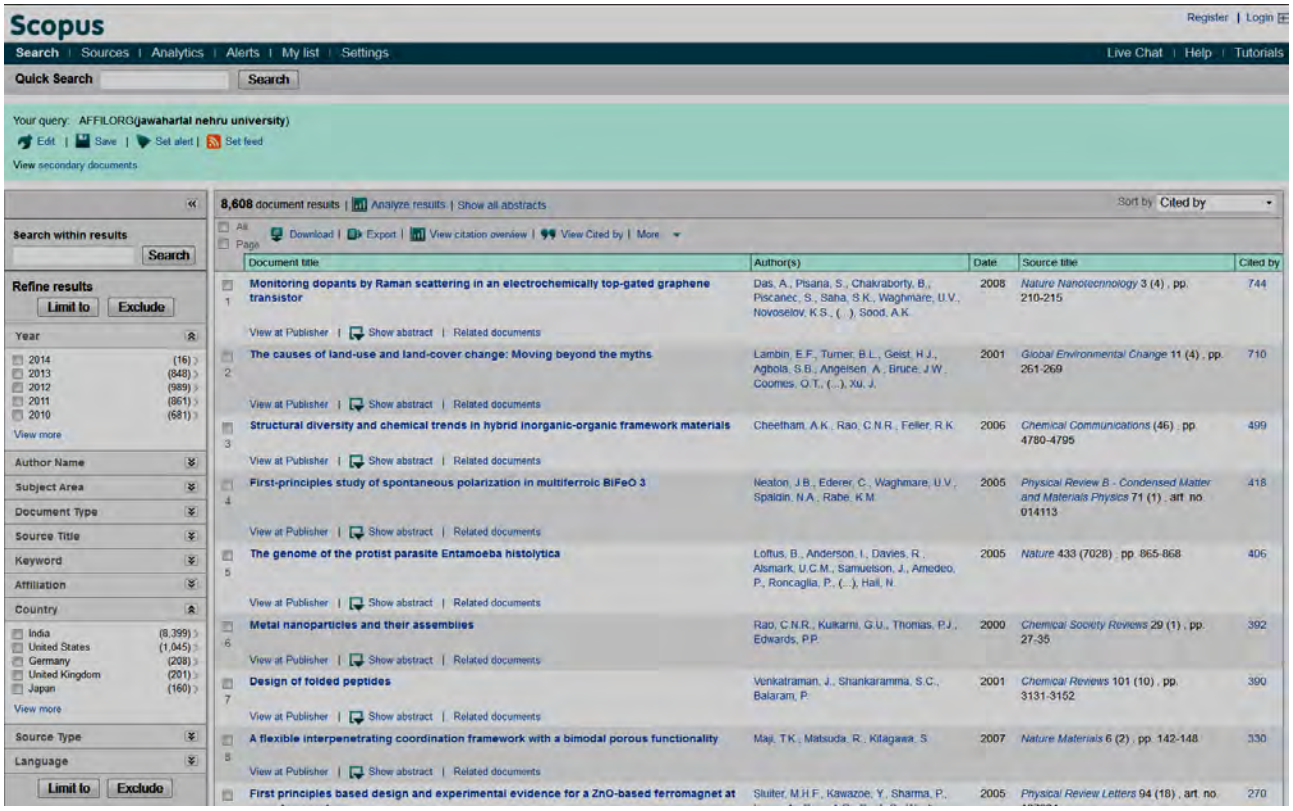


Figure 9: A Search Result from *Scopus*

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

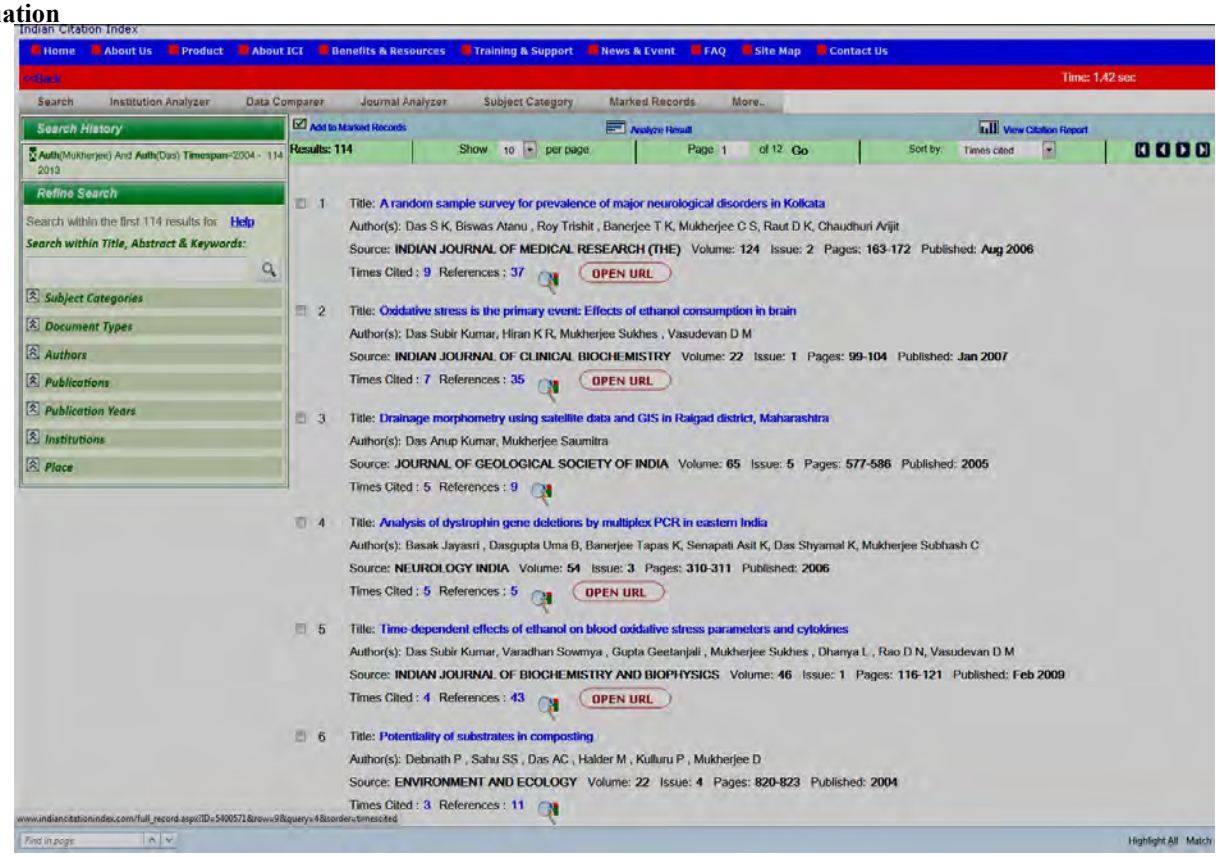


Figure 11: A Search Result, sorted by TimesCited

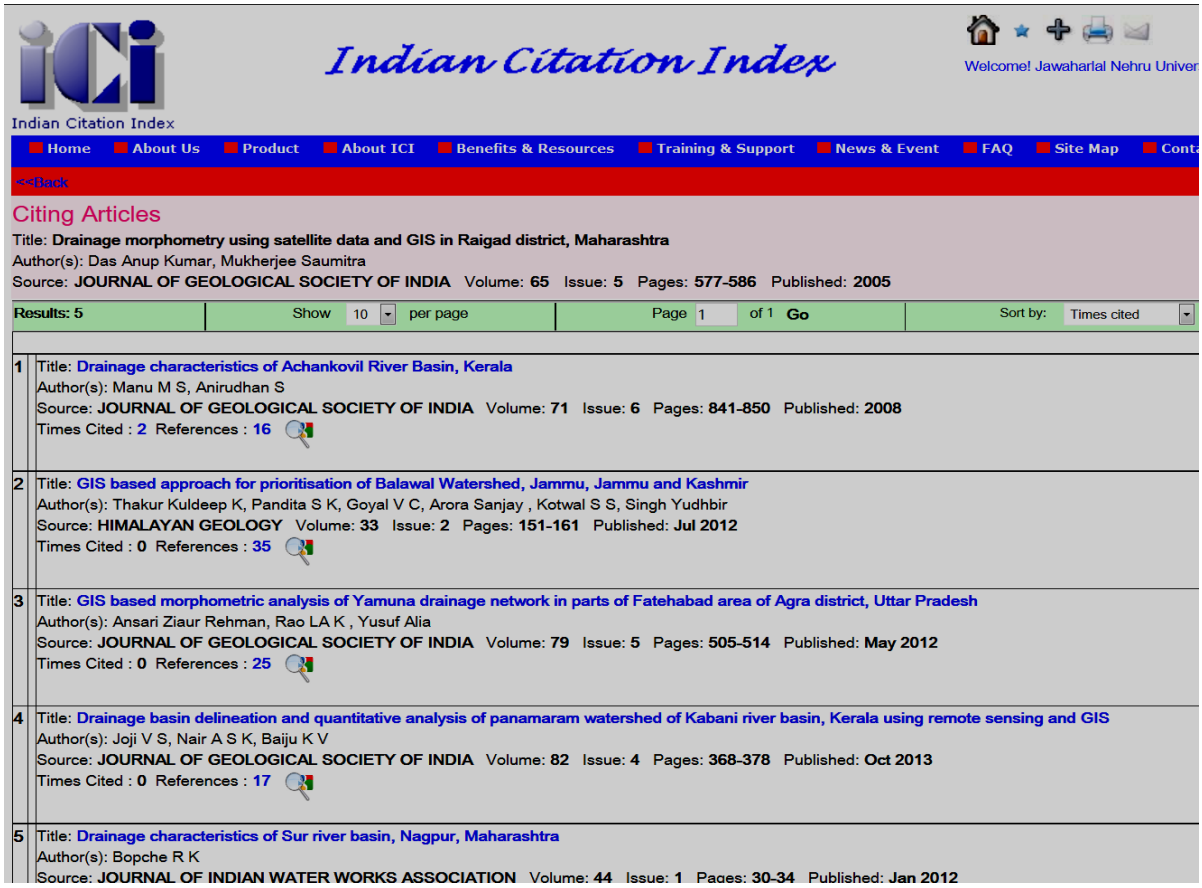


Figure 12: A Detail List of Citing Items of an Article

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

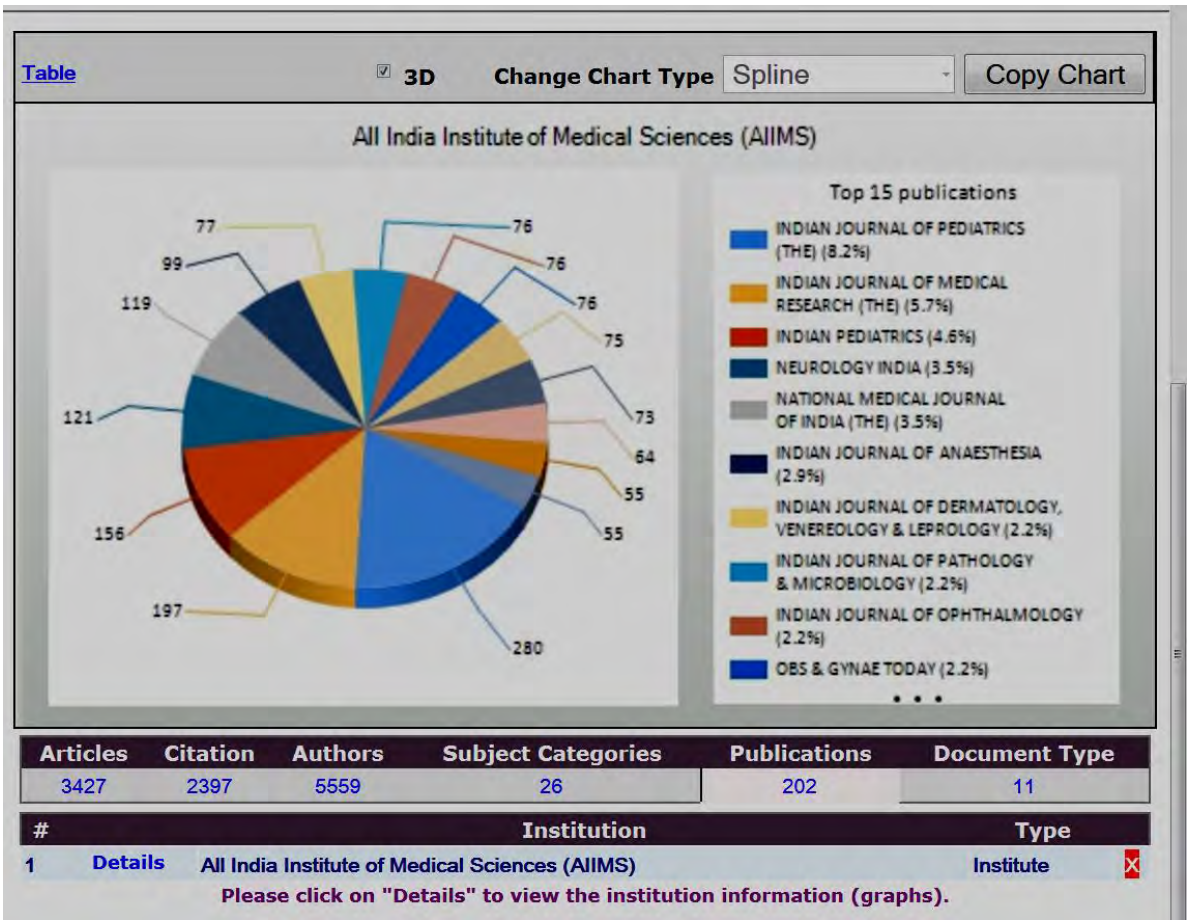


Figure 13: Data Visualization using *ICI* Institution Analyzer

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.

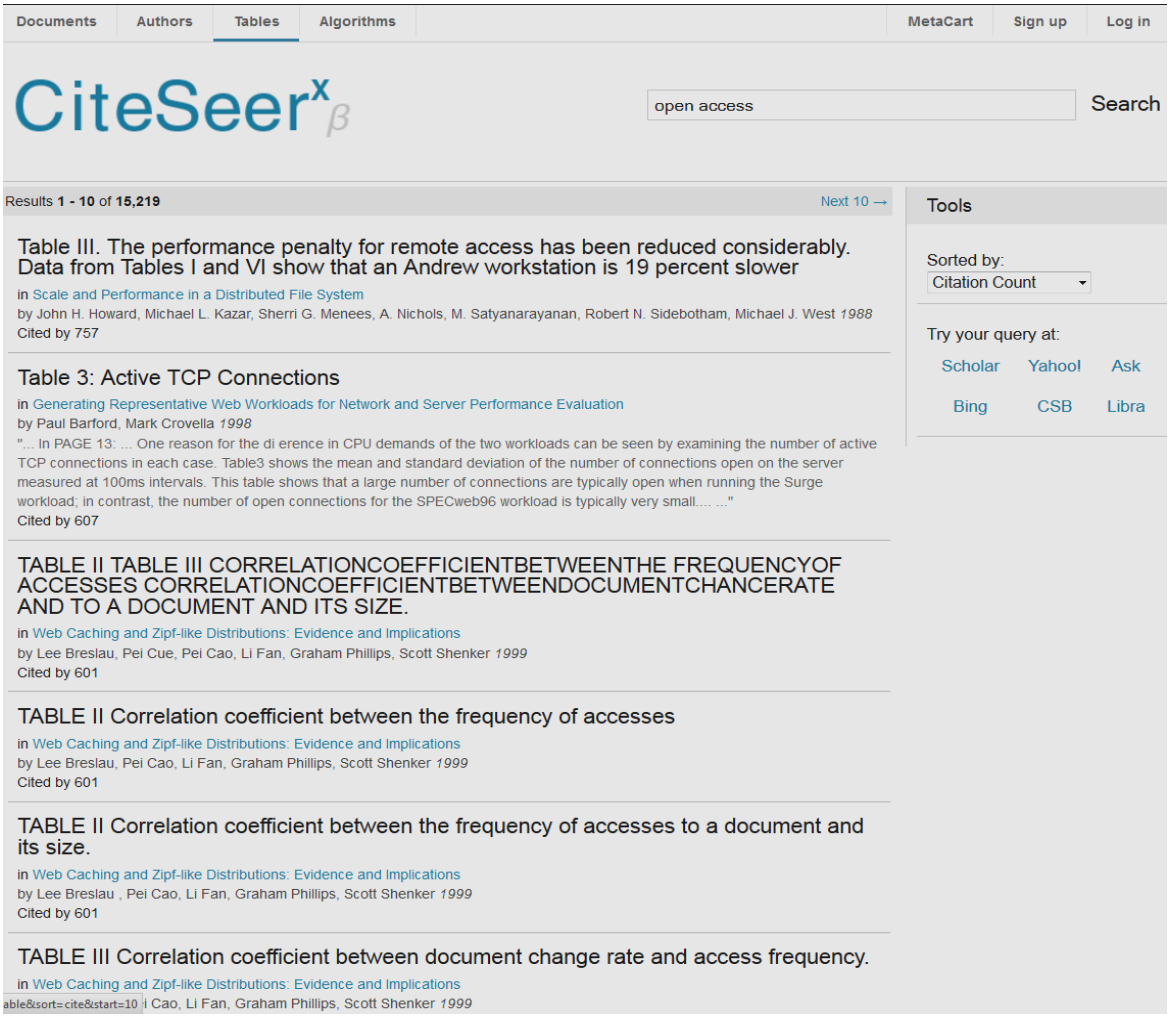


Figure 14: A Search Result retrieved by Citeseer^{x} Search Engine

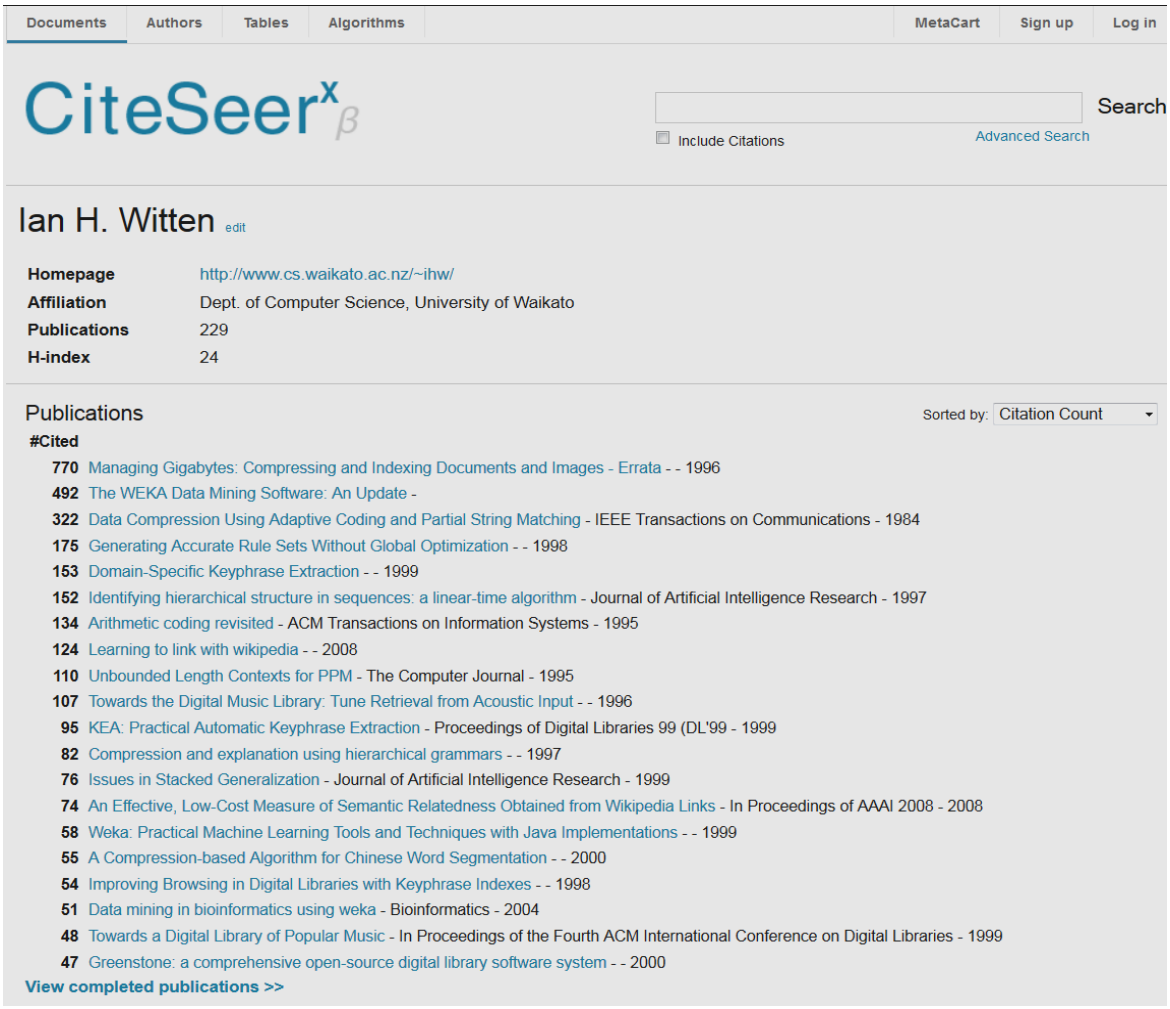


Figure 15: An Author's Profile, retrieved using Authors Search function of Citeseer^{x}

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

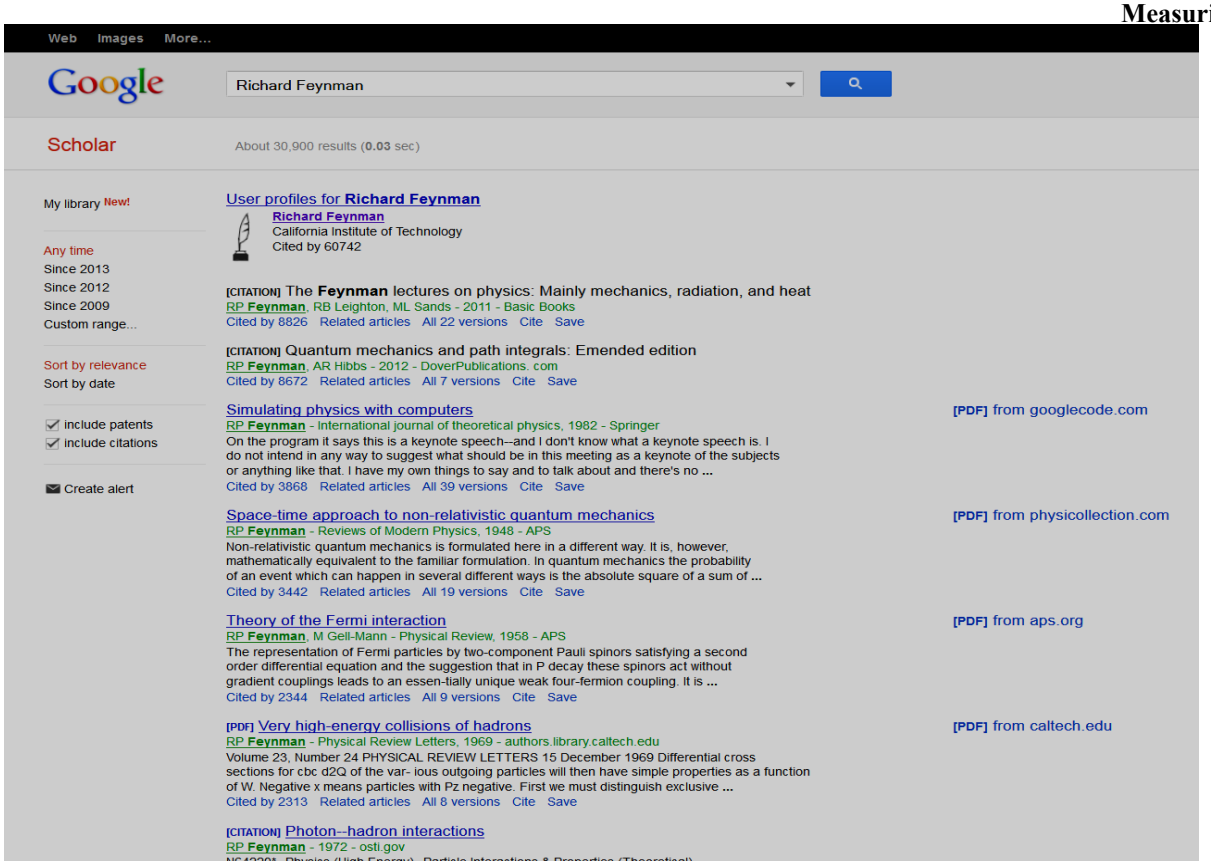


Figure 16: Display of a Google Scholar Search Result, publications by Richard Feynman

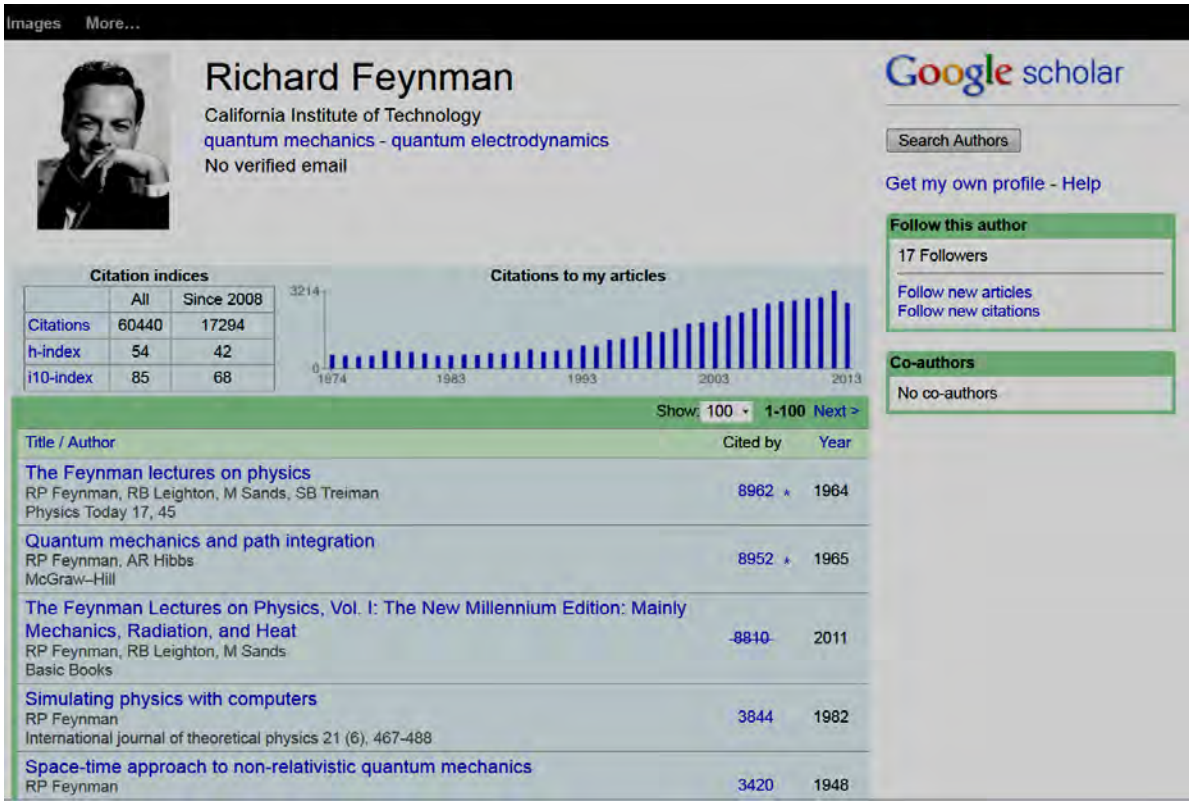
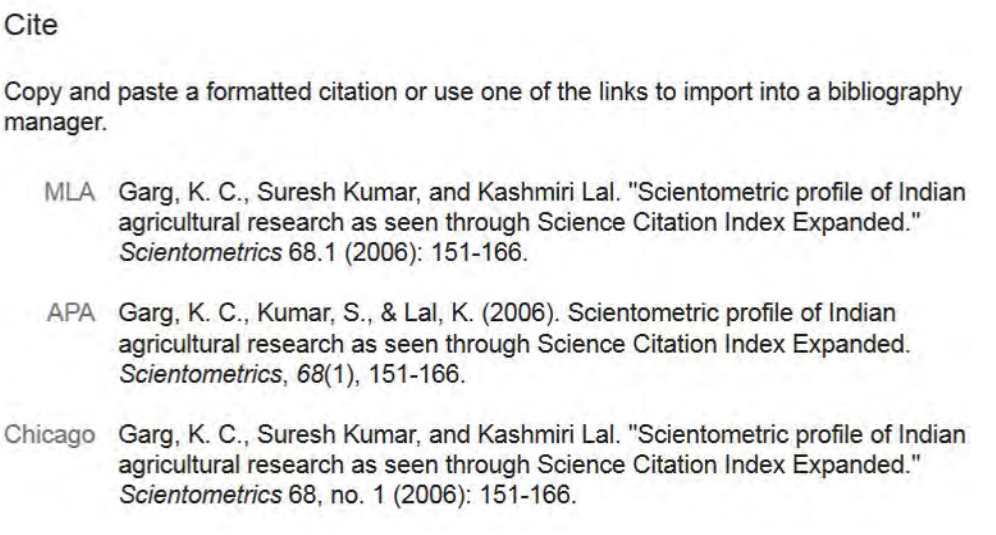


Figure 17: Display of Public Profile of Prof. Richard Feynman in Google Scholar Citations

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.	

