

Open Access Journals Quality – How to Measure It?

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Abstract:

Purpose of this paper is to present different ways of Open Access journals' evaluation. Application of electronic channels of distribution for periodicals has provided access to data (e.g. usage), that was not visible before. There has grown a new opportunity to develop quantitative measurement methods. Since long time the most often used evaluation form has been peer-review process (qualitative). From 1950's when the idea of Journal Impact Factor by Garfield was introduced there has been some other factors based on the citation data developed, like immediacy index or h-index. Citations analysis as an evaluation method has been also adapted to Open Access journals. In 1996 Ingwersen has developed Web Impact Factor, which can be also applied to evaluation of online periodicals. His idea is based on the thesis, that link data can be used analogous to citation data. In 2006 Brody has shown that there is a correlation between number of citations and number of downloads of the articles. This research provided a foundation to introduce Usage Impact Factor by Bollen and Sompel in the next year (2007). For last few decades there was a significant development in the area of quantitative evaluation of periodicals and there are still new opportunities to grow.

Introduction

Knowledge development depends on scientific communication condition. For long time (nearly for four centuries) articles in printed periodicals has been regarded as a main channel for communication between scientist. The dominant approach to quality assessment of journals was peer-review process. Quantitative method of evaluation began to coexist after 1955, when Garfield introduced Journal Impact Factor¹ - based on the citation analysis. The factor has been presented in first part of the paper.

Afterward, since 1980's the role of print in scholarly communication began to change. At this time first experiments on electronic periodicals has been launched.² During next ten years significant development of World Wide Web has been noticed. Therefore soon opportunities for scientific periodicals distribution has been recognized. However there has also been many sceptical responses among scientist and publishers. Nevertheless according to Tenopir³ about year 1999, we can recognize an important break through in attitude to scientific electronic

¹ E. Garfield, *The history and meaning of Journal Impact Factor*. The Journal of the American Medical Association, vol. 295, no. 1, 2006. [Online] Available from: <http://jama.ama-assn.org/cgi/content/full/295/1/90#REF-JCO50055-1> [Accessed 30-04-2009].

² *New horizons in adult education& human resource development*. [Online] Available from: http://education.fiu.edu/newhorizons/past_journals.htm [Accessed 30-04-2009].

³ C. Tenopir, *Use and users of electronic library resources: an overview and analysis of recent research studies*, Washington 2003.

publishing. Growth of number of good quality scholarly electronic journals had influenced adaptation of this form of scientific communication. In 1996 Ingwersen⁴ noticed that links directed to certain Web Page can be seen as online citations for the Page. According to this thesis he introduced Web Impact Factor, which has been discussed in following part of the paper.

Another important change in distribution of periodicals is regarded to initiatives aiming to ensure easier, cheaper and faster knowledge sharing. Scholarly Publishing and Academic Coalition⁵ has been launched by Association of Research Libraries⁶ in 1998, another important date in Open Access foundation is 1999 - Open Archives Initiatives⁷ establishment. Creation of repositories provided opportunity to access statistics including data on documents' downloads, usage, etc. This data has been adapted by Metrics from Scholarly Usage of Resources (MESUR) to introduce Usage Impact Factor in 2007. The third part of the paper is devoted to the factor.

From qualitative to quantitative

Peer review process (qualitative) has been adapted since seventeen century to ensure quality of articles. Currently most of the top ranked journals use these method to accept or reject an article for publishing. Articles are being reviewed by experts from the certain field. However it would be incorrect to assume that these method of articles evaluation has been untouched. Changes mentioned in introduction influencing scientific community caused peer review evolution into different models. The peer review model's are⁸:

- **Traditional** – before publishing, by expert;
- **Open** – before publishing, by expert, reviews available for readers, after publishing comments by readers allowed (*BMJ*);
- **Open and permissive** – before publishing, at least three reviews (whatever positive or negative) of editorial board members, reviews available for readers, after publishing comments by readers allowed (*Biology Direct*);
- **Community** – manuscript is public while discussed by community (and reviewed by invited reviewers), after this final version is being published (*Journal of Interactive Media in Education, Atmospheric Chemistry and Physics*);
- **Permissive, post-publication commentary** – minimal criteria for acceptance of the paper and after publication scientific community comments and annotates articles (*PloS ONE*);
- **No peer review, post-publication commentary** – (*Nature Precedings, Philica*).

