



Open Access Usage Statistics: Problems and Solutions

Abdolreza Noroozi Chakoli (PhD)ⁱ
Shahed University, Tehran, Iran

Lale Samadiⁱⁱ
Library and Information Center, Iranian Philosophy
Institute, Tehran, Iran

Leila Chehrenegarⁱⁱⁱ
Ministry of Education, Tehran, Iran

Mehrdad Rostamzadeh^{iv}
National Research Institute for Science Policy
Ministry of Science, Research and Technology
Tehran, Iran

Meeting: 141.E-metrics SIG: current challenges and activities

WORLD LIBRARY AND INFORMATION CONGRESS: 76TH IFLA GENERAL CONFERENCE AND ASSEMBLY
10-15 August 2010, Gothenburg, Sweden
<http://www.ifla.org/en/ifla76>

Abstract

Open access publishing modes are expanding their presence and increase the use of scientific resources. With so many open access resources now being available electronically, electronic resource usage statistics (or e-metrics) are potentially very useful in determining the use and relevance of the electronic collection with the users. Thus, Librarians use statistics to evaluate the use and relevance of open access collections with their users' needs. Though open access usage statistics contain a wealth of information, mining that information from the massive amounts of data can be time consuming, expensive, and dangerous. Therefore, the policy of using the statistics should contain guidelines for the collection and processing of the data. According to the mentioned points, the paper intends to describe some problems and challenges for using the open access usage statistics and presents some solutions.

Keywords

Open access- usage statistics- problems- solutions- users

1. Overview

In the traditional, hard-copy publishing environment, usage of publications held in the library was difficult to measure systematically. This meant that meaningful usage statistics were either not available, or were insufficiently reliable to form a basis for decisions about the relative value of different publications. In the online publishing environment, it is not only possible to measure usage in a systematic way, it is desirable to do so, from the perspective of the publisher as well as the librarian (Shepherd, 2006).

A few years ago, it was provided for users to access the open access resources in online environment. Though there is access to this valuable resources through some publishers and organization nonprofits, their usage statistics are important both for publishers and librarians.

Librarians require online open access usage statistics to enable them to:

- assess the value of different online products/services;
- make better-informed providing decisions;
- plan infrastructure and allocation of resources; and
- support the users and promotion of library services.

Nonprofit Publishers require online open access usage statistics to allow them to:

- experiment with new valuing models that reflect the current value of online publications, rather than the historical hard-copy holdings from which they were derived;
- assess the relative importance of the different channels by which information reaches user;
- provide editorial support for new product development, etc;
- plan infrastructure, improve site design and navigation; and
- obtain the improved users analysis and demographics.

In recent years there has been a growing awareness of the need for an international effort, involving nonprofit publishers, librarians and intermediaries, to develop acceptable, global standards for measuring online usage. The objective of some of these projects such as COUNTER (Counting Online Usage of NeTworked Electronic Resources) is to develop agreed international Codes of Practices governing the recording and exchange of online usage data for different categories of content.

It is important to stress that improving the quality of open access usage statistics benefits nonprofit publishers and intermediaries as well as librarians. Considering these points nonprofit publishers and intermediaries will be able to provide data to their users in a format they actually want and learn more about genuine usage patterns. They will also be able to assess the relative importance of the different channels by which their online open access resources reach the users satisfaction and aggregate data for them that is using more than one delivery channel. New valuing models for online open access resources are emerging that require publishers to take usage into account; usage data supporting these should be credible. The infrastructure required to support electronic resources is sophisticated and costly; access to reliable open access usage statistics will help publishers make an appropriate allocation of caches, mirror sites, etc.

According to the mentioned points, this article attempts to study some problems about collecting, analyzing and using of usage statistics on open access databases and presents solutions.

1. Open access advantage

Open access is now seen to have different benefits. The justification for open access has thus turned away from the serials pricing argument, towards the argument for open access advantage.

In this view of open access, the open access (OA) gain is in the extra impact that research accrues through being openly available to those who cannot afford subscription access. This is a very common sense view of how open access works, and there is much very reliable evidence to show that it is true. Any librarian who manages an institutional repository will maintain some sort of statistical count of downloads from their service, and— once the activities of robots are filtered out— it is pretty clear that real human beings are using open access repositories to read full text articles (Joint, 2009).

With Northern hemisphere institutional repositories, the peaks of access and downloading tend to come in the Northern hemisphere summer, when university researchers stop full-time teaching and have spare capacity to do research. Open access downloads spike at this time (unlike robot activity, which is constant throughout the year).