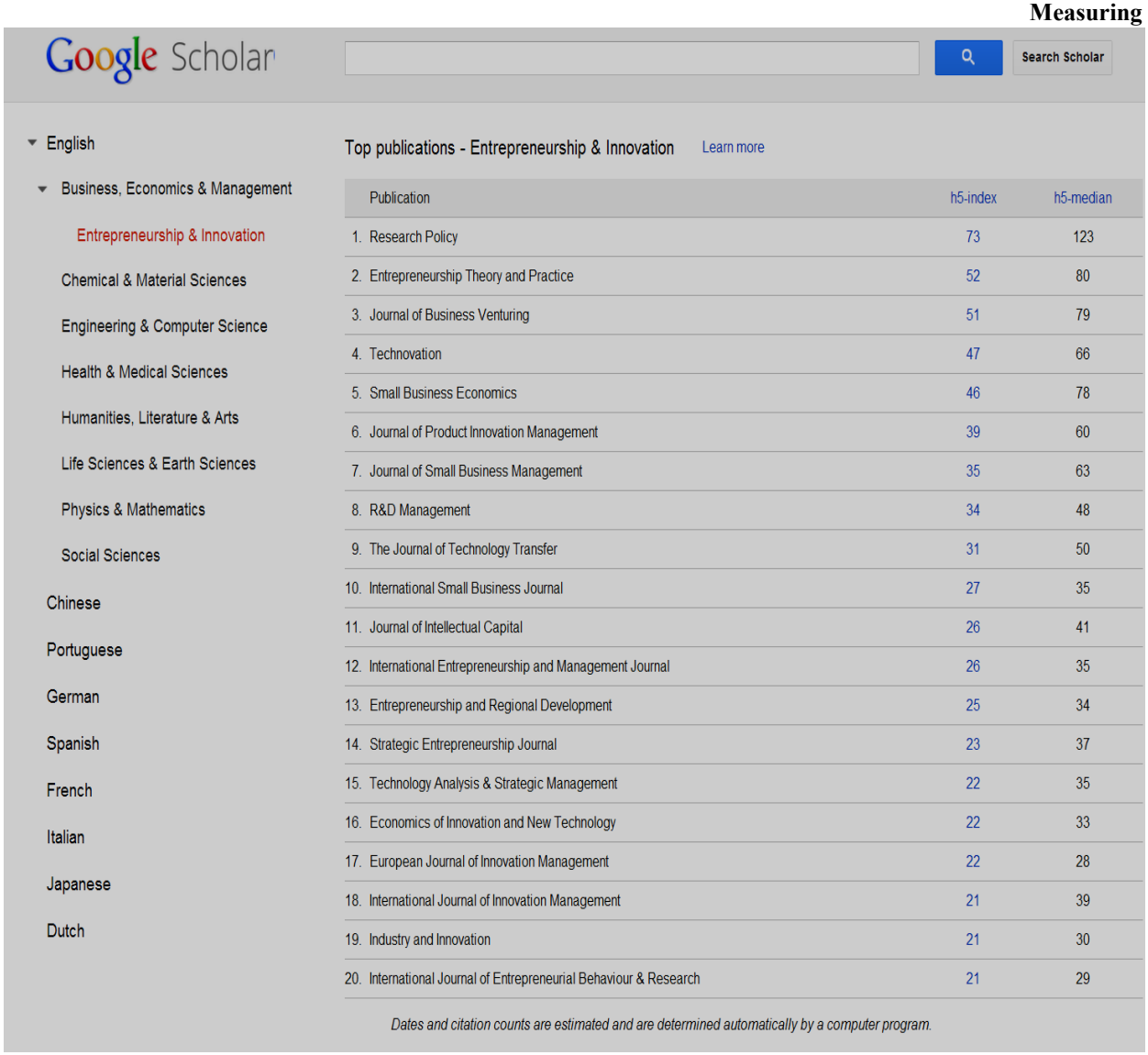


Figure 18: Rank List of Top Journals in a Sub-category

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

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

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.

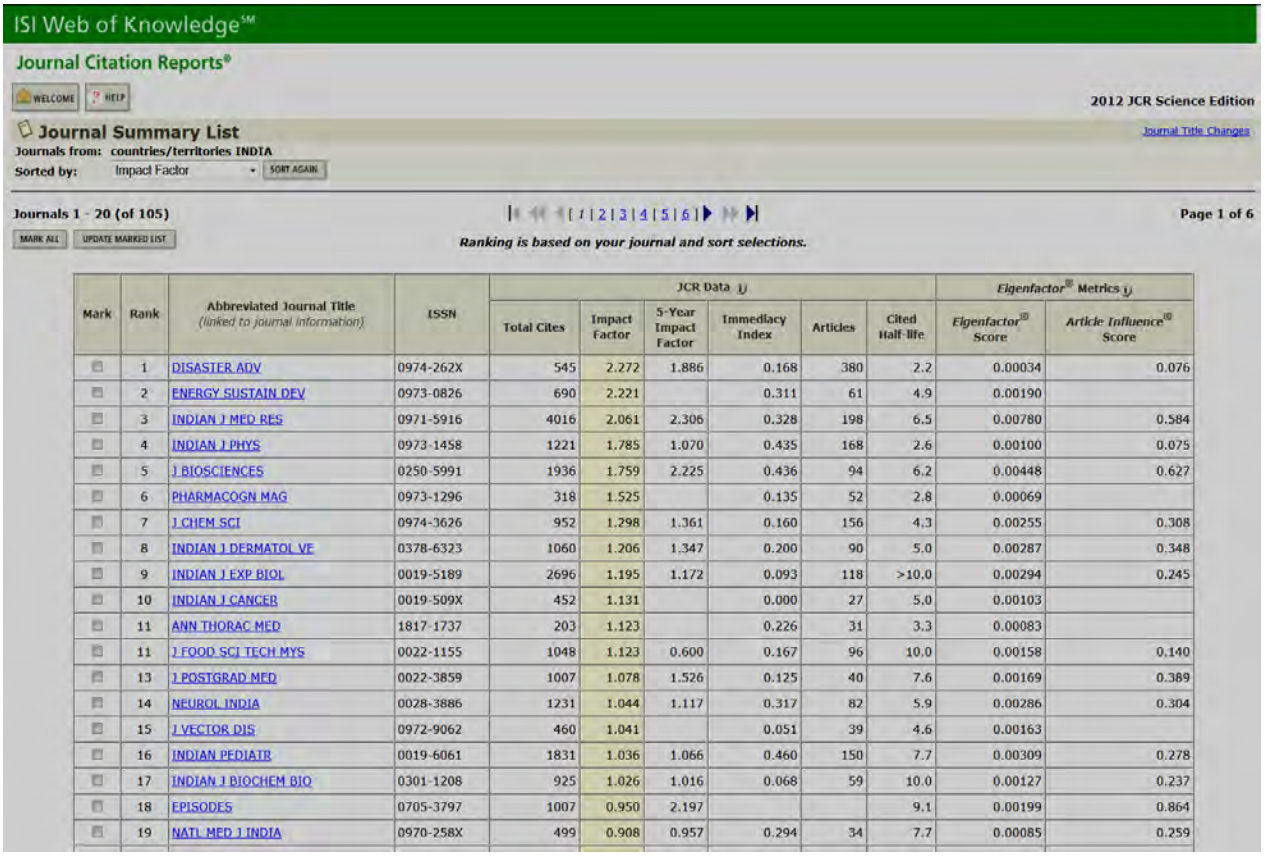
Journal Self Cites

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.

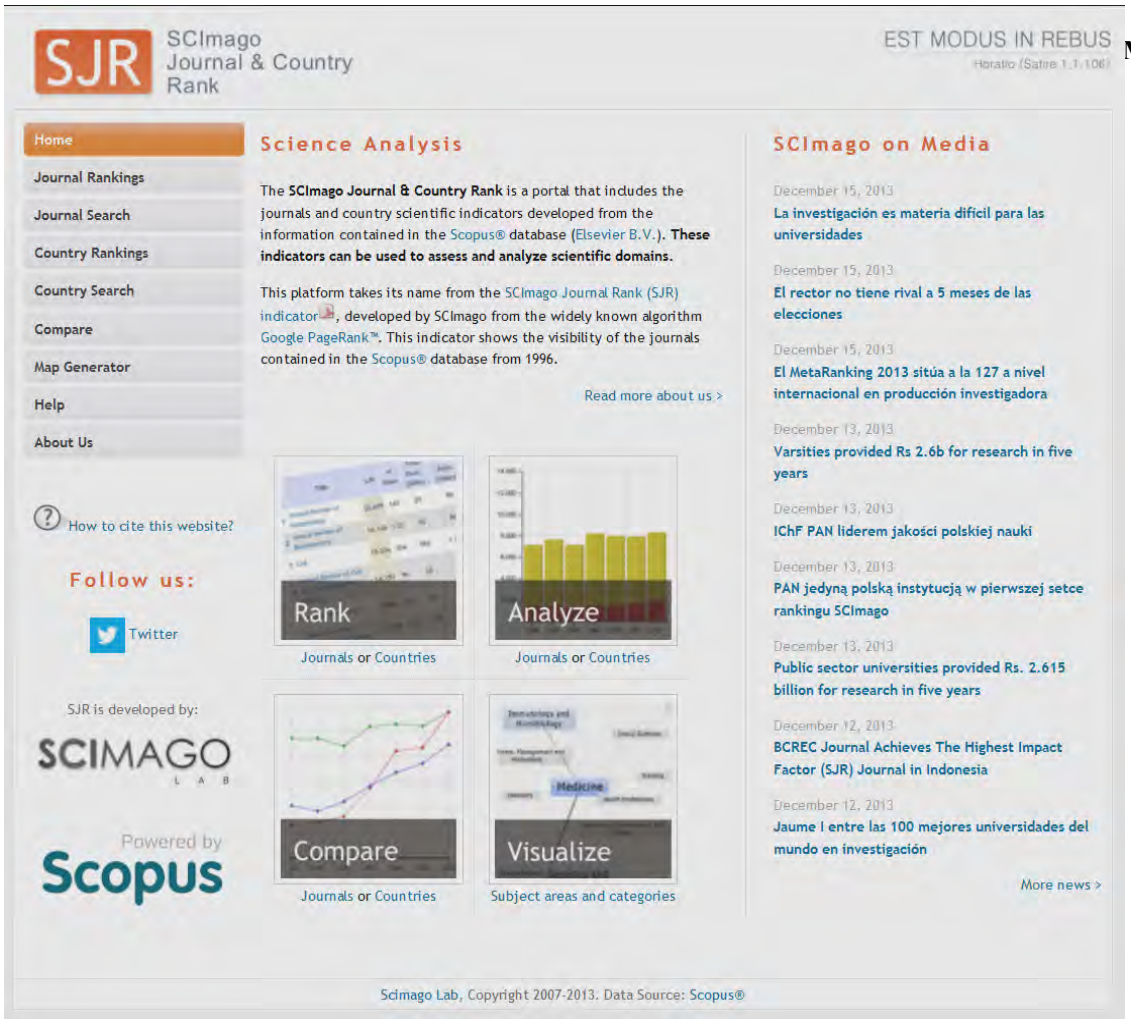


Figure 21: Homepage of SJR Website

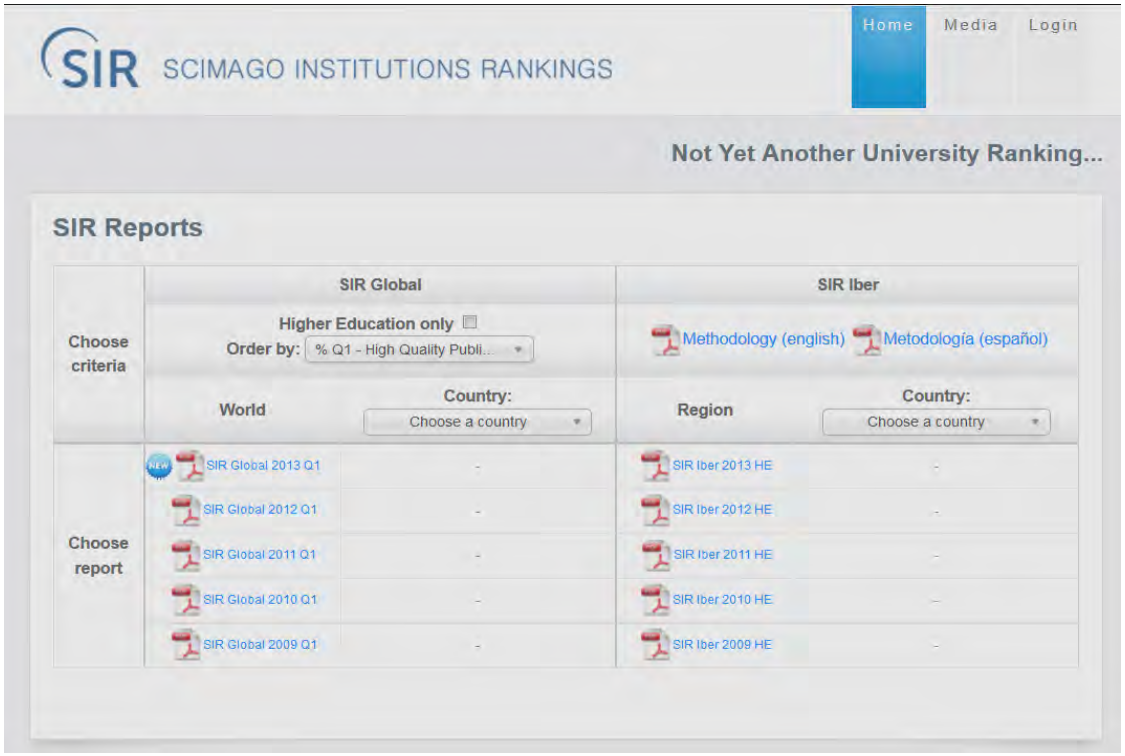


Figure 22: Homepage of The SCImago Institutions Rankings (SIR) Website

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.

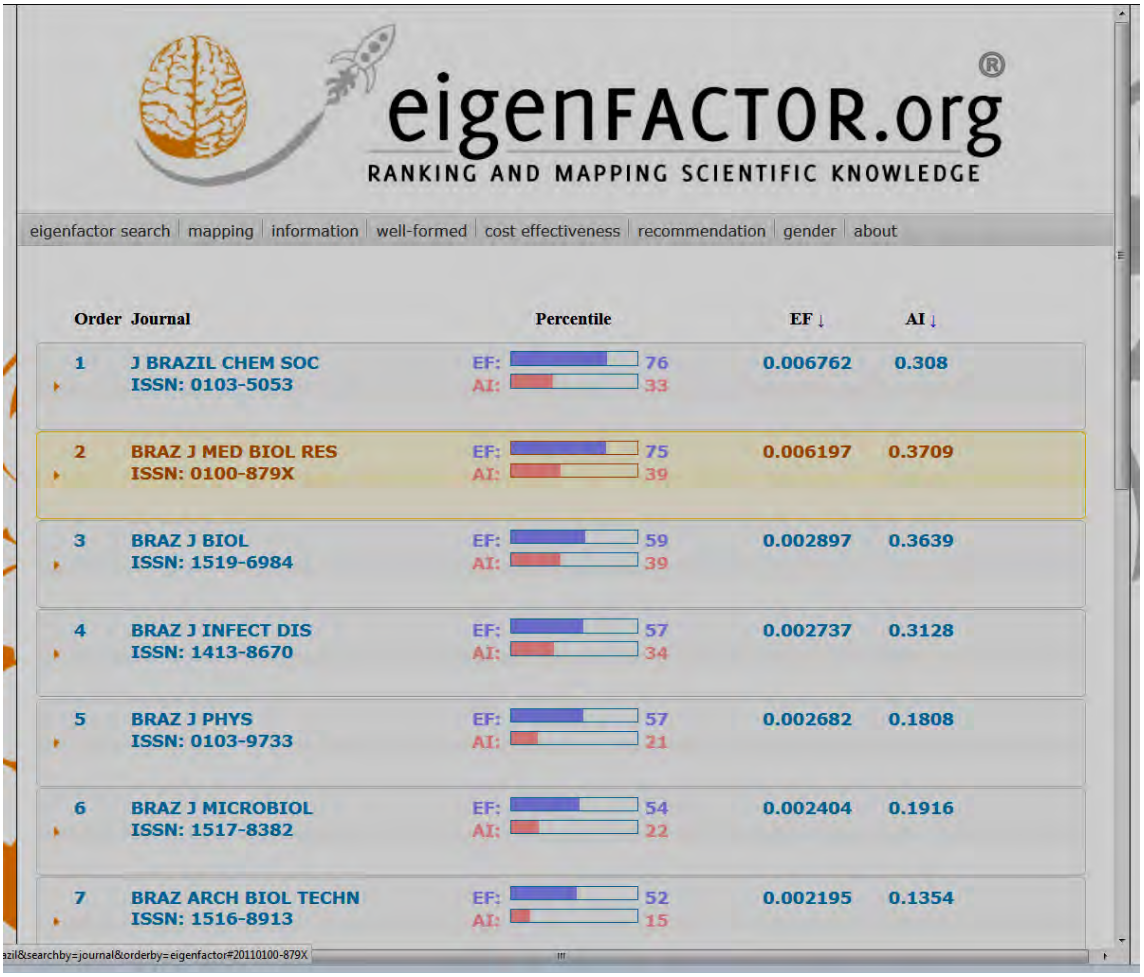


Figure 23: Searching eigenFactor by Journal Name – Brazil*

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.

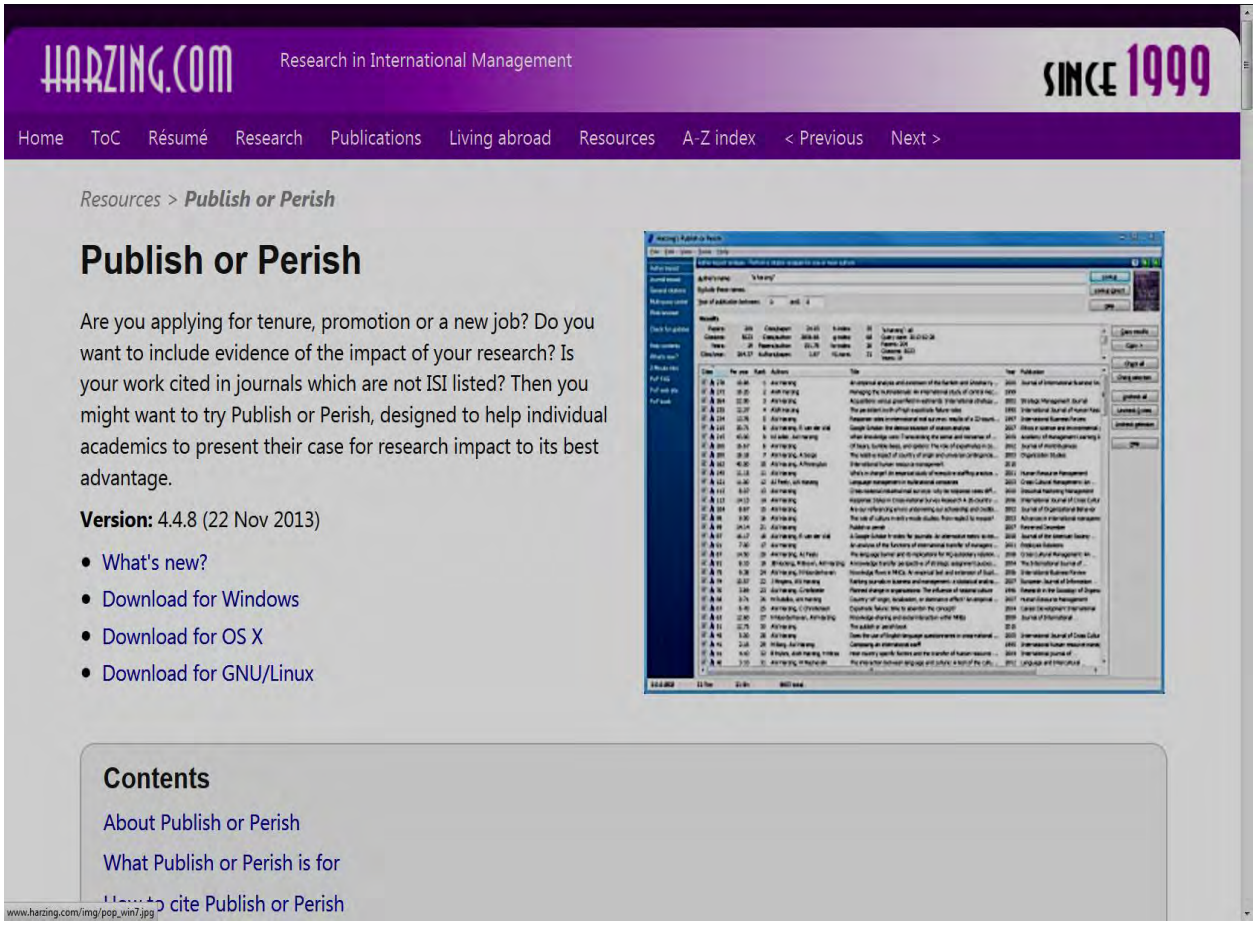


Figure 25: Homepage of POP Software

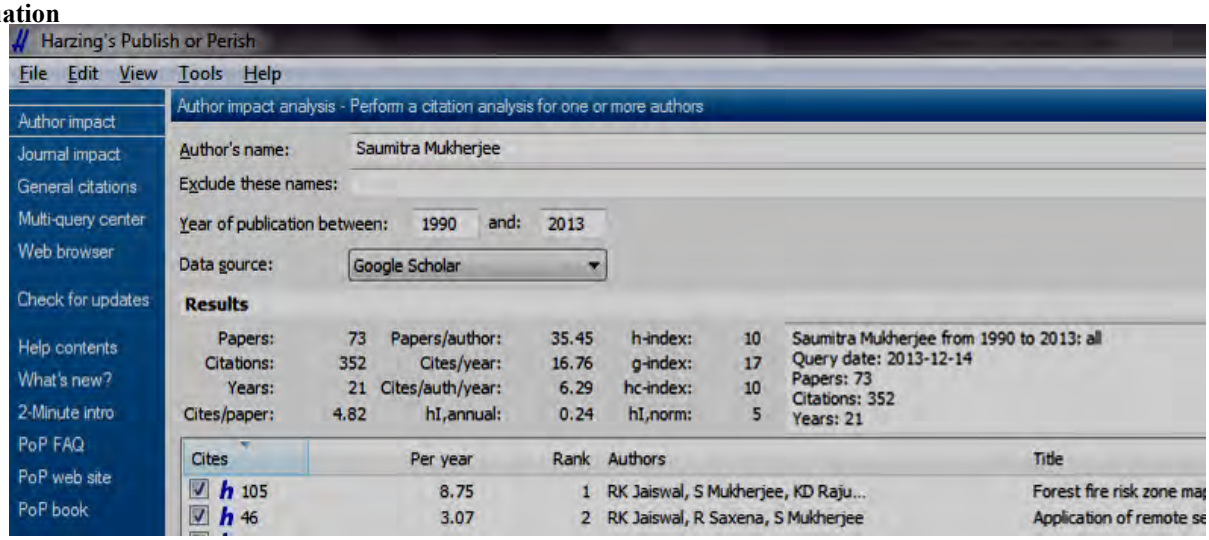


Figure 26: Use of POP Software for Author Impact Analysis

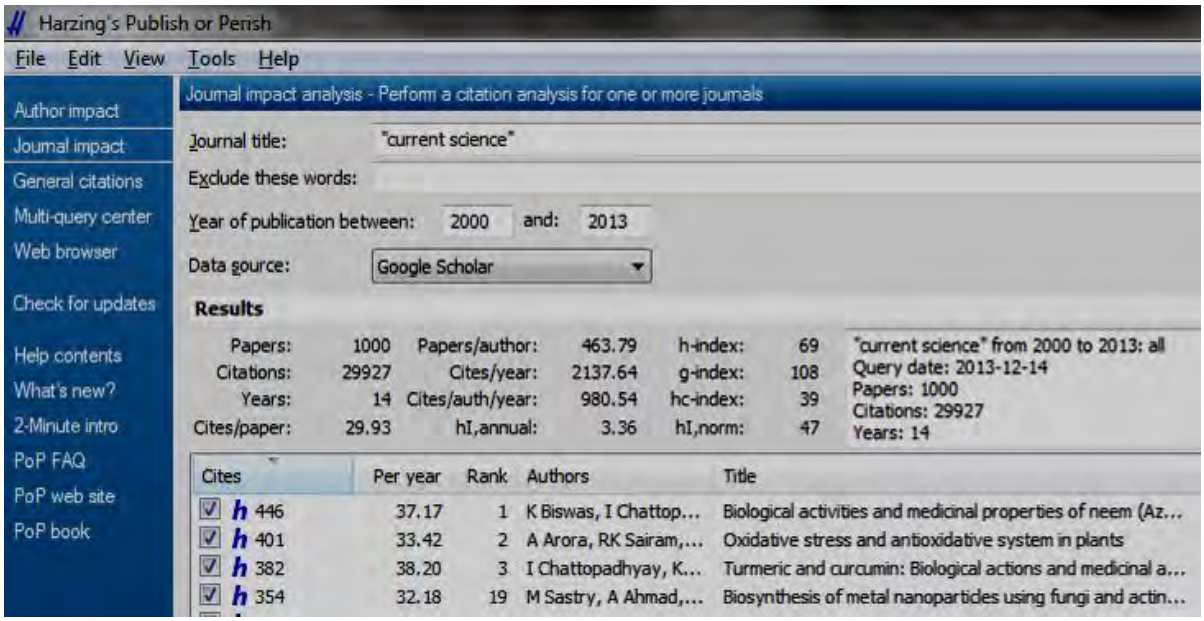


Figure 27: Use of POP Software for Journal Impact Analysis for One or More Journals

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.

