# **Usage Metrics for Open Access Repositories**

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# Abstract

Recent studies point to an increased focus on metrics / measuring in regard to open access repositories (OAR). Whereas historically the display of download figures for popular content was a way of promoting an OAR within its respective institution, more recently interest has shifted on how to better utilise OAR usage statistics for more formalised purposes. The authors examine the nature of the more commonly used web-based repository approaches, identify their major shortcomings, and describe recent initiatives to enhance functionality. They then discuss citation analysis and proposals to link this to web-based usage statistics, particularly in the context of high-level drivers focused on research quality and effectiveness. The paper concludes by outlining opportunities for institutions to engage with new metric models.

# **1** Introduction

Historically the literature has focused on key success factors for ensuring participation in institutional repositories, with some studies reporting on motivations for non-participation. As these repositories have matured, some institutions have incorporated publicly available statistical usage reports as a way of both increasing participation and justifying the strategic importance of the repository to the institution's research profile.

Initially this data has been utilised principally for internal purposes. However, with the advent of research assessment exercises (RAEs) in several countries and the increasing need to demonstrate return on investment for funded research, there has arisen a desire to utilise this data for external reporting purposes.

Web-based repository site statistics have traditionally provided the basis for usage statistics. In this paper we have examined the nature of the more commonly used approaches, identified their major shortcomings, and looked at recent initiatives to enhance functionality. We have then looked at citation analysis and proposals to link this to web-based usage statistics, particularly in the context of high-level drivers.

# 2 Web-based repository statistics

As Willinsky [HREF4] observes, open source software such as DSpace, eprints.org and Fedora, is widely used for managing and indexing institutional repositories. For purposes of illustration, we have selected eprints.org and DSpace to discuss the various ways in which analytical statistics are being generated. Web-based repository statistics are often referred to as "web usage" statistics; however we acknowledge Scholze and Dobratz's view that "the more precise term is access data as usage can not be defined precisely [HREF5]."

According to one of the developers of DSpace, Richard Jones, the system came with a basic log file analyser: "The original script was almost purely an aggregator: it simply counted actions performed and reported up on them. Later some more sophisticated aggregating features were added as well as embedding it into the DSpace UI and providing a relatively coherent time-based reporting process [HREF6]." More recently a default implementation of DSpace can provide reports which include data such as:

- A customisable general summary of activities in the archive, by default including:
  - Number of item views
  - Number of collection visits
  - Number of community visits
  - Number of OAI Requests
- Customisable summary of archive contents
- Broken-down list of item viewings
- A full break-down of all system activity
- User logins
- Most popular searches

T-Space, University of Toronto's research repository, offers typical, standard DSpace statistics [HREF7] and provides data on a monthly basis as well.

It would appear that an increasing number of EPrints (eprints.org) sites are using a statistical package based on initial code done at the University of Melbourne and subsequently developed at University of Tasmania by Arthur Sale and Christian McGee [HREF8]. It utilises a combination of the open source AWStats [HREF9] and MaxMind's free GeoIP database [HREF10] to provide:

- Almost real time processing of event logs (adjustable from once a day to more frequently)
- Database based stored data (in a separate MySQL database)
- Detection and processing of the country of origin of accesses, with the local campus separated from the local country due to its different characteristics
- Monthly download stats allows detection of citation or presentation events

- List of documents by access frequency in 4 weeks, monthly, yearly or total (customisable)
- User-friendly graphics and tabular data, including realistic country flags

## 2.1 Efforts to enhance statistical reports

In examining a large number of both eprints.org and DSpace sites, the authors have concluded that at worst a statistical report is nothing more than two columns of numbers corresponding to "month" and "total usage" of the repository and at best it provides an analysis by individual item according to a range of criteria. The latter reflects the increasing pressure for more informative repository statistics. We will return to the relevant drivers later in this paper.

In an effort to provide comparative data about repository usage, two British EPrints repositories have taken slightly different approaches. The White Rose Consortium [HREF11] provides cumulative figures for both "downloads" and "hits" since the repository's inception as well as line charts for the past 12 months of those same two activities. Nottingham eTheses [HREF12] uses pie charts to dynamically report on the countries corresponding to the computers requesting files, http status codes of all requests, file sizes, and files requested. In both cases cumulative data is represented graphically for better conceptualisation by the end-user.

