CHAPTER – 3

CITATIONS AND RELATED CONCEPTS
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Unless stated otherwise, the term citation is used synonymously with the term bibliographic reference. Studies of citations appearing in abstracting and indexing services, in subject bibliographies, or in lists or catalogues of the holding of libraries are discussed here.

3.1 Standardization of Citation Inscription:

Citations have a significant feature of describing a certain text in a standardized code. Although different publication manuals give different codes and many publishers and journals use their own standards, these manuals and standards usually instruct the author to write his or her references as a combination of author name, title, journal name or publisher, year of publication, and page numbers. References themselves are thus texts pointing to other texts (Wouters, 1999). This does not entail that the cited texts are always to be found where the citing texts say they are.

3.1.1 Referencing systems:

There are two types of citation systems - Vancouver Referencing and Parenthetical referencing. These systems are described below:

3.1.1.1 Vancouver Referencing:

The Vancouver system was proposed in a meeting held in 1978 at Vancouver, BC, Canada. It takes its name from that meeting. The National Library of Medicine in the U.S. further developed this style and remarked in that version: "should be considered as the authoritative style". It was updated on August, 2009 by Open Journals Publishing (Neville, 2012).
3.1.1.2 Parenthetical referencing:
In 1896, Sedgwick Minot of the Harvard Medical School presented a paper with the ‘author-date’ citation style. Although it originated in biology, it is now more common in humanities, history, and social science. Parenthetical referencing is also known as Harvard referencing. Guide to the Harvard Style of Referencing, fourth edition was published in 2012 (Chernin, 1988).

3.1.2 Citation Style:
The citation styles can be broadly divided into generally accepted styles common to the Humanities and the Sciences, though there is considerable overlap. Some style guides are quite flexible and cover both parenthetical and note citation systems i.e. the Chicago Manual of Style, but other styles, such as MLA and APA styles, specify formats within the context of a single citation system. Some of the styles are described below:

3.1.2.1 APA Citation Style:
In 1929, the Publication Manual with a set of procedures to increase the ease of reading comprehension was established. It was a seven-page document at the primary stage. In 1952, the booklet was expanded and published. The first edition covered word choice, grammar, punctuation, formatting, journal publication etc. The subsequent editions were released in 1974, 1983, 1994, and 2001 primarily for the simplicity of its reference citation style. The 6th edition was published in 2009 (The basics of APA Style. (n.d.).)
3.1.2.2 MLA Style Manual:

3.1.2.3 Chicago Manual of Style:
The Chicago Manual of Style was first published in 1906 under the title “Manual of Style: Being a compilation of the typographical rules in force at the University of Chicago Press to which are appended specimens of type in use”. In August 2010, the 16th edition was published simultaneously in the hardcover and the online editions (Chernin, 1988).

3.1.2.4 The Bluebook:
Erwin Griswold first proposed this style for articles in the Harvard Law Review. The cover was changed from brown to blue to avoid comparison with a color associated with Nazi Germany in 1939 (Dickerson, 1996). A majority of U.S. law schools and U.S. federal courts use the Bluebook. The latest edition is 19th edition. An online subscription version of The Bluebook was launched in 2008.

3.1.2.5 The ALWD Citation Manual:
Four U.S. jurisdictions i.e. United States Court, United States Supreme Court, United States Bankruptcy Court and United States District Court have adopted ALWD in 2000 which was compiled by the Association of Legal Writing Directors. This style is used in citations in academic legal articles. The 4th edition was published in 2010 (ALWD Citation Manual, n.d.).
3.1.2.6 ASA style:
In the October 1991 meeting of American Sociological Association (ASA) addressed problems of their own referencing style. The draft of this style was completed in October 1992 and was first published in 1996 (Richards, 2005). This Style is used by authors preparing manuscripts for publication in ASA journals. The fourth edition was published in 2010.

3.1.2.7 Microsoft Manual of Style:
The Microsoft Manual of Style for Technical Publications (MSTP) was designed to guide the technical writers, editors, and content managers working with Microsoft products. The first edition was published in 1995. The fourth edition was published in January, 2012 (Woolley, 2012).