The next question to ask is: what does this pattern of use of open access repositories actually signify? Surely high-powered researchers at world class research institutions will already have subscription access to the best journals in their area – these researchers cannot be turning to open access repositories as their first port of call for full text?

There is definitely potential for a lavishly funded JISC project to investigate such a question, but suffice to say that there are a number of plausible explanations for the popularity of open access repositories. Firstly, even academics at institutions with rich e-journal holdings may prefer to access those very same e-journal articles directly, rather than via the password protected route of locally authenticated resources. One may only save a few mouse clicks and key strokes by choosing such an access route, but small advantages can make or break any product in a market and thus may explain this pattern of open access preference.

Secondly, researchers in fields not apparently related to the subject of an open access article may not have local subscription access to the e-journal article version of that OA paper. If an e-journal does not fit the research profile of their home institution, it will not be purchased, thus preventing the serendipitous discovery of articles in cross-disciplinary research areas. So, open access has a particular role to play in facilitating this sort of information provision across rigid subject divides.

And lastly, there are academics and scholars who have simply no significant access to commercial e-journal provision, due to lack of financial resources. Open access is the only access route for those whose studies are hampered by poverty.

Thus, there are many good reasons for the popularity of open access repositories, all of which centre on the increased visibility that open access gives to papers whose availability is otherwise limited by subscription firewalls. Open access increases the impact of papers, and this extra impact is in effect the proof of open access advantage.

However, this amplification of impact has become particularly important in countries where research funding is tied to the measurable impact of published research. Where such funding metrics are used, increasing impact also means increasing the earning potential of your research.

2. Some challenges in using of usage statistics for open access databases

There are some problems in using the open access databases. Some of these problems refer to the format of obtained data from their softwares. Some other problems are related to the analyzing methods and some others are referred to the necessity of coordinating with international standards. Even what have to be considered as the usage, is one of the problems that must be a unique defined. But some databases don't follow it. Therefore, the obtained statistics have not too benefits to evaluate and compare a database with its similar other databases. In the continuation, it will be attempted to enter the discussion with more details.

3-1. Using of Transaction Log Analysis (TLA) as complementary data

Transaction Log Analysis (TLA) is used to achieve some objectives, such as improved system design, advanced searching assistance, or identified user information-searching behavior. For web-searching research, TLA is defined as a use of data collected in a transaction log to investigate particular research questions concerning interactions among web users, the web search engine, or the web content during searching episodes.

TLA trends itself to a grounded theory approach (Glaser & Strauss, 1967). This approach embassies a systematic discovery of theory from data using methods of comparison and sampling. The resulting theories and models are grounded in observations of the "real world", rather than abstractly in generated. Therefore, grounded theory is an inductive approach to theory of model development rather than the deductive alternative.

However, there are some critiques about it. Some these critiques (Blecic et al., 1998; Hancock-Beaulieu et al., 1990; Phippen et al., 2004) report that transaction logs do not record the users' perceptions of the search, cannot measure the underlying the information need of the searchers, and cannot gauge the searchers' satisfaction with search results. Kurth (1993) comments that transaction logs can only deal with the actions that the user takes, not their perceptions, emotions, or background skills. Kurth (1993) further identifies three methodological issues with TLA: execution, conception, and communication. Kurth (1993) states that TLA can be difficult to execute due to collection, storage, and analysis issues associated with the hefty volume and complexity of the data set (i.e., significant number of variables). With complex data sets, it is sometime difficult to develop a conceptual methodology for analyzing the dependent variables. Communication problems occur when researchers do not define terms and metrics in sufficient detail to allow other researchers to interpret and verify their results. Certainly, any researcher who has utilized TLA would agree with these critiques.

Because transaction logs are primarily a server-side data collection method; therefore, some interactions' events are masked from these logging mechanisms, such as when the user clicks on the back or print button on the browser software, or cuts or pastes information from one window

to another on a client computer. Transaction logs also, as stated previously, do not record the underlying situational, cognitive, or affective elements of the searching process.

However, although Kurth's critique (1993) some other criticizers are still generally valid, advances in transaction logging software, standardize transaction log format, and improved data analysis software and methods have addressed many of these shortcomings (Jansen, 2006).

Using TLA as a methodology, one examines the characteristics of searching episodes in order to isolate trends and identify typical interactions between searchers and the systems and it can be useful to analyze the usage statistics on open access databases. TLA involves the following three major stages, which are as follows (Jansen, 2006):

1. collection: the process of collecting the interaction data for a given period in a transaction log;
2. preparation: the process of cleaning and preparing the transaction log data for analysis; and
3. analysis: the process of analyzing of the prepared data.