Realising the importance of statistics for individual records --as opposed to cumulative figures for the whole repository-- the University of Tasmania, in the software package mentioned previously, has incorporated the ability to report on individual "documents" [HREF13]. Bar charts report on history of downloads and downloads by country.

Several DSpace sites also offer statistics at the individual record level. University of Rochester provides a cumulative figure for "hits" for each file attached to a single record [HREF14]. University of Toronto provides "advanced statistics" which are restricted to that university's community. Eloy Rodrigues at the Universidade do Minho's RepositoriUM has written a Statistics Add-on module [HREF15]; statistics are recorded at the record / document level for "consultas" (hits) and downloads by country, with a graphical representation of the corresponding country flag.

Griffith University, which uses DSpace for its Griffith Research Online repository, has prototyped a Statistics Add-on module that incorporates a number of features based on 3 different entry points:

1. Overall repository statistics: Cumulative figures are provided for "brief views", full views", "downloads", and "click throughs". The first 3 categories are standard for DSpace; the last one counts the number of times links are clicked within records to external sites, e.g. publisher and conference websites with the full-text version of publications. Total statistics are derived on the basis of a configurable, specified date range and according to whether IP addresses should be calculated for "External only", "Griffith only" or "All". In addition, statistics are analysed on the basis of country and domain.

- 2. Individual record statistics: Each individual repository record has a clickable link to a statistics page which displays the same options listed in "Overall repository statistics". However the statistics are obviously limited to that record.
- 3. Author statistics: Griffith University authors login to a separate Research Administration module where they are automatically authenticated via LDAP. Here they can generate an authoritative list of their publication records in Griffith Research Online --which addresses the issue of variant author names associated with repository records-- and a summary report similar to the "Overall repository statistics" but limited to just their publications. Each title in the list is a clickable link which takes them to the same statistical page described in option 2 above.

## 2.2 Shortcomings of web analytics

Unlike citation data which has to be extracted, web usage is automatically recorded. However, as Carr observes, "Everyone knows that web logs are unreliable and incomplete [HREF16]." They provide at best a rough estimation of repository usage. Lowndes and Sidhu [HREF17] have noted that web server log analysis can be adversely affected by proxy caching, activity of search engine robots and spiders, and dynamic IP assignation by ISPs. Scholze [HREF18] has identified issues associated with data validity, fraud and data manipulation, and privacy and related legal issues.

At the most fundamental level, the challenge is to define what is actually being counted. Westell [<u>HREF19</u>] best summarises the issue when she observes: "Web sites now routinely measure 'hits' . . . with no consensus on what comprises a 'hit'." Repositories vary as to whether viewing pages and / or downloading documents will be measured. For example, University of Queensland has headings in its eprints.org repository entitled "File downloads" and "Abstract view only", which clearly differentiate between the two activities. ePrints@IISc, on the other hand, reports on "access" which is defined as: "Abstract only view or PDF view -when a user views both abstract and PDF, it counts as 1 access."

Fortunately there appears to be general consensus within the industry on the necessity for international agreement on what data needs to / can be collected. As Carr [HREF16] concludes, "international agreement on baselines are [sic] key."

## 2.3 Current collaborative repository statistics initiatives

Several projects devoted to statistics services are of interest, particularly for Australian repositories. The JISC (Joint Information Systems Committee)-funded Interoperable Repository Statistics (IRS) project is currently investigating a joint approach to open access statistics gathering and sharing. Critical to the process is understanding what statistics are important and useful to academics and researchers [HREF20]:

For example, is it relevant if a paper is downloaded by another research institution rather than a home user? Should the downloads be weighted by the downloading institution?

How should multiple downloads of the same document from the same institution be treated? What does it mean for a paper to be read by 30 different users? Should IRs try to set a cookie to track sessions? Should they ask for registration? Should there be a central registration service?

One of the key partners on the IRS project --Professor Arthur Sale from University of Tasmania-- is also a key participant in the Australian-based BEST (Benchmark Statistics Service) project. Funded by Australian Partnership for Sustainable Repositories (APSR), the project will build upon the findings of the JISC IRS project by designing a service for "collecting, aggregating, analysing and presenting this statistical information related to repository collections and usage [HREF21]." A pilot service will include DSpace, EPrints and Fedora clients.