3.1.2.8 The New York Times Manual of Style:
In 1950, the ‘New York Times Manual of Style and Usage’ was first released for porters. An updated version was published in 2002. The New York Times journalists and editors use a frequently updated online reference version every day (Simon, 1999).

3.1.2.9 Hart's Rules:
Hart's Rules style for compositors and readers at the University Press, Oxford was first compiled in 1893 by Horace Hart who was the Controller of the University Press. The 39th edition (1983) was reprinted fifteen times. In 2012 Oxford University Press published a new edition of the Oxford Manual of Style (Hart style guidelines, n.d.).
3.1.2.10 ACS style:
   It was developed by the American Chemical Society in 1986. This style is used for research papers in the field of chemistry. The ACS style is a set of standards for writing documents relating to chemistry, including a standard method of citation in academic publications. The third edition was published in 2006 (ACS Style Guide, n.d.).

3.1.2.11 Indian Standard:
   Indian Standards Institution (now Bureau of Indian Standards) prepared a standard for bibliographical reference in the year 1963. Its revision was done in the year 1978 (IS: 2381 - 1978 'Recommendations for Bibliographical References: Essential and Supplementary Elements'). Since then the requirements have changed and the revision of the same is overdue (Gupta, n.d.).
3.2 Citation analysis:
Counting citations is often called "citation analysis". Citation analysis is the assessment of the frequency, patterns, and graphs of citations in articles and books. It uses citations in scholarly works to establish links to other works or other researchers. Citation analysis is one of the most widely used method of bibliometrics (Rubin, 2010).

3.2.1 Historical background of citation index:
A citation index links between articles that researchers make when they cite other articles. In 1873, “Shepard’s Citations” was the first citation system, created by Frank Shepard. In 1960, Eugene Garfield’s Institute for Scientific Information (ISI) introduced the first citation index for papers published in academic journals called "Science Citation Index (SCI)". During the 1970s and 1980s “Science Citation Index” developed from print to digital form. In 1997, ISI launched “Web of Science”, the web-based interface of “Science Citation Index”. Invention of automated citation indexing (i.e. CiteSeer) has changed the nature of citation analysis research. Today citation analysis tools are easily available to compute various impact measures for scholars based on data from citation indices (Hoang, 2010).

3.2.2 Methods of citation analysis:
There are several methods for citation analysis i.e. bibliographic coupling, cocitation analysis, amsler measure etc. A chronological overview of citation analysis methods are described below:

3.2.2.1 Bibliographic coupling:
The concept of bibliographic coupling was introduced by M. M. Kessler in a paper published in 1963. Bibliographic coupling links to papers that cite the same
articles, 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 been citing, the stronger their relationship is. Bibliographic coupling strength cannot change over time (Garfield, 2001).

3.2.2.2 Co-citation analysis:
In 1973 Henry Small first introduced co-citation analysis by considering a document’s incoming citations to assess similarity. Irina Marshakova another Russian researcher also published her paper on co-citation analysis in the same year. Both of the works are independent. Co-citation is defined as the frequency with which two documents are cited together by other documents (Henry, 1973).

3.2.2.3 Amsler measure:
This measure was proposed by Robert Amsler in 1972. Amsler measure is a similarity measure used to establish a subject similarity between two items fusing both Bibliographic Coupling and Co-Citation. “Two items A and B are related if A and B are references by many same items, if A and B both reference many same items, or A references a third item C that references B” (Amsler, 1972).

3.2.2.4 Author co-citation analysis:
In 1981 Howard White and Belver Griffith introduced the concept of author co-citation analysis. It is shown that the mapping of a particular area of science can be done using authors as units of analysis and the co-citations of pairs of authors as the variable that indicates their “distances” from each other (White & Griffith, 1981).
3.2.2.5 **Co-citation proximity analysis:**

Co-citation Proximity Analysis was conceived by Gipp in 2006. “It relates to a method and a system for detecting a similarity of documents. The similarity of documents is detected with the help of an analysis of citations in one or more citation document(s), wherein the distance between the individual citations is used as criterion of the analysis (Gipp & Beel, 2011)."
3.3 Measures of scientific impact

Citations can be counted as measures of the usage and impact of the cited work (Garfield, 1973). This is called citation analysis or bibliometrics. There are many measures that have been proposed till now. The most important measures are described here.