For TLA, interactions are the physical expressions of communication exchanges between the searcher and the system. For example a searcher may submit a query to an open access database. (i.e., an interaction). The database (system) may respond with a results page (i.e., an interaction). The searcher may click on an Uniform Resource Locator (URL) in the results listing (i.e., an interaction). So, For TLA, interactions is more mechanical expression of underlying information needs or motivations.

Now, transaction logs are powerful tool for collecting data on the interactions between users and open access databases. One can combine TLA with other data collection methods or other research results to improve the robustness of the analysis. Overall, TLA is a powerful tool for open access databases and web-searching research, and it process outlined here can be helpful in future open access databases and web-searching research endeavors.

3-2. Compatibility with International Guidelines

The elements of usage statistics have to match the international guidelines such as ICOLC. The Priority measurement elements in the ICOLC Guidelines are consisted (Breland, 2000):

- 1) Number of queries, i.e., the basic number of searches undertaken;
- 2) Number of menu selections, i.e., the number of selections from alphabetical of subject-based menus resulting from search engines;
- 3) Number of sessions, i.e., the number of logins;
- 4) Number of turnaways, i.e., because the number of simultaneous users specified in the contract was exceeded; and
- 5) Number of items examined; i.e., viewed, printed, marked, downloaded, or e-mailed.

3-3. Using standard definitions by all publishers

It is necessary for standard definitions to be used by all publishers so that one open access statistical package can be compared with another. The reporting of usage data by open access publishers to state should be: electronic; real time; allow various breakdowns; and permit exporting of data for cross-publisher analysis. It is necessary for consistent reporting of data by libraries themselves to state and national agencies to facilitate benchmarking and peer comparison. Also, traditional library use statistics might not be applicable to the current environment and new measures of electronic usage are necessary for a complete picture of library use. Yet obtaining much of the key data are dependent upon the publisher and thus beyond the library's control (Breland, 2000).

3-4. Analyzing usage statistics in its context

In addition to importance of using standard definitions by all publishers that before-mentioned, usage statistics are only meaningful if placed into context. For example, one should not focus on raw use numbers, but should use them to compare with similar journals. Furthermore, an inefficient search engine that produces false hits can exaggerate use statistics (Breland, 2000). So, usage statistics should be standardized and private between the publisher and user. However, some libraries would view usage data out-of-context and cancel low-use titles.

3-5. What is the usage and what is the difference between visit, search and FT retrieval?

Despite the long history of computerized monitoring and the recent flurry of activity, several enduring issues remain and should not be ignored. First, definitions of the basic terms are crucial. The notions of a visit, search, and FT retrieval are three basic terms that should be carefully defined and consistently applied, if possible. Virtual visits are akin to turnstile counts. Second, what is usage, and what do we really know with confidence about how persons use information, especially digital information? From the physical world of bricks and mortar, paper and ink, we know that when we measure turnstile counts and the circulation of print-based materials, we are measuring allegedly good indicators of use, not the actual use itself. In the open access online realm, measuring page views and full-text items downloaded does not really get us closer to use itself. We still are measuring only good indicators of use. When all is said and done, however, we must remember that open access resource usage statistics may not move us any closer to a clear understanding of real use of information than did gate counts and circulation statistics. We continue to study presumably good indicators of use, not use itself. Third, we need to be careful about any inferences we make from an analysis of usage data about the needs, interests, and preferences of open access users. How do users actually apply open access resources and services to the information and learning projects of their lives? (Peters, 2002)

3-6. Problems and challenges in collecting and analyzing

There is a lack of clear and consistent definition of data elements; publishers do not "count" things in the same manner as one another; membership in a nonprofit consortium can skew the statistics of the individual open access in that consortium; libraries structure themselves differently in regards to electronic resources, making data gathering difficult; libraries do not control access to and use of important data about publisher-supplied resources; and the nature of open access electronic resources is changing rapidly and, therefore, data elements are shifting.