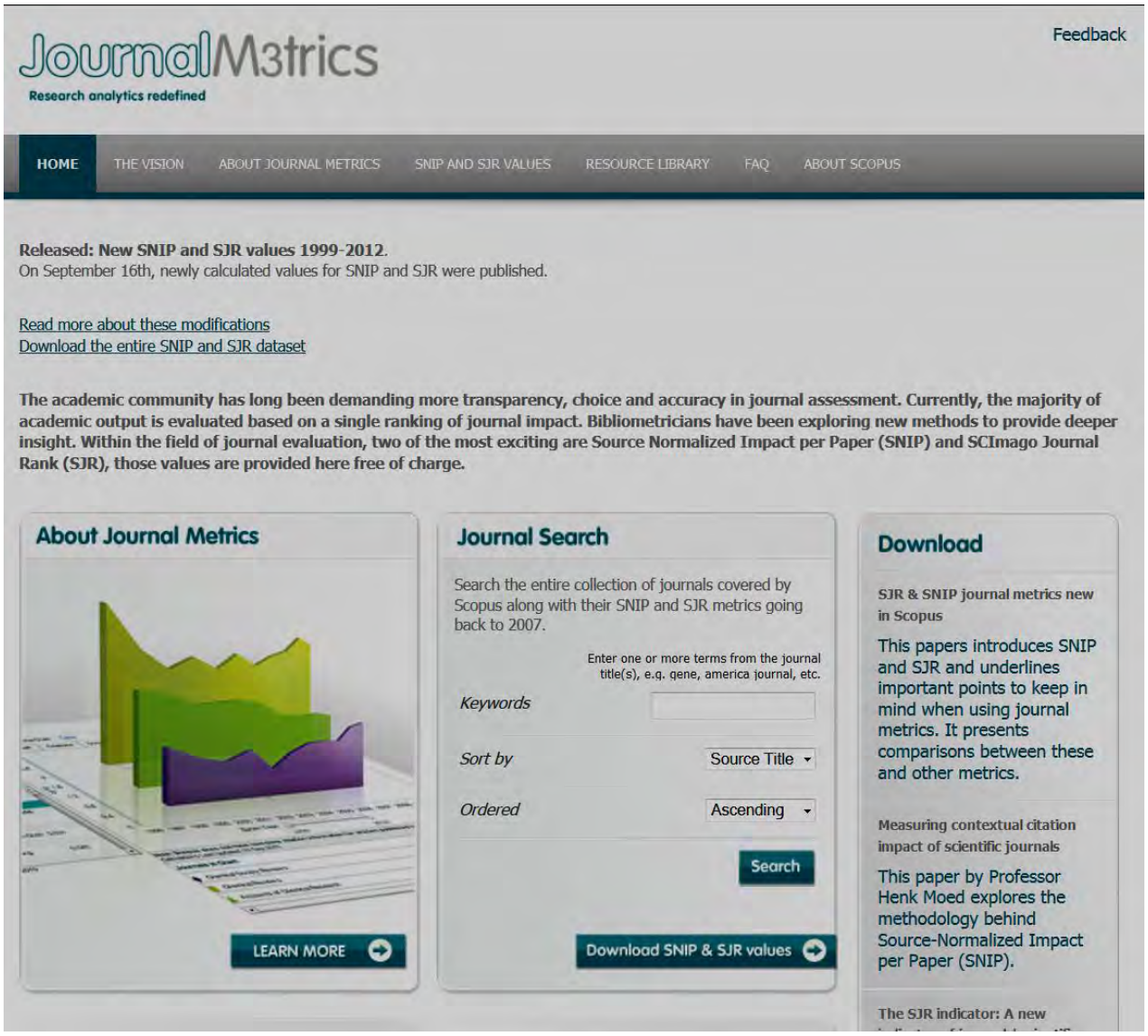


Figure 28: Homepage of JournalMetrics.com

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

UNIT 3 ARTICLE AND AUTHOR LEVEL MEASUREMENTS

Structure

3.0 INTRODUCTION

In the previous Unit you have learned about citation-related indicators available from citation databases and related web-based services. Now, you will know about more personalized tools available for increasing your visibility in social media and interacting with online academic communities based on your research interests.

In this Unit you will learn about article and author level measurements and more particularly as to how an article level metrics is built around counting an article's presence in the social media and online media space. You can create your own researcher's profile in academic social networks, providers of unique identifiers as well as altmetric service providers for increasing global visibility not only of your research works but also of your institutions and research team members.

This Unit will make you understand what web resources and solutions are available to researchers across the world in all subject areas.

[31] http://www.youtube.com/watch?v=fw4qalLWhjM

3.1 LEARNING OUTCOMES

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

- Use article-level metrics or altmetrics using online altmetrics tools such as Altmetric.com[32] and ImpactStory.org[33];
- Create and use researcher's profile in social networks for academics and researchers for reaching out to global researchers' communities;
- Create unique author's identity at ResearcherID.com[34] and ORCID.org[35] online registries, and their interoperability for accessing contributed/ published papers; and
- Understand the functions of two regional journal networks namely Scielo[36] and Redalyc[37] and their impact in open access publishing in the global South.

3.2 UNIQUE IDENTIFIERS FOR AUTHORS AND RESEARCHERS

In many countries some names of individuals, with a combination of one's first name and surname, are very common or similar. When searching online databases by a particular name of a contributor, a search result may show more than expected number of bibliographic records of papers although contributed by different persons with a similar name. Thus, a unique identifier for an author or a contributor of a scholarly publication is very essential to distinguish an individual from a group of individuals with a similar name. A unique identifier helps in resolving the author ambiguity. Presently, two online systems are widely available to the researchers' communities for obtaining a unique identifier of an author or a research contributor. These two systems are namely ResearcherID and Open Researcher and Contributor ID (ORCID), which are available at ResearcherID.com and ORCID.org websites respectively.

These two systems are interoperable and can have linked data between them. Authors' IDs in ResearcherID.com are linked with *Web of Science* (*WoS*) database. A profile in this website can obtain bibliographic records from *WoS* database, matching author's contributions. Authors' IDs in ORCID.org are linked with *Scopus* database. A profile in this website can obtain bibliographic records from *Scopus* database, matching author's contributions. When you submit your manuscripts to *WoS*-covered or *Scopus*-covered journals for publishing, they usually accept manuscripts through an online submission and peer review system. In the submission process, journals usually ask any of the unique identifiers, ResearcherID or ORCID iD. *WoS*-covered journals usually

[32] http://www.altmetric.com/
[33] http://impactstory.org/
[34] http://www.researcherid.com/Home.action
[35] http://orcid.org/
[36] http://www.scielo.br/
[37] http://www.redalyc.org/home.oa

prefer ResearcherID, whereas *Scopus*-covered journals prefer ORCID iD. Some online manuscripts submission systems accept both IDs. *WoS* database is searchable by both unique identifiers.

Both ResearcherID.com and ORCID.org websites have become valuable resources to authors and other researchers as well as institutions. While an author can create public profile in these two websites and obtain a unique identifier respectively, both websites maintain online registry of authors that can be searchable by name, keywords, affiliation and country. If a public profile is available for an author, his list of publications and full-text contents of these publications (through external hyperlinks) can be viewed by other researchers, funding agencies and institutions seeking academic collaborations.

3.2.1 ResearcherID

The ResearcherID.com, facilitated by Thomson Reuters, is a web-based global registry of authors and researchers. A researcher can freely create a unique identifier called ResearcherID in this system, which is permanent in nature and can be added to publishers' databases for uniquely identifying him/her as a contributor. In addition to becoming part of an authors' registry, the researcher can create a public profile and add his/her publication list from *WoS* database or RIS file. While the publication list is available in a researcher's profile, certain citation metrics, citing articles network and collaboration network can be visible to the profile owner as well as other users' searching profiles in this online registry.

ResearcherID profile helps in tracking citation count, average citations and h-index of an author from *WoS* database. Thus, this website becomes very useful tool for author level measurement if a researcher has good number of papers in his/her credit, which are indexed in *WoS* database.

Figure 30 shows the basic functions of ResearcherID registry and how a researcher can obtain citation metrics and analyse impact of research works while making his/her profile public. ResearcherID.com website offers a number of useful features and benefits to researchers as indicated in Text Box 1. Figure 31 displays citation metrics of a registered author having a unique ResearcherID and a public profile in this website. Figure 32 displays citing articles network of the same author depicting top twenty countries citing his works. This Figure also visually displays citation relationships based on *WoS* data.

ResearcherID profile can also be interlinked with EndNoteBasic[38], an online reference manager tool freely available to researchers. EndNoteBasic imports bibliographic data of your published works from ResearcherID profile and stores in your publication list. Here, you can store up to 50,000 bibliographic references in your account, which will help you to prepare bibliographies on different topics or authors for ongoing or future research.

[38] http://www.myendnoteweb.com

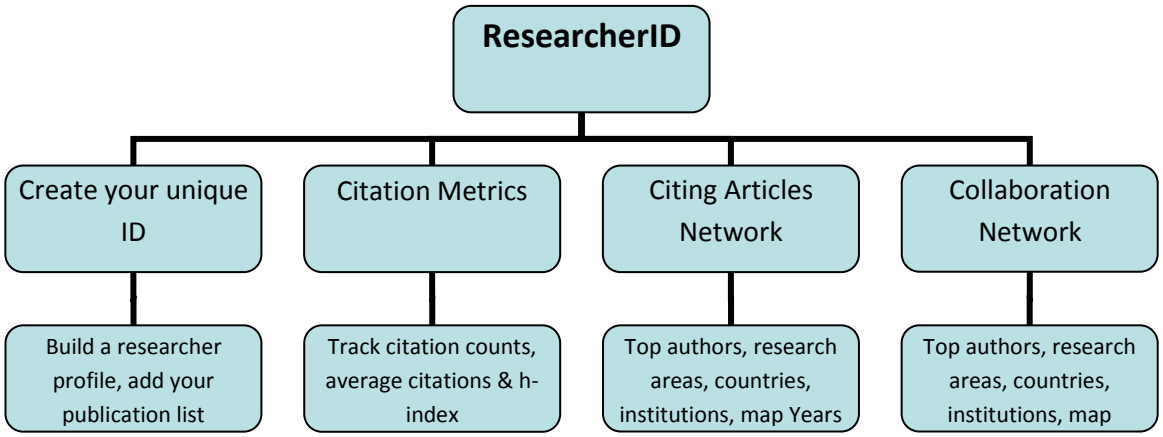


Figure 30: Basic Functions of ResearcherID Registry

Text Box 1: Main Features and Benefits of ResearcherID.com

Benefits

- Creates a custom profile, choosing what information is public or private.
- Builds an online publication list using *Web of Science* search services, the EndNote Basic online search, or by uploading RIS files.
- Manages your ResearcherID publication list with EndNote Basic.
- Generates citation metrics with times cited information for items added from *Web of Science*.
- Gets links to full text for items added from *Web of Science* (subject to your subscriptions to full text).
- Adds past institution affiliations to your profile.
- Explores the world of research with an interactive map that can help locate researchers by a country and topic, or use the new country tag cloud.
- ResearcherID can automatically track times cited counts and citation metrics for records found in *Web of Science*. Add your publications directly from *Web of Science* searches.

Features

- ResearcherID Badge: Advertise a member's ResearcherID profile on your Web page or Blog. The Badge creates a hovering display of recent publications, and allows viewers to also link to the member's full profile in ResearcherID.
- Collaboration Network: Visually explore who the researcher is collaborating with.
- Citing Articles Network: Visually explore citation relationships based on *Web of Science* data.

Source: http://thomsonreuters.com/researcherid/

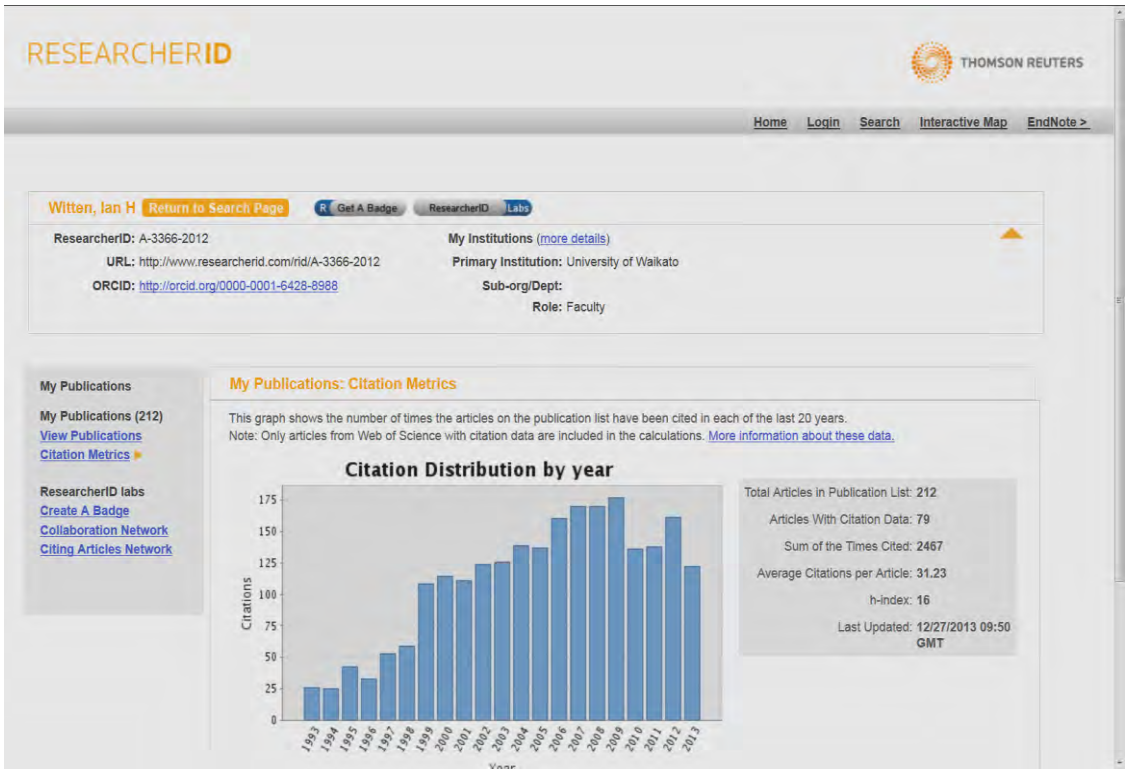


Figure 31: Citation Metrics of a Registered Author

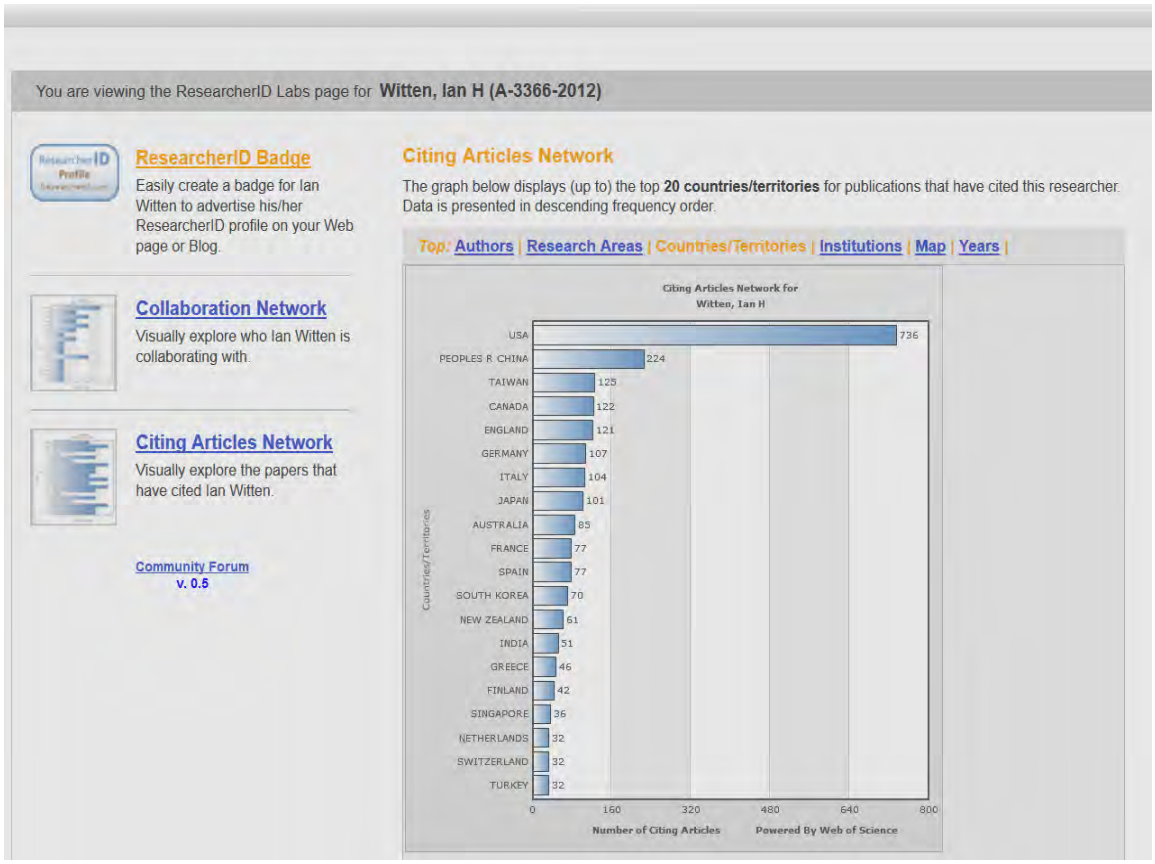


Figure 32: Citing Articles Network of the Same Author

3.2.2 ORCID (Open Researcher and Contributor ID)

Similar to ResearcherID.com, ORCID.org provides a persistent digital identifier that distinguishes a researcher from every other researcher. Creation of an ORCID iD for a researcher is very easy and free. Here, you have to provide certain personal and professional details to include your name in a registry of unique researcher identifiers. After successful registration, a unique ORCID iD is generated and a user profile is created in the website. You can integrate your other profiles or unique author's identifiers available elsewhere such as ResearcherID, *Scopus* and LinkedIn. Your publication list will also be added to your profile, which includes bibliographic information of published scholarly works and hyperlink to full-text contents of each work. A publication list can be obtained from *Scopus* database that will include bibliographic record of papers published in *Scopus*-covered journals. Other relevant works can also be added in your profile through importing bibliographic data from a RIS file of your list of publications.

ORCID.org maintains a searchable registry of researchers that helps in identifying researchers from your field, from an institution, a collaborator, a city or a country. Funding agencies also can keep track on researchers' works, funded by them or considering funding in near future. The website provides APIs that support system-to-system communication and authentication to online systems of funders, publishers and others that require ORCID identifiers.

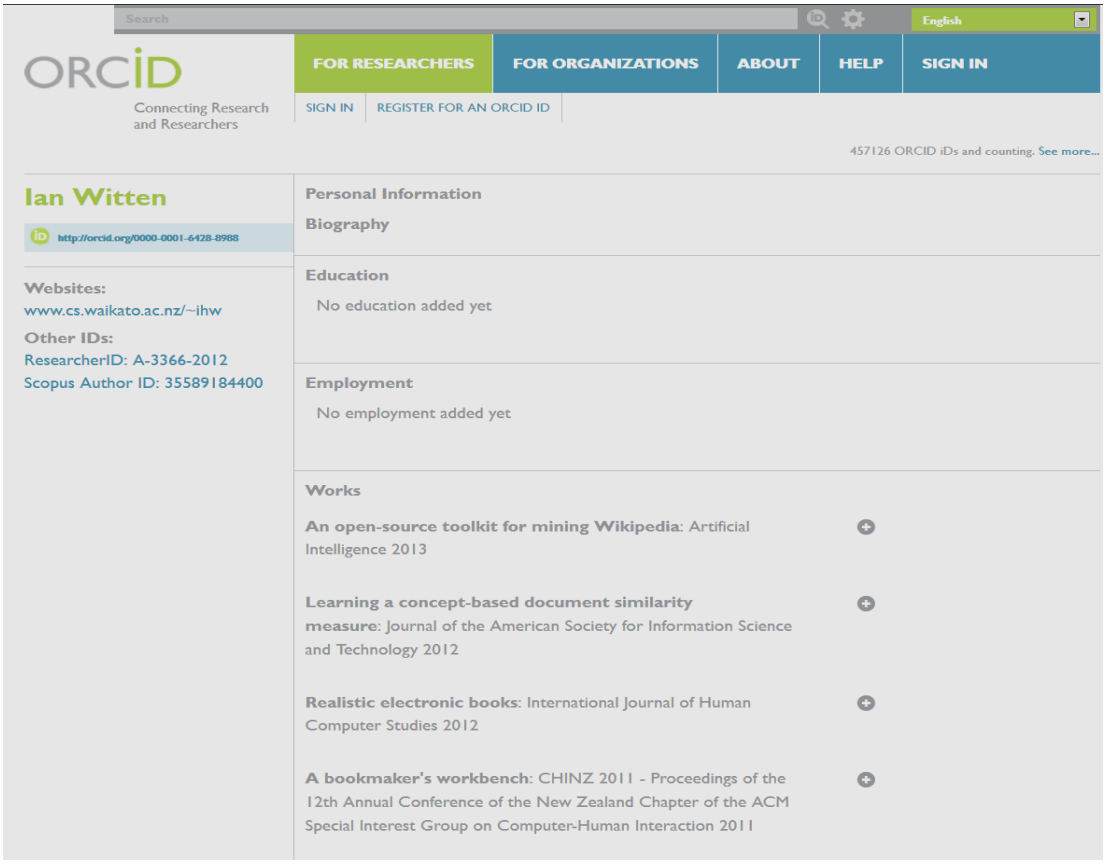


Figure 33: An Author's ID and Profile in ORCID.org website

Text Box 2: ORCID's Mission, Principles and Steps for Creation of an ORCID iD

Mission

ORCID aims to solve the name ambiguity problem in research and scholarly communications by creating a central registry of unique identifiers for individual researchers and an open and transparent linking mechanism between ORCID and other current researcher ID schemes. These identifiers, and the relationships among them, can be linked to the researcher's output to enhance the scientific discovery process and to improve the efficiency of research funding and collaboration within the research community.

Principles

- ORCID will work to support the creation of a permanent, clear and unambiguous record of research and scholarly communication by enabling reliable attribution of authors and contributors.
- ORCID will transcend discipline, geographic, national and institutional, boundaries.
- Participation in ORCID is open to any organization that has an interest in research and scholarly communications.
- Access to ORCID services will be based on transparent and non-discriminatory terms posted on the ORCID website.
- Researchers will be able to create, edit, and maintain an ORCID identifier and record free of charge.
- Researchers will control the defined privacy settings of their own ORCID record data.
- All data contributed to ORCID by researchers or claimed by them will be available in standard formats for free download (subject to the researchers' own privacy settings) that is updated once a year and released under a CC0 waiver.
- All software developed by ORCID will be publicly released under an Open Source Software license approved by the Open Source Initiative. For the software it adopts, ORCID will prefer Open Source.
- ORCID identifiers and record data (subject to privacy settings) will be made available via a combination of no charge and for a fee APIs and services. Any fees will be set to ensure the sustainability of ORCID as a not-for-profit, charitable organization focused on the long-term persistence of the ORCID system.
- ORCID will be governed by representatives from a broad cross-section of stakeholders, the majority of whom are not-for-profit, and will strive for maximal transparency by publicly posting summaries of all board meetings and annual financial reports.

Distinguish Yourself in Three Easy Steps

1. ***Register***: Get your unique ORCID identifier Register now! Registration takes 30 seconds.
2. ***Add Your Info***: Enhance your ORCID record with your professional information and link to your other identifiers (such as *Scopus* or ResearcherID or LinkedIn).
3. ***Use Your ORCID ID***: Include your ORCID identifier on your Webpage, when you submit publications, apply for grants, and in any research workflow to ensure you get credit for your work.

Source: http://orcid.org/about/

3.3 ARTICLE LEVEL METRICS (ALTMETRICS)

Outputs or impacts of scientific research are periodically measured worldwide with different parameters, where a variant number of different tools and techniques are used. The Journal Impact Factor (JIF), H-Index and a number of variations of these two citation-based metrics are used commonly for evaluating impacts of journals and their contributing authors and institutions. However, many funders, research administrators, scientific communities and other stakeholders felt these indicators as inadequate, inappropriate and skewed due to various reasons. The San Francisco Declaration on Research Assessment (DORA) publicly declared a statement on 16th December 2012 supporting altmetrics or alternative metrics also widely known as article level metrics), which is a clear transition from the citation-based indicators such as JIF and H-index to measuring impacts beyond citations of a particular piece of research work. DORA got considerable support from the funding bodies, publishers, research institutions, and scientific communities as altmetrics is focused on capturing the increasing variety of online references to a scholar's work. Altmetrics offers a different view of the influence of that work. In the editorial of the *Bulletin of the American Society for Information Science and Technology*, April-May 2013 issue in a special section on altmetrics, the Guest Editor identifies: "Altmetrics offer four potential advantages:

- A more nuanced understanding of impact, showing us which scholarly products are read, discussed, saved and recommended as well as cited.
- Often more timely data, showing evidence of impact in days instead of years.
- A window on the impact of web-native scholarly products like datasets, software, blog posts, videos and more.
- Indications of impacts on diverse audiences including scholars but also practitioners, clinicians, educators and the general public." (Piwowar, 2013)

Thus, an altmetric score of a scholar's work encompasses not only citation count but also number of times it is viewed, saved, shared, discussed, tagged, highlighted in news, and other such counts in academic social media and online networks. It also involves normalization of some counts based on subject area of an article. Figure 34 elaborates enumeration of an altmetric score from different sources. Figure 35 shows altmetric score of one of the highest rating articles, which is amongst top 1% in generating global attention of researchers, practitioners, journalists and bloggers communities. This paper ranks second in *Science* magazine, compared to all papers published therein. Figure 35 also shows detail counts of social media that talked about this paper. This way an altmetric score can help in measuring impact of a scholarly work to researchers' communities. Text Box 3 shows target audience, or who care about an altmetric score.

The DORA as well as *Altmetrics Manifesto* indicate two major providers of altmetric score, namely Altmetric.com and ImpactStory.org. Many others are

now under development stage, whereas some are in experimental or testing stages. Other important ones are namely PlumAnalytics.com, ScienceCard.org, PeerEvaluation.org, ResearchScorecard.com, and ReaderMeter.org. Many individual journal publishers are also engaged in development of in-house article level metrics (ALM) tools, which they will integrate into their online journals in near future. A leading online journal publisher – PLOS (Public Library of Science) has widely publicized its interests in article level metrics. PLOS has developed an Application Programming Interface (API) (http://api.plos.org) and other online tools for generating article level metrics for each published article. Article level measurement using tools from Altmetric.com and ImpactStory.org is described in the following Section.