There clearly is a focus on collaborative efforts to identify and then implement agreed baselines for the comparison of statistics on a global scale. The importance of such initiatives should not be underestimated in the current climate which is increasingly focused on measuring research quality and effectiveness.

## **3 Citation analysis and journal impact**

In examining measures of "research quality", citation data has been viewed traditionally as the "golden standard". It is the principal bibliometric data source for evaluating scholarly status. Citations are considered one indicator of the importance and influence of an article and --by extrapolation-- the journal in which it is published as well as its author(s). Citation data also forms the basis for the well-known --and controversial-- journal impact factor discussed in the following section.

## 3.1 Citations

Citation analysis is the examination of the frequency and pattern of citations in publications. Citation impact is the total number of times an article is cited, which is deemed to indicate the impact of that author's work as well as a measure of their reputation. Initially citation indexes, of which the Institute for Scientific Information (ISI)'s Science Citation Index was the first major academic example, allowed the user to easily establish which later documents cited which earlier documents. In more recent years several citation-based initiatives have attracted wide attention.

CiteSeer [HREF22] is a public search engine and digital library for scientific and academic papers. CiteSeer crawls and harvests on the web and uses autonomous citation indexing to permit querying by citation or by document ranking them by citation impact. Source data and references from documents are extracted and then used to build an index composed of cited and citing relationships. The discipline emphasis was initially on computer and information science; more recently however the model has been extended to cover academic documents in business and e-business. Thomson Scientific has utilised this same technology to develop a commercial product, Web Citation Index (WCI), which is undergoing beta testing in 2007. The published version of an article is indexed in Thomson Scientific's Web of Science, whereas the preprint or postprint version accessible in an institutional repository (IR) is indexed in WCI. There are bidirectional links between the two services.

Citebase [HREF23] is offered as a prototype, covering articles from physics, maths, information science, and (published only) biomedical papers. It ranks articles and authors by citation impact, co-citation impact or download impact, and can be extended to incorporate multiple metrics of research impact. It also offers a download / citation correlator. Although it is limited to just performing rank-ordering of Citebase searches --as Google does-- it has the potential to do much more.

The H-index or Hirsch number, proposed by physicist Jorge Hirsch in 2005, is designed to go beyond simple statistics such as the total number of citations or publications, to distinguish influential scientists from those who simply publish many papers [HREF24]. The score is based on the highest number of papers that a scientist has produced that have had at least this number of citations. So, a score of h = 25 means that an author has published 25 papers, each of which has been cited at least 25 times. In effect, published papers with fewer citations than h do not count in the analysis. The objective is to assess the quality rather than quantity of researchers' publications.

## 3.2 Journal impact factor

Journal impact factor --generally referred to as impact factor (IF)-- equates to a two-year citation rate. It is defined as the "the ratio between the number of citations to articles published in a journal over a 2 year period, divided by the total number of citeable articles published in that same period [HREF25]." Therefore impact factor uses citations as a basis for ranking, comparing and evaluating journals. Whereas the focus with citation impact is on "how frequently and widely are you (as an author) being cited?", the focus with impact factor shifts to "how highly ranked is the journal in which you publish?"

The limitations to the de facto industry standard, the ISI IF, are well documented: "citation data lags scholarly trends due to publication delays, the ISI IF is calculated for only about 9,000 journals, journal level statistics do not accurately represent the value of a particular article, and the semantics of citation (e.g. disagreement vs. endorsement) is not always clear [HREF26]". There is the failure to include many high quality journals in the applied aspects of some subjects, such as marketing communications, public relations and promotion management and many important but not peer-reviewed technical magazines. Even in the sciences, it is not fully relevant to fields, such as some in engineering, where the principal scientific output is conference proceedings, technical reports, and patents. This product fails to address adequate coverage for the social sciences and humanities, particularly because journals are frequently not the primary means of scholarly communication for many areas. Finally there are differences in citation patterns between disciplines, which may not be readily apparent to anyone applying the data at an institutional level, i.e. across a wide range of fields.

