

Citation Indices: A Conceptual Review

Vidula Walimbe¹, Dr. Shashikala Gurpur²

¹Symbiosis International University, Pune

²Dean, Symbiosis Law School, Pune

Abstract - The article describes science citation index and patent citation index and helps in establishing the importance of citation indices in research and technology development. The major focus is on the patent citation index and its application for the development of new technologies. Patent records contain a wealth of information, including the inventor's identity, location, and employer, as well as the technological field of the invention. Patents also contain citation references to previous patents, which allow one to trace links across inventions. This article demonstrates the usefulness of patent and citation data as a window on the process of technological change and as a powerful tool for research of the economics of innovation.

Key Words: citation, index, patent, science citation index, PCI, Indian citation index

1. INTRODUCTION

"If you can measure that of which you speak, and can express it by a number, you know something of your subject; but if you cannot measure it, your knowledge is meager and unsatisfactory." William Thomson, Lord Kelvin

Citation is the process of acknowledging or citing the author, year, title, and locus of publication (journal, book, or other) of a source used in a published work. Such citations can be counted as measures of the usage and impact of the cited work. This is called citation analysis or bibliometrics. In the world of scientific journals, researchers publish their research results in journals in the hope that their findings and ideas will influence further studies in related areas. Citations represent a form of evidence suggesting research influences. The creation of reliable source in the area of science was carried by Eugene Garfield in the year 1964. Garfield proposed an index of Impact Factor (IF), which was then chosen by Science Citation Index (SCI) in 1960 as a mean to specify the influence--and by extension, the value--of the indexed journals¹ (Andrew). The IF indicator determines the annual impact of a journal by using the number of its backward citations from the chosen year to the previous 2 years divided by the total number of the papers. Citation indexes track references that authors put in the bibliographies of published papers. They provide a way to search for and analyze the literature in a way not possible

through simple keyword/topical searching. It also enables users to gather data on the "impact" of journals, as well as assessing particular areas of research activity and publication. Citation indexing began in the 1950s, and has long been dominated by the Institute for Scientific Information (ISI, which was acquired by and is now renamed Thomson Reuters), the creator and publisher of the three citation indexes available today: Science Citation Index (SCI), Social Sciences Citation Index (SSCI), and Arts & Humanities Citation Index (AHCI), plus two Conference Proceedings Citation Indexes (CPCI).

Usage of research work of researcher always pays importance and value to the author and also to the work. Work in the form of article, patents and notes in the subject get its impact when it got cited in the literature of importance. Trace the citations in different publications involves constant perusal, which is rather difficult for an author. The mapping of citations in a subject and also in allied subjects is really very intricate work and the whole idea emerged as early as tool to visualize citation relationships and understand the meaning of a cited reference search in web of knowledge. Citation index later on started analyzing relation between various components of citations such as its source of publication, authorship, author affiliations and places. The Journal Citation Reports included various indicators of research importance and later on it became tool for research output evaluation of a researcher and institution. Many countries made their efforts to create their own Citation Index and established their citation analysis centre as Bibliometric, Scientometric and Infometric centers. When the era of information digitization escalates fast and emerging as Web Access information reshape the Citation Index into Web of Science. The Google Scholar and Scopus are also tracing the citations and related works in the subject. Web of Science is developed by ISI (Web of Knowledge) in the year 1900. Web of Science has a base of Citation Index of ISI, where one can have different access options to get total citations of a research work and also various research indicators. The understanding of structure and functions of Citation Index helps in designing and creation of citation mapping, impact of research and research trends in the subjects.

2. CITATION INDEX

The concept of citation indexing is simple. Almost all the papers, notes, reviews, corrections, and correspondence

¹ Andrew P. Kurmis, *Understanding the Limitations of the Journal Impact Factor*, The Journal Of Bone & Joint Surgery · Jbjs.Org Volume 85-A · Number 12, December 2003