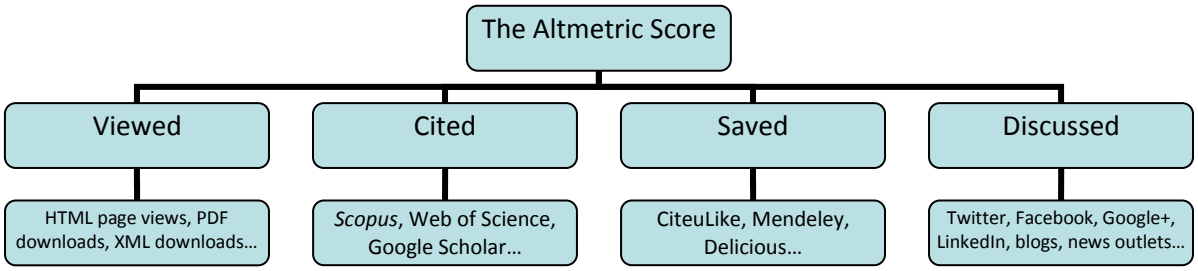


Figure 34: Deriving an Altmetric Score

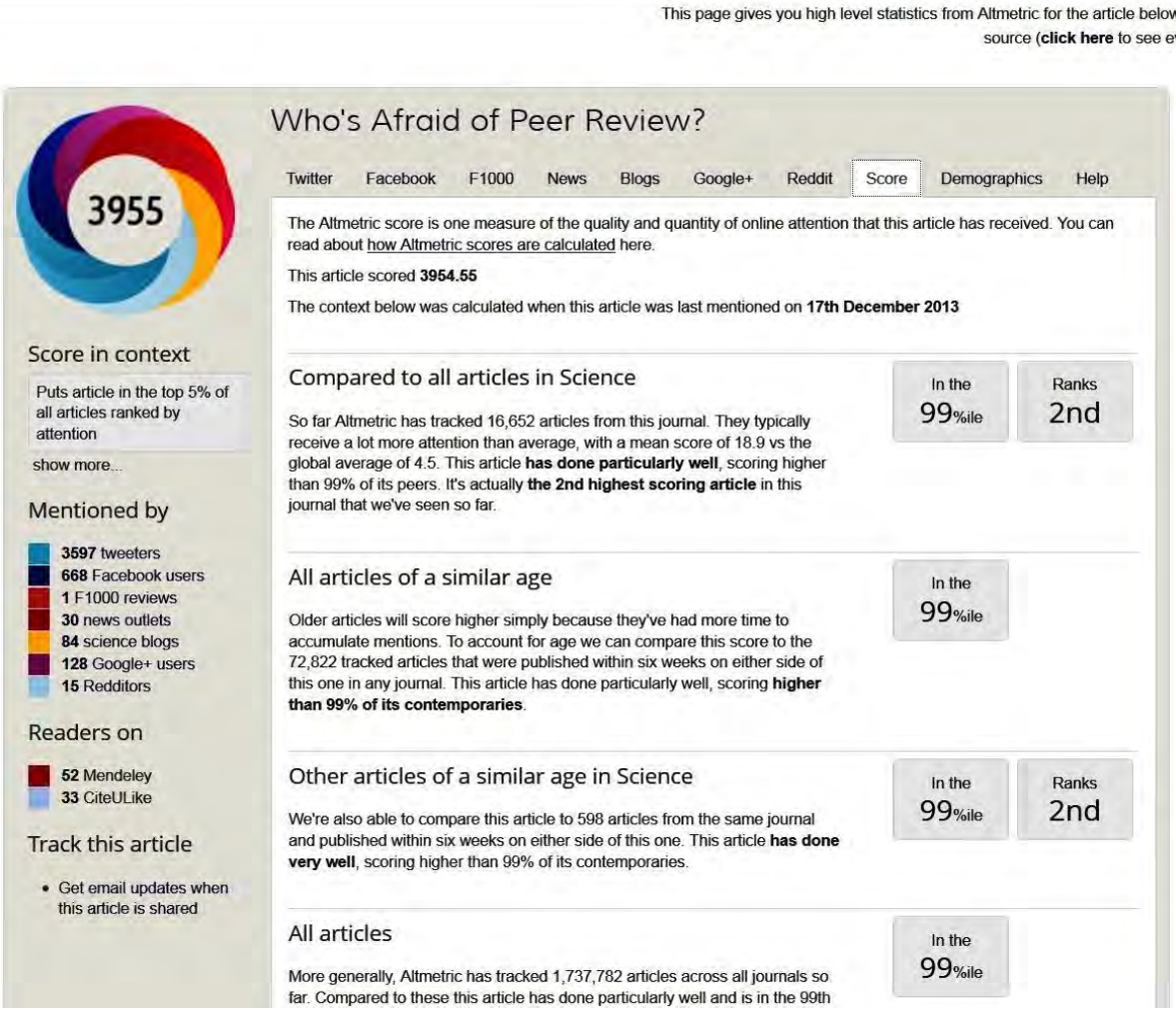


Figure 35: Altmetric Score of one of the Highest Rating Articles (amongst top 1%)

Text Box 3: Target Users of Altmetric Score

Whom is Altmetric for?

For Researchers

Complement your reading by instantly visualising a paper's online attention. Discover new scholarly articles in hundreds of disciplines, while monitoring your personal research impact in academia and beyond.

For Publishers

Showcase research impact to your authors and readers in a beautiful new way. Monitor, search and measure all of the conversations about your journal's articles, as well as those published by your competitors.

For Librarians & Repository Managers

Add value to your libraries and institutional repositories. Track article level metrics for your institution's research outputs, and show faculty, staff and students a richer picture of their online research impact.

3.3.1 Measuring Altmetrics using Altmetric.com

The Altmetric.com is the leading provider of article level metrics data. This website, registered by Altmetric LLP, offers many tools for web integration of altmetric data that help individual researchers, authors, publishers and institutions in instantly obtaining overall altmetric score of published articles. Articles published in online journals having unique digital object identifier (DOIs) are only considered to obtain an altmetric score for each article. Major online journal publishers have been found using tools provided by this website.

Some of the available tools are described below:

AltmetricExplorer: It is a powerful and intuitive web application that helps to see all of the attention surrounding papers of an e-journal. This helps online journal publishers in generating article level metrics from a journal's webpage (e.g., HTML page of an article). AltmetricExplorer can be integrated into journal's website. It instantly generates an altmetric score for each article aggregating counts from different Web 2.0 enabled online resources and more particularly from the social media platforms and online news media. Text Box 4 tells us how the altmetric score is calculated.

Altmetric it!: Altmetric bookmarklet, called Altmetric it!, is a simple browser tool that lets you instantly get article level metrics for any recent paper. It is a kind of browser plugin that can be integrated into your web browser Chrome, Firefox or Safari. Its installation is very easy and free to any researcher or academic. You just open this page www.altmetric.com/bookmarklet.php, grab <Altmetric it!> box, and drag it to your bookmarks bar in your browser. Whenever you visit a scholarly document having a DOI through your web browser, click on <Altmetric it> icon at bookmarks bar, then you will get

article level metrics with a colourful altmetric donut signifying ALM score of that particular paper and little more details of this score. You will also have an option to see more details of this score and citing social media.

Altmetric API: It is an application programming interface that enables you to enrich your pages with article level metrics data. It helps system to system interaction and obtaining ALM data from different data sources as indicated in Figure 34. Altmetric.com also offers an Altmetric WordPress plugin that helps web programmers and bloggers in embedding an altmetric badge to highlight an altmetric score.

Altmetric Badge: It is a ready-to-use embeddable badge for your article pages that let you showcase impact in a beautiful way. This tool generates small donut shaped multicolour, multilayer visualisations to quickly convey information about each article, with summary of score from different data sources. Figure 36 shows an Altmetric badge depicting how an article is being outreached and appraised through social media. However, this altmetric score does not include download statistics of the said article.

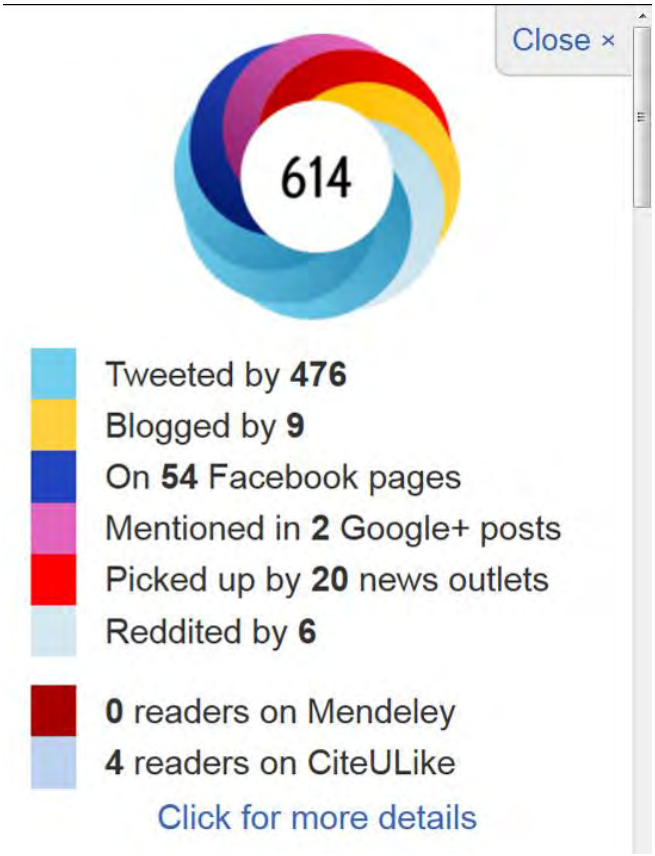


Figure 36: An Altmetric Badge

Text Box 4: Understanding Altmetric Score, as obtained through Altmetric.com

How is the Altmetric score calculated?

The Altmetric score is a general measure of the attention that an article, book or dataset has received online. It reflects:

- **The quantity of attention received** - in general the more people talking about an article the higher the score.
- **The quality of that attention** - a news story counts for more than a Facebook post. Attention from a researcher counts more than attention from an automated Twitter bot.

The Altmetric score is useful to rank articles based on attention - it can't tell you anything about the quality of the article itself, though reading the linked discussions might. It is important to know that the score is based on the kinds of attention that Altmetric tracks (specifically links to or saves of scholarly articles, books and datasets) and to be mindful of potential limitations. You should also bear in mind that different subject areas usually aren't directly comparable: a popular physics paper may have a far lower Altmetric score than an average genetics paper. We don't use reader counts from Mendeley or CiteULike in the score calculation.

Steps taken to Calculate the Score

Collect mentions: We aggregate the different pieces of content (tweets, news stories, blog posts, Facebook wall posts, Stack Exchange threads... we call them all posts) mentioning each article. Intuitively, some forms of attention are of a 'higher quality' than others. If you ask scientists if they'd rather have somebody tweet about their article or write a piece in the New York Times about it then they'll choose the latter most of the time. So all else being equal each type of content will contribute a different base score to the article's total. For example, a tweet may be worth 1 and a blog post 5. In practice these scores are usually modified by subsequent steps in the scoring algorithm. ***Practical example***: a news story in the NYT will, by default, contribute more to an article's final score than a single tweet.

Collect & analyse profiles: We fetch the profile of the user who created each post whenever possible. We also scan the Altmetric database for the items those users have already mentioned. We look at how often the user links out to scholarly content, if they're biased towards any one publisher or journal and what type of people follow or are friends with them. All this information is used to produce a weighting that influences how much each post contributes to the final score. ***Practical example***: posts from an automated journal TOC (that posts new papers to Facebook as they are published) will contribute very little to the article's final score. Posts from a doctor who links to articles once or twice a week and is followed by other doctors will score relatively highly.

Search other datasets: For some types of attention like blogs and the mainstream media it doesn't make sense to look at post author profiles. In these cases we typically try to measure influence by looking at how much attention the source of attention gets on different social media sites. ***Practical example***: more people tweet or repost BBC News science stories than science articles in Le Figaro - so posts from the BBC News site contribute more to the article's final score than posts written by Le Figaro.

Produce Final score

We total the contributions made by post after applying any relevant modifiers.

Source: http://support.altmetric.com/knowledgebase/articles/83337-how-is-the-altmetric-score-calculated-

3.3.2 Measuring Altmetrics using ImpactStory.org

The ImpactStory.org is another leading provider of article level metrics data. This website offers registered users creating their impact profile on the web, revealing diverse impacts of their articles, books, presentations, datasets and software. This is a collaborative not-for-profit open source project supported by the U.S. National Science Foundation, Alfred P. Sloan Foundation and Open Society Foundation. ImpactStory.org helps in creating author's profile and adding publication list through importing bibliographic records from different sources such as *Scopus* database, ORCID.org, Google Scholar Citations, SlideShare and many others.

A researcher can create a profile for free in this website to know how many times his/her work has been downloaded, bookmarked, and blogged. Text Box 5 depicts how researchers, research groups, funders and repositories can be benefited from this website. A researcher can also generate code to embed ImpactStory profile into his institutional CV and research blog.

Figure 37 shows homepage of ImpactStory website, which gives link to profile creation page by clicking on <Make my impact profile> to "share the full story of your research impact". Figure 38 shows a sample profile, where articles are categorised as <highly saved>, <highly discussed>, <highly cited>, <saved>, <discussed>, <cited>, and <viewed>. When you click on the title of a paper you will get a detailed ALM score indicating counts from different data sources.

Text Box 5: Target Audience of ImpactStory.org Altmetrics

Whom is it for?

- **Researchers:** who want to know how many times their work has been downloaded, bookmarked, and blogged.
- **Research Groups:** who want to look at the broad impact of their work and see who has demonstrated interest.
- **Funders:** who want to see what sort of impact they may be missing when only considering citations to papers.
- **Repositories:** who want to report on how their research products are being discussed
- **All of Us:** who believe that people should be rewarded when their work (no matter what the format) makes a positive impact (no matter what the venue). Aggregating evidence of impact will facilitate appropriate rewards, thereby encouraging additional openness of useful forms of research output.

Source: Impactstory.org/faq

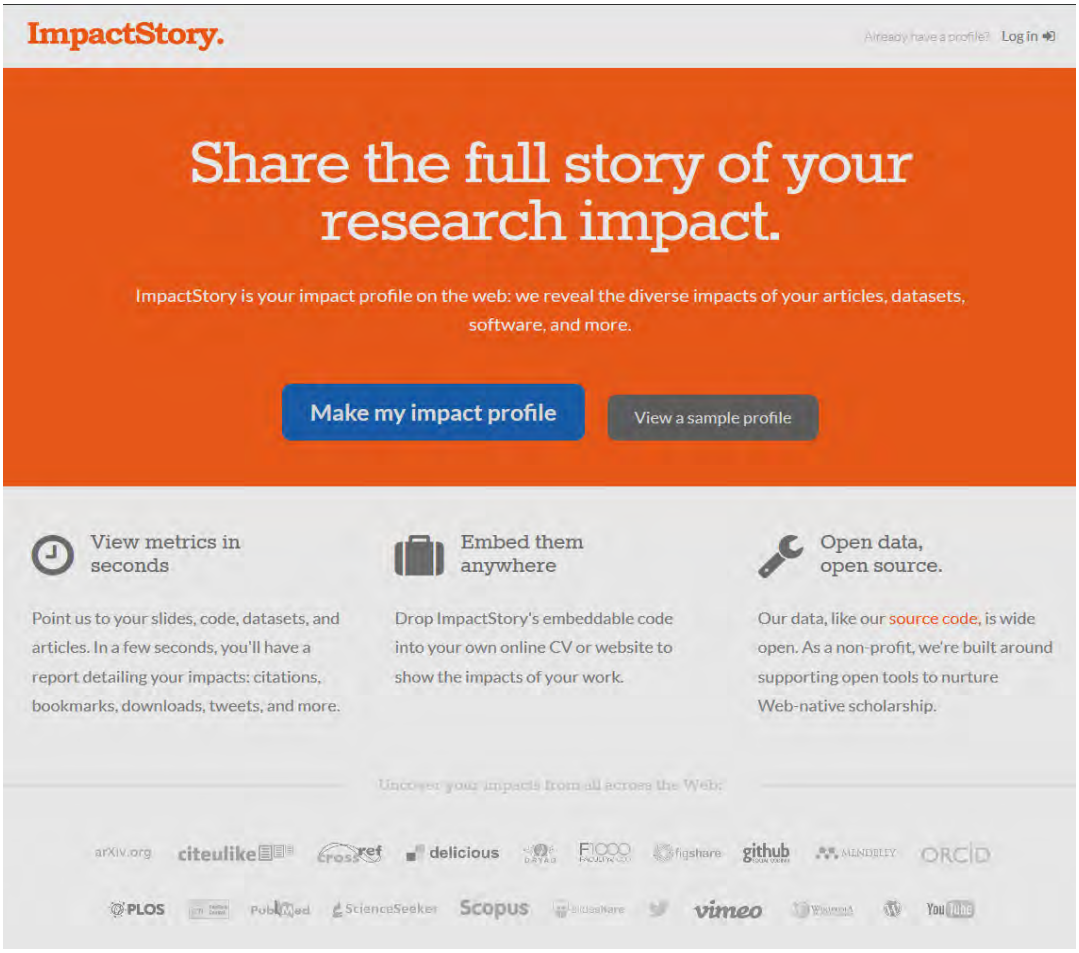


Figure 37: Home Page of ImpactStory.org

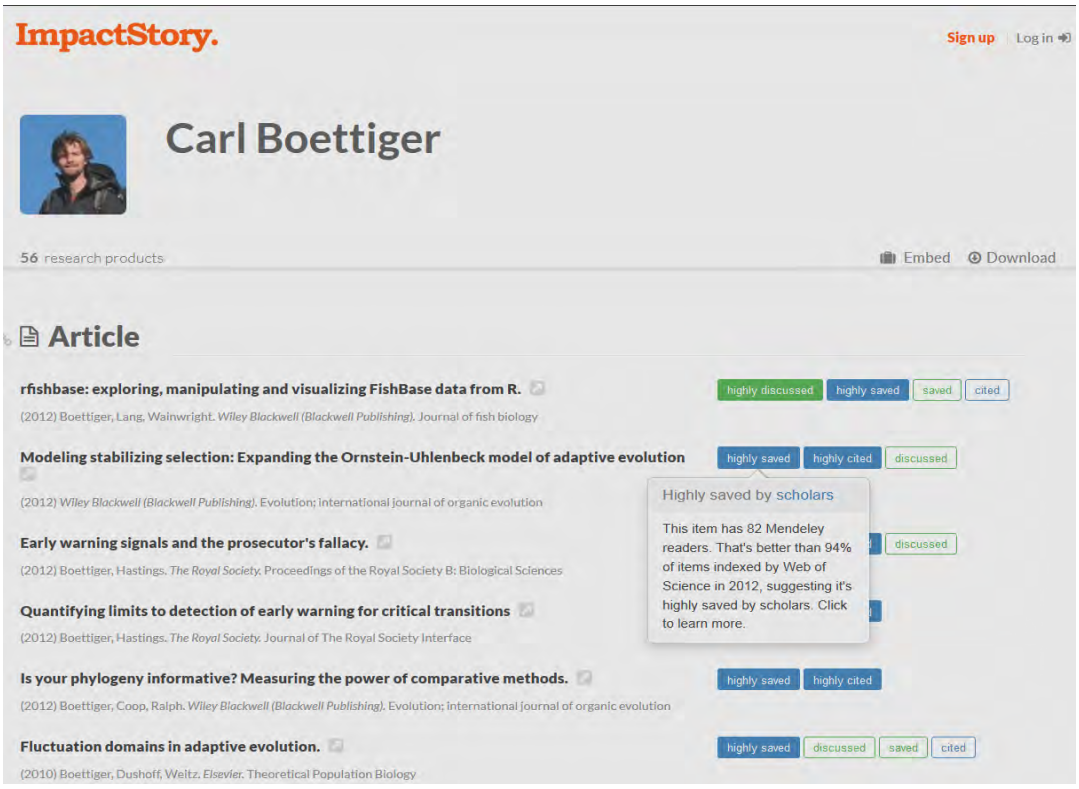


Figure 38: A Sample Profile in ImpactStory.org

3.3.3 Article Level Metrics for Online Journals

The concept of article level metrics (ALM) or altmetrics is greatly supported by online journals and more particularly biomedical and open access journals. The new age online journals, as mentioned in Table 18, have been providing article level metrics for each published work. For deriving an ALM score, these journals use different widely available altmetric tools such as AltmetricExplorer and ImpactStory, and aggregate counts in different aspects of article's influence or usage, such as viewed, cited, saved and discussed as shown in Figure 34. Now-a-days these online and open access journals also provide social bookmarking tools in HTML page of every article to facilitate users to instantly share or discuss about that particular article.

Table 18: Indicative List of Journals Providing Article Metrics for Every Online Article

Name of Journal	Web Address	Article Metrics Tool Used
BMJ Open (& other BMJ journals)	http://bmjopen.bmj.com	AltmetricExplorer
eLIFE	http://elife.elifesciences.org	AltmetricExplorer
Nature Communications	www.nature.com/ncomms/	AltmetricExplorer
PeerJ	http://peerj.com	ImpactStory
PLOS One (& other PLOS journals)	www.plosone.org	AltmetricExplorer

The PLOS (Public Library of Science) is one of the pioneering publishers that introduced article level metrics for its open access journals. PLOS article metrics derive from different data sources as indicated in Figure 39. It includes counts with respect to usage, views, downloads, citations, social bookmarking, blogs, media coverage and comments.

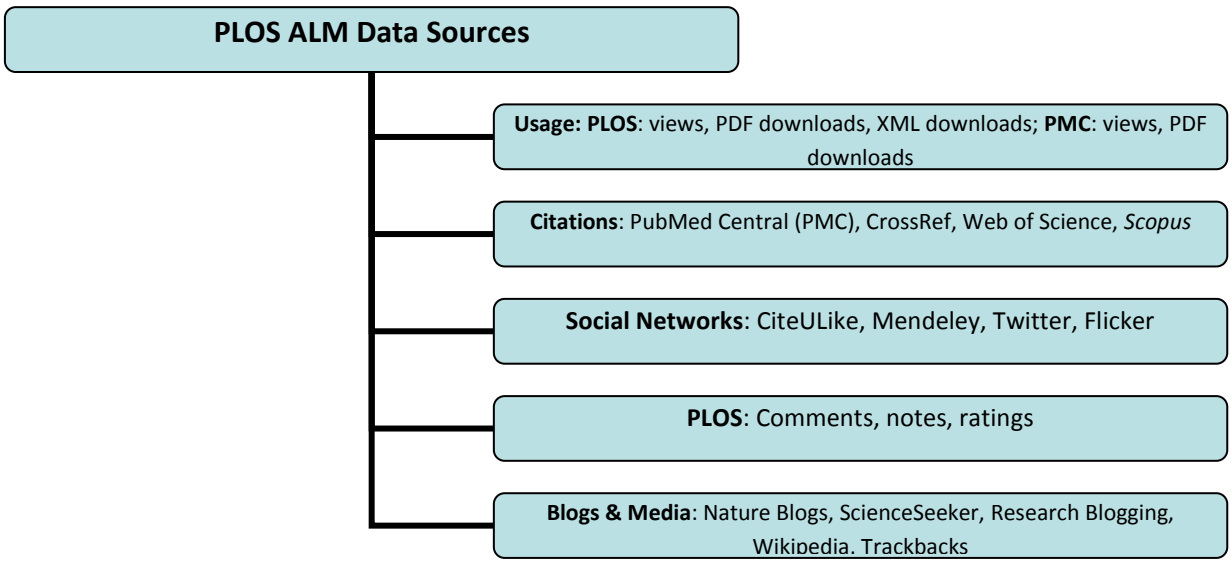


Figure 39: Data Sources for PLOS Article Level Metrics

Research Evaluation Metrics

Figure 40 provides first level of article metrics of an open access article published in PLOS One journal, depicting number of times it is viewed, shared and saved. While click on <Metrics> tab in this page, the second level of article metrics of the same paper will appear as shown in Figure 41 that gives detailed information of article share or usage with their respective data sources. PLoS publishes a regular report covering a wide range of metrics covering all of it journals. This is easy to download as a .csv file.

As indicated in Table 18, many other online journals are also actively considering inclusion of article metrics features in their article page. For this inclusion they are mostly adding the available tool AltmetricExplorer and embedding the Altmetric badge in article metrics page of every article. Figure 42 shows article metrics as available with *Nature Communications* online journal. Here an Altmetric badge is embedded. On the other hand, a few journals now embed ImpactStory-based article metrics. As ImpactStory.org provides open source solution to article metrics, its usage amongst online journals is expected to rise.

Text Box 6: Understanding PLOS Article Level Metrics

PLOS Article Level Metrics

Purpose: ALMs provide a suite of established metrics that measure the overall performance and reach of published research articles.

For Whom

- **Researchers**: Maximize the impact of your research.
- **Publishers**: Enhance publication value through real time views of reach and influence.
- **Institutions**: Capture researcher impact for hiring, tenure, and promotion decisions.
- **Funders**: Track the performance and impact of research funding.

Article Level Metrics measure the dissemination and reach of published research articles. Traditionally, the impact of research articles has been measured by the ~~publication~~ journal. But a more informative view is one that examines the overall performance and reach of the articles themselves. Article-Level Metrics are a comprehensive set of impact indicators that enable numerous ways to assess and navigate research most relevant to the field itself, including:

- usage
- citations
- social bookmarking and dissemination activity
- media and blog coverage
- discussion activity and ratings

Article-Level Metrics are available, upon publication, for every article published by PLOS. Researchers can stay up-to-date with their published work and share information about the impact of their publications with collaborators, funders, institutions, and the research community at large. These metrics are also a powerful way to navigate and discover others' work. Metrics can be customized to address the needs of researchers, publishers, institutional decision-makers, or funders.

Source: http://article-level-metrics.plos.org/alm-info/

Figure 40: First Level Article Metrics of a Paper in PLOS One Journal

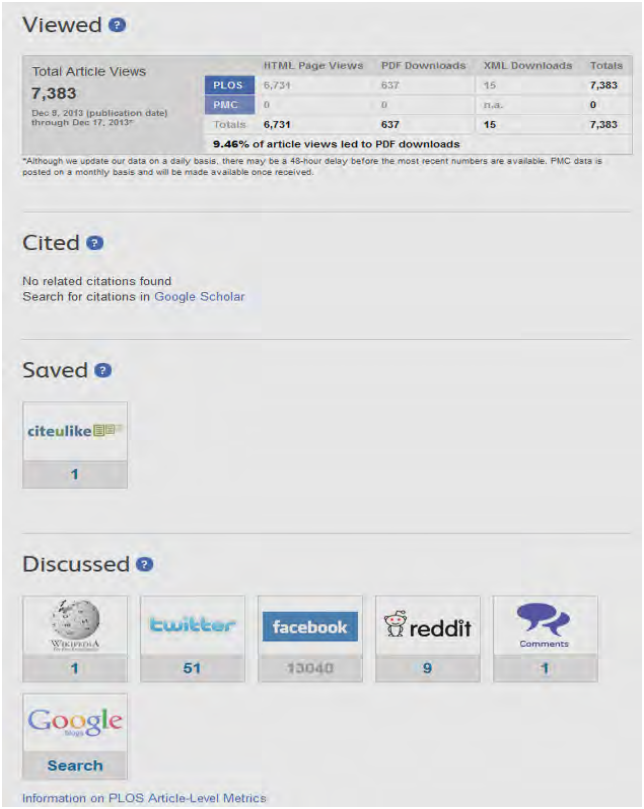


Figure 41: Second Level Article Metrics of the Same Paper in PLOS One

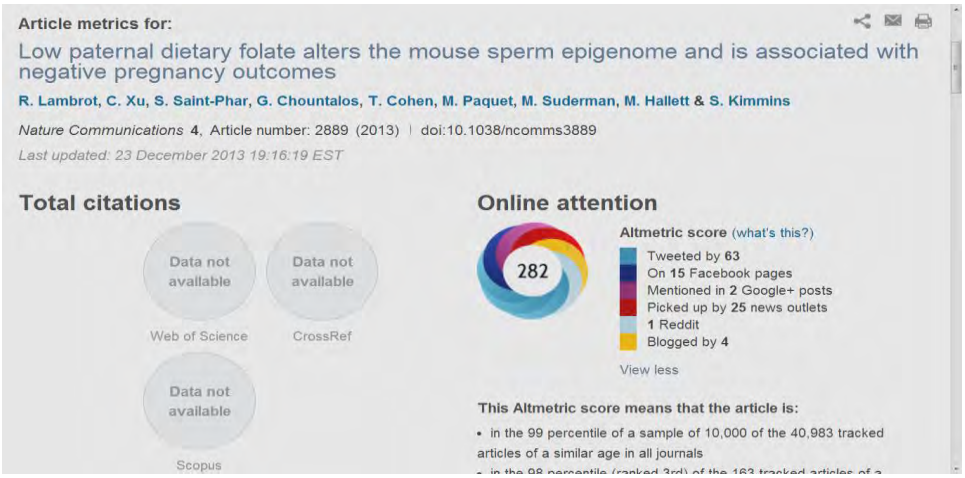


Figure 42: Article Metrics of a Paper in Nature Communications, integrating an Altmetric Badge

3.4 ACADEMIC SOCIAL NETWORKS

As we saw in earlier sections, researchers in the twenty-first century are very keen to maintain online researchers' profiles, social networking, transnational networking through online forums, and peer-to-peer collaborations. While a plenty of general purpose social networking sites are globally available, some online social networks are meant for academics and researchers. Academic social networks facilitate creation of online groups for discussion based on particular research interests. Table 19 provides an indicative list of social networking websites that facilitate networking of academics and researchers. While ResearchGate[39] and Academia.edu[40] facilitate user-to-user interactions through e-groups, getCITED.org[41] and SSRN[42] don't have such web 2.0 feature. Further details of these academic social networks are available in the following Sections.

Table 19: Major Academic Social Networks

	ResearchGate.net	Academia.edu	getCITED.org	SSRN.com
Target Group	Researchers	Academics: researchers, students	Researchers	Researchers, Authors
Subject Coverage	All	All	All	Social Sciences, Humanities and Law
Founded in	2008	2008	2004	1994
Mission	To give science back to the people who make it happen and to help researchers build reputation and accelerate scientific progress.	To accelerate the world's research; to make science faster and more open.	To make records of scholarly work publicly available.	To provide rapid worldwide distribution of research to authors and their readers and to facilitate communication among them at the lowest possible cost.
Web 2.0 Interactivity	Yes	Yes	No	No

3.4.1 ResearchGate.net

The ResearchGate.Net is one of the most prominent professional networks for scientists and researchers. Established in 2008, it is a social media space for researchers to make their research visible to global researchers' communities. Any researcher from any subject area can freely create researcher's profile and

[39] http://www.researchgate.net/
[40] http://www.academia.edu/
[41] http://www.getcited.org/
[42] http://www.ssrn.com/en/

upload their published, unpublished, working papers and research datasets for worldwide dissemination. The researcher here has options to upload full-text contents, or to provide only bibliographic details. He/she can also add details of his/her completed and ongoing research projects for further discussions, dialogues and collaborations with network members. Figure 44 indicates basic functions of this online network. Figure 43 shows homepage of ResearchGate website.

