Exploring alternative cyberbibliometrics for evaluation of scholarly performance in the social sciences and humanities in Taiwan

Muh-chyun Tang[1] , Chun-mei Wang[1], Kuang-hua Chen[1], Jieh Hsiang[2]
[1]Department of Library and Information Science, National Taiwan University
[2]Department of Computer Science and Information Engineering, National Taiwan University
No. 1, Sec. 4, Roosevelt Road, Taipei, Taiwan 10617
mctang@ntu.edu.tw, r99126019@ntu.edu.tw, khchen@ntu.edu.tw, hsiang@csie.ntu.edu.tw

ABSTRACT
Research output and impact metrics derived from commercial citation databases such as Web of Science and Scopus have become commonly used indicators of predominantly English language scholarly performance. Yet it has been pointed out that existing metrics are largely inadequate to reflect scholars' overall peer-mediated performance, especially in the social sciences and humanities (SSH) where publication forms are more diverse. In this paper alternative metrics exploring a variety of communication sources were explored, with the aim of better reflecting SSH scholarship. Data for a group of 16 SSH scholars resident on Taiwan were collected, along with the number of grants and awards received from the chief public grantmaking body for the sciences on the island. Principle component analysis revealed four underlying dimensions represented by the 18 metrics. Multiple-regression analyses were performed to examine how well each of the metrics and dimensions predicted the number of public grants awarded the study cohorts. Differences in the significance of the predictors were found between the social sciences and humanities. The results suggest the need to consider disciplinary differences when evaluating scholarly performance.

Keywords
Scholarly performance, Bibliometrics, Evaluation metrics

INTRODUCTION

Though originally created by the Institute of Scientific Information (ISI) for the purpose of facilitating access to literature in sciences, ISI's Web of Science (WOS), now owned by Thomson Reuters, includes the Social Science Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI). WoS' comprehensiveness and choice of highly cited, internationally recognizable journals has made it a popular tool for evaluating predominantly English language scholarly performance, at both the individual and institutional levels. In newly industrialized economies academic institutions aspiring to develop a more prominent role in international scholarship, the comprehensive citation indexes such as Scopus and WoS have become de facto measures for assessing scholarly performance. It has been demonstrated, however, that the journal-oriented bibliographic metrics in the hard sciences might not be as efficacious for demonstrating impact of scholarship in the social sciences and humanities (SSH). Real world controversies naturally arise over these narrowly defined yardsticks of scholarly performance. Prudence dictates that scholarly performance should not be confined to journal-based bibliographic assessment alone and indeed most faculty promotion dossier requirements include emphasis on classroom teaching performance and academic mentorship advising skills through inclusion of student evaluations. In addition, several aspects of scholarly practices in SSH make it necessary to consider alternative metrics to complement the currently dominant WoS or Scopus based metrics. Firstly, while in the hard sciences, journals have become the main venue of fostering global academic discourse through publication; in SSH the channels of scholarly communication are more diverse. It is more common for social scientists and humanists to publish and cite research in the form of monographs (Clemens et al, 1995; Fry, 2004; Fry & Talja, 2004; Nederhof, 2006). Furthermore, while scientists address mostly to their fellow scientists, audiences for SSH scholars are more diverse as they often exert their influence on the public though their publications or appearances in the press or non-academic oriented periodicals. Indeed, it has been shown that, in the social sciences and humanities, a greater share of publications are directed at the non-academic public (e.g. Van Der Meulen & Leydesdorff, 1991). Thirdly, while English has become the lingua franca in the sciences, many social scientists and humanists find it more appropriate to convey the subtlety of their research in their mother tongues.

Because of a more significant national or regional orientation in social sciences and the humanities, research in these fields are more likely to appear in domestic journals (Nederhof, 2006), which are underrepresented in the English-dominated SSCI and A&HCI.