⁴ P. Ingwersen. *Webometrics: ten years of expansion*. [Online] In: Proceedings International Workshop on Webometrics, Informetrics and Scientometrics & Seventh COLLNET Meeting, Nancy (France), 2006. Available from: <http://eprints.rclis.org/archive/00006264/> [Accessed 30-04-2009].

⁵ *Scholarly Publishing and Academic Coalition*. [Online] Available from: <http://www.arl.org/sparc/> [Accessed 30-04-2009].

⁶ *Association of Research Libraries*. [Online] Available from: <http://www.arl.org/> [Accessed 30-04-2009].

⁷ *Open Archives Initiatives*. [Online] Available from: <http://www.openarchives.org/> [Accessed 30-04-2009].

⁸ M. Hodgkinson, *Open peer review and community peer review*, 2007. [Online] Available from: <http://journalology.blogspot.com/2007/06/open-peer-review-community-peer-review.html> [Accessed 30-04-2009].

Peer review process (by experts or by community) remains the only appreciable way of articles evaluation before their publication. Nevertheless after publication the number of possibilities for quantitative methods impact measurement grows.

Quantitative measurement of periodicals reaches seventeenth century. However the most widespread quantitative tool - **Journal Impact Factor** has been introduced by Garfield in XX century. The development of citation data bases preceded the factor presentation. Because JIF is based on citation data available in Thomson Reuters (before Institute for Scientific Information)⁹. There are some variations of the impact, e.g. five year impact factor, revised impact factor (excluding self-citations)¹⁰. However they are based on similar formula. This paper presents unified impact factor calculations formula (look Fig.1).

Figure 1: Unified Journal Impact Factor calculations formula

Journal Impact Factor ⓘ			
Cites in 2003 to articles published in:	2002 = 34	Number of articles published in:	2002 = 27
	2001 = 56		2001 = 29
	Sum: 90		Sum: 56
Calculation:	Cites to recent articles	90	= 1.607
	Number of recent articles	56	

Source: *Journal Citation Reports* [online]. The Thomson Corporation, 2005
http://scientific.thomsonreuters.com/media/scpdf/jcr4_sem_0305.pdf .

Journal Impact Factor calculated by dividing the number of citations from certain year (in the example – 2003) for articles from some certain periodical published in two years before (in this cases 2001 and 2002) with the number of articles published in the two years (2001, 2002).

There has also been other factors developed: echo factor, popularity factor, immediacy index, influence weight, half life or h-index developed by Hirsh¹¹. These calculations are also based on citation data.

These factor does not measure quality of the certain journal directly, but rather its reputation and prestige. However chance to find low quality article in high reputation journal is rather low. Therefore this factors are important in scientific communication.

Most of all JIF is being use in libraries as a guideline helpful for collection management. The factor is also significant for researchers as suggestion what to read and where to publish as well. Moreover the factors are being used in evaluation of scientist (what can be seen as a misuse by some researches) or research institutes and decision process for research or projects funding.

During the long years of the JIF existence it has been criticized many times¹². The factor might be misused, when comparing periodicals form different fields. The number is comparative inside the field, but outside it might not be (for example because of popularity of

⁹ Thomson Reuters. [Online] Available from: <http://scientific.thomson.com/> [Accessed 30-04-2009].

¹⁰ *The Thomson scientific impact factor*. [Online] Available from: http://thomsonreuters.com/business_units/scientific/free/essays/impactfactor/ [Accessed 30-04-2009].

¹¹ C. D. Kelly, M., D. Jennions, *The h index and career assessment by numbers*, Trends in Ecology & Evolution, vol. 21, issue 4, 2006, p167-170.

¹² *Impact factor*. [Online] Available from: http://en.wikipedia.org/wiki/Journal_impact_factor [Accessed 30-04-2009].

certain fields or scientific branches). Another misuse of the factor might occur in libraries when librarians base only on the list of high ranked journals, not on the needs readers in the certain library may have – created by school profile, student specialization or others.

Another critical approach refers to citation characteristics. There could be different kind of references classified according to motives of citation (negative, positive, classical works – which occurs very often). Still they are counted in the same way, even though its' value is different. Therefore the JIF does not fully reflects the periodical's influence.