published in scientific journals contain citations. These cite generally by title, author, and where and when published documents that support, illustrate, or elaborate on what the author has to say. Citations are the formal, explicit linkages between papers that have particular points in common. A citation index is built around these linkages. It lists publications that have been cited and identifies the sources of the citations. Anyone conducting a literature search can find from one to dozens of additional papers on a subject just by knowing one that has been cited. And every paper that is found provides a list of new citations with which to continue the search. The main strength of citation indexing is its simplicity. In compiling a subject index it is important that the specialized knowledge of the subject along with in-depth indexing is needed. The cost involved in in-depth indexing is critical. Citation indexing solves the depth versus cost problem by substituting the authors' citations for the indexer's judgments. This approach has the advantage of eliminating the need for intellectual indexing without compromising either the depth of the index or the quality of its "terms." quality has two components. One is search productivity, which is concerned with finding the largest possible number of relevant papers. The other is search efficiency, which is concerned with minimizing the number of irrelevant papers the searcher must check out to identify the relevant details. Indexing depth is the primary quantitative measure of search effectiveness. Larger the number of indexing terms used, more is the detailed description and search effectiveness².

Citations, used as indexing statements, provide search simplicity, productivity, and efficiency of avoiding the semantics problems. Even if citation index are compiled from literature of a limited number of disciplines published within a given time frame, the citations it would use as indexing statements are not bound by these limits. Authors and researchers usually cite papers outside their discipline and the citations range over a time frame. The use of these citations as indexing statements enables a citation index to provide a trail of information that follows the process of scientific development as it relates to inter-disciplinary subjects and moves back and forth in time. This characteristic greatly increases the search productivity of a citation index. The ability to search back and forth in time from the past literature to the current literature, to identify cross-disciplinary developments, to eliminate the search restrictions and complexity imposed by semantic problems, and to provide an in-depth index to the literature within a practical time and cost framework have all proved to be significant in practice.

Citation index has gained acceptance, despite its newness and departure from traditional indexing methods. Citation indexing plays an important role in current-awareness

²Eugene Garfield - A Conceptual View of Citation Indexing - <http://garfield.library.upenn.edu/ci/chapter1.PDF>

services, library management, and studies of the policies, history, and literature of science. Citations can be of any age and from any source, citation searching will often yield results that would not have been obtained in a conventional subject search. Citation Index is a complete solution to scientific literature search and at present it is available online with data search and has a wider acceptance through Web of Science. Online version enables searchers to locate recent articles which cite earlier published work and saves time and money by eliminating the need to acquire and search discipline-oriented indexes. Citation index for specific language is needed to be constructed. Evaluation of the work of any scientist and of the journals covering specific areas of science is possible through Citation Index by distilling the credits with the established norms³. Citation index needs to be upgraded from time-to-time by creating and designing it for specific subject using latest technology and manual efforts.

3. PATENT CITATION INDEX

Patents have long been recognized as a very rich data source for the study of innovation and technical change. Indeed, there are numerous advantages to the use of patent data: each patent contains highly detailed information on the innovation; patents display extremely wide coverage in terms of technologies, assignees, and geography; there are already millions of them (the flow being of over 150,000 US Patent and Trademark Office [USPTO] patent grants per year); the data contained in patents are supplied entirely on a voluntarily basis, etc.

Patent information is an important source for scientific and technological knowledge. More than 90% of patent specifications come from research and development (R&D) results and about 80% of which never appears in formal publications. There are serious limitations as well, the most glaring being that not all innovations are patented, simply because not all inventions meet the patentability criteria, and because the inventor has to make a strategic decision to patent, as opposed to relying on secrecy or other means of appropriability⁴. Unfortunately, there is very little data on the extent to which patents are representative of the wider universe of inventions, since there is no systematic data about inventions that are not patented. This is an important, wide-open area for future research. The large-scale use of patent data in economic research goes back to Scherer, Schmookler, and Griliches. One of the major limitations of these research programs, was that they relied exclusively on patent counts as indicators of innovative output. However, it has long been recognized that innovations vary enormously

³ Kristin Whitman, Gain the advantage in citation analysis: the Derwent Patent Citation Index.