As a registered member in this online platform, you can read the latest publications in your field shared by other fellow researchers; discuss your work with other specialists; and collaborate with colleagues located in the same country or other countries around the world. A researcher's profile provides statistics related to his/her research works, such as number of papers available, total publication views, total full-text downloads, total dataset downloads, total full-text requests, citations. Your profile also indicates number of *Followers* you have and number of researchers you are *Following*, and *Top Co-authors*.

ResearchGate generates *RG Score* for every registered researcher. The RG Score is a metric that measures scientific reputation based on how all of your research is received by your peers. It is a mix of indicators based on statistics related to your publications, questions, answers and followers. RG Score is ~~a~~ derived in combination of publications (their views, downloads & citations), questions & answers (interactions with other members) and number of followers. In Figure 45, a member's RG Score is shown as 40.73, while he authored 358 publications with 777 citations and 529.24 impact points.

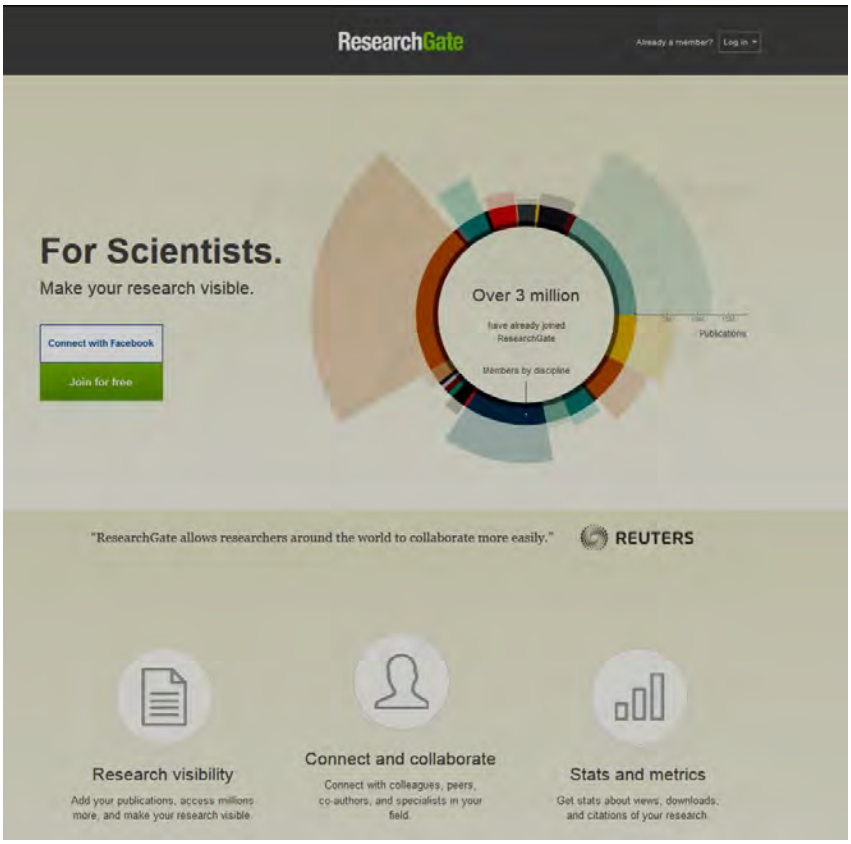


Figure 43: Homepage of ResearchGate.net

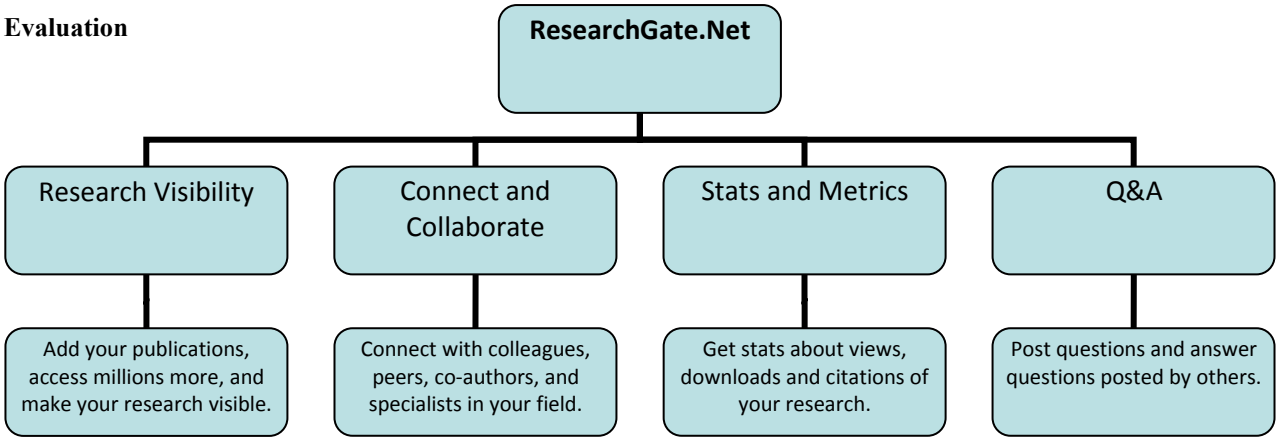


Figure 44: Basic Functions of ResearchGate.Net

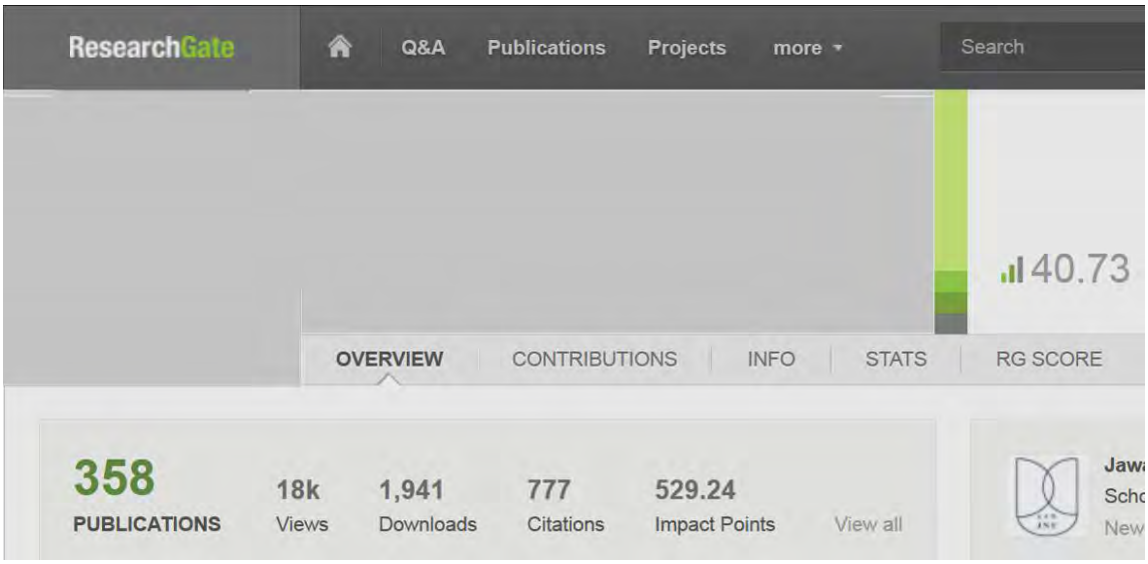


Figure 45: Showing RG Score of a Profile in ResearchGate.net

3.4.2 Academia.edu

The Academia.edu is one of the largest social networking websites for academics. Established in 2008, it is a social media space for academics and researchers to make their academic works visible to global communities of academicians and researchers. Any student, a researcher or a faculty member from any subject area, affiliated to a higher educational institution or a university, can freely create a profile and upload his/her published or unpublished papers, conference presentations and research datasets for worldwide dissemination. The researcher here has options to upload full-text contents, or to provide only bibliographic details. He/she can seek academic collaborations, professional advice and feedbacks from fellow network members. One may follow a number of researchers and peers. Many of the persons one *Following* are either his/her mentors, fellow researchers, colleagues, peers, supervisors, teachers, collaborators and co-authors. Higher number of Followers indicates that researcher's research works get considerable attention to researchers in his/her domain and adding value to the volumes of current research literature.

Figure 46 indicates basic functions of this social networking website. Figure 47 shows homepage of Academia.edu website, indicating growing strength of members' community. The website facilitates searching people, research interests and universities from its search interface. Figure 48 shows a profile in Academia.Edu with profile statistics, such as, profile views, document views, number of uploaded papers, number of followers, and number of people she is following.

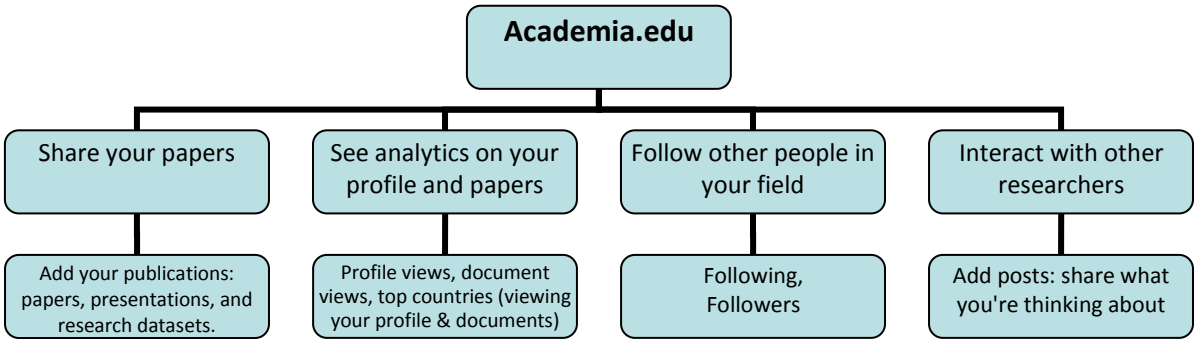


Figure 46: Basic Functions of Academia.Edu

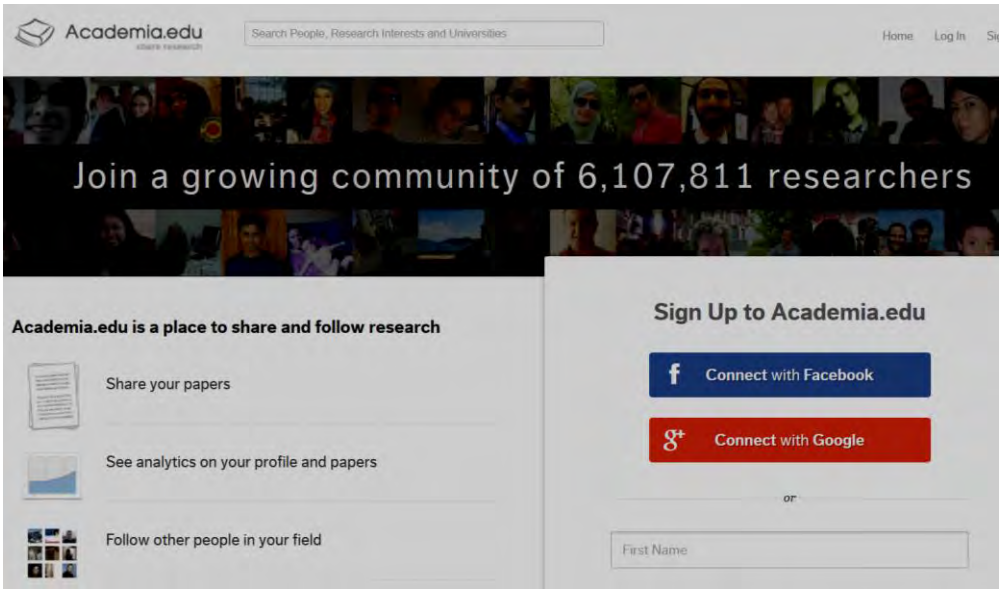


Figure 47: Homepage of Academia.edu

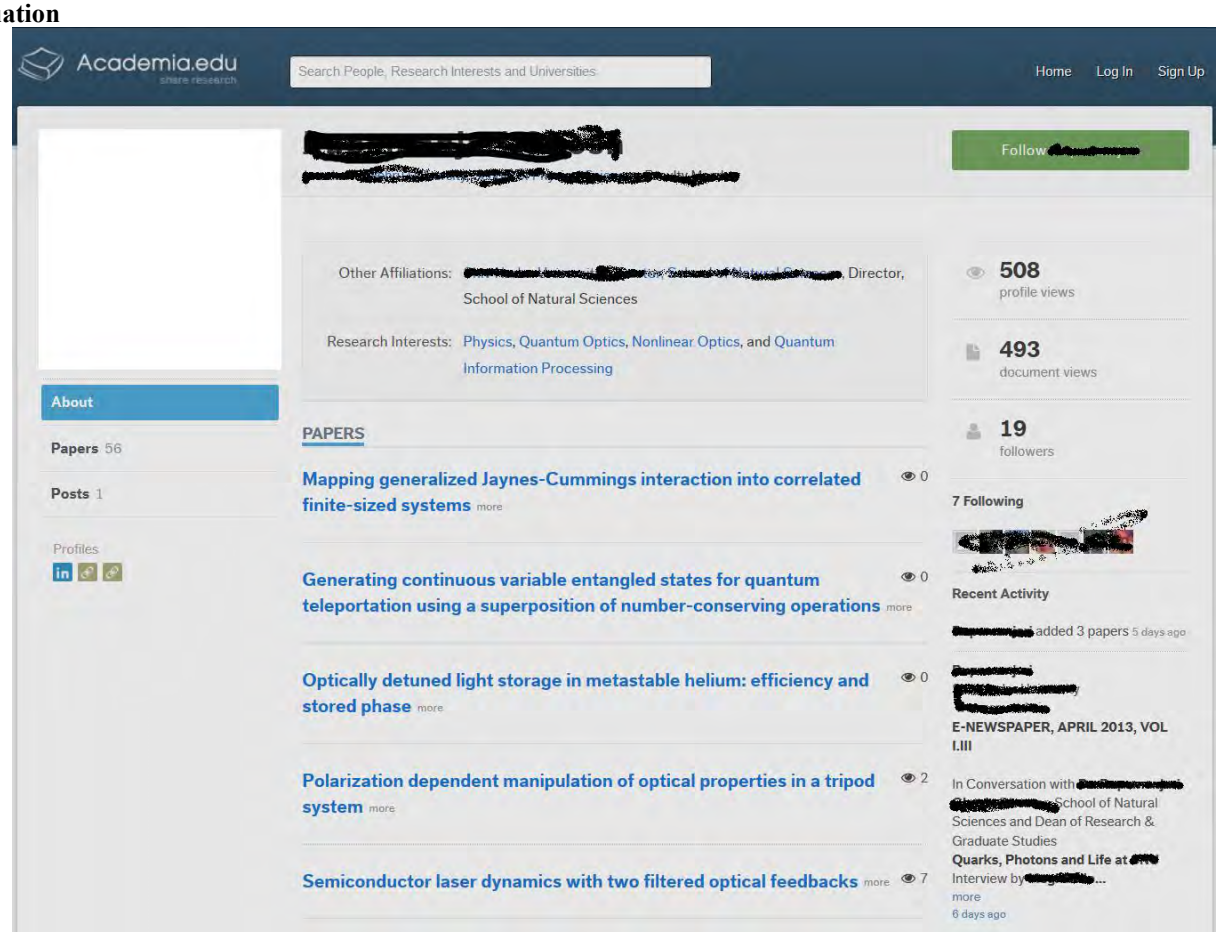


Figure 48: A Profile in Academia.Edu with Profile Statistics

3.4.3 getCITED.org

The getCITED.org is registration-based website facilitating academic communities in sharing bibliographic information on published and unpublished academic papers and other documents. Established in 2005, it has become a social space for academics and researchers to make their academic works visible to global communities of academicians and researchers. Any researcher or a faculty member from any subject area, affiliated to a higher educational institution, research institution or university, can freely create a profile and upload his/her list of publications. A registered user can add bibliographic details of his/her published or unpublished papers, books, book chapters, theses, dissertations, conference presentations, reports and other documents for increasing their worldwide visibility. However, this site does not have facility of uploading full-text contents.

Figure 49 shows homepage of getCITED.org website, indicating basic statistics of available contents. This page also indicates that only a registered member can update information not only for his/her own profile, but also for his/her institutions or known colleagues. The website facilitates searching publications, institutions, people and faculties from its basic search interface. Figure 50 shows a researcher's profile in getCITED.org with profile statistics,

such as, number of publications in each category, citation rank, researcher's rank, number of citations, number of views of his/her profile.

This website performs more as a repository of bibliographic contents than an academic social network. This platform does not facilitate social networking with other members of and sharing knowledge products within the academic communities.

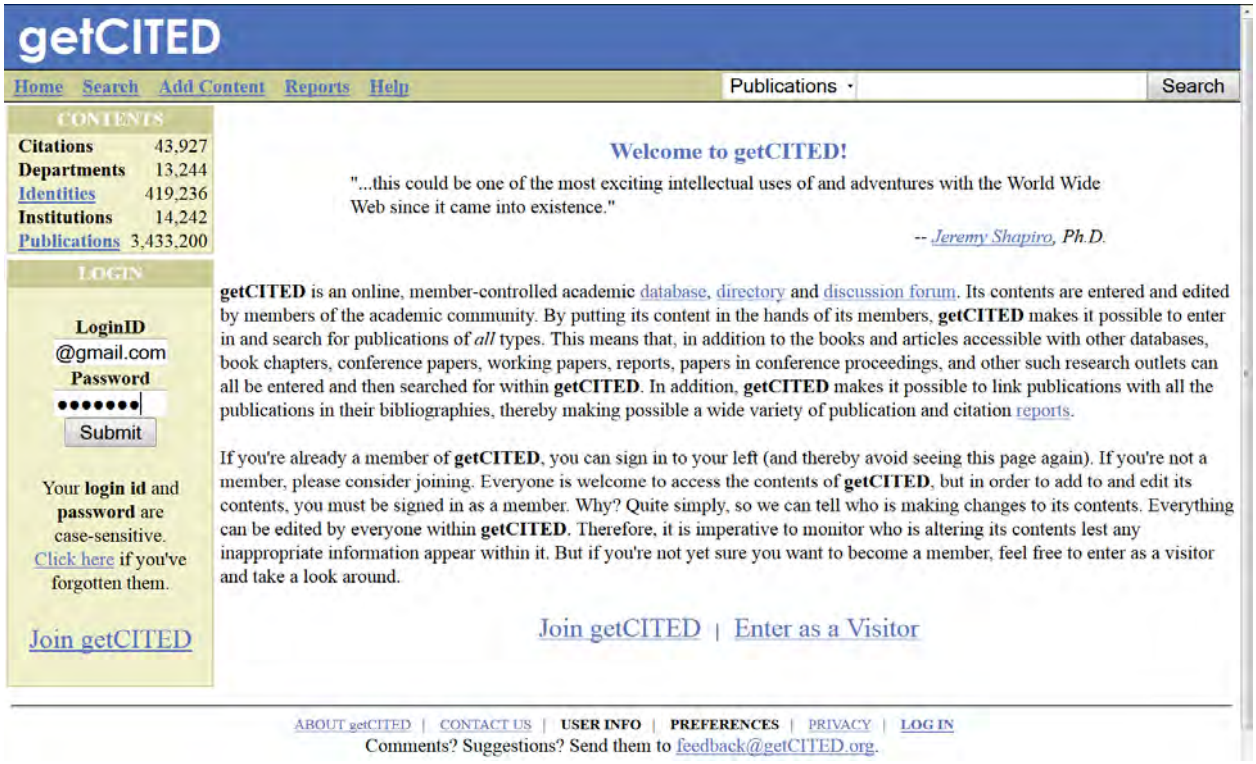


Figure 49: Homepage of getCITED.org

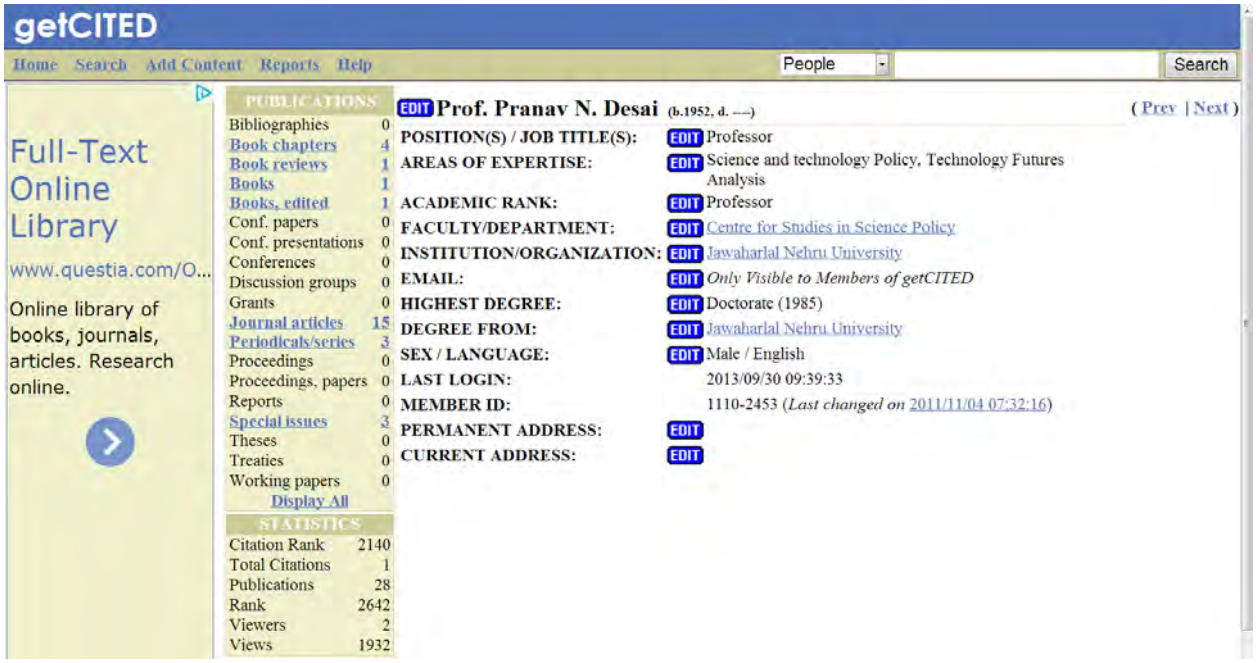


Figure 50: A Profile in getCITED.org with Profile Statistics

3.4.4 Social Science Research Network (SSRN)

The Social Science Research Network (SSRN.com) is a document repository for worldwide dissemination of social science information. It comprises about 22 specialized research networks in many of the specialized domains of social sciences, humanities and law. Individuals, institutions, publishers and scientific societies can share their publications and other academic contents for global dissemination through a single gateway. This website was launched in 1993 and is presently owned by the Social Science Electronic Publishing Inc., based in the United States. Its individual and institutional members spread around the world have made this website one of the top-ranking digital repositories with significant amount of open access contents. The SSRN website secured fifth position in the 13th edition of the world Ranking Web of Repositories (http://repositories.webometrics.info/en/world), which was announced in July 2013.

SSRN has a unique "Partners in Publishing" program and it works with over 1,800 scientific journals and research institutions. These partners provide information on forthcoming papers and permission to have their work posted to SSRN. SSRN aggregates working papers from many leading institutions and think tanks. Each registered individual member is free to upload his/her published papers and other academic contents and disseminate to global researchers communities. Full-text contents submitted by an author for global dissemination can be of either open access or out of any copyright restriction. However, an author's briefcase or workspace usually displays papers in four categories: (i) Publicly available papers, (ii) In process papers, (iii) Privately available papers, and (iv) Inactive papers. Only papers in category (i) are available in the SSRN eLibrary. The papers of eLibrary are searchable from SSRN portal and by external search engines.

Figure 51 displays how SSRN portal organizes contents based of ranking of top papers, authors and institutions. These top ranking profiles also include citation metrics and download statistics. Figure 52 shows homepage of SSRN portal, which also facilitates navigating research contents through specialized research networks, top papers, top authors and top organizations. Figure 53 shows top 30,000 authors with citation metrics and other indicators. Indicators include: author-level Eigenfactor score, number of papers per author, total downloads per paper per author, total citations per paper per author, number of downloads in last twelve months, etc.

Figure 51: Display of Top Papers, Authors & Institutions with Citation Metrics in SSRN Portal

Figure 52: Homepage of SSRN Portal

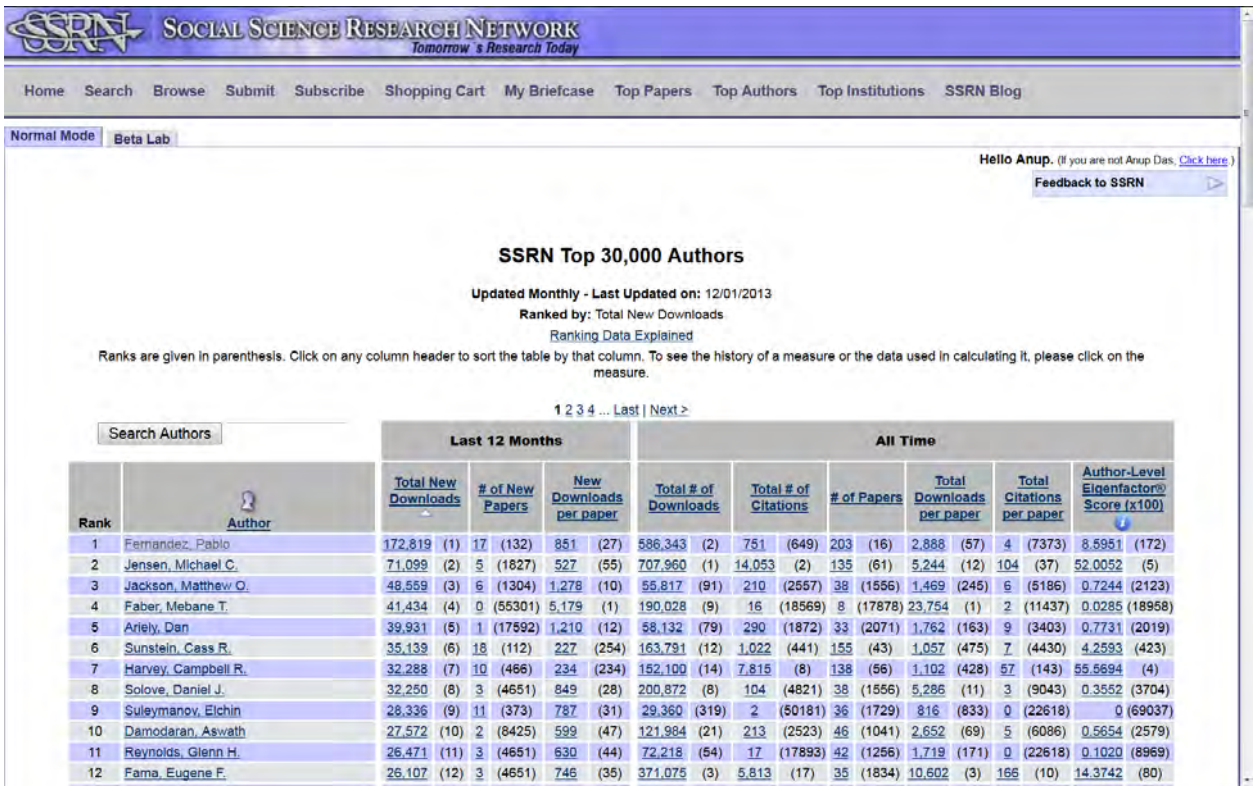


Figure 53: Display of Top 30,000 Authors with Citation Metrics in SSRN Portal

3.4.5 Other Important Social Networks useful for Authors and Researchers

While article level metrics count social bookmarking and social sharing of scholarly works through social media platforms, many of the conventional social networking websites receive special attention from the authors, researchers and academics. Table 20 provides an indicative list of social networking websites which are frequently used by researchers. Facebook is the most popular social network. Major journal publishers, journals, scholarly societies, institutions, organizations and online service providers all have their respective community page in Facebook to outreach their activities and services to global communities. Twitter is a social networking platform mostly used for microblogging of information. LinkedIn is a social platform for professional networking. Slideshare is the world's largest online community to share and upload presentations online. Here Individuals or organizations can upload and share PowerPoint, PDF, or OpenOffice presentations as well as video presentations. Besides presentations, SlideShare also supports documents, PDF, videos and webinars. Figshare is a social platform for sharing open datasets, figures and tables. Figshare allows researchers to publish all of their data in a citable, searchable and sharable manner. All data is persistently stored online in Figshare under the most liberal Creative Commons licensing policy**.**

All these general purpose social networking platforms supplement use of specialized social networking websites for researchers and academics, viz. ResearchGate.net and Adademia.edu. So, when you publish a scholarly paper, sharing information about availability of your paper through general purpose social networks as well as academic social networks will ensure its global visibility, higher usage, download, citation and help in improving its altmetrics score.