JIF is concerned as manipulative. There are some ways to increase journal impact factor. Periodicals policy could be changed according to for example encourage authors to submit articles on certain fashionable topic.¹³ Such action effects rise of citation to the journal, even if the quality of the articles on the fashionable topic is not high.

Still JIF is being widely used because of long tradition, high coverage and its objectiveness (while reviews of expert are subjective). It is very useful for measuring science development trends and links between disciplines, etc.

Web Citations

Analogous use of online references (links) to regular citations in periodicals has been noticed by Ingwersen in 1996. He assumed that there might be factor calculated similarly to JIF, he named it **Web Impact Factor**. The formula is to sum up number of pages linking to the certain web page (including self-linking pages) and divide it by number of web pages published in the web site, which are indexed in the web site (look figure 2). Revised WIF calculations exclude self-linking pages (look figure 3).

<p>Figure 2: Calculation for Web Impact Factor A= total link pages (all inlink and self-link pages) <hr/> D= number of web pages published in the web site which are indexed by the search engine, not all web pages available in the web site <hr/> WIF= A/D = Web Impact Factor</p>	<p>Figure 3: Calculation for WIF revised to exclude self-links A= total links to a web site (all inlink and self-link pages) B= inlinks to the web site (this is a subset of A) C= self-links and navigational links within the same web site D= number of web pages published in the web site which are indexed by the search engine, not all web pages available in the web site R-WIF= revised WIF (B / D)</p>
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Source: A. Noruzi, *The Web Impact Factor: a critical review*, *The Electronic Library*, 24, 2006. [Online] (http://eprints.rclis.org/archive/00005543/01/Web_Impact_Factors,_A_critical_review.pdf).

WIF measures *frequency with which average web page in a web site has been linked at a given point in time*.¹⁴ Similar to JIF, WIF gives general view on popularity and prestige of the web site rather than quality. How ever we can expect most of the high WIF web pages to present high quality.

Dissimilar to JIF, WIF was not intended to measure journals impact only, but every kind of web sites'. Currently it is being used to create collaboration networks of institutions or

¹³ R. Mosatersky, *The numbers that's devouring science*, *The chronicle of higher education*, vol. 52, issue 8, 2005. [Online] Available from: <http://chronicle.com/free/v52/i08/08a01201.htm> [Accessed 30-04-2009].

¹⁴ A. Noruzi, *The Web Impact Factor: a critical review*, *The Electronic Library*, 24, 2006. [Online] Available from: http://eprints.rclis.org/archive/00005543/01/Web_Impact_Factors,_A_critical_review.pdf [Accessed 30-04-2009].

organisations from some certain field. It might be used to test search engines coverage and completeness. Furthermore it is used to compare web site's importance to others in the same field or country. There has raised a question: Can WIF be used for impact measurement of Web sites of journals or for online available periodicals? Research conducted by for example by An and Qiu in 2004¹⁵ showed that it is possible. Moreover they have shown that there is significant correlation between JIF and WIF.

Unfortunately WIF might be misused as well. First of all the factor depends on search engine coverage, therefore generalisation of the results must be conducted carefully. Another problem is that high linking rate might not be associated with high quality of the web site. Similar to JIF, WIF is depend on field or branch the pages represent. It might be not possible to compare web sites from different disciplines. The factor might also be seen as manipulative, because some webmasters may ask to link to their pages or ask authors to link to the pages on certain web site, etc. However WIF conducted with the consciousness of its limitations and with other factors or kind of evaluation (e.g. heuristic) is useful for journals quality measurement.

Not only citation – usage

Before impact factor based on usage data was introduced, there was an attempt to provide reading factor in 2001.¹⁶ Furthermore Brody¹⁷ in 2006 has shown that there is a correlation between number of citations and number of downloads of the articles. Still the key role in creating factor based on usage of materials played project MESUR, which aim was to provide toolkit based on usage data for assessment of *the impact of scholarly communication items, and hence of scholars*.¹⁸ The area of research was not the journals only, but all the communication items as stated. The project was held from 2006 to 2008. Team lead by Bollen and Sompel presented **Usage Impact Factor**.¹⁹ The factor is a result of dividing number of uses recorded in year Y of articles published in journal J in the two proceeding years (Y-1) and (Y-2) by the number of articles published by journal J in the two proceeding years.