Due to differences in research and communication practices (See Nederhof, 2006 for a review), there have been calls for alternative evaluation frameworks or metrics that better reflect scholarly performance in SSH (Nederhof, 2006). In this study we set out to explore a set of new metrics that aims to address the shortfalls of applying Scopus and WoS based bibliometrics in SSH in a domestic Asian context. The selection of the metrics was based on areas where SSH scholars' performance might manifest itself but which had been overlooked in the past. It was hoped that a more SSH specific metrics would reflect better a scholar's overall research effort and performance. In the following section we report the definitions of the new metrics and the procedures of data collection. A small group of SSH scholars was sampled and their data on these metrics were collected so that we could study how well the new metrics correlated with existing metrics and how well each was able to predict a scholar's performance.

RESEARCH QUESTIONS

The overall objective of this study is to explore the feasibility and validity of the proposed alternative metrics for evaluating scholarly performance in the social sciences and humanities. Specifically the following questions were addressed:

1. How well do the existing bibliometrics-based metrics and the newly created metrics agree among and between each other?
2. What are the underlying dimensions the existing and these new metrics present?
3. How good are the measures in explaining/predicting scholarly performance? Among the measures, which have more explanatory power for scholars' performance?
4. Are there differences in the suitability/validity of the measures between the social sciences and the humanities?

METHODOLOGY

A total of 18 metrics were created, whose definition and data collection procedures are given in the following. Other than the 18 metrics, two criterion variables, numbers of awards and grants received from the chief public grant making body for the sciences, the National Science Council (NSC) on Taiwan, that aim at reflecting the overall standing of each individual in the scholarly community were also collected. These two proxies of a scholar's overall standing would then serve as the criterion variables against which regression models can be generated so that the predictive power of each metric can be assessed.

A total of sixteen researchers (ten in the humanities, six in the social sciences) affiliated with the Advanced Institute of Humanities and Social Sciences at National Taiwan University were selected and their data on these measures were collected. The institute was created for the purpose of facilitating interdisciplinary collaboration among SSH scholars in the university.

Based on the sources of data and the performance criteria they represent, the performance metrics can be grouped into the following four categories.

Scholarly output metrics

Traditional output metrics include the number of journal articles (# of Journal articles), monographs (# of books), and conference papers (# of conference articles) authored by the scholars. An extension to the number of the monographs authored was to measure how widely they have been used. In White et al (2009), the "libcitation count" was proposed that measures the impact of a work by the number of times it is included in library holdings. In our study usage of monographs was approximated by their library circulation record. This metric records the number of times each monograph has been circulated in the National Taiwan University Library (# of times in circulation), the library with the largest collection on Taiwan. For authors who have produced multiple titles, the sum of their on-campus circulation counts was taken as an indication of their influence. Other than formally published output, the number of theses/dissertations each scholar has advised was also collected to give a more inclusive assessment of mentoring performance (# of supervised graduate student theses/dissertations), an important aspect of scholarly performance. This data was obtained through searching the Digital Library of Theses and Dissertations in Taiwan.

Scholarly impact metrics

Traditional impact metrics measure the number of citations in aggregated journal databases. We collected each author's citation counts from both international databases Scopus and WoS, and domestic databases THCI (Taiwan Humanities Citation Index) and ACI (Academic Citation Index). Data from both Scopus and WoS were used because, despite significant overlap in their coverage, it has been shown that they are complementary and both are needed for a more comprehensive assessment of scholarly impact. (Meho & Yang, 2007; Norris & Oppenheim, 2007) These metrics were named "# of citations in Scopus", "# of citation in WoS", "# of citations in THCI" and "# of citations in ACI", respectively. While ACI is a more comprehensive journal citation database that covers various subjects in the humanities and social sciences, THCI is a humanities oriented database developed by the NSC of Taiwan. It should be noted that there is overlap in the coverage between THCI and ACI. A selected group of journals called THCI Core was also included in ACI.

To broaden the assessment of scholars' impact, their citation counts in theses and dissertations were also collected. This was done by searching the National Digital Library of These and Dissertation in Taiwan (# of citations in TH&D).

Public communication output metrics

Other than their peers in academia, SSH scholars, depending on the relevance and implications of their research to the public, sometimes need to communicate their works to the general public. To capture this aspect of scholarly output, we recorded the number of articles authored by the scholars published in the press (# of news articles) and non-academic oriented periodicals (# of non-academic articles) on Taiwan. This was done by searching the Taiwanese Periodical Literature System.