⁴ Jaffe, A, Technological Opportunity and Spillovers of R&D: Evidence from Firms' Patents, Profits, and Market Value, *American Economic Review*, Vol. 76 (1986), pp. 984-1001.

in their technological and economic “importance” or “value,” and that the distribution of such “values” is extremely skewed. Thus simple patent counts are inherently limited in the extent to which they can capture such heterogeneity (Griliches, Pakes, and Hall). The line of research initiated by Pakes and Schankerman using patent renewal data clearly revealed these features of the patent data. Patent citations suggested themselves as a means to tackle heterogeneity, as well as a way to trace spillovers⁵. In order to understand the role that patent citations have come to play in this context, there is a need to look in detail into the patent document as a legal entity and as an information source. A patent awards to inventors the right to exclude others from the unauthorized use of the disclosed invention, for a predetermined period of time. For a patent to be granted, the innovation must fulfill the following criteria: (i) it has to be *novel* in a legally defined sense; (ii) it has to be *non-obvious*, in that a skilled practitioner of the technology would not have known how to do it; and (iii) it must be *useful*, meaning that it has potential commercial value. If a patent is granted, an extensive public document is created. The front page of a patent contains detailed information about the invention, the inventor. The work of Schmookler involved assigning patent counts to industries, whereas Griliches’ project entailed matching patents to a sample of Compustat firms. In both cases the resulting data used were yearly *patent counts* by industries or firms. Scherer’s project involved the creation of a “technology flow matrix” by industry of origin and industries of use. Whether or not this right translates into market power depends upon a host of other factors, including the legal strength of these rights, the speed of technical advance, the ease of imitation, etc. These citations serve an important legal function, since they delimit the scope of the property rights awarded by the patent.

The World Intellectual Property Organization (WIPO) found that effective use of patent information can greatly shorten R&D time up to 60% and can save R&D costs up to 40%. Information from patent documents not only stimulates new research directions but also promotes new usages of current technologies. Furthermore, patent analyses can reveal or predict corporate competitiveness, technology life cycle, and industrial growth. As Gay and Le Bas (2005) summarized, patent citations can be used to:

- (1) Assess the value of technological inventions;
 - (2) Identify the origins, or the “knowledge base,” of inventions; and
 - (3) Detect and predict technological knowledge flows.
- Thus, patent citations presumably convey information on two major aspects of innovations. The first is linkages between inventions, inventors, and assignees along time and space. In particular, patent citations enable the quantitative, detailed study of spillovers, along geographical, institutional,

⁵ Trajtenberg, M. *Patents, Citations and Innovations: A Window on the Knowledge Economy*, Cambridge: MIT Press, 2002.

and related dimensions. The second is that citations may be used as indicators of the “importance” of individual patents, thus introducing a way of gauging the enormous heterogeneity in the “value” of patents.

4. PATENT CITATION ANALYSIS

The technique for measuring the quality of patents is patent citation analysis. This technique is based on the examination of the citation links from a patent to other patents and scientific literature. There are two main sources of citations on a patent: the inventor (or applicant) and an examiner of the patent application. In some countries, the inventor and those involved in the patent application are under a duty to disclose any material (such as patents and scientific literature) that is material to patentability – and these disclosures are recorded as citations. Also, when the patent application is examined, the patent examination will also add citations that are found during examination. The nature of the examiner’s references makes an important contribution to the effectiveness of a citation index of the patent literature. They are generated as part of the search for prior-art that can be grounds for disallowing a claim, restricting the scope of the application, or supporting a legal point. The examiner’s prior-art search is conducted within both legal and technological frameworks and is based not only on what is literally stated in the disclosure but also on what is implied. In other words, judgments of what constitutes anticipatory prior-art often are highly interpretive. For all these reasons, the scope of the prior-art search is quite broad, delving into a variety of subclasses, plus the examiner’s own files and personal knowledge. Such a search produces references that index the patent in a way that an indexer could not and permit the citation index to reach across subclasses of the patent literature in the same way that it reaches across disciplines and specialties in the journal literature. In other words, a patent citation index can bring together patents that are unrelated in terms of their principal subject matter⁶. The idea behind patent citation analysis is that patents cited by many later patents tend to contain important ideas upon which many later inventors are building. A company with a large number of cited patents is thus likely to possess technology that is central to developments in its industry.

Not all important patents are highly cited, nor is every highly cited patent important. However, numerous validation studies have revealed the existence of a strong positive relationship between citations and technological importance. Other studies have revealed a positive relationship between patent indicators and stock market valuations and between highly-cited patents and increased sales and profits in the pharmaceutical industry. The citation links among patents

⁶ Eugene Garfield - The Application of Citation Indexing to the Patent Literature - <http://garfield.library.upenn.edu/ci/chapter1.PDF>

also indicate the speed at which a company is innovating. Companies whose patents cite relatively recent patents are likely to be innovating faster than companies whose patents cite older patents.