3. Some solutions against challenges

4-1. Compound use of Transaction Log Analysis

The Advances in transaction logging software, standardize transaction log format, and improved data analysis software and methods have addressed many of its shortcomings (Jansen, 2006). Now, transaction logs are powerful tool for collecting data on the interactions between users and e-resources such as open access databases. We can combine log analysis data with user survey and interview studies. Then compare them to obtain more complete results. When combined with survey and interview studies, log analysis is an effective way to detect discrepancies between what users say they do (for example, in a focus group study) and what they actually do when they use an online system or web site (Covey, 2002). In fact, log analysis is a suitable method for raising evidence-led questions to be asked in questionnaire surveys or interview studies from the

users. Furthermore, Log analysis is a suitable method for studying and comparing information seeking behaviour of user groups. Log data provide the researcher with detailed information about different aspects of information seeking behaviour of users such as time of use, type of material used, navigational patterns, and so forth (Jamali; Nicholas; Hungtinton, 2005).

Therefore, using this data, TLA can provide significant insights into users and the databases interactions, and it complements other methods of analysis by overcoming imitations inherent in these methods. With respect to shortcomings, one can combine TLA with other data collection methods or other research results to improve the robustness of the analysis. Overall, TLA is a powerful tool for open access databases and web-searching research, and the TLA process outlined here can be helpful in future open access databases and web-searching research endeavors (Jansen, 2006). Qualitative and quantitative user- behavior analysis, such as online surveys, real- time observation, real- time surveys, and feedback gathering is complementary to the transaction log- based quantitative usage analysis. General usage patterns can be identified by means of transaction log analysis, and qualitative analysis tools can be applied to understand the causes of the phenomena observed (Ke; Kwakkelaar; Tai; Chen, 2002).

4-2. Suggestions for collecting the usage data

The libraries have to considerate key points below as their priorities for collecting data on open access electronic resources (Kyrillidou, 2001):

- to get usage data to compare added value and to promote under-used resources;
- to achieve a consistent approach and standard reporting formats;
- to get advice on analyzing the data and using it for decision making and support allocation;
- to answer the questions “Why are we counting?” and “What measures are meaningful?”;
and
- to achieve all this in a timely manner.

On one hand, by collecting data over a long period of time, we are able to track some of the changing research habits at open access resources, and the increasing user satisfaction (Cheng; Bischof; Nathanson, 2002).

For beginning a systematic program of open access usage statistics collection, management, and interpretation, the following are some suggestions (Conyers, 2004):

- Start small – begin with an easily manageable, or perhaps an urgent project. Add one project at a time. After a while, you will realize that you have gathered a considerable amount of useful information.
- Before starting to collect statistics, define the purpose and how you want to use the numbers. The purpose of the project will, in all likelihood, affect how you proceed in collecting the data.
- Take full advantage of technology to help you collect and disseminate data. Share the information with your colleagues and/or users whenever possible, and make the statistical database available online.
- Consider statistics and/or assessment in the beginning when you first start a new project. It is much easier to gather relevant information if you make it part of the design of your program.

- Long-term statistics are vital to a well-balanced analysis of use. The sooner the collection process begins, the sooner you will have adequate data to analyze.
- If you undertake a large project, find out if you have suitable software and research colleagues that might assist in data collection and analysis.

In addition, it is necessary to present a unique definition of usage as mentioned.

Usage of the collection can be divided into three levels. Level I, studies how the user accesses the collection. Level II, looks for some indication of user interests in using the collection they have accessed such as viewing, printing, downloading and requesting. Level III, goes one step further— studying evidence of users actually using the information for their learning or research such as citation analysis (Yi and Borin, 2006) (Borin; Yi, 2008).

4-3. Considering the Contexts to analyze the e-resource usage reports

Just as there are basic ways to analyze open access resource usage statistics, so too are there basic contexts into which these usage reports can be placed (Peters, 2002):

- *Resource context.* How is usage of the open access resource evolving over time? After a year's worth of usage data have been compiled, the usage statistics for a month or quarter can be compared to those for the same month/quarter of the preceding year. The OhioLINK academic library consortium, for example, now has several years worth of usage statistics for a large collection of open access resources. They can begin to identify long-term trends in the adoption, diffusion, and use of these e-resources.
- *Temporal context.* In order to successfully understand, interpret, and apply an open access resource usage report, the analyzer must have a thorough knowledge of the open access resource content, interface, search engine, and general structure.
- *Similar resource context.* Open access usage statistics for similar e-resources can be compared and contrasted. For example, It is advised to compare using open access with the purchased databases such as EBSCO, IAC, and BHIL and etc.
- *Peer institution context.* Open access usages statistics for the same resource from peer institutions can be compared.
- *Print counterpart context.* Sometimes the usage statistics for the print counterpart to an e-resource can be compared with the open access resource usage statistics. There are inherent dangers and limitations with this method of contextualization, however. Luther (2000, p. 3) notes: "What little data librarians have on the use of print cannot serve as a basis for projections on the use of open access electronic journals" (Peters, , 2002).