Table 20: Important Social Networks useful for Authors and Researchers

	Facebook	**Twitter**	**Google+**	**LinkedIn**	**SlideShare**	**FigShare**
Target Group	Any citizen	Any citizen	Any citizen	Professionals	Researchers; Professionals	Researchers
Founded	2004	2006	2011	2003	2006	2011
Mission	To give people the power to share and make the world more open and connected.	To give everyone the power to create and share ideas and information instantly, without barriers.	To bring the nuance and richness of real-life sharing to the web, and making all of Google better by including people, their relationships and their interests.	Connect the world's professionals to make them more productive and successful.	The world's largest community to share and upload presentations online.	Publish all of your research outputs!
Type of Social Media	General purpose.	General purpose.	General purpose.	Professional	Format specific	Format specific
Acceptable Formats	-	-	-	-	Presentations	Datasets, Figures and Tables

3.5 REGIONAL JOURNAL NETWORKS WITH BIBLIOMETRIC INDICATORS

3.5.1 SciELO – Scientific Electronic Library Online (SciELO.org)

The Scientific Electronic Library Online, popularly known as SciELO, is a programme of the São Paulo Research Foundation (FAPESP) launched in 1998, for the cooperative publishing of open access journals on the Internet. SciELO initially received technical support from the Latin America and Caribbean Center on Health Sciences Information (BIREME/PAHO/WHO). Since 2002, the Project is also supported by the Brazilian National Council for Scientific and Technological Development (CNPq). Since its launching, the SciELO publishing model was progressively adopted by national research institutions of Ibero-American countries and South Africa comprising the SciELO Network. Now it hosts peer-reviewed scientific literature originated from Latin America, Spain, Portugal and South Africa. SciELO is one of the earliest initiatives in the global South to provide open access to scientific literature. The SciELO.br website secured first position in category of Top Portals in 13th edition of the Ranking Web of Repositories.

Members in the SciELO Network, responsible for content creation and aggregation in its portal SciELO.org, are drawn from 16 countries, i.e. Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Spain, Mexico, Peru, Portugal, South Africa, Venezuela, Bolivia, Paraguay, Uruguay and West Indies. As in December 2013, SciELO hosts about 1145 journals in all major disciplines of science, social sciences and humanities.

SciELO produces a large amount of valuable scientific contents generated and published by journals from emerging regions, such as Latin America, the Caribbean and South Africa. SciELO's multilingual global portal helps in making its resources visible and accessible globally.

Very, recently the SciELO has entered into a collaboration agreement with Thomson Reuters to develop a new product titled 'SciELO Citation Index', based on resources available with SciELO portal. SciELO Citation Index will be part of Thomson Reuters' Web of Knowledge database and available from 2014. SciELO will continually publish and host open access journals and its full-text contents will be linked from the SciELO Citation Index.

SciELO maintains a few bibliometric indicators based on citation indicators and other metrics. When integrated with SciELO Citation Index, their indicators will be enriched and will be very useful for more analytical evaluation of research originated from the Latin America.

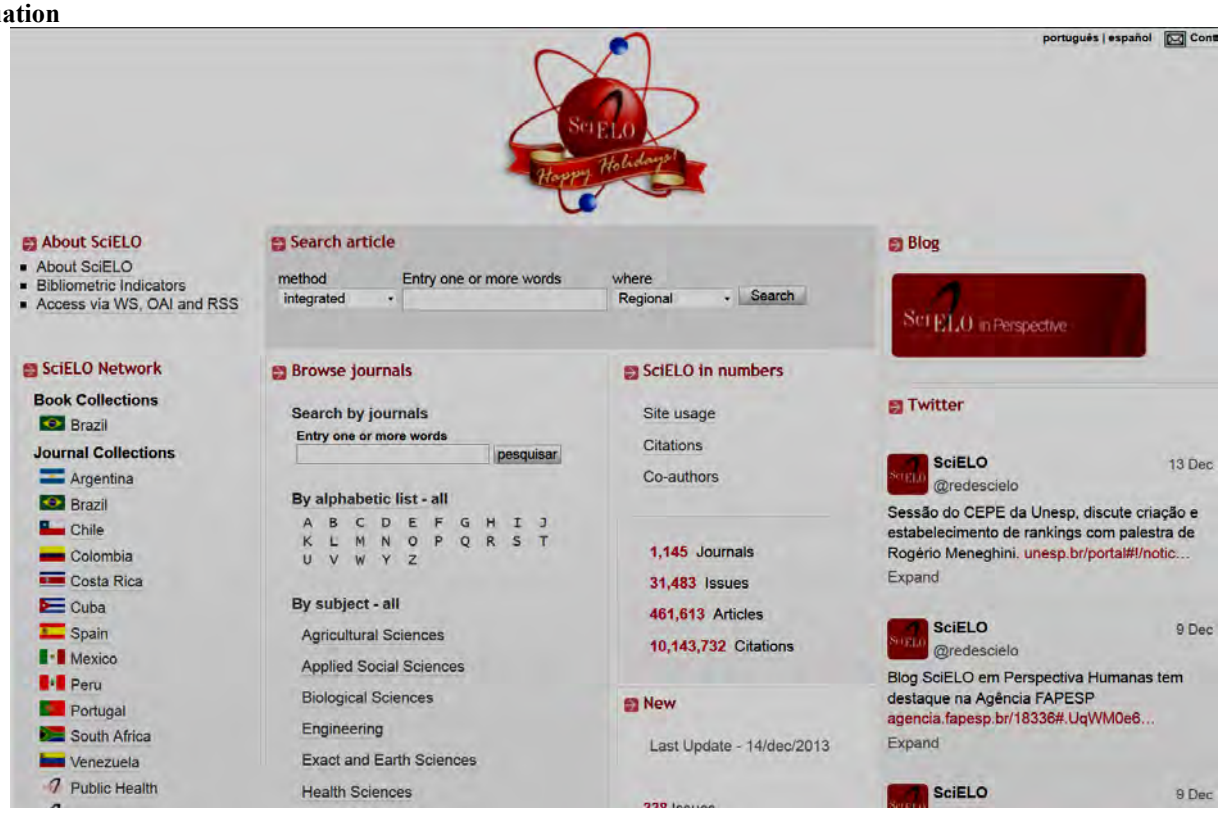


Figure 54: Homepage of SciELO.org Portal providing Open Access to Scientific Literature

3.5.2 Redalyc.org

The Redalyc.org is an online multidisciplinary scientific information system and open access platform for sharing scientific literature published from the Latin America and the Caribbean, Spain and Portugal. It is also a network of scientific journals from the Ibero-American group of nations. The motto of this online platform is "*Open access to the world scientific production in Ibero-American journals*". Its slogan is "*Science that is not seen does not exist*" to outreach scientific literature published in journals in this region to worldwide scientific communities. This slogan comes out to deal with the poor representation of scientists and their scientific contributions from this region in mainstream scientific databases and citation indexes. The Redalyc project started in October 2002 and presently hosted by Universidad Autónoma del Estado de México (UAEM).

Presently this portal provides open access to contents from 885 scientific journals published in 15 Ibero-American countries, namely, Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Spain, Mexico, Peru, Portugal, Puerto Rico, Dominican Republic, Uruguay and Venezuela. This portal fully embraces open access and its material is released under a Creative Commons license and is free to download. Majority of the full-text papers, available with this portal, are written in either Spanish or Portuguese language. This portal also provides abstracts of papers in English, Spanish and Portuguese languages. The subjects' coverage of this portal, as on 12th December 2012, is

shown in Table 21. The portal also hosts a special collection named CLACSO (http://clacso.redalyc.org), supported by the Latin American Council of Social Sciences, covering full-text contents of 63 journals in social sciences, arts and humanities disciplines.

The portal generates certain bibliometric indicators and usage statistics that measure citations and usage of archived papers in this platform. This portal has different searching and navigation options for easy retrieval of archived documents from its databases.

Table 21: Subjects' Coverage in Redalyc.Org Portal

Subject Areas	Number of Journals
Social Sciences	518
Sciences	251
Arts and Humanities	99
Multidisciplinary	17
Total	**885**

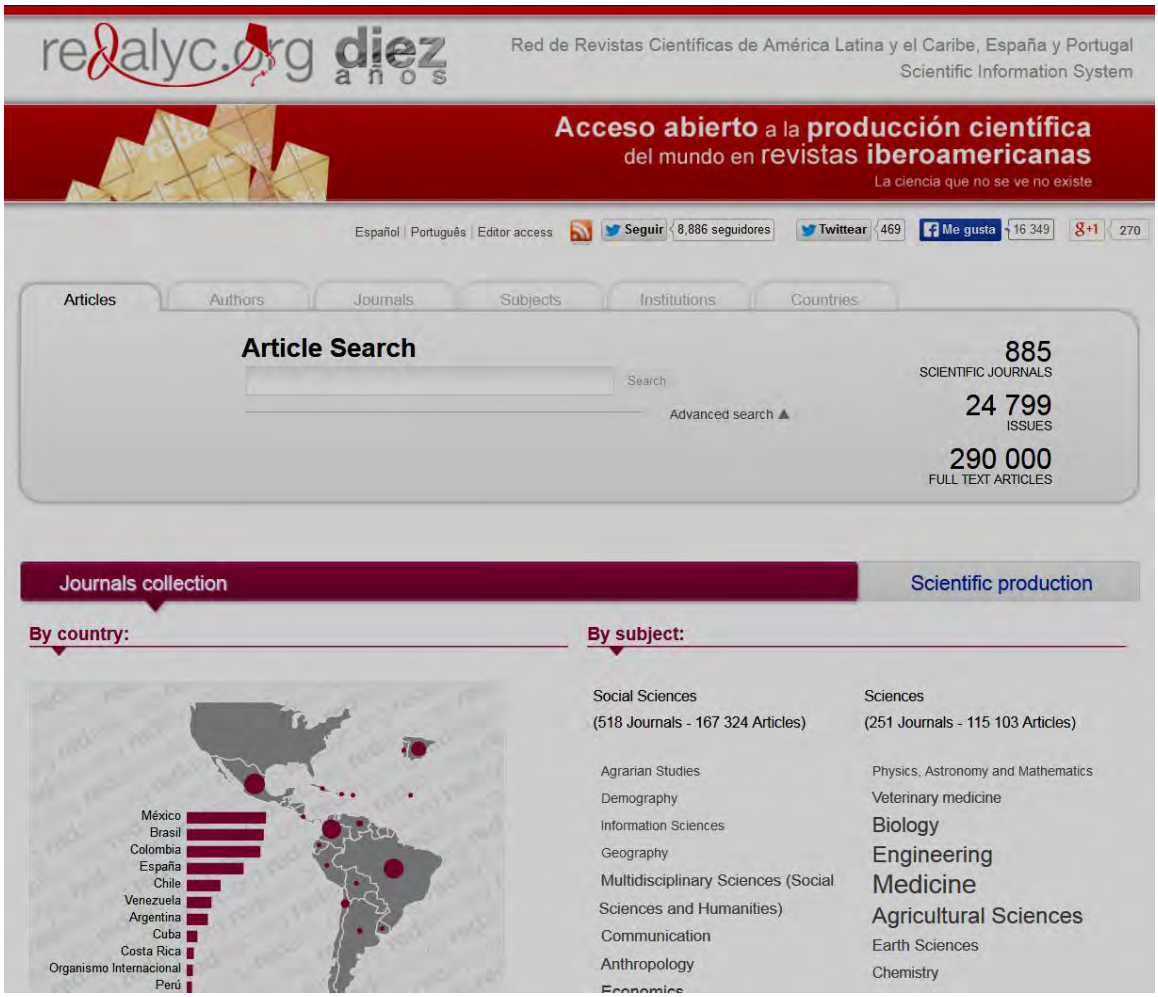


Figure 55: Homepage of Redalyc.org Scientific Information System

3.6 LET US SUM UP

In this Unit, you have learned use of different websites for creating researcher's unique identifiers and researcher's profile that help in disseminating your scholarly works to worldwide communities. Researchers can interact, collaborate, share and seek professional advice from peer-group members through academic social networking websites. More you share in social media and social bookmarking websites about your recently published works, more likely you will get higher citations and higher counts in article level metrics of your papers.

Many online journal publishers are providing article metrics along with article page of every published article. This helps authors to know social impact or social acceptance of that particular paper. Other researchers also can identify highly popular or highly downloaded papers in a journal.

The emergence of article level metrics or altmetrics has been taken seriously by science publishers, research academies, scientific societies and research funding agencies. However, open access journals and online journals published from developing countries are yet to provide article level metrics in the journals' respective article page. This sector is expected to grow in higher pace. On the other hand, we also have observed that papers contributed by scientists from the developed nations have much higher altmetric score than papers contributed by scientists from the developing nations. This is due to lower presence of scientists from developing nations in social media space. The science blogging and social bookmarking by researchers located in developing countries and their social media presence are also expected to grow in this decade.

3.7 CHECK YOUR PROGRESS

1) What is the regional focus of SciELO database?
   i) Africa
   ii) North America
   iii) Asia and Oceania
   iv) Ibero America

2) What is the regional focus of SciELO database?
   i) North America
   ii) Africa
   iii) Latin America
   iv) Europe

3) Which company did introduce ResearcherID?
   i) Institute for Scientific Information
   ii) Thomson Reuters
   iii) Elsevier
   v) Springer

4) Which count is not included in an altmetric score?
   i) Facebook/Twitter share
   ii) PDF downloads
   iii) Mendeley save
   v) *Scopus* citations

5) Where do you find papers indicating 'highly saved'?
   i) Academia.Edu
   ii) ResearchGate.net
   iii) ORCID.org
   vi) ImpactStory.org

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 learn more about how these products can be used for measurement of articles and contributors.

- *Alternate Routes: Journal Metrics Revisited* **Video**[43]
- *Altmetric for librarians* **Video**[44]
- *Altmetric It: find the discussions around scientific papers* **Video**[45]
- *Article level metrics for publishers by Altmetric* **Video**[46]
- *Article-Level Metrics at PLOS & Beyond* **Video**[47]
- *How to use the SSRN (Social Science Research Network)* **Video**[48]
- *Open Researcher Contributor ID (ORCID)* **Video**[49]

[43] http://www.youtube.com/watch?v=B7WRbybStps
[44] http://www.youtube.com/watch?v=RzVxoUx9tfc
[45] http://www.youtube.com/watch?v=_Alsg7AyrhM
[46] http://www.youtube.com/watch?v=XE8hDetxEt0
[47] http://vimeo.com/40871077
[48] http://www.youtube.com/watch?v=HUWrcszyDQM
[49] http://www.youtube.com/watch?v=fqXQnHz2OYE

UNIT 4 ONLINE CITATION AND REFERENCE MANAGEMENT TOOLS

Structure

4.0 INTRODUCTION

The article level metrics, as discussed in Unit 3 of this Module, emphasises saving of a bibliographic record of a paper in online reference management tools freely available to researchers across the world. The article metrics tools Altmetric.com and ImpactStory.org specifically count 'saving' or social bookmarking of a particular reference in online reference managers at CiteULike.org[50] and Mendeley[51].com. This 'saving' can occur in an individual researcher's online library or a group's online library.

You may recall an Altmetric Badge that mentions "52 readers on Mendeley, 33 readers on CiteULike". This indicates the number of times a particular article is saved or social bookmarked by different users or e-groups in the respective websites.

This Unit highlights five freely available online reference managers, namely, Mendeley, CiteULike, Zotero[52], Google Scholar Library and EndNote Basic. Of these five online reference managers, two have launched freely available desktop reference management software which can connect to their respective online databases and pull matching records to desktop system. The desktop version of reference managers freely available to researchers are: Mendeley and Zotero.

[50] http://www.citeulike.org/
[51] http://www.mendeley.com/en/2/1/
[52] https://www.zotero.org/

4.1 LEARNING OUTCOMES

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

- Use online and desktop versions of reference managers for organizing your references, list of publications, reading lists and citations; and
- Use collaboration features of online reference managers for discussing professional or scholarly matters.

4.2 ONLINE CITATION AND REFERENCE MANAGEMENT TOOLS

Literature search is a continuous process in a researcher's life. Quantum of literature ~~is~~ available to a senior researcher is very high. Keeping all gathered literature systematically in a single place for easy retrieval and citation is a very laborious and time-consuming task. In the collection of a senior researcher with a significant number of publications, there will be enough materials that are related to his past research works, ongoing research works and forthcoming research works. Many of his past research works also got published and received a number of cited references. On the other hand, his published papers have also citing references figuring in his own papers. So, this senior researcher now has a large collection of literature from past, ongoing and forthcoming research works plus cited references. Figure 56 depicts quantum of research literatures available with a senior researcher.

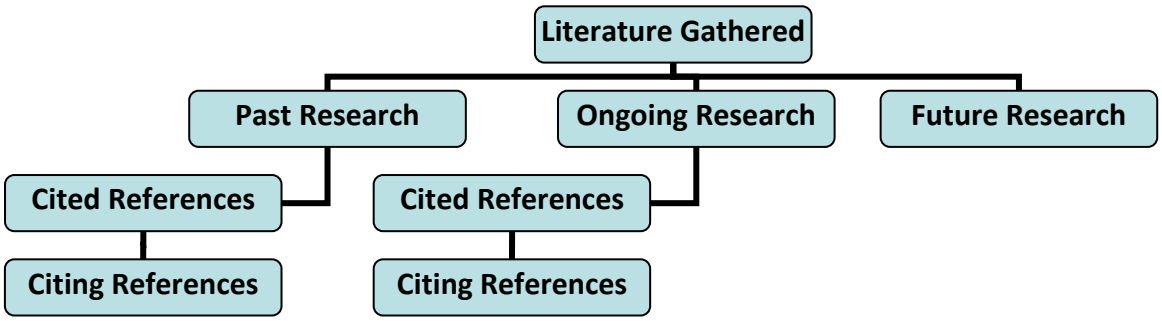


Figure 56: Research Literature and References Available to a Senior Researcher

Now, the major task for a researcher is to systematically arrange and keep all these gathered literatures in a single place. In early years of a researcher's professional life, these papers were made available in computer folders or tagged printed folders, based on the format of each paper. There is always a possibility of getting lost full-text contents of some important papers in paper-based filing system. Hence, a number of reference management software (both proprietary and open source) has come up to aid researchers. Since the beginning of the twenty-first century, a number of web-based solutions related to online reference management have become available to the communities of researchers. The best part of these web-based solutions is that these websites are freely available to global researchers engaged in collaborative research projects. One researcher can save bibliographic information of a collection of research papers and then can share this collection to his collaborative research

partners or co-authors. Some web-based services also help a researcher in saving bibliographic information of all his published papers, cited references and citing references, so that he/she can easily retrieve, view, read or share a relevant paper.

Table 22 shows commonly used online reference managers freely available to the researchers around the world. These web-based platforms help researchers collect, save, retrieve and share references for future works as well as enrichment with social bookmarking of bibliographic information. Some of the platforms offer functionality of creation and participation in social groups, where research collaborators can participate in interactive group for collaborative knowledge creation. These platforms also help researchers ~~to~~ connect to online bibliographic and citation databases and collect bibliographic records from these databases. The online reference managers mentioned in Table 22 are Mendeley, CiteULike, Zotero, EndNoteBasic and Google Scholar Library. As indicated in Table 22, some of them have their respective Bookmarklet to gather bibliographic information from an article's webpage of an online journal, and save this bibliographic record in signed-in library of the user. These five online platforms are discussed in detail in the following Sections. Some online reference managers also have desktop applications to help a researcher in maintaining a library of bibliographic records in researcher's personal computer or local disks. Desktop applications from Mendeley and Zotero are freely available, whereas EndNote has a priced software application.

Table 23 shows an indicative list of related products available to the researchers' communities. Two desktop reference managers, namely BibExcel and Publish or Perish (PoP) Software – both are available freely, but have somewhat different functionalities. PoP software is discussed in Unit 23 of this Module. RefWorks is another useful online reference manager only available to its customers through subscription or an annual fee.

Table 22: Freely Available Common Online Reference Managers

	Mendeley	**CiteULike**	**Zotero**	**EndNoteBasic**	**Google Scholar Library**
Target Group	Academics: researchers, students	Academics: researchers, students	Academics: researchers, students	Academics: researchers, students	Academics: researchers, students
Founded/ Launched	2007	2004	2006	2013	2013
Mission	Making science more open and collabo-rative.	To help you ~~to~~ store, organise and share the scholarly papers you are reading.	To help you collect, organize, and analyze research papers and share them in a variety of ways.	To support the advancement of science and research community with tools needed to accomplish individual, institutional and societal goals.	Your personal collection of articles in Scholar.

Owner Company/ Developer	Elsevier	Oversity Limited	Center for History and New Media at GMU, USA	Thomson Reuters	Google Inc.
Desktop Version	Yes (Free)	No	Yes (Open Source)	Yes (Priced)	No
Website	Mendeley.com	CiteULike.org	Zotero.org	Myendnoteweb.com	Scholar.google.com
Add to Altmetric Score	Yes	Yes	No	No	No
Create Social Groups	Yes	Yes	Yes	No	No
Bookmarklet	Yes	Yes	Yes	Yes	No

Table 23: Similar Products (Reference Managers) Available to Researchers

Name	Website	Owner Company/ Developer	Desktop Version	Type
BibExcel	www8.umu.se/inforsk/Bibexcel/	Olle Persson, Inforsk, Umeå Univ, Sweden	Yes	Open Source
Publish or Perish (PoP) Software	www.harzing.com/pop.htm	Anne-Wil Harzing	Yes	Proprietary, Free
RefWorks	www.refworks-cos.com/refworks/	ProQuest	No	Online

4.2.1 Mendeley

The Mendeley is one of the most preferred online reference managers freely available to researchers across the world. Launched in 2007, it was later acquired by Elsevier B.V. – the owner company of online products – *Scopus* and *ScienceDirect*. Mendeley became leading online reference manager and PDF organizer, in terms of its popularity amongst researchers and academics. Any researcher can create a free online account in Mendeley platform, store bibliographic records as well as full-text documents in PDF or other formats and later retrieve those saved documents as per their research requirements. A personal library of a user can store all downloaded or collected literature one uses in ongoing, past or forthcoming research projects. Mendeley offers 2GB (gigabytes) personal storage space, where you can store full-text documents up to that cumulative file size limit, and 100MB (megabytes) shared storage space, where you can share full-text documents up to that cumulative file size limit. However, beyond this limit you have options to upgrade to their value-added services with a monthly or an annual price plan, namely, Mendeley Premium Packages and Mendeley Institutional Edition.

Figure 57 shows basic features of Mendeley web reference managers. Mendeley desktop application and a plug-in application for MS-Word and MS Internet Explorer can be freely downloaded. After installation in your computer of these two applications, you can synchronize your online collection

or personal library with your desktop collection. The software helps in creating bibliographies in any popular referencing or citation style, such as APA 6th Edition, MLA Style or Chicago Style. Mendeley web also helps in creating collaborative bibliographies with references shared by different members of an e-group.

Figure 58 shows basic features of Mendeley desktop application. Mendeley desktop is one of the most downloaded reference management software, where a user can organize his/her PDF collections and add annotated notes in each document file. It also has full-text search facility so that a user can easily retrieve a particular document having matching texts. Mendeley desktop facilitates web-searching of references from online databases and search engines, and retrieves search result in the application window. Figure 59 shows a screenshot of a literature search session using Mendeley desktop. This search result also helps a user to download full-text documents from online resources.

Figure 60 shows how Mendeley bookmarklet is used to import a citation from a publisher's article page and save it to a user account in Mendeley web. Figure 61 shows a popular online group Altmetrics that facilitates social sharing or social bookmarking of scholarly works on article metrics and other related concepts. An e-group also facilitates its members in online discussions, group work and research collaboration. An e-group can be created in Mendeley as an open group with open participation from anybody registered in Mendeley web, or a close group with participation by invitation only.