The link between patents and scientific papers reveals the extent to which companies are building on scientific research. Companies whose patents cite large numbers of scientific papers are assumed to be working closely with developments in scientific research. Strong links to science are particularly important in industries such as biotechnology and pharmaceuticals. Many important advances in these industries are developed in universities, and are reported in the scientific literature.

One of the criticisms of citation analysis is that it may not work in fast-moving industries, due to the time lags involved in the patent process. It is certainly true that it takes time for a patent to accumulate a large number of citations from later patents, so highly-cited patents may not represent the cutting-edge of technology. However, this does not mean that citation analysis cannot be used in these industries. A company with a large number of highly cited patents has exhibited the ability to produce innovative technologies that have had a strong influence on later developments in its industry. This shows that the company has a strong R&D capability, which is likely to increase its ability to produce important technologies in the future. An expert in patent search can help in exploring the value that can be derived by citation analysis. The usefulness of patent citations can also be stated as a measure of the "importance" of a firm's patents, as indicated by the stock market valuation of the firm's intangible stock of knowledge. In a research carried out by Bronwyn H. Hall, Adam Jaffe, Manuel Trajtenberg, by using patents and citations for 1963-1999, the authors estimate Tobin's q equations on the ratios of R&D to assets stocks, patents to R&D, and citations to patents. The findings were that each ratio significantly impacts market value, with an extra citation per patent boosting market value by 3%. Further findings indicate that "unpredictable" citations have a stronger effect than the predictable portion, and that self-citations are more valuable than external citations. It is widely understood that the R&D conducted by private firms is an investment activity, the output of which is an intangible asset that can be labeled as the firm's "knowledge stock." If this asset is known to contribute positively to the firm's future net cash flows, then the size of a firm's knowledge stock should be reflected in the observed market value of the firm. This implies that a firm's R&D investments should be capitalized in the firm's market value⁷.

⁷Bronwyn H. Hall, Adam Jaffe, Manuel Trajtenberg, Market value and patent citations-
http://elsa.berkeley.edu/~bhall/papers/HallJaffeTrajtenberg_RJEjan04.pdf

There are reasons to believe that citations convey not just technological but also economically significant information: Patented innovations are for the most part the result of costly R&D conducted by profit seeking organizations; if firms invest in further developing an innovation disclosed in a previous patent, then the resulting (citing) patents presumably signify that the cited innovation is economically valuable. Moreover, citations typically keep coming over the long run, giving plenty of time to dissipate the original uncertainty regarding both the technological viability and the commercial worth of the cited innovation. Thus, if citations are observed years after the grant of the cited patent, it must be that the latter had indeed proven to be valuable. A detailed survey of inventors provides some direct evidence on citations as indicative of the presumed links across innovations (Jaffe, Trajtenberg, and Fogarty, 2000).

5. INDIAN SCENARIO OF PATENT CITATIONS

India is a huge part of the global society, has long and distinguished history as a country, possess capability and vital resource to influence, mark presence on the emerging universe of knowledge. India is contributing good amount of knowledge but there is a lack in tool for evaluation and measurement of its knowledge.

Citations to Indian Patents

A study of Indian patents cited was done in the paper of V.K Gupta. It revealed the overall pattern of citations received by Indian patents during 1990 to 2007. It is observed that of the 2,132 patents only 764 patents (36%) received one or more citations. Significantly, one percent of these patents (ten patents) received 457 citations (more than 20 citations per patent; fifteen percent of the total citations) indicating their high value and continued technological significance. There were 179 patents (23% of the total) that received 1,494 citations (49% of the total); citation per patent being five or more than five but less than twenty. The remaining 585 patents (76% of 764) received 1076 citations (35% of the total); citation per patent being less than five. The assignees whose patents received significant number of citations included the Council of Scientific and Industrial Research, Dr. Reddy's Research Foundation, Ranbaxy Laboratories Limited, Panacea Biotec Limited, ST Microelectronics Pvt Ltd., Rover Writing Instruments, Anand International, Indian Oil Corporation, and Dabur Research Foundation. The technological areas that received significant citations included drugs and pharmaceuticals and contraceptive or other devices for use in medical or veterinary sciences (A61K, A61F, A61M), chemistry or chemical technologies (C07D, B01J, C07C), electric communication, transmission, and digital data processing (H04B, G06F), measuring or

testing viz. investigating materials by analyzing their chemical or physical properties (G01N) and design patents⁸.