In the past three years several competitors --commercial and non-commercial-- have emerged, which have attracted attention as well as adopters. These include Elsevier's Scopus [HREF27], Microsoft's

Windows Live Search Academic [HREF28], and Google Scholar [HREF29]. It is not the authors' intention to discuss these products as such but rather to make two observations. In the first place, the rapid emergence of new metric resources clearly indicates the perspective that citation metrics are "big business". Secondly, the announcement, for example, by Elsevier in April 2007 that it plans to incorporate Hirsch's h-index into Scopus indicates that companies are actively investigating methods for removing the "blunt instrument" approach of the current impact factor. That is to say, they are attempting to modify their products in ways that are seen to address the limitations previously discussed.

In 2006 Johan Bollen, Marko A. Rodriguez, and Herbert Van de Sompel [HREF30] proposed using Google's PageRank algorithm:

The ISI Impact Factor (ISI IF) is defined as the mean number of citations a journal receives over a 2 year period. By merely counting the amount of citations and disregarding the prestige of the citing journals, the ISI IF is a metric of popularity, not of prestige. We demonstrate how a weighted version of the popular PageRank algorithm can be used to obtain a metric that reflects prestige. We contrast the rankings of journals according to their ISI IF and their weighted PageRank, and we provide an analysis that reveals both significant overlaps and differences. Furthermore, we introduce the Y-factor which is a simple combination of both the ISI IF and the weighted PageRank, and find that the resulting journal rankings correspond well to a general understanding of journal status.

As with the H-index, there has been widespread interest in Bollen's work because of the focus on quality, not quantity. These new proposed metrics are a direct response to the challenge that citation analysis --specifically citation counts-- is currently being applied to both individuals and journals in a way that was never intended by Eugene Garfield, founder of the Institute for Scientific Information. In the final analysis no single resource should be considered absolute in terms of providing data on the citation count of articles and /or authors, let alone potential impact. The challenge, of course, is to standardise on new models --with an intentional emphasis on the plural-- that provide meaningful data for a wide range of stakeholders.

## 3.3 Change drivers

Funding bodies and governments are seeking improved return on investment for funded research. With this accountability comes an implied need for metrics. Research assessment exercises (RAEs) in several countries --both operational and planned-- have relied quite heavily thus far on the traditional metrics previously discussed. At the same time, however, other factors are coming into play which reinforce the emerging importance of open access repositories.

Bjørnshauge, for instance, emphasises that, along with the dissemination of publications, IRs are often intended to record the [scientific] published output of an institution. For this reason he concludes that they can and will play an increasing role in research assessment and performance measurement

[HREF5]. This view is further substantiated by changes in funding rules for various national funding agencies. In Australia, for example, several important research funding bodies, e.g. Australian Research Council (ARC) and the National Health and Medical Research Council (NHMRC), have clearly outlined in their respective funding rules for 2008 an expectation that "any publications arising from a research project [will be deposited] in an appropriate subject and/or institutional repository wherever such a repository is available to the researcher(s) [HREF31]."

In principle, both RAES and research funding bodies are interested in the actual impact of research, not just a researcher's productivity. Moed's definition of impact -- "The *impact* of a piece of research is the degree to which it has been useful to other researchers and users in generating further research and applications: how much the work has been read, used, built-upon, applied and cited in other research as well as in educational, technological, cultural, social and practical applications [HREF32]", clearly positions OARs as a valuable component within the total research environment.

Another important area is that of university rankings --yet another source of much controversy as to methodology. In contrast to the much publicised compilations of Shanghai Jiao Tong University and the Times Higher Education Supplement, it is useful to contrast the Webometrics Ranking of World Universities, which takes into account an institution's commitment to open access initiatives. With specific reference to the criterion of self-archiving, the web site states: " As much of these papers are published as rich files, pdf, ps or doc, this practice increases notably the performance of an institution in our rankings [HREF33]."

In terms of these important drivers the challenge is to ensure that the traditional, fast, relatively inexpensive metrics (citation and impact) are supplemented by additional measures.