Web-based metrics

With the continued migration of scholarly communication to the digital realm, Web (Aguillo et al., 2006; Björneborn& Ingwersen, 2004; Thelwall, 2008) and social media-based metrics (Priem et al, 2010) have attracted much attention recently. Efforts have been made to use Web data for the assessment of scholarly impact. It was found, for example, in Thelwall and Harries (2004), that universities with higher rated scholars produce significantly more Web content but not necessarily with higher impact as measured by inlinks. We adapted the Universities Ranking Webometrics, initially developed by CSIC in Spain (Aguillo et.al., 2006), for our purpose of measuring each individual scholar's Web presence. The world University Webometrics consists of four components: size, visibility, rich files and scholar (See Table 1 for definition). Instead of using university domain names, we used individual scholars' personal webpage or blog URL as the query to generate these four metrics at the individual level. In World University Ranking, a weighted sum of the four values was used as the basis for ranking; here they were treated independently so that we were able to examine the predictive value of each individual component. Another source of scholarly impact that has been largely overlooked in citation counts is syllabi (Kousha & Thelwall, 2008). We tallied the number of times each scholar's works have been cited in online syllabi to give an indication of the impact of his/her works on teaching. Again, the sum was taken if multiple works were cited. Another source of web data we used was Wikipedia. The number of times each scholar's works have been cited in Wikipedia was summed up, which, along with the entry created specifically for any particular scholar, constitutes a "Wikipedia_presence" metric.

Overall standing for scholarly performance

Probably the most difficult part of this research is to objectively articulate criterion variables based on which a consensus regarding each scholar's respective stature can be estimated. An objective and independent assessment of a scholar's standing is needed if we want to validate the value of each metric listed above. Two proxies of scholars' academic standing, # of grants and # of awards received, were created based on the number of grants and research awards received from the NSC. As both processes were based on peer-review we believe that they were able to accurately reflect a scholar's standing in the scholarly community to which s/he belongs. The "# of grants" metrics was calculated simply by summing up the grants received by each scholar. A weighted "awards received" metric was created that takes into account the frequency of receiving awards of different degrees of prestige. There are three kinds of research awards given out by the NSC on Taiwan: excellence, outstanding, and honorable mentions; they were given a weight of 3, 2, and 1, respectively. In the regression models we constructed, these two overall performance variables would serve as the criterion variables, whereas the scholarly performance metrics would be the predictors so that the relative explanatory power of each metric can be determined.

Webometrics_ Size	Number of pages in one's personal website or blog indexed by three major search engines
Webometrics_ Visibility	The number of external inlinks received by one's website or blog
Webometrics_ Rich Files	Number of rich files (pdf, doc, docx, ppt, pptx) indexed by three major search engines
Webometrics_ Scholar	Number of files within one's website indexed by Google Scholar

Table 1. Definition of Webometrics components

	Humanities	Social Science
# of news articles	5.20(8.82)	91.67(167.51)
# of non-academic articles	6.20(12.75)	16.83(37.35)
# of syllabi citations	42.50(92.51)	70.33(50.19)
# of circulation	577.20(1187.66)	772.00(947.51)
# of citations in TH&D	536.60(1104.28)	1033.83(791.23)
# of advisees	4.90(6.45)	40.33(26.61)
Wikipedia_presence	1.90(2.64)	1.83(3.54)
Webometrics_Visibility	19.50(60.27)	10.67(17.48)
Webometrics_Size	116.90(292.20)	39.50(47.47)
Webometrics_Rich Files	85.00(260.81)	25.83(44.20)
Webometrics_Scholar	2.40(7.59)	0.00(0.00)
# of citations in THCI	84.80(154.35)	16.33(28.63)
# of citations in ACI	95.60(194.08)	119.33(96.55)
# of citations in Scopus	0.00(0.00)	9.33(14.36)
# of citations in WOS	0.40(1.26)	10.00(11.11)
# of books	17.40(29.13)	19.33(28.29)
# of journal articles	63.20(100.79)	117.83(135.64)
# of conference articles	50.20(38.10)	68.05(59.23)
award received	3.60(4.20)	6.10(3.97)
# of grants	6.17(3.84)	13.33(5.20)