4-4. Using the new development of usage statistics services

It is important new development of usage statistics services to be used. In the UK, the new step towards comparable item-level usage statistics was taken by the recently-initiated PIRUS project. Its aim is to formulate a COUNTER-compliant standard for publishers and repositories for the measurement of the usage of journal articles (Merk; Scholze; Windisch, 2009). The standard will also be designed to be applicable in a repository context. PIRUS has been funded by JISC from September to December 2008; it marks a joint effort between publishers and repository

representatives and it will be useful to measure the open access Journals (Merk; Scholze; Windisch, 2009).

In the German context, the results of the current report primarily was taken further by the DFG-funded project OA-Statistics. Within the Knowledge Exchange (2007), the organizations DEFF, DFG, JISC, and SURF were already sharing their views on usage statistics.

Beyond technical and organizational implementation, it is important to provide repositories and authors with information and support in dealing with usage statistics; this will increase the acceptance of usage statistics as well as compliance with the standards. So far, the OpenDOAR policy tool has helped repositories to formulate policies on metadata, data, content, submission, and preservation. This tool could be extended to provide possible policies for open access usage statistics. OpenDOAR is an authoritative directory of academic Open Access repositories. It could also in the future give an overview of the different usage statistics policies in repositories. The open access users could easily find out whether the repository publishes usage statistics and what their granularity or format is. In addition, the SHERPA/RoMEO service listing the Open Access Policies of publishers could be extended to display information about which statistical data is available from publishers under which conditions.

4. Conclusion

Despite the slow development of standards for open access usage statistics, and despite the slow adoption of mainstreamed open access usage statistics analyses in collection and library management fields, there are several attainable outcomes of the use of computerized monitoring to study open access usage. We can come to know the basic facets of how humans seek and use open access resources in online environments. It now is possible to study usage patterns over time. A good usage statistics analysis program can provide informed leverage during license use talks. For a user-centric analysis, it is possible to identify low and no-use subpopulations for targeted awareness campaigns. Although inter-institutional comparisons must be made with caution, because many factors may contribute to different usage levels of the same open access resource at purportedly similar users, they can provide useful benchmarks or “aspirationmarks” (Peters, 2002).

Now, we need to develop measurement and assessment methods to accurately portray how users are using open access resources. Some of the basic “natural” laws of library and information science may not apply as well or as consistently in the realm of electronic information discovery and use. For example, Blečić *et al.* (forthcoming) speculate that the 80/20 rule (i.e. that 20 percent of the resources in a collection account for 80 percent of the use) may not apply to the use of collections of open access e-journals. Analysis of open access e-resource usage statistics serves much more than simply causing us to review and possibly revise some fundamental conclusions and assumptions of library and information science. Open access usage statistics represent a huge opportunity to transform the profession. We may be able to systematically learn more about the online information seeking and open access usage patterns and needs of open access databases patrons than we ever hoped to know about their use of physical libraries.

Return to the three essential steps in studying any type of human behaviour: data collection, data analysis, and applying the new knowledge gained from the analysis. In the good old days, humans performed all three steps. When transaction logs were introduced over 40 years ago, computers took over the responsibility of gathering the data (but humans still programmed how the computers were to log the data). When Web server log analysis software started to appear in the mid-1990s, the focus of this software was on analyzing the data captured in the Web server

logs. Humans still had to interpret the analysis and apply the results, but computers were doing much of the data capture and analysis. In the near future we may see many online information environments that complete the transition from human activity to computer activity in this area. That is to say, the computer system will gather, analyze, interpret the analysis, and apply this new found knowledge by itself, without much direct human intervention. Online information environments such as open access databases, will become self-improving. They will modify their organization and presentation in order to better serve the people who are using them, based on the analysis of data collected about human behaviour in these information environments. Furthermore, these online information environments may become self-customizing at the level of individual users.