# 4 Enhanced and alternative metrics for open access repositories

Bollen has reported on the work done at Los Alamos National Laboratory and California State University. Usage data is collected through link resolvers, which requires the establishment of an infrastructure to enable this. It is argued that IRs should be able to become part of that infrastructure, i.e. they should at least be OpenURL enabled [HREF5]. An infrastructure which involves all relevant services --e.g. library catalogues, online databases and repositories-- maximises the visibility of publications. The key therefore is interoperability so that citation data, for example, can be integrated between open access and commercial entities in order to receive the citation data of **all** resources, not just a few. The Interoperable Repository Statistics (IRS) project maintains that "As far as peer reviewed papers are concerned, since copies deposited in IRs are intended as an open access supplement to the published version, it would be an advantage to be able to aggregate usage statistics of all versions of a paper, for example, linking usage of IR and journal versions." It goes on to quote David Goodman: 'Even the publishers are interested (in IRs), wanting very much to have objective figures for how their articles are distributed [HREF6].' DINI (German Initiative for Networked Information) and DFG (German Research Foundation) organised a major workshop in 2006 to discuss enhanced and alternative metrics of publication impact because of the increase in the number of scientific publications available via open access in institutional repositories [HREF5]. Bodies such as JISC, SURF (SURFfoundation) and SPARC (Scholarly Publishing and Academic Resources Coalition) Europe are funding initiatives to consider a wider basis of data and other algorithms to process this data in order to produce quantitative metrics of scientific visibility.

A number of European workshops between 2006 and 2007 have recommended closer co-operation with COUNTER (Counting Online Usage of NeTworked Electronic Resources). A key recommendation from the IR Workshop Strand Report [KE Danish07usage] was to work with COUNTER to support more complex object structures, e.g. conference proceedings, chapters in edited volumes and e-learning objects. As of April 2007 COUNTER identified a number of specific issues which it was addressing, including "setting standards for the usage of content held by institutional repositories [HREF34]."

In the US, MESUR (Metrics from Scholarly Usage of Resources) is a funded study of usage-based metrics. The objective is to create a large-scale reference data set (semantic network) that relates all relevant bibliographic, citation and usage data according to a model of the scholarly communication process [HREF35]. The defined metrics will be cross-validated in terms of COUNTER usage statistics, impact factor (IF), and citation counts. The end result will be the formulation of guidelines and recommendations for future applications of metrics derived from scholarly usage data. The fundamental point which Bollen and others make is that given the millions of articles which are stored in repositories worldwide, there is an even larger number of "usage events" which occur daily, e.g. viewing records and downloading content (files). An even more compelling factor is that many recent studies have shown that in a variety of communities, download figures for open access papers are strongly correlated with subsequent citations [HREF36].

At the aforementioned DINI / DFG Workshop, participants agreed that there needed to be a combination of different metrics, taking into account that the purpose of statistics would differ for different stakeholders. Documents could be analysed differently for separate purposes, e.g. teaching versus research: "There is no urgent need to be cited regarding for example a lecture book, (in other words to gain prestige), but rather that students read it (which means to gain popularity). In this example, it would be more appropriate to collect access rather than citation statistics [HREF5]."

New metrics could "eventually help to gnaw through the monopoly of scholarly publishers that is established by the necessity for researchers to publish in ISI-selected journals as a means to advance their careers [HREF25]."

# **5** Conclusion

Historically research quality has been evaluated on the basis of a range of measures, including citation analysis and journal impact factor. These are at best blunt instruments which have been readily applied because they can be relatively fast and easy to extract, although this functionality has tended to reside in the commercial domain. This widespread practice --historically controversial-- has been the renewed focus of attention from the research community in recent years, especially given the fierce competition for funding dollars. Steele and others [HREF37] have summarised a key component in the current measurement model: "So if Thomson Scientific metrics alone are often used in research assessment exercises, and underpin the compilation of university league tables, then the selectivity of journals by them creates a significant issue for evaluation purposes." One could well wonder what has happened to the effective dissemination of knowledge as a primary basis for "publishing" when authors now have to be as concerned about what vehicle to publish in as they are about the actual content of what they are communicating.

The current --and projected-- growth in OARs is placing pressure on the scholarly and research community to evolve a wider range of metrics, including more quantitative analysis and assessment. The authors have discussed web repository usage statistics, particularly downloads, as equally relevant and auditable evidence for the use of research. In addition they have reported on a number of international projects which are investigating and / or prototyping systems to integrate OAR / IR usage statistics with citation data. The evolution of new metric models will be accelerated because of the rate of change within the scholarly publishing paradigm.