Table 2. Mean and SD of the metrics and overall scholarly performance variables

RESULTS AND DISCUSSION

Descriptive statistics

Table 2 gives the Mean and Standard Deviation (SD) of the metrics collected, broken down by humanities and social sciences. The data show that social sciences have greater value than humanities in all except "# of citations in THCI" and the four Webometrics categories. The greater value of "# of citations in THCI" for humanities scholars does not come as a surprise. Caution should be used, however, to generalize from these Webometrics results to the SSH fields as many of the scholars studied did not have values on these metrics; therefore the differences were more likely to be susceptible to random variance.

A visual examination of the data distribution showed positive skewness, thus in figure 1 the median was used as the central tendency measure. Logarithmic transformation was performed on all the metrics before further analyses were made.

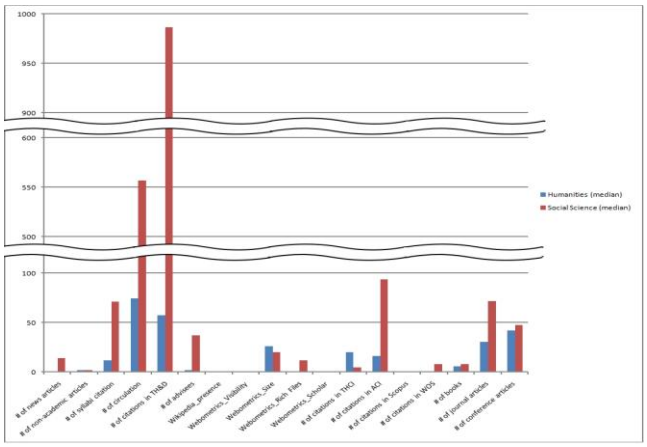

Figure 1. Median of the metrics and overall scholarly performance variables

Correlation among metrics

Bivariate correlations were calculated for all pairs of metrics, including the two criterion variables, "# of grants received" and "awards received (See Table 3)." Except Wikipedia and Webometrics based measures, all our new metrics (the first tier in Table 3), were shown to be highly correlated with the two criterion variables. Among the traditional bibliometrics-based metrics (the third tier in Table 3), those associated with research inputs, such as "# of books", "# of journal articles", and "# of conference papers" published, were shown to correlate with the "award received" metric, while metrics related to research impact, such as "# of citations in ACI", "# of citations in WoS", and "# of citations in Scopus", were shown to correlate with the "# of grants" received metric. The results seem to suggest that our two criterion variables, though moderately correlated with each other, r (16) = .54, p <.05, could be seen to represent two distinct aspects of scholarly performance: output and impact. While the output metrics are more aligned with "awards received", the impact measures correlated better with "# of grants" criterion.

	Award received	# of grants
# of non-academic articles	.692**	.549*
# of syllabi citations	.710**	.729**
# of circulation	.732**	.587*
# of citations in TH&D	.732**	.771**
# of advisees	.511*	.673**
Wikipedia presence	.473	.313
Webometrics_Visibility	.383	.500*
Webometrics_Size	.473	.257
Webometrics_Rich Files	.420	.590*
Webometrics_Scholar	.430	.105
# of citations in THCI	.462	.051
# of citations in ACI	.743**	.651**
# of citations in Scopus	.479	.724**
# of citations in WoS	.469	.744**
# of books	.671**	.546
# of journal articles	.770**	.625**
# of conference papers	.644**	.415

**. Correlation is significant at the 0.05 level (2-tailed).*
***. Correlation is significant at the 0.01 level (2-tailed).*

Table 3. Correlations among the metrics and scholarly performance variables

Not all pair-wise correlations were statistically significant. The "newspaper metric" was found to have no significant correlation with any other measure. The rest of the newly created measures (see the column in Table 4) were shown