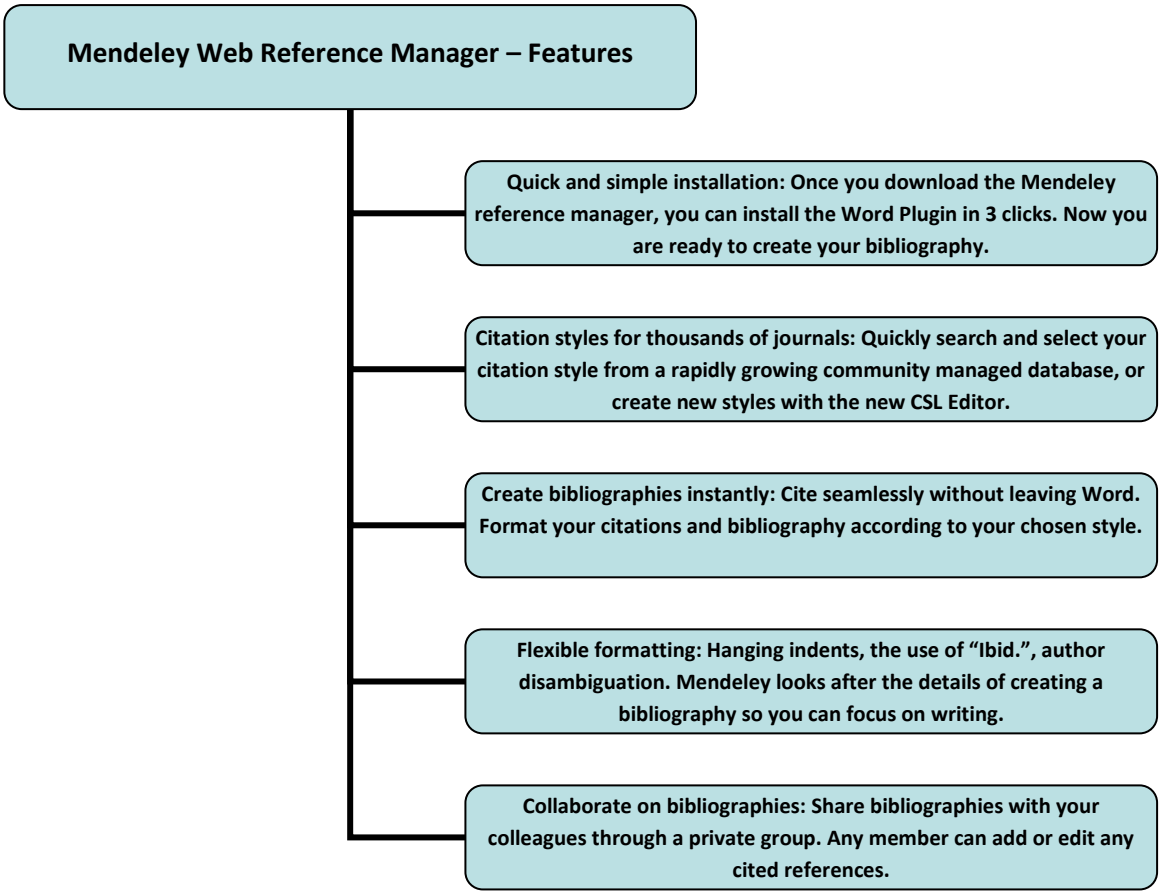


Figure 57: Basic Features of Mendeley Web Reference Manager

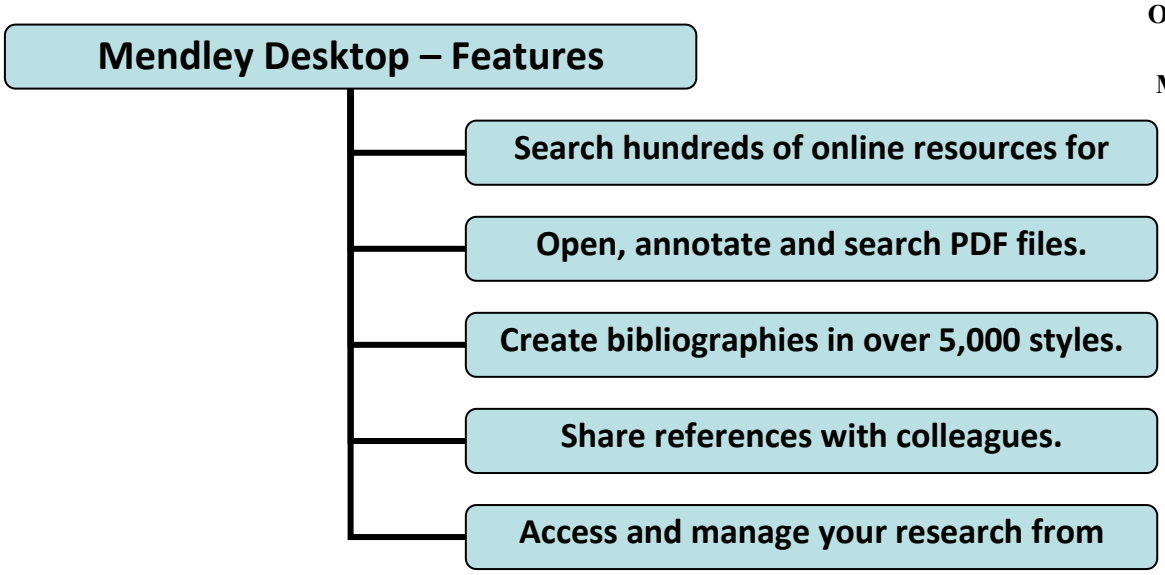


Figure 58: Basic Features of Mendeley Desktop Reference Manager

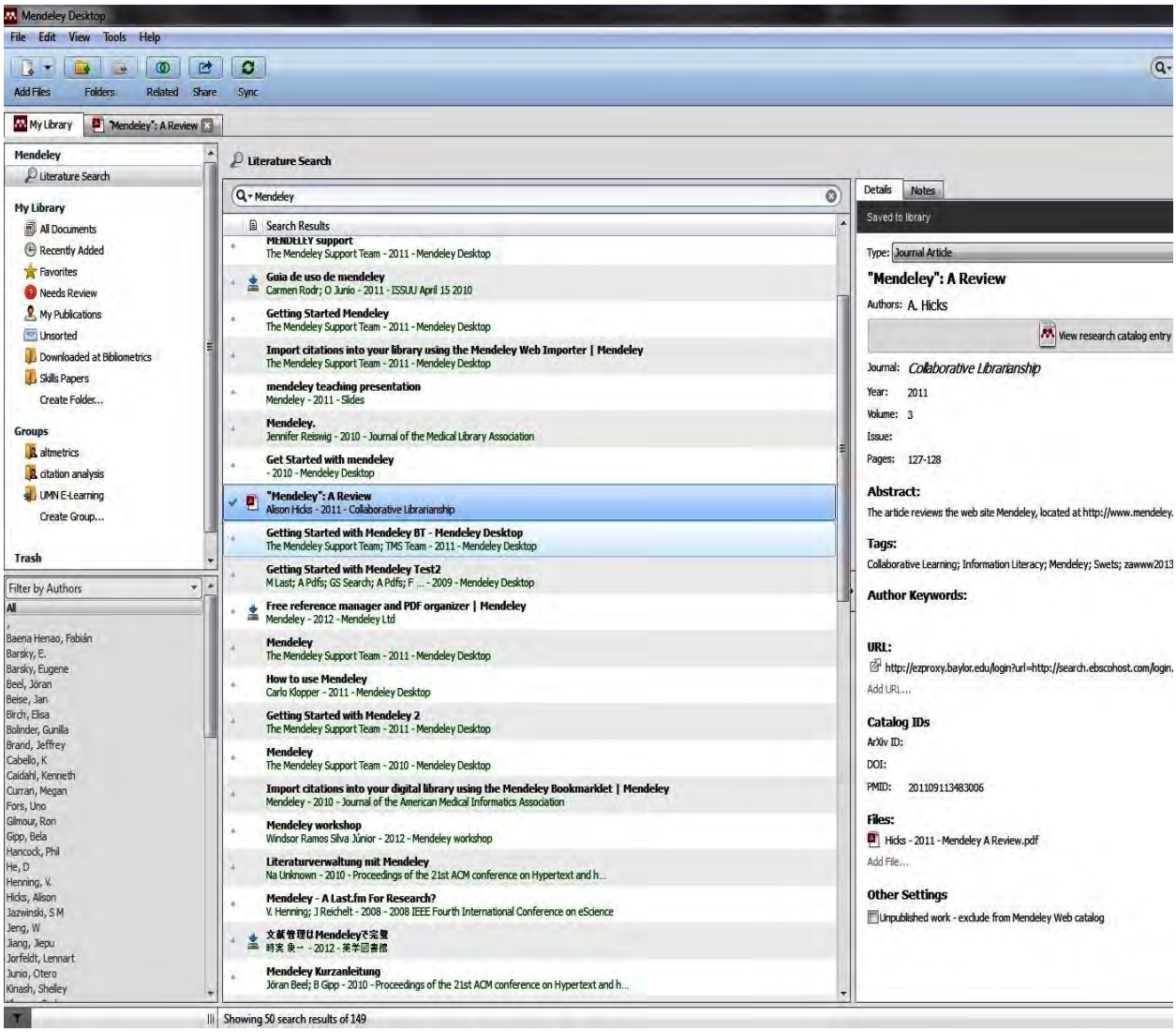


Figure 59: Literature Search using Mendeley Desktop

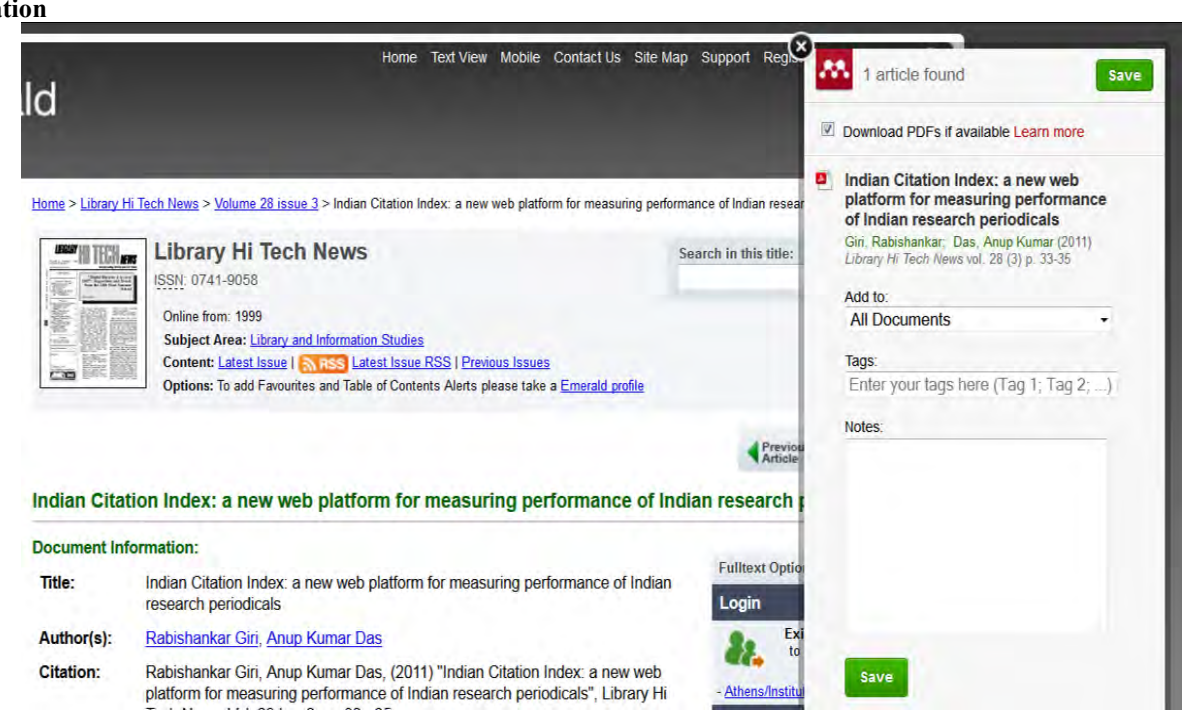


Figure 60: Use of Mendeley Bookmarklet to Import Citation to a User Account

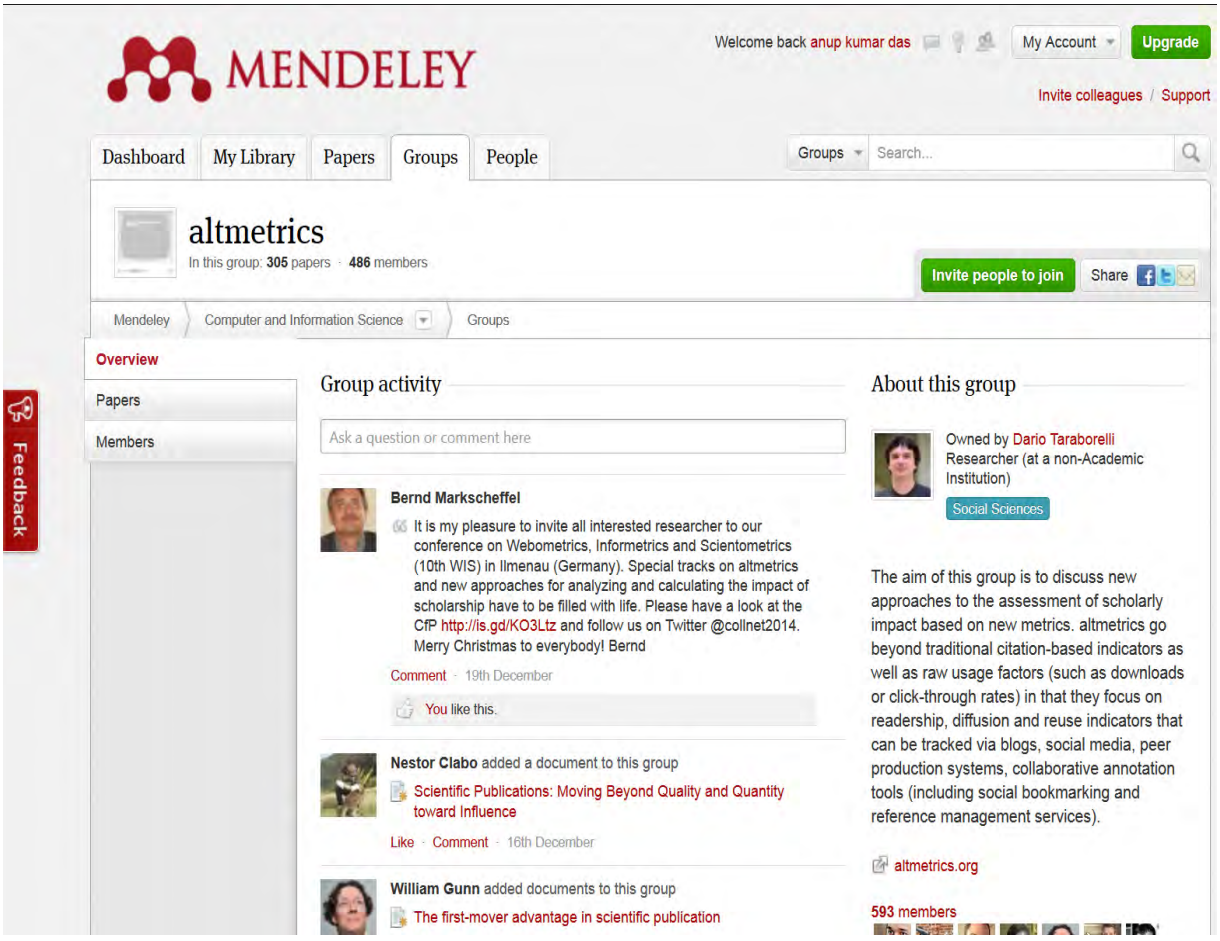


Figure 61: A Mendeley Group – Altmetrics

4.2.2 CiteULike

The CiteULike is another most preferred online reference manager freely available to researchers across the world. Launched in 2004, CiteULike became pioneer in offering services of online reference manager and PDF organizer. It became very popular since its inception amongst researchers and academics. Any researcher can create a free online account in CiteULike platform, store bibliographic records as well as full-text documents in PDF or other formats and later retrieve those saved documents as per their research requirements. MyCiteULike, the personalized profile of a registered user in CiteULike website, provides the following information:

- Latest News (latest forum message)
- Recommendations
- Library
  - Most recent entry
- Activity (most recent entry in each of your groups and connections)
  - Connections
  - Groups
- Watchlist, and
- CiteGeist (Most frequently posted articles during the past week).

It has many functionalities similar to Mendeley web. Figure 62 highlights basic features of CiteULike web reference manager. A CiteULike bookmarklet is also available to CiteULike users to import a citation from a publisher's article page and save it to a user account in CiteULike web. Figure 64 shows an online group that facilitates social sharing or social bookmarking of scholarly papers in a subject area related to that group. A user can search and join an existing e-group based on his/her research interests. A user can also create a new e-group and send invitations to registered CiteULike members with similar research interests for collaborative creation of online bibliographies. As seen in Figure 64, CiteULike accepts online advertisements for its sustainability offers free services to its registered users.

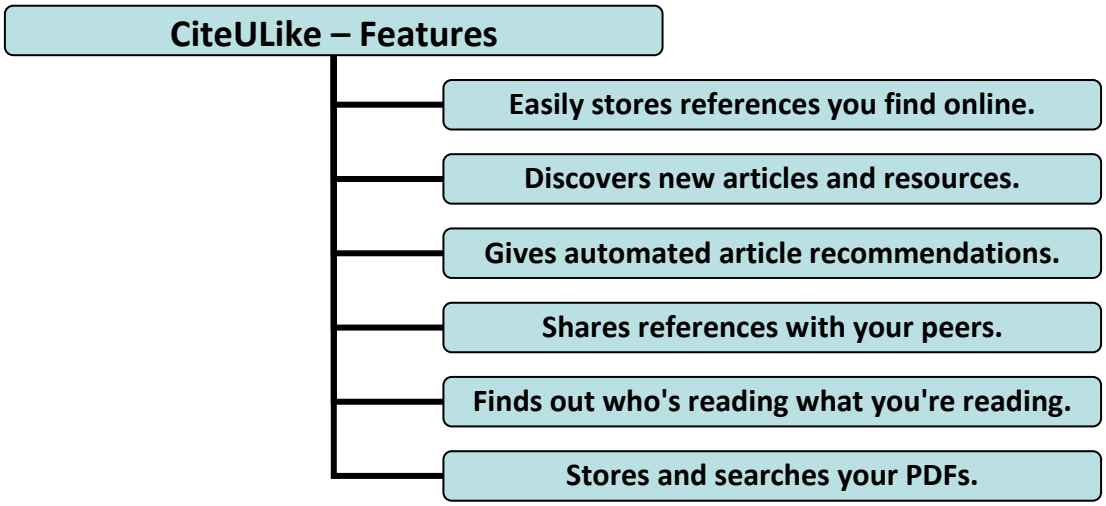


Figure 62: Basic Features of CiteULike Web Reference Manager

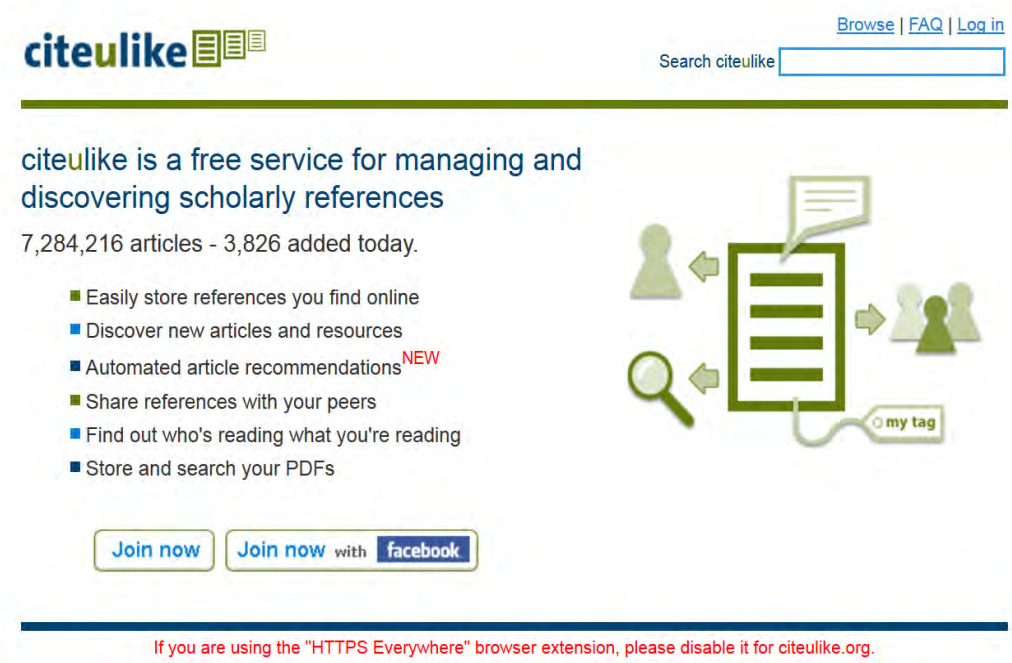


Figure 63: Homepage of CiteULike Website, Linking to User Joining Page

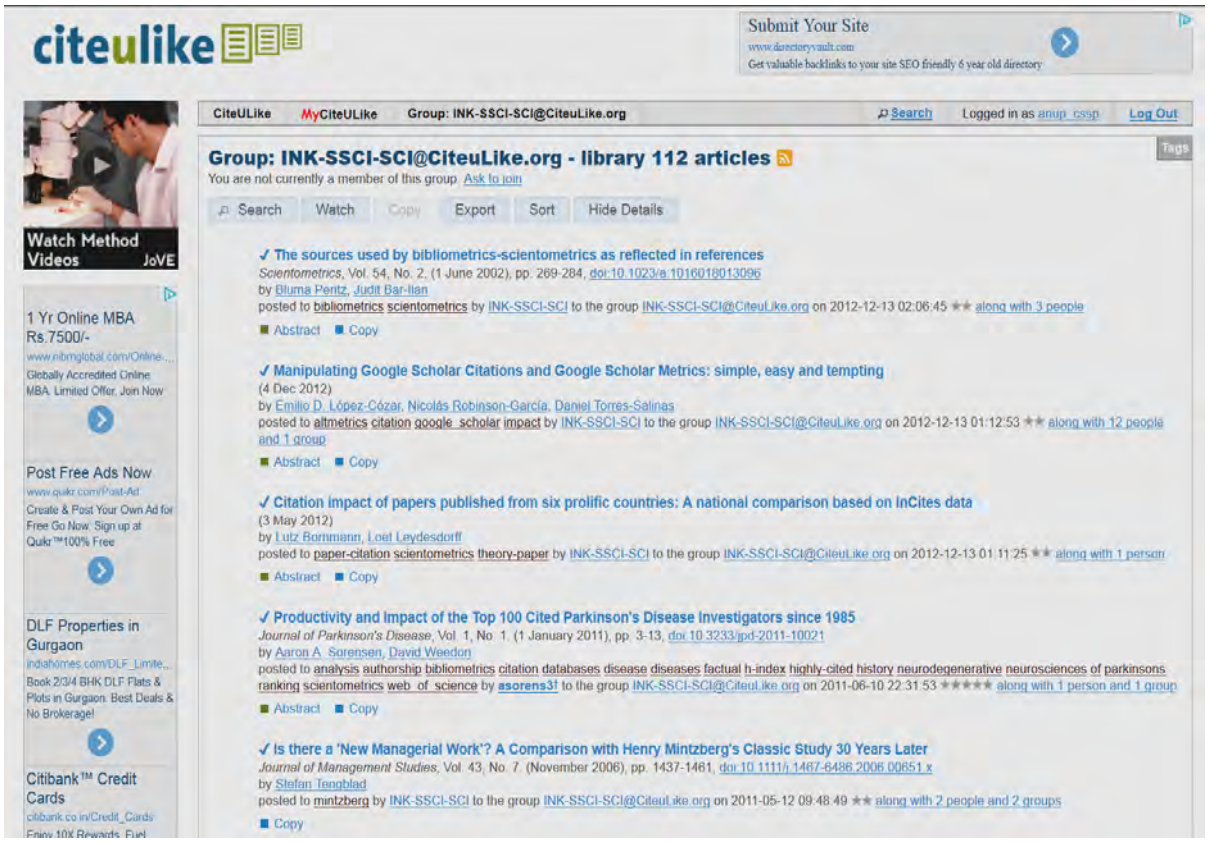


Figure 64: Articles Saved by a CiteULike Group

4.2.3 Zotero

The Zotero is another online reference manager freely available to researchers across the world. It was launched in 2006 as a project of the Roy Rosenzweig Center for History and New Media in George Mason University in the United States, with its web-based solution as well as desktop open source application for reference management and PDF organizer. It has become popular amongst researchers and academics in many countries. Any researcher can create a free online account in Zotero platform, store bibliographic records as well as full-text documents in PDF or other formats and later retrieve those saved documents as per their research requirements. Any researcher can freely download Zotero desktop application for reference management and organizing full-text documents in a desktop environment. Zotero bookmarklet is also available to Zotero users to import a citation from a publisher's article page and save it to a user account in Zotero web. Zotero website helps a registered user to maintain a personalized library with a collection of scholarly works he collected from different online databases and online journals. A registered user then can organize, analyse and share papers from his collection in variety of ways, such as sharing in online groups. Text Box 7 elaborates basic functions of Zotero web platform. It helps a registered user to collect, organize, cite, and synchronize references of scholarly works and collaborate with research groups and online forums for knowledge enrichment.

Figure 65 shows homepage of Zotero website, indicating different functionalities and collaborative tools available to a registered user. This page also links to My Library and Groups available to a user. Figure 66 shows a searchable collection of papers in My Library using Zotero desktop application. Similar to Mendeley, Zotero desktop also imports references saved in its online collection at My Library of Zotero web platform.

Text Box 7: Basic Functions of Zotero

COLLECT – Grab your research with a single click.

A personal research assistant. Zotero is the only research tool that automatically senses content in your web browser, allowing you to add it to your personal library with a single click. Whether you're searching for a preprint on arXiv.org, a journal article from JSTOR, a news story from the *New York Times*, or a book from your university library catalogue, Zotero has covered with support for thousands of sites.

Store anything. Zotero collects all your research in a single, searchable interface. You can add PDFs, images, audio and video files, snapshots of web pages, and really anything else. Zotero automatically indexes the full-text content of your library, enabling you to find exactly what you're looking for with just a few keystrokes.

ORGANIZE – It has never been easier to sort your research.

Say goodbye to folders. Zotero organizes your research into collections that act like iTunes playlists. Research items can be added to any number of named collections and sub-collections, which in turn can be organized in whatever way you like. With saved searches, you can create smart collections that automatically fill with relevant materials as you add them to your library.

Tag it. Assign tags to your library items to organize your research using your own keywords. The tag selector enables you to filter your library instantly to view matching items. Zotero can even use database and library data to tag items automatically as you add them.

CITE – You're never more than a click away from a bibliography.

Cite perfectly. Whether you need to create footnotes, endnotes, in-text citations, or bibliographies, Zotero will do all the dirty work for you, leaving you free to focus on your writing. Create citations in Word and OpenOffice without ever leaving your word processor and add references to an email, a Google Doc, or some other editor simply by dragging one or more references out of Zotero.

Always in style. Ready to submit your manuscript to Tropical Doctor or French Historical Studies? We've got you covered: with native integration of the powerful and flexible Citation Style Language (CSL). Zotero supports thousands of publication formats with more styles added daily.

SYNC – Your data is always where you need it.

Research everywhere. Zotero automatically synchronizes your data across as many devices as you choose. Add data to your research library on your work PC, and organize your collections of data on your home laptop. All of your notes, files, and bibliographic data remain seamlessly and silently up-to-date. Returning from field work? Your data will be waiting for you when you get home.

Painless data transfer. Upgrading to a new computer? Zotero will automatically pull down a complete copy of your research library from our server network. Even if you don't yet have Zotero installed, you can always access your research from any web browser in the world.

COLLABORATE – Work together and share with the world.

Works well with others. Create and join research groups to focus on any topic you choose. Each group can share its own research library, complete with files, bibliographic data, notes, and discussion threads. Tag and analyze your research together with others. Work with a single colleague or an entire class: Zotero groups can include as many members as you please.

Share with the world. Or not. Zotero groups can be private or public, open or closed. You decide. For example, you and a few colleagues might initially work on a research project in private. After publication, why not share your research notes and library with the world?

Source: www.zotero.org

A personal library of a user in Zotero web platform can store all downloaded or collected literatures as required in his ongoing, past or forthcoming research projects. Zotero offers 300 MB personal free storage space to every user, where you can store full-text contents up to that cumulative file size limit. Beyond this limit you have option to upgrade your storage with a monthly or an annual price plan.

Figure 65: Homepage of Zotero Website

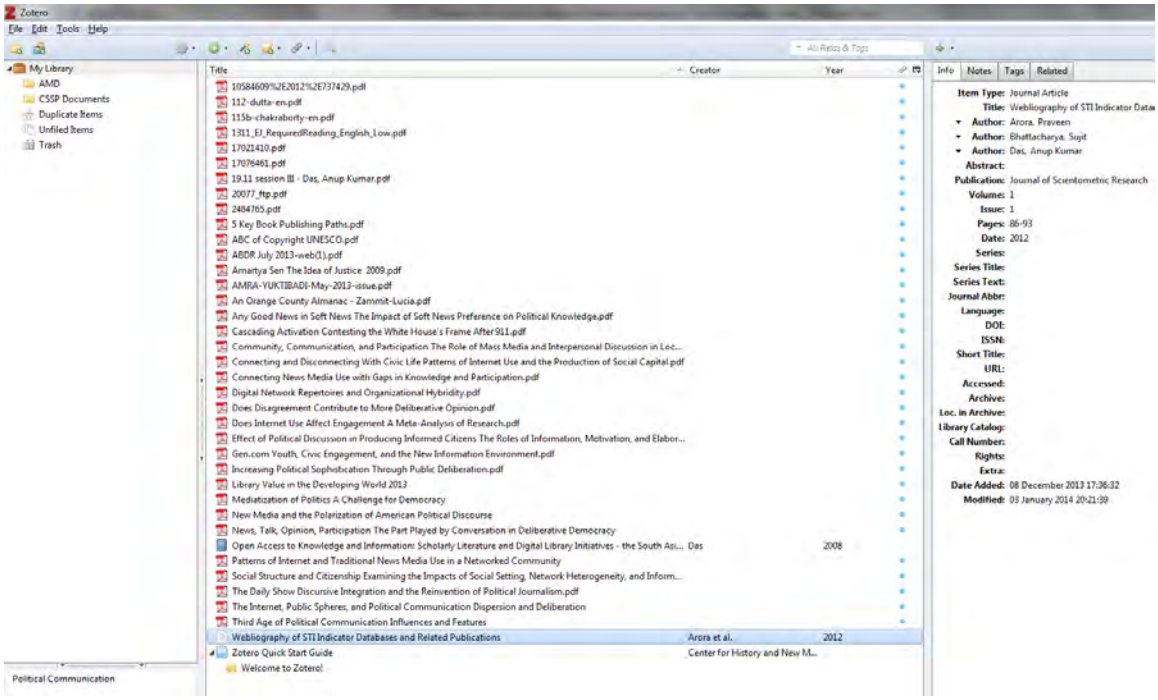
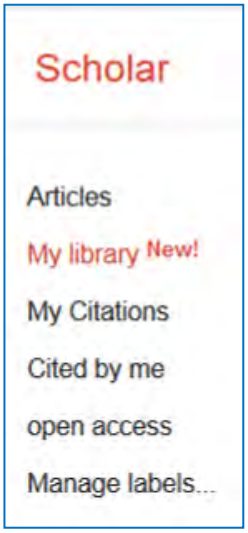


Figure 66: Searchable Collection of Papers in My Library using Zotero Desktop

4.2.4 Google Scholar Library

Launched on 19th November 2013, Google Scholar Library is a web-based reference management service linked to Google Scholar and Google Scholar Citations web services freely available to researchers and academics across the world. A registered user of Google or Gmail account can maintain a Google Scholar Library (GSL). It is a freely available service with functionalities of an online reference manager. However, GSL does not have functionalities of a PDF organizer, as available with Mendeley, CiteULike or Zotero.