Looking towards the future, it would seem that the business of publishing is rapidly approaching a crossroad at which the traditional publishing industry will reach its peak. Open access publishing, which has not been covered in this paper, will develop as a parallel publishing method in its own right. Whereas Thomson Scientific's measures of impact measure the past, new measures such as downloads will be better predictors of the future. Institutions will need to seek information and measures from both publishing streams to see the full picture. Publishing will follow peer review. Open access will derive new measures of prestige created by links to traditional publishing. Participation in certain open access initiatives, and the results of new measure exercises, will generate new sources of prestige which will compete with the old journal-based attribution of prestige. Institutions will need to start engaging with new measures as well as open access publishing to stake a claim in the newly developing prestige market. Institutions' willingness to play in the new domain will be a major force in the new order, which will come with its own new rules. Reputation takes time to develop. Previously mid-ranked institutions will improve their status just because they have expeditiously rolled out a well-developed online presence, making their research highly available. Some currently highly ranked institutions will lose status because they did not exercise vision soon enough to play in the new order. There is now an opportunity to unsettle the order. Time is of the essence and judicious timing is an ambitious institution's best asset.

## **Hypertext References**

HREF1

http://jprglobal.tripod.com/

#### HREF2

http://www.griffith.edu.au/researchonline/

#### HREF3

http://www.griffith.edu.au/

#### HREF4

http://www.firstmonday.org/issues/issue10\_8/willinsky/

#### HREF5

http://www.dini.de/veranstaltung/workshop/oaimpact/oa-impact-wsreport2006-03-30.pdf

#### HREF6

http://irs.eprints.org/about.html

#### HREF7

https://tspace.library.utoronto.ca/statistics

#### HREF8

http://eprints.utas.edu.au/262/

#### HREF9

http://awstats.sourceforge.net/

#### HREF10

http://www.maxmind.com/

#### HREF11

http://www.leeds.ac.uk/library/sherpa/access\_stats.html

#### HREF12

http://etheses.nottingham.ac.uk/stats.html

#### HREF13

http://eprints.utas.edu.au/

#### HREF14

https://urresearch.rochester.edu/handle/1802/2688

#### HREF15

https://repositorium.sdum.uminho.pt/handle/1822/4803

#### HREF16

http://indico.cern.ch/materialDisplay.py?

 $\underline{contribId}{=}8\&sessionId{=}14\&materiaIId{=}slides\&confId{=}5710$ 

#### HREF17

http://www.ukoln.ac.uk/web-focus/events/workshops/webmaster-2005/sessions/lowndes/

#### HREF18

http://indico.cern.ch/materialDisplay.py?

 $\underline{contribId}{=}6\&sessionId{=}14\&materiaIId{=}slides\&confId{=}5710$ 

#### HREF19

 $\underline{http://cat.inist.fr/?aModele=afficheN\&cpsidt=17902672}$ 

#### HREF20

http://irs.eprints.org/about.html

HREF21
http://pilot.apsr.edu.au/wiki/index.php/BEST
HREF22
http://citeseer.ist.psu.edu/
HREF23
http://www.citebase.org/
HREF24
http://www.nature.com/nature/journal/v436/n7053/full/436900a.html
HREF25
http://public.lanl.gov/herbertv/papers/ipm05jb-final.pdf
HREF26
http://www.cs.bell-labs.com/cm/cs/who/pfps/temp/web/www2007.org/posters/poster860.pdf
HREF27
http://www.info.scopus.com/
HREF28
http://search.live.com/results.aspx?scope=academic&q=
HREF29
http://scholar.google.com/
HREF30
http://www.arxiv.org/PS_cache/cs/pdf/0601/0601030v1.pdf
HREF31
http://www.arc.gov.au/pdf/DP08_FundingRules.pdf
HREF32
http://cogprints.org/4841/
HREF33
http://www.webometrics.info/glossary.html
HREF34
http://projectcounter.org/faqs.html
HREF35
http://indico.cern.ch/getFile.py/access?
contribId=7&sessionId=14&resId=0&materialId=slides&confId=5710
HREF36
http://opcit.eprints.org/oacitation-biblio.html
HREF37
http://dspace.anu.edu.au/handle/1885/44486

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