	# of citation in THCI	# of citation in ACI	# of citation in Scopus	# of citations in WoS	# of books	# of journal articles	# of conference papers
# of non-academic articles	.657*	.604*	.523*	.526*	.722**	.728**	.605**
# of syllabi citations	.449	.943**	.468	.603*	.835**	.911**	.724**
# of circulation	.613*	.890**	.340	.458	.728**	.837**	.565*
# of citations in TH&D	.363	.908**	.432	.561*	.693*	.741*	.541*
# of advisees	.014	.707**	.553*	.651**	.686**	.781**	.529*
Wikipedia presence	.728**	.569*	.290	.324	.571*	.554*	.531*

**. Correlation is significant at the 0.05 level (2-tailed).*
***. Correlation is significant at the 0.01 level (2-tailed).*

Table 4. Correlations among new and existing metrics

Principle component analysis

A principle component analysis was then performed to elucidate the underlying dimensions of these eighteen metrics. The resulting rotated solution, as shown in Table 5, yielded four interpretable factors: "domestic scholarly input and impact", "Webometrics", "humanities oriented impact", and "international impact", which cumulatively accounted for 84 percent of the variance.

	Component			
	1	2	3	4
# of citations in ACI	.918	.183	.254	.114
# of syllabi citations	.893	.202	.178	.264
# of citations in TH&D	.844	.179	.087	.196
# of circulation	.819	.115	.326	.144
# of journal articles	.814	.255	.340	.294
# of books	.766	.271	.380	.189
# of advisees	.753	.182	-.211	.504
# of conference articles	.688	.047	.447	.097
Webometrics_Visibility	.259	.879	-.070	.108
Webometrics_Rich Files	.322	.854	-.013	.285
Webometrics_Size	-.014	.851	.343	.120
Webometrics_Scholar	.219	.800	.337	-.165
Wikipedia_presence	.284	.124	.843	.223
# of citations in THCI	.390	.173	.816	-.267
# of non-academic articles	.339	.392	.702	.440
# of citations in Scopus	.200	.149	-.016	.873
# of citations in WoS	.402	.137	-.026	.797
# of news articles	.123	-.030	.291	.586
Percentage of variance explained	52.55	12.91	11.42	7.12

Table 5. Rotated Component Matrix

Regression analyses

Multiple regression analyses were conducted using stepwise procedure to evaluate how well the metrics, conventional and new, predicted the two criteria, "awards received", and "# of grants received." When "awards received" was used as the criterion variable, only "# of journal articles" published was included in the predictive model, which explained 59 percent of the variance. As for "# of grants received", two impact measures, "# of citations in TH&D" and "# of citations in Scopus" were included in the linear model, the combination of which explained 75 percent of the variance, adjusted R^2 = .75, F (2, 13)=23.45, p = .00 (see Table 6). The "# of citations in Scopus" metrics predicted significantly over and above the "# of citations in TH&D" measure, R^2 change =.19, F (1, 13) = 11.28, p =.005. Consistent with our findings from bivariate correlations, research impact measures were shown to be associated with the "# of grants received" criterion.

To examine disciplinary differences, regression analyses were performed among humanities and social sciences scholars, respectively. For humanities scholarship, "# of times in circulation" of their works in the library turned out to be the sole significant predictor, adjudged R^2 = .68, F (1, 8) = 20.22, p = .002. Whereas in the social sciences, "# of citations in Scopus", adjusted R^2 = .68, F (1, 4) = 11.82, p = .026, was the only significant predictor of overall scholarly performance as measured by the number of public grants received. The differences in the nature of these two predictors suggest a different focus of publication channels where scholars' influences are manifested.

While social scientists' impact was captured by citation counts in Scopus, an international focus journal database, humanities scholars' impact was represented better by monographs written in those native languages used mostly by their domestic audiences.

	Variable entered	R^2	Adjusted R^2	P
All cases	# of citations in TH&D	.60	.57	.000
	# of citations in TH&D # of citations in Scopus	.78	.75	.005
Humanities	# of circulation	.72	.68	.002
Social Sciences	# of citations in Scopus	.78	.75	.005

Table 6. Dependent variable: # of grants received

Another set of regression analyses was conducted, with the same set of criteria; this time using the four factors resultant from the principle component analysis as the predictors. When predicting "awards received", only the "domestic scholarly input and impact" factor was found to be a significant predictor, adjusted R^2 = .38, F (1, 8) = 6.30, p = .035. As for "# of grants received", in addition to "domestic scholarly input and impact", "international impact" was also found to be a significant predictor. The linear combination of the two variables accounted for 60 percent of the variance, adjusted R^2 = .60, F (2, 13) = 12.32, p = .001.