Patent Citation Index Databases:

1. Patent Citation Index is produced by Thomason Reuters called Patent Citation Index (PCI)

The *Patents Citation Index (PCI - File 342)*, produced by Thomson Reuters (Scientific), provides access to 54.5 million patent and literature citations found in 7.8 million patent families. In each update, Examiner citations from about 50,000 documents from major patent-issuing authorities are added to the file. Each record in the database describes a patent family for a single invention. The patent family data corresponds to the patent family data provided in Derwent World Patents Index (DWPI - Files 350,351,352) at the time that the most recent citations were added to the database. The *PCI* record provides a view of retrospective technology for an invention (cited patents and literature references) and its impact on subsequent technology (citing patents). Citations referenced by examiners or inventors in patent documents are called "cited" patents or literature references in the *PCI* record and correspond to the search reports that accompany patent publications. When a citation references older inventions/patents, it is also added to the family record as a "citing" patent. Examiner citations are provided for family members added to the file from the following patent-issuing authorities: Belgium (BE), European Patent Office (EP), France (FR), Germany (DE), Japan (JP), Netherlands (NL), Spain (ES), United Kingdom (GB), United States (US), and WIPO/PCT (WO). Inventor citations are also included for the time period, May 1994 - May 1997.

2. Indian Citation Index

At international level few tools/databases are available that evaluate/ analyze India's knowledge content. As an initiative to develop Indian Citation Index, Mr. Prakash Chand, Ex Scientist NISCAIR, CSIR and M/s Divan Enterprise have developed and brought out multidisciplinary Indian Citation Index (ICI) by scanning ~1000 journals of Indian origin. Indian Citation Index (ICI) is a home grown abstracts and citation database, with multidisciplinary objective information/knowledge contents from about 1000 top Indian scholarly journals. It provides powerful search engine basically to perform search and evaluation for researchers, policy makers, decision makers etc. ICI database is a powerful tool that let you search, track, measure and collaborate in the sciences, social sciences, arts, and humanities to turns raw data/information into the powerful knowledge you need. Indian Citation Index (ICI) database is an abstracts and citation database intended to measure and

perform two basic functions, general literature search and evaluation using citations similar to international databases. Indian Citation Index (ICI) use intellectual links by listing both cited and citing works. Like other indexes, this enables one to move back in time to previously published papers. But uniquely one can also look forward in time to determine who has subsequently cited an earlier piece of research. Indian Citation Index (ICI) empowers scholarly community to map the knowledge published in local national journals/periodicals. Whether you are just starting your scholarly work, academic research as an experienced researcher or teacher, or a librarian or administrator, ICI delivers objective content and the tools to support your role in the research workflow

3. CONCLUSIONS

"During the examination process, the examiner searches the pertinent portion of the 'classified' patent file. His purpose is to identify any prior disclosures of technology...which anticipate the claimed invention and preclude the issuance of a patent; which might be similar to the claimed invention and limit the scope of patent protection...; or which, generally, reveal the state of the technology to which the invention is directed....If such documents are found they are made known to the inventor, and are 'cited' in any patent which matures from the application...Thus, the number of times a patent document is cited may be a measure of its technological significance." Citations allow one also to probe into other aspects of innovations, such as their "originality," "generality," links to science, etc. - [Trajtenberg, Henderson, and Jaffe].

The key question is whether the relationships identified by the citation index make the citing patent, which is the one retrieved, relevant to the interests of the searcher. There are no categorical answers to this question. There is not even an objective measure of relevancy. What one person considers relevant is dismissed by another as being irrelevant. The inventors and patent examiners have a difficult time agreeing on what is relevant. The question is best answered by saying simply that a citation index of the patent literature identifies relationships between patents that are not identified any other way, and that these relationships permit the rapid retrieval of information that is relevant to the search a significant percentage of the time. Certainly there is no useful tool for determining whether the technology disclosed in a particular patent has been modified, improved, or utilized-in any way.