While you search for documents through Google Scholar search engine, you will get many documents matching your search criteria. Click "Save" below a retrieved document in a search result to save it to your library named as "My library". Click "My library" to see all saved articles in your library, and then you will be able to search further from this collection. You can also use labels to organize your articles. If you are a registered user having a profile in Google Scholar Citations, then you will have some more personalized collection of bibliographic references. You have now, three labels, namely,

a) **My library**: It contains articles you've saved or cited. You can see all the articles in your library and search their full text. You can also use labels to organize your articles.

b) **My Citations**: It contains your profile articles.

c) **Cited by me**: It contains articles you've cited.

Figure 67 displays a Google Scholar Library of a registered user, showing all saved articles. If you want to know further bibliographic details of a saved paper, you can click on the title of the paper and then get a new page as shown in Figure 68 showing bibliographic details of a record in GSL.

The Google Scholar Library is expected to become very popular amongst researchers, academics and students communities and is also expected gain immense popularity similar to Google Scholar and Google Scholar Citations.

Find the article you want to add in Google Scholar and click the "Save" link under the search result. Then you get My Library similar to Figure 67.

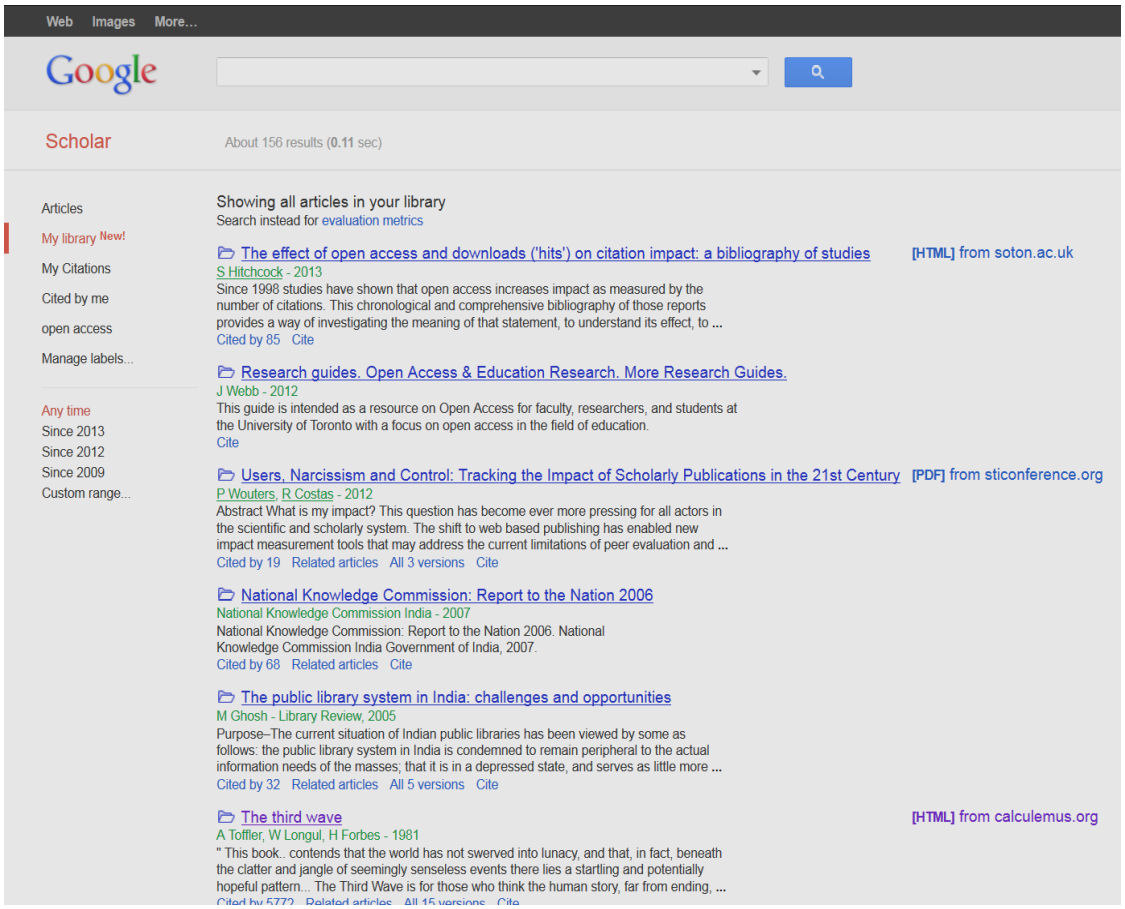


Figure 67: Showing All Saved Articles in Google Scholar Library

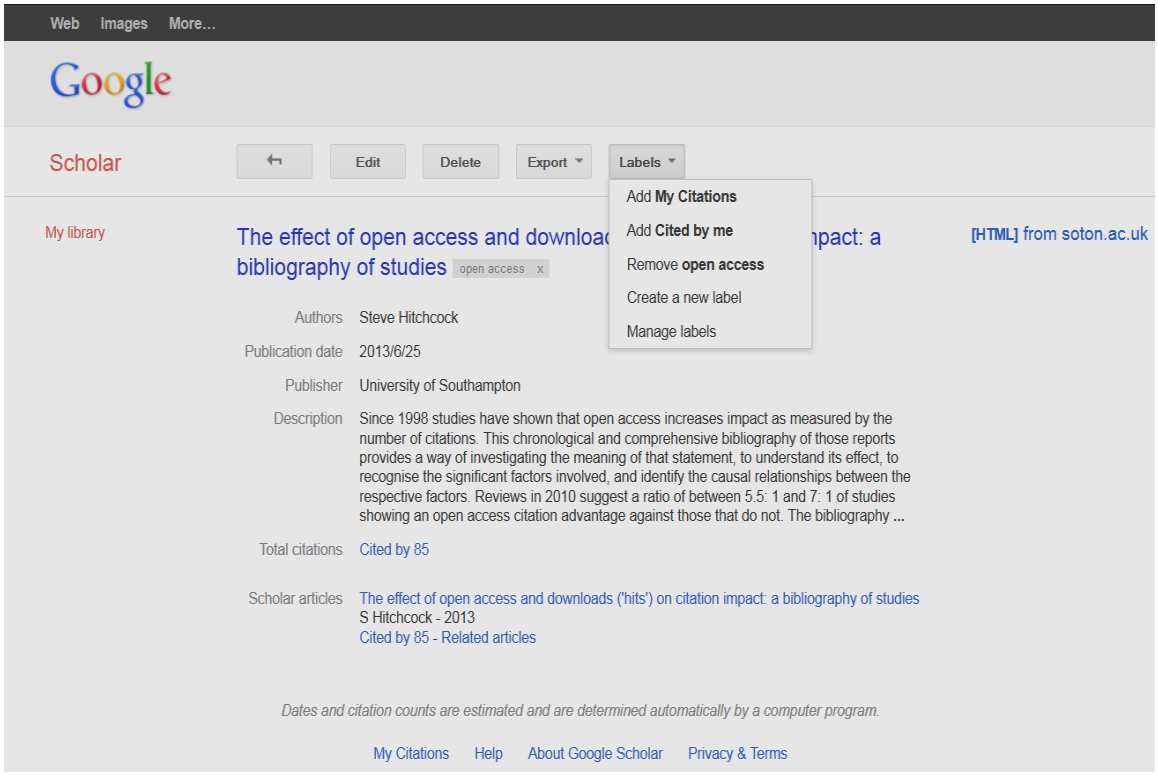


Figure 68: Showing Bibliographic Details of A Record in Google Scholar Library

4.2.5 EndNote Basic

The EndNote is well-known proprietary reference management software widely used by researchers across the world. In December 2006 the brand owner and developer Thomson Reuters launched a web-based version of EndNote, called EndNote Web. In April 2013 Thomson Reuters launched a free version of EndNote Web, called EndNote Basic – available to researchers across the world without any annual or monthly subscription charges. However, EndNote Basic has some limited functionalities as compared to its full-version. Similar to Mendeley and Zotero, EndNote Basic has less storage space to store full-text contents of references in a user's library collection. Table 24 shows different functionalities available to EndNote Basic vis-à-vis full-version. However, functionalities available with EndNote Basic are comparable with free versions of Mendeley and Zotero, in terms of storage space available to a free account.

EndNote Basic can gather bibliographic information using EndNote Bookmarklet from an article page of electronic journals and store this bibliographic record in your personal library available with your user account. EndNote Basic offers you a *Cite While You Write*™ plug-in for MS-Word. You can use the EndNote plug-in to insert references, and format citations and bibliographies automatically while you write your papers in Word. This plug-in also allows you to save online references to your library in Internet Explorer for Windows. Table 25 indicates basic functions of EndNote Basic, which include collection of references, organization of references, formatting a citation for preparation of a bibliography or citing in your paper based on standard citation styles.

Figure 69 shows the EndNote Basic sign-up page for creating a new free account at www.endnote.com/basic. This page also indicates functionalities available with a free account. Figure 70 indicates that a singed-in user account has two-type collections of bibliographic references, namely, (i) My References and (ii) My Publications. My References can host different collections with different tags or collection names. My Publications can give you full bibliographic information of your published works, usually gathered from your ResearcherID profile. You can upload full-text content in PDF and Figure, and attach them along with any stored reference in your library. Figure 71 indicates functioning of EndNote BookMarklet to capture a new reference from an article's web-page and store this bibliographic reference in your EndNote Basic account.

Table 24: Comparison between Features of EndNote Basic and EndNote Full version

EndNote Basic	EndNote Full-version
Free	Priced
Store up to 50,000 references.	Unlimited reference storage.
20 most popular bibliographic styles.	More than 5,000 bibliographic styles.
2GB of files storage.	5GB of file storage.
Online search of the 5 most popular databases.	Online search of several hundred databases.
Webpage reference capture.	Webpage reference capture.
These features are not available.	♦ Automatic reference updating. ♦ Annotate, and search PDF text, notes, and annotations. ♦ Complex bibliography handling tools. ♦ Multiple bibliographies capability. ♦ Composite references. ♦ Journal abbreviations recognition and standardization.

Table 25: Basic Features Available in EndNote Basic

COLLECT	ORGANIZE	FORMAT
Collects references from electronic and traditional sources. • Searches online database • Creates a reference manually • Imports references	***Organizes your references for your research topics and papers.*** • Creates a new group • Shares a group • Finds duplicate references	***Creates a formatted bibliography for your paper or cites references while you write.*** • Creates a formatted bibliography • *Cite While You Write*™ Plug-in • Formats a paper

Figure 69: EndNote Basic Sign-Up Page (at www.endnote.com/basic)

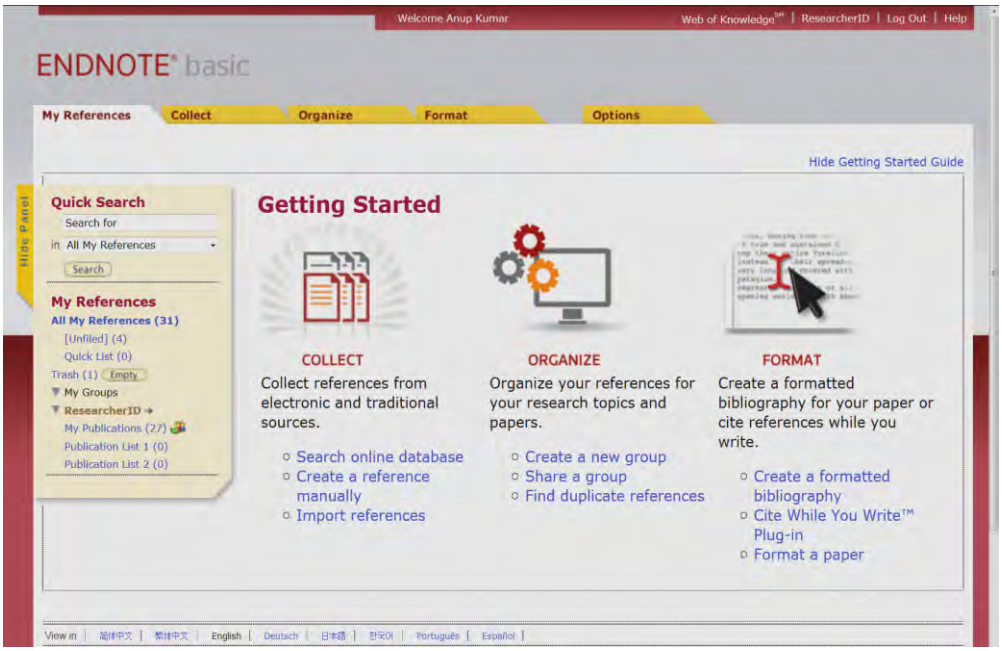


Figure 70: Homepage of EndNote Basic after Sign-In

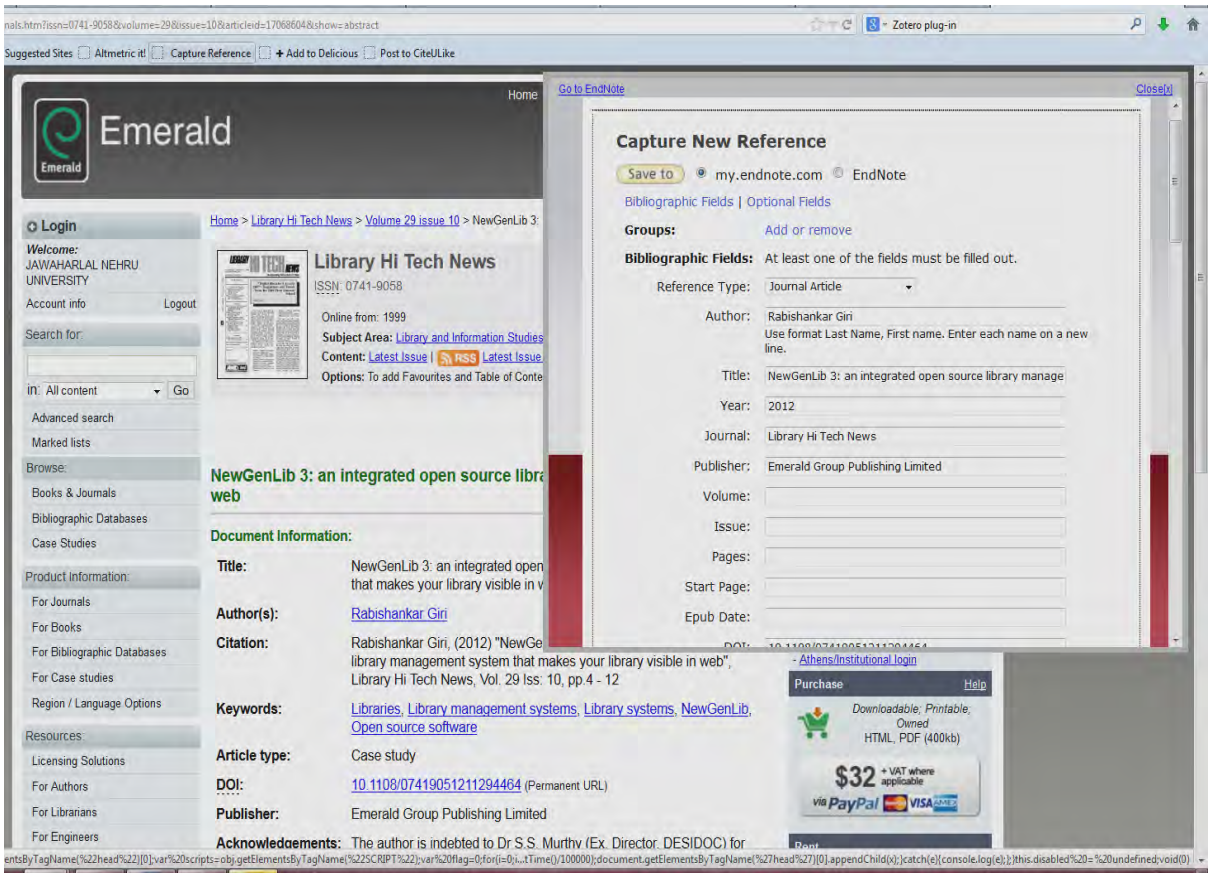


Figure 71: Capture New Reference using EndNote BookMarklet

4.3 LET US SUM UP

In this Unit, you have learned use of different online reference managers and PDF organizers for storing and managing bibliographic references in your online profile or online account. These online reference managers have options of creating free online account with certain free storage limit, similar to any other web-service giving free storage facilities with certain limit. You also have options to subscribe to an extra storage space and some other value-added services for a fee.

Some of these online reference managers also have free or open source desktop applications for maintaining references offline in your desktop computers. These desktop applications are very easy to download, use and sometimes easy to synchronize with your online collections or libraries linked to your user account.

In the Units 1-4 of this Module you have learned creation of personalized profiles or user account in the following websites as shown in Table 26 for different scholarly or academic purposes. You are now free to open your public profile online, let your list of publications and your research contributions globally visible, and collaborate with researchers across the world.

Table 26: Personalized Public Profile of Researchers in Academic Websites

Website	Main Purpose	Global Visibility of Your Public Profile
ResearchGate	Academic Social Networking	Yes
Getcited.org	Academic Social Networking	Yes
Acadmica.Edu	Academic Social Networking	Yes
ImpactStory	Citations Tracking; Article Level Metrics of Your Publications	Yes
Google Scholar Citations	Citations Tracking; Online Reference Manager	Yes
ORCID.org	Authors' Registry with Unique Identifiers	Yes
ResearcherID	Authors' Registry with Unique Identifiers	Yes
EndNote Basic	Online Reference Manager	No
CiteULike.org	Online Reference Manager	Yes
Mendeley	Online Reference Manager; Academic Social Networking	Yes
Zotero	Online Reference Manager; Academic Social Networking	Yes

4.4 CHECK YOUR PROGRESS

1) How much free storage space is available to a user in *Mendeley* web?
   i) 2 GB
   ii) 3 GB
   iii) 300 MB
   iv) 200 MB

2) Which company does presently own Mendeley?
   i) Institute for Scientific Information
   ii) Thomson Reuters
   iii) Elsevier
   iv) Springer

3) Which company did introduce EndNote Basic?
   i) Institute for Scientific Information
   ii) Thomson Reuters
   iii) Elsevier
   iv) Springer

4) How much free storage space is available to a user in EndNote Basic?
   i) 2 GB
   ii) 3 GB
   iii) 4 GB
   v) 8 GB

5) How much free storage space is available to a user in Zotero web?
   i) 2 GB
   ii) 3 GB
   iii) 300 MB
   iv) 200 MB

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 individuals and libraries. Now, you learn more about how these products can be used for measurement of scholarly communications and for evaluating research or researchers.

- *A tour of CiteULike* **Video**[53]
- *EndNote Basic (formerly EndNote Web) Express Training* **Video**[54]
- *Getting Started with Zotero: Using Zotero Standalone* **Video**[55]
- *Google Scholar "My Citations" Tutorial* **Video**[56]
- *Mendeley Reference Manager Tutorial* **Video**[57]
- *Zotero Screencast Tutorual* **Video**[58]

[53] http://www.youtube.com/watch?v=LkNeEUV4sPs
[54] http://vimeo.com/68250018
[55] http://www.youtube.com/watch?v=H8UTehdF92s
[56] http://www.youtube.com/watch?v=cV4N6pl1FgU
[57] http://www.youtube.com/watch?v=K9J6mVyWIVY

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

REFERENCES AND FURTHER READINGS

Adie, E., & Roe, W. (2013). Altmetric: Enriching Scholarly Content with Article-Level Discussion and Metrics. *Learned Publishing*, *26*(1), 11-17.

Bailón-Moreno, R., Jurado-Alameda, E., Ruiz-Baños, R., & Courtial, J. P. (2005). Bibliometric laws: Empirical flaws of fit. *Scientometrics*, *63*(2), 209-229. Retrieved from http://eprints.rclis.org/12847/1/Bailon-Moreno,_R_.pdf.

Bogers, T., & Van den Bosch, A. (2008). Recommending Scientific Articles Using Citeulike. In *Proceedings of the 2008 ACM Conference on Recommender Systems* (pp. 287-290).

Campanario, J.M. (2003). Citation Analysis. In: *International Encyclopaedia of Information and Library Science*, 2nd edition. London: Routledge.

Colledge, Lisa et. al. (2010). SJR and SNIP: two new journal metrics in Elsevier's *Scopus*. *Serials*, 23(3), 215-221. Retrieved from http://uksg.metapress.com/content/31814565236758v6/fulltext.pdf

Das, A.K., Arora, P. & Bhattacharya, S (2012). Webliography of STI Indicator Databases and Related Publications. *Journal of Scientometric Research*, 1(1), 86-93.

DORA (2012). *The San Francisco Declaration on Research Assessment (DORA)*. USA: American Society for Cell Biology (ASCB). Retrieved from http://www.ascb.org/dora/files/SFDeclarationFINAL.pdf

Drott, M. C. (1981). Bradford's Law: Theory, Empiricism and the Gaps Between. *Library Trends*, *30*(1), 41-52. Retrieved from www.ideals.illinois.edu/bitstream/handle/2142/7189/librarytrendsv30i1_opt.pdf.

Egghe, L. (2006). Theory and practise of the g-index. *Scientometrics*, 69(1), 131-152.

Garfield, Eugene (1994). Expected Citation Rates, Half-Life, and Impact Ratios: Comparing Apples to Apples in Evaluation Research. *Current Contents*, Retrieved from http://wokinfo.com/essays/expected-citation-rates/.

Garfield, Eugene (1994). The Concept of Citation Indexing: A Unique and Innovative Tool for Navigating the Research Literature. *Current Contents*, Retrieved from http://wokinfo.com/essays/concept-of-citation-indexing/.

Garfield, Eugene (2010). The Evolution of the *Science Citation Index*. *International Microbiology*, 10(1): 65-69. doi:10.2436/20.1501.01.10. Retrieved from:http://garfield.library.upenn.edu/papers/barcelona2007a.pdf.

Gilmour, Ron & Cobus-Kuo, Laura (2011). Reference Management Software: a Comparative Analysis of Four Products. *Issues in Science and Technology Librarianship*. Retrieved from http://www.istl.org/11-summer/refereed2.html.

Giri, R.S. & Das, A.K. (2011). *Indian Citation Index*: A *New Web Platform for Measuring Performance of Indian Research Periodicals. Library Hi Tech News*, 28(3), 33-35.

Harzing, Anne-Wil (2010). *The Publish or Perish Book: Your Guide to Effective and Responsible Citation Analysis*. Melbourne, Australia: Tarma Software Research.

Hirsch, J. E. (2005). An index to quantify an individual's scientific research output. *Proceedings of the National Academy of Sciences of the United States of America*, 102(46), 16569. Retrieved from http://arxiv.org/abs/physics/0508025

Iribarren-Maestro, I.; Lascurain-Sánchez, M.L. & Sanz-Casado, E. (2009). The Use of Bibliometric Techniques in Evaluating Social Sciences and

Humanities. In: *Celebrating Scholarly Communication Studies: A Festschrift for Olle Persson at his 60th Birthday*. Retrieved from http://www8.umu.se/inforsk/Bibexcel/ollepersson60.pdf.

Katz, J. Sylvan (1999). *Bibliometric Indicators and the Social Sciences*. UK: ESRC/ SPRU, University of Sussex. Retrieved from http://www.sussex.ac.uk/Users/sylvank/pubs/ESRC.pdf.

Li, X., Thelwall, M., & Giustini, D. (2012). Validating Online Reference Managers for Scholarly Impact Measurement. *Scientometrics*, *91*(2), 461-471.

LSE Public Policy Group (2011). *Maximizing the Impacts of Your Research: A Handbook for Social Scientists.* London: London School of Economics. Retrieved from http://www.lse.ac.uk/government/research/resgroups/LSEPublicPolicy/Docs/LSE_Impact_Handbook_April_2011.pdf.

Moed, Henk F. (2005). *Citation Analysis in Research Evaluation*. Dordrecht, The Netherlands: Springer.

Pendlebury, David A. (2008). *Using Bibliometrics in Evaluating Research*. Retrieved from http://wokinfo.com/media/mtrp/UsingBibliometricsinEval_WP.pdf.

Persson, O.; Danell, R. & Schneider, J.W. (2009). How to use Bibexcel for various types of bibliometric analysis. In: *Celebrating Scholarly Communication Studies: A Festschrift for Olle Persson at his 60th Birthday*. Retrieved from http://www8.umu.se/inforsk/Bibexcel/ollepersson60.pdf. .

Piwowar, Heather (2013). Altmetrics: Value all research products. *Nature*, 493(7431), 159-159.

Piwowar, Heather (2013). Introduction to altmetrics: What, why and where? *Bulletin of the American Society for Information Science and Technology*, *39*(4), 8-9.

Poiter, W. G. (1981). Lotka's law revisited. *Library Trends*, *30*(1), 21-39. Retrieved from www.ideals.illinois.edu/bitstream/handle/2142/7189/librarytrendsv30i1_opt.pdf.

Priem, J., Piwowar, H. A., & Hemminger, B. M. (2012). Altmetrics in the wild: Using social media to explore scholarly impact. *arXiv preprint,* arXiv:1203.4745. Retrieved from Web. 2014.

Priem, J., Taraborelli, D., Groth, P., & Neylon, C. (2010). *Altmetrics: A Manifesto*. Retrieved from http://altmetrics.org/manifesto/

Prytherch, R.J. (2005). *Harrod's Librarians' Glossary and Reference Book: A Dictionary of Over 10,200 Terms, Organizations, Projects and Acronyms in the Areas of Information Management, Library Science, Publishing and Archive Management*. 10th ed. Hampshire, England: Ashgate Publishing.

Reitz, Joan M. (2013). *Online Dictionary for Library and Information Science*. Retrieved from http://www.abc-clio.com/ODLIS/searchODLIS.aspx

Smith, L.C. (1981). Citation Analysis. *Library Trends*, *30*(1), 83-106. Retrieved from www.ideals.illinois.edu/bitstream/handle/2142/7189/librarytrendsv30i1_opt.pdf.

Tananbaum, Greg (2013). *Article Level Metrics: A SPARC Primer*. Retrieved from http://sparc.arl.org/sites/default/files/sparc-alm-primer.pdf

Testa, James (2011). *The Globalization of Web of Science*^{SM}*: 2005-2010*. Retrieved from http://wokinfo.com/media/pdf/global*WoS*-essay.pdf

Thelwall, Mike (2013). *Webometrics and Social Web Research Methods*. UK: University of Wolverhampton. Retrieved from http://www.scit.wlv.ac.uk/~cm1993/papers/IntroductionToWebometricsAndSocialWebAnalysis.pdf.

Thomson Reuters (2013). *Glossary of Thomson Scientific Terminology*. Retrieved from http://ip-science.thomsonreuters.com/support/patents/patinf/terms/.

Wouters, P., & Costas, R. (2012). *Users, Narcissism and Control: Tracking the Impact of Scholarly Publications in the 21st Century*. Utrecht, Netherlands: SURF Foundation. Retrieved from www.surf.nl/binaries/content/assets/surf/en/knowledgebase/2011/Users+narcissism+and+control.pdf.

Wyllys, R.E. (1981). Empirical and Theoretical Bases of Zipf's Law. *Library Trends*, *30*(1), 53-64. Retrieved from www.ideals.illinois.edu/bitstream/handle/2142/7189/librarytrendsv30i1_opt.pdf.

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