3.3.1 The h-index:

The index was suggested by Jorge E. Hirsch, a physicist, as a tool for determining theoretical physicists' relative quality. This index is known as Hirsch index or Hirsch number (h-index). According to him, a scholar with an index of h has published h papers each of which has been cited in other papers at least h times. Thus, the h-index reflects both the number of publications and the number of citations per publication (McDonald, 2005).

3.3.2 The g-index:

It was suggested in 2006 by Leo Egghe. “Given a set of articles ranked in decreasing order of the number of citations that they received, the g-index is the largest number such that the top g articles received at least g squared citations” (Egghe, 2006). Unlike the h-index, the g-index depends on the full citation count of very highly cited papers.

3.3.3 The h-b-index:

It is an extension of the h-index, developed by Michael Banks of the Max Planck Institute for Solid State Research in Germany, takes the index further by evaluating the impact of compounds used in solid-state physics and scientific topics in general. The h-b-index is defined in the same manner as the h-index, but is based on a topic search instead of a scientist’s name (Banks, 2006).
3.3.4 The Eigenfactor score:
It is a rating of the total importance of a scientific journal. Journals are rated according to the number of incoming citations, with citations from highly ranked journals weighted to make a larger contribution to the eigenfactor than those from poorly ranked journals. It was introduced by Jevin West and Carl Bergstrom at the University of Washington in 2008 (Bergstrom, 2007).

3.3.5 The e-Index:
Chun-Ting Zhang proposed the e-index in 2009. The h-index suffers from some drawbacks that limit its use in accurately and fairly comparing the scientific output of different researchers. To solve these problems he proposed the e-index, where e2 represents the ignored excess citations, in addition to the h2 citations for h-core papers. (Zhang, 2009).

3.3.6 SCImago Journal Rank:
While the general theories behind the creation of the EigenFactor and the SCImago Journal Rank Indicator indices are comparable, the sources of the citation data differ. The SCImago Journal Rank Indicator is not based on ISI data, but is based on data from the Scopus citation index (SCImago Journal Rank, n.d.).

3.3.7 Impact Factor:
The Impact Factor is calculated by dividing the number of citations in the JCR year by the total number of articles published in the two previous years. It was devised by Eugene Garfield, the founder of the Institute for Scientific Information. Impact factors are calculated yearly starting from 1975 for those journals that are indexed in the Journal Citation Reports (Garfield, 1973).
3.4 Evaluative citation analysis

3.4.1 Evaluation of journals:

Journals can be evaluated for different purposes, and hence the results of such evaluation exercises can be quite different depending on the indicator(s) used. The impact factor, in one of its versions, is probably the most used indicator when it comes to test the visibility of a journal on the research front. Generalized impact factors, over periods longer than the traditional two years, are better indicators for the long-term value of a journal (Ronald, 2002). Seglen (1997) showed the problems associated with the use of journal impact factors. Therefore, the journal impact factors can simply be added up to obtain objective and quantitative measure of the author's scientific achievement (Borgman & Furner, 2002).