To summarize, the analysis of Indian patent output indicates that the spurt in growth of patenting is directly attributable to the Indian industry's growing inventiveness and competitiveness. From the Government sector, the Council of Scientific and Industrial Research has greatly contributed to the patenting activity both within India as well as abroad. Indian industry has expanded its base across countries and

⁸V.K Gupta - Science and Technology-S&T Outputs and Patents - Indian Patent Output 1999-2007

has sought protection of its inventions in countries synonymous with their commercial interests. The academic sector has also oriented its thrust towards patenting. The idea of developing a patent citation index for technologies developed by Indian scientists can be very useful to understand the rapid technology flow over recent years. Over the years much of the energy is devoted to the development of an analogous research base and infrastructure for patent bibliometrics that is for the use of patents, and patent citations in the evaluation of technological activities. There are remarkable similarities between literature bibliometrics and patent bibliometrics, and they are both applicable to the same wide ranges of problems⁹. The old linear model of the way in which science, technology, and economics develop, postulates that scientists do research, publish, and place that information in the public domain. It then gets codified, taught, and eventually works its way into technology and is utilized by inventors who produce patented inventions, which are manufactured and sold, with a consequent contribution to economics. In some of the modern areas of technology there is virtually no time lag between science and technology. Thus there is a need to study similarities between literature and patent distributions and intimate relationship between technology and science.

Thus idea behind this article is to propose to the Indian Patent Office citation-index for the exclusive use of the examiners and could be justified on a strict cost-benefit basis just by including all the references from the abandoned applications, which are never classified. The references to the patents that led to the decisions of abandonment represent an important store of information that probably would greatly reduce the number and the length of searches that the examiners must conduct.

REFERENCES

- [1] Alan C. Marco – The dynamics of patent citations-Vassar College Economics Working Paper
- [2] Barbara Quint - Elsevier's Scopus Introduces Citation Tracker: Challenge to Thomson ISI's Web of Science? - Posted On January 23, 2006
- [3] Bronwyn H. Hall, Adam Jaffe, Manuel Trajtenberg - Market value and patent citations
- JEL Classification: O31, O38
- [4] Dar-Zen Chen Æ Chang-Pin Lin Æ Mu-Hsuan Huang Æ Chen-Yu Huang - Constructing a new patent bibliometric performance measure by using modified citation rate analyses with dynamic backward citation windows- *Scientometrics* (2010) 82:149–163
- [5] Freddy Pachys - Importance Factor New Patent Valuation Index - Pec's University
- [6] Jacques Michel, Bernd Bettels - Patent citation analysis - A closer look at the basic input data from patent search reports - *Scientometrics*, Vol. 51, No. 1 (2001) 185–201
- [7] Jacques Michel, Bernd Bettels - Patent citation analysis: A closer look at the basic input data from patent search reports - - *Scientometrics*, Budapest Vol. 51, No. 1 (2001) 185–201
- [8] Lokman I. Meho - Which citation database: Web of Science, Scopus, or Google Scholar? Special Libraries Association 2009 Annual Conference, School of Library and Information Science, Indiana University, Bloomington - meho@indiana.edu. June 16, 2009
- [9] Narin - Patent Bibliometrics - *Scientometrics*, Vol. 30, No. 1 (1994) 147-155
- [10] Anup Kumar Das , Open access to Research Literature In India: Contemporary Scenario, International Society for *Scientometrics and Informetrics* (ISSI)- 2005-2009
- [11] Paul Almeida – Knowledge Sourcing by foreign multinationals: Patent Citation Analysis in the US semiconductor industry
- [12] Shailendra Kumar and Manisha Singh - Structure and Functions of Citation Index - 8th International CALIBER - 2011, Goa University, Goa, March 02-04, 2011
- [13] Susovan Debbarman: A bibliometric study of Indian patent applications from 1995 to 2005- *Annals of Library and Information Studies*, Vol, 56, June 2008, pp153-163
- [14] Szu-chia Scarlett Lo - A Comparative Study of Linkage Indexes: Co-assignee, Reciprocal Citation, Patent Coupling and Co-patent. *Journal of Library and Information Studies* 8:1 (June 2010) P. 11-27
- [15] V. Cavaller, *Scientometrics and patent bibliometrics in RUL analysis: A new approach to valuation of intangible assets- VINE*, Vol. 39 Iss: 1, pp.80 – 91
- [16] Kristin Whitman, Gain the advantage in citation analysis: the Derwent Patent Citation Index - Posted on August 31, 2010, Intellogist

⁹ F. Narin - Patent Bibliometrics - *Scientometrics*, vol. 30, no. 1 (1994) 147-155