References

1. Blečić, D; Bangalore, N.S.; Dorsch, J. L.; Henderson, C. L.; Koeing, M. H.& Weller, A.C. (1998). "Using transaction log analysis to improve OPAC retrieval results". **College and Research Libraries**. 59 (1), p. 39- 50.
2. Borin, Jacqueline; Yi, Hua. (2008). "Indicators for collection evaluation: a new dimensional framework". **Collection Building**. Vol. 27, No. 4, p. 136- 143.
3. Breland, June. (2006). "Usage statistics for the evaluation of electronic resources (conference reports)". **Lib. Coll. Acq. & Tech. Serv.** . 24. p. 267- 350.
4. Cheng, Rachel; Bischof, Steve; Nathanson, Alan J. (2002). "Data collection for user-oriented library services: Wesleyan University Library's experience". **OCLC Systems & Services**. Vol.18, No. 4, p. 195- 204.
5. Conyers, Angela. (2004). "E-measures: developing statistical measures for electronic information services". **VINE: The Journal of Information and Knowledge Management Systems**. Vol. 34, No. 4, P. 148- 153.
6. Covey, D.T. (2002). "Usability and Usability Assessment: Library Practices and Concerns". **Council on Library and Information Resources**. [Online]. Available at: <http://www.clir.org/pubs/reports/pub105/pub105.pdf> (visited 20 March 2009).
7. Glaser, B. & Strauss, A. (1967 June). **The discovery of grounded theory: strategies for qualitative research**. Chicago Aldine Publishing Co.
8. Honcock- Beavlieu, M.; Robertson, S. & Nielsen, C. (1990). **Evaluation of online catalogues: an assessment of methods (BL Research Paper 78)**. London: The British Library Research and Development Department.
9. Jamali, Hamid R.; Nicholas, David; Hungtinton, Paul. (2005). "The use and users of scholarly e-journals: a review of log analysis studies". **Aslib Proceedings: New Information Perspectives**. Vol. 57, No. 6, p. 554- 571.
10. Jansen, Bernard J. (2006). "Search log analysis: what is it, what's been done, how to do it". **Library & Information Science Research**. 28. p. 407-432
11. Joint, Nicholas. (2009). "The Antaeus column: does the "open access" advantage exist? A librarian's perspective". **Academic libraries; Digital storage; Generation and dissemination of information**. Vol. 58, No. 7, P. 477- 481.
12. Ke, H.; Kwakkelaar, R.; Tai, Y.; Chen, L. (2002), "Exploring behaviour of e-journal users in science and technology: transaction log analysis of Elsevier's ScienceDirect OnSite in

- Taiwan". **Library and Information Science Research**. (also e-mail to the author, 25 May 2004). Vol. 24, No.3, pp.265-91.
13. Ke, Hao-Ren; Kwakkelaar, Rolf; Tai, Yu-Min; Chen, Li-Chun. (2002). "Exploring behavior of E-journal users in science and technology: Transaction log analysis of Elsevier's ScienceDirect OnSite in Taiwan". **Library & Information Science Research**. 24. p. 265–291.
 14. Knowledge Exchange .(2007). "Institutional repositories workshop strand report, strand title: Usage statistics". [Online]. available at: www.knowledge-exchange.info/Default.aspx?ID=164 (visited 2 October 2008).
 15. Kurth, M. (1993). "The limits and limitations of transaction log analysis". **Library Hi Tech**, 11 (2), p. 98- 104.
 16. Kyrillidou, M. (2001), "An overview of performance measures in higher education and libraries". **Journal of Library Administration**. Vol. 35, No.4, p.7-18.
 17. Luther, J. (2000). "*White Paper on Electronic Journal Usage Statistics*". **Council on Library and Information Resources, Washington, DC**.
 18. Merk, Christine; Scholze, Frank; Windisch, Nils. (2009). " Item-level usage statistics". **Library Hi Tech**. Vol. 27, No. 1, P. 151- 162.
 19. Miller, Rush; Schmidt, Sherrie. "E-Metrics: Measures for electronic researches". *In: **Keynote delivered at the 4th Northumbria International Conference on Performance Management in Libraries and Information Services***. [S.L.: S.N., S.D.].
 20. Peters, Thomas A. (2002). "What's the use? The value of e-resource usage statistics". **New Library World**. Vol. 103, No. 1/2, p. 39- 47.
 21. Phippen, A.; Sheppard, L.; & Fumell, S. (2004). "A practical evaluation of web analytics". **Internet research: electronic networking applications and policy**. 14, p. 284- 293.
 22. Shepherd, Peter T. (2006). "COUNTER: usage statistics for performance measurement". **Performance Measurement and Metrics**. Vol. 7, No. 3., p. 142- 152.
 23. Yi, H., Borin, J. (2006). "Measuring trends in electronic resource usage: analyzing database statistics to assess current and future directions". **Management Innovation & Library Services, Proceedings of the 3rd Shanghai International Library Forum**, pp.352-66.