To investigate disciplinary differences, regression analyses were conducted separately among humanities and social sciences scholars using the four factors resulting from factor analysis as the predictors and "# of grants received" as the criterion. For the humanities, "domestic input and impact" was the only significant predictor, accounting for about 50 percent of the variance, adjusted R^2 = .49, F (1, 8) = 9.49, p = .015. The "humanities oriented impact" factor was not included in the model despite its high correlation with the criterion (r = .72). We suspect that this might result from the fact that a large amount of the variance had been explained by the "domestic input and impact" factor.

As for social sciences, no significant factor was included in the model. However, it was found that the factor "international impact" had the highest correlation with "# of grants received" (r = .76), followed by Webometrics (r = .63), while both "domestic input and impact" and "humanities oriented impact" had negative correlations with the criterion. The results, combined with our earlier findings, seem to indicate that there is indeed a disciplinary

difference in scholarly communication practice between the social sciences and humanities.

	Variable entered	R^2	Adjusted R^2	*P*
All cases	Domestic input and impact	.35	.31	.015
	Domestic input and impact International impact	.66	.60	.001
Humanities	Domestic input and impact	.54	.49	.015
Social Sciences	-	-	-	-

Table 7. Dependent variable: # of grants received

CONCLUSION

This study set out to explore alternative metrics that might better reflect scholarly performance in SSH, with a distinctive domestic focus. It is believed that scholarly performance in SSH is multifaceted and should not be measured exclusively through the now prevalent journal database-based metrics. A group of alternative metrics was generated, most noticeably of which was the inclusion of non-academic articles, monograph usage, and Web based data such as citations in online syllabi and Wikipedia. To test the validity of these metrics, two criterion variables, "# of grants" and "awards received", were also created to serve as proxies of a scholar's standing in their respective research communities. Our analyses revealed significant correlations between the newly created metrics and the existing bibliometrics-based metrics. Significant correlations were also found between the new metrics with the two overall scholar standing variables.

Furthermore, a principle component analysis revealed four underlying dimension of the metrics collected: "domestic scholarly input and impact", "Webometrics", "humanities oriented impact", and "international impact".

To further examine the validity of these metrics, multiple regression analysis using the metrics as the predictors and scholars' awards and grants received as the criteria were performed. The results indicated that the number of awards received tended to correlate with the output-oriented metrics, whereas the number of grants received tends to be more closely associated with a scholar's domestic and international journal citation counts. Regression analyses performed separately in the social sciences and humanities revealed disciplinary differences in how a scholar's performance was perceived. In the humanities, scholarly performance was found to be highly associated with the usage of books authored by a scholar as measured by library circulation. A more journal oriented and international outlook was found in the social sciences as the citation counts in Scopus emerged as the most significant predictor of the number of grants received by a social scientist.

There are, inevitably, limitations in our findings here as we are currently still at the exploratory stage of the study. Presently only a group of 16 scholars' data was collected. The study team had feared that less established scholars' might be lacking relevant data for some of our metrics. Therefore these relatively more established scholars were chosen in the hopes of collecting richer data on our various metrics, though it was found that the Webometrics-based data were still sparse. As this was not a sample representative of the SSH communities in Taiwan, caution needs to be taken about the generalizability of our findings here. The other limitation of our study was the selection of the overall performance criteria for the purpose of validating the value of each metric. One might challenge the use of numbers of public grants and awards received as proxies of a scholar's overall performance. Other alternative criteria, such as peer-review based data might be collected in the future to calibrate our findings. Despite the limitations, we believe that our findings indeed point to the need for more inclusive evaluative metrics to do justice to scholars' efforts in SSH. Our findings of the disciplinary differences between the social sciences and humanities, often lumped together when contrast is made between the hard sciences and "other" fields of research. Indeed, differences of publication practices within different branches of humanities (Must, 2012) and social sciences (Huang & Chang, 2008) have also been noted. Our results suggest the need to include new metrics able to more inclusively capture and better reflect the diverse communication practices in different scholarly communities.