Figure 4 : Usage Impact Factor formula

$$\text{UIF}_j^y = \frac{R^y(A_j^{y-1} \cup A_j^{y-2})}{|A_j^{y-1} \cup A_j^{y-2}|}$$

Source: J. Bollen, H. van de Sompel, *Usage Impact Factor: the effects of sample characteristics on usage-based impact metrics*, 2006. [Online] (http://arxiv.org/PS_cache/cs/pdf/0610/0610154v2.pdf).

¹⁵ An, L. and J. Qiu, *Research on the Relationships between Chinese Journal Impact Factors and External Web Link Counts and Web Impact Factors*. The Journal of Academic Librarianship, 2004. 30(3): p. 199-204.

¹⁶ S. J. Darmoni et al., *Reading factor: a new bibliometric criterion for managing digital libraries*, Journal of the Medical Library Association, 90(3), 2002. [Online] Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=116406> [Accessed 30-04-2009].

¹⁷ T., D., Brody, *Evaluating research impact through Open Access to scholarly communication*, 2006. [Online] Available from: <http://eprints.ecs.soton.ac.uk/13313/1/brody.pdf> [Accessed 30-04-2009].

¹⁸ *Metrics from Scholarly Usage of Resources*. [Online] Available from: <http://www.mesur.org/MESUR.html> [Accessed 30-04-2009].

¹⁹ J. Bollen, H. van de Sompel, *Usage Impact Factor: the effects of sample characteristics on usage-based impact metrics*, 2006. [Online] Available from: http://arxiv.org/PS_cache/cs/pdf/0610/0610154v2.pdf [Accessed 30-04-2009].

There is also another project worth mentioning - COUNTER²⁰ (Counting Online Usage of Networked Electronic Resources). This project's aim is to develop a new usage factor measure for journals. The usage factor is calculated as the result of dividing total usage over period X of articles published during period Y by total articles published during period Y.²¹ The calculations of both factors are very similar, though the first one is more detailed.

Usage factor is valuable for librarians, who can better fulfill readers needs knowing their usage preference. Usage data compared with JIF can give a significant clue, what sources are indispensable and should be included in the collection. Usage informs scientists of the value the article or research may carry. Unfortunately the risk of manipulating the factor exist. The ways to increase usage to rise the factor could be invented. Another issue regards usage of high quality articles, which because of various reasons can be addressed only to a very small number of readers. Their usage factor would be low, but the quality is unchanged. Therefore this factor cannot be applied as the only tool for measurement.

Conclusion – how to measure?

The most complete journal quality measurement should include all of the methods presented above. However assessment of quality of the certain article or periodical is provided directly only with qualitative tool - peer review process. Quantitative measures refers to articles prestige, popularity or usefulness. High factor of any kind of these alone can not point out a correct quality level of an article or periodical. On the other hand measuring impact of an item must not be presented without qualitative factors. Journal Impact Factor is useful to point out directions (especial interdisciplinary) for disciplines to grow. Moreover it shows the periodical prestige and general impact on the scientific community, what enlarge high quality articles application to the periodical. Furthermore it shows influence of the certain article to new knowledge creation. Web Impact Factor supplements JIF with data usually not included in the JIF calculations. Impact on online environment becomes as important as in the regular means of scientific communication. Finally Usage Impact Factor gives an insight in influence to the academic community an article or journal may have. Good quality article should cause significant impact and receive high value factors.

The factors presented above can be adapted to any kind of journals. However this paper refers to Open Access periodicals. Data of these form of distribution journals are easier available then the others. Moreover quality of the OA publications sustains an important issue. There is still a lot to be done to associate OA and good quality. One of the way to achieve this goal is to introduce a objective and persuasive quality measurement of OA. The basis for the Open Access or traditional journals measurement should stay unchanged.

²⁰ Project Counter . [Online] Available from: <http://www.projectcounter.org/faqs.html> [Accessed 30-04-2009].

²¹ R. Gedye, *The Usage Impact Factor: how can we enhance the relevance of usage as an indicator of relative value*. [Online] Available from: <http://www.uksg.org/sites/uksg.org/files/GedyeUsageFactorPresentationUKSG2008.ppt> [Accessed 30-04-2009].