3.4.2 Evaluation of Researcher:

Citation based evaluations techniques for the research performance of academic programmes and individual faculty members have been explored in the past several years in many ways. Cornin and Overfelt (1994) identify three different approaches model. Measure of efficiency and effectiveness of colleges and universities are often tied to instrumental measures, such as student credit hours generated relative to tuition rates of productive versus leisure time of faculty (Boekaerts, Koning & Vedder, 2006). If the multiple methods give the same scoring rank, the evaluations would be easier. But different scoring methods can yield totally different rankings. This is one aspect of the ‘multiple-author-problem’ as reviewed by Harsanyi (1993). For discussing interdisciplinary citations, there is an extraordinarily large difference in citation impact between disciplines nevertheless many bibliometric investigations ignore this circumstance (Van Raan, 1996).
3.4.3 Evaluation of Organization:
Research groups, departments, and entire universities and corporations may be evaluated in much the same way as to assess the performance of individuals. The value of using citation-based institutional rankings as science-and-technology (S&T) indicator is “obvious” (Garfield & Welljams-Dorof, 1992). Zoyons, Moed, and Luwel (1999) describe their comparative evaluation of a Belgian research institute in microelectronics, in which indicators of its own performance and that of its peer institutions were derived both from counts of citations received by publications written by members of those institutions and from structural maps created using co-citation and co-word techniques. Vinkler (2000) summarizes the applicability of a range of metrics, varying in degree of sophistication, for evaluating the performance of research teams.
3.5 Bibliometrics
The term ‘bibliometrics’ was coined by Alan Pritchard in a paper published in 1969, titled “Statistical Bibliography or Bibliometrics?”. He defined the term as "the application of mathematics and statistical methods to books and other media of communication". Bibliometrics is a type of research method used in library and information science. It utilizes quantitative analysis and statistics to describe patterns of publication within a given field or body of literature.

3.5.1 Laws of Bibliometrics:
One of the main areas in bibliometric research concerns the application of bibliometric laws. The three most commonly used laws in bibliometrics are: Lotka's law of scientific productivity, Bradford's law of scatter, and Zipf's law of word occurrence.

3.5.1.1 Zipf's Law
American linguist George Kingsley Zipf first proposed this law in 1949. It was also noted in 1913 by German physicist Felix Auerbach. Zipf's Law is often used to predict the frequency of words within a text. The Law states that the words occurring within that text in order of decreasing frequency, the rank of a word on that list multiplied by its frequency will equal a constant (Potter 1988).

3.5.1.2 Lotka's Law
This law was introduced by Alfred J. Lotka in 1926. Lotka's Law describes the frequency of publication by authors in a given field. According to Lotka's Law of scientific productivity, only six percent of the authors in a field will produce more than 10 articles. It is often used to estimate the frequency with which authors will appear in an online catalogue (Potter 1988).
3.5.1.3 Bradford's Law
Samuel C. Bradford in 1934 first described this law by exponentially diminishing returns of extending a search for references in science journals. It states that journals in a single field can be divided into three parts or zones, each containing the same number of articles. The mathematical relationship of different zones was defined as 1: n: n² (Wilkinson, 1972).

3.5.2 Bibliometric Branches
3.5.2.1 Scientometrics
Scientometrics is the scientific measurement of the work of scientists, especially by way of analyzing their publications and the citations within them. Since Vassily V. Nalimov coined the term 'scientometrics' in the 1960s, this term has grown in popularity and is used to describe the study of science: growth, structure, interrelationships and productivity. Modern scientometrics is mostly based on the work of Derek J. de Solla Price and Eugene Garfield (Hood & Wilson, 2001).

3.5.2.2 Informetrics
The term ‘Informetrics’ (in German informetrie) was coined by Nacke in 1979. Informetrics is mostly used synonymously with bibliometrics. Sometimes, however, informetrics is claimed to be a broader field, not limited to documents. Informetrics deals with the measurement of mathematical theory and modelling of all aspects of information and the storage and retrieval of information (Bonitz, 1982).

3.5.2.3 Webometrics
The term ‘Webometrics’ was first coined by Tomas Almind and Peter Ingwersen in 1997. It is an idea that a link pointing to a webpage means a 'vote' to that webpage or document is based on bibliometric methods to rank scientific production
and seems to be widely accepted by the research community together with the term Cybermetrics (Thelwall, Vaughan and Björneborn, 2005).

3.5.2.4 Altmetrics
This method was proposed by Jason Priem. This method captures ways in which articles are disseminated throughout in the expanding scholarly ecosystem, and reach beyond the scope of traditional trackers and filters. By monitoring and capturing the imprint of research from the moment of publication as it circulates throughout the community, altmetrics also measures the aggregate impact of the research enterprise itself. This article level metrics can be applied to people, journals, books, data sets, presentations, videos, source code repositories, web pages, etc. (Priem, Taraborelli, Groth & Neylon, 2010).
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