At this stage, the data on the scholars was manually retrieved and sorted out. To ensure more efficient retrieval of the data on SSH scholars in Taiwan, we are currently developing a Web-based retrieval platform that incorporates the heuristics learned from our previous data mining experiences. This may greatly increase the efficiency of sampling a greater number of scholars thus increasing the generalizability of future studies. It is also hoped that a more accessible data platform will stimulate and facilitate widespread discussion on the evaluation of domestic and international scholarly performance among SSH scholars on Taiwan.

ACKNOWLEDGMENTS

The study is sponsored by "The Aim for the Top University Project, Integrated Platform of Digital Humanities" at National Taiwan University in Taiwan.

REFERENCES

Aguillo, I. F., Granadino, B., Ortega, J. L., & Prieto, J. A. (2006). Scientific research activity and communication measured with cybermetrics indicators. *Journal of the American Society for Information Science and Technology, 57*(10), 1296-1302.

Aguillo, I. F., Ortega, J. L., & Fernández, M. (2008). Webometric ranking of world universities: Introduction,

methodology, and future developments. *Higher Education in Europe, 33*(2-3), 233-244.

Björneborn, L., & Ingwersen, P. (2004). Toward a basic framework for webometrics. *Journal of the American Society for Information Science and Technology, 55*(14), 1216-1227.

Clemens, E. S., Powell, W. W., McIlwaine, K., & Okamoto, D. (1995). Careers in print: Books, journals, and scholarly reputations. American Journal of Sociology, 433-494.

Fry, J. (2006). Scholarly research and information practices: a domain analytic approach. *Information processing & management, 42*(1), 299-316.

Fry, J., & Talja, S. (2004). The cultural shaping of scholarly communication: Explaining e- journal use within and across academic fields. *Proceedings of the American society for information science and technology, 41*(1), 20-30.

Huang, M., & Chang, Y. (2008). Characteristics of research output in social sciences and humanities: From a research evaluation perspective. *Journal of the American Society for Information Science and Technology, 59*(1), 1819-1828.

Kousha, K., & Thelwall, M. (2008). Assessing the impact of disciplinary research on teaching: An automatic analysis of online syllabuses. *Journal of the American Society for Information Science and Technology, 59*(13), 2060-2069.

Meho, L. I., & Yang, K. (2007). Impact of data sources on citation counts and rankings of LIS faculty: Web of science versus scopus and google scholar. *Journal of the American Society for Information Science and Technology, 58*(13), 2105-2125.

Must, Ü. (2012). Alone or together: Examples from history research. *Scientometrics, 92*(2), 527-537.

Nederhof, A. J. (2006). Bibliometric monitoring of research performance in the social sciences and the humanities: A review. *Scientometrics, 66*(1), 81-100.

Nederhof, A., & Erlings, C. (1993). A bibliometric study of productivity and impact of modern language and literature research in the Netherlands, 1982-1991. *Leiden: report CWTS-93-09*.

Norris, M., & Oppenheim, C. (2007). Comparing alternatives to the Web of Science for coverage of the social sciences' literature. *Journal of Informetrics, 1*(2), 161-169.

Priem, J., Piwowar, H., & Hemminger, B. (2011). Altmetrics in the wild: An exploratory study of impact metrics based on social media. Presented at Metrics 2011: Symposium on Informetric and Scientometric Research. New Orleans, LA, USA, October 12.

Thelwall, M. (2008). Bibliometrics to webometrics. *Journal of information science, 34*(4), 605-621.

Thelwall, M. & Harries, G. (2004). Do the Web sites of higher rated scholars have significantly more online impact? *Journal of the American Society for Information Science and Technology, 55*(2), 149-159.

Van der Meulen, B., & Leydesdorff, L. (1991). Has the study of philosophy at Dutch universities changed under economic and political pressures? *Science, Technology & Human Values, 16*(3), 288-321.

White, H. D., et al.(2009). Libcitations: A measure for comparative assessment of book publications in the humanities and social sciences. *Journal of the American Society for Information Science and Technology, 60*(6), 1083–1096.