Is Google Scholar Useful for the Evaluation of Non-English Scientific Journals? The Case of Chinese Journals

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Abstract
This study aims to explore how useful Google Scholar is for the evaluation of non-English journals with the case of Chinese journals. Based on a sample of 150 Chinese journals across two disciplines, it provides a comparison between Google Scholar and Chongqing VIP, which is an important Chinese citation database, from three aspects: resource coverage, journal ranking and citation data. Results indicate that Google Scholar is equipped with sufficient resources and citation data for the evaluation of Chinese journals. However, the Chinese journal ranking reported by Google Scholar Metrics is not developed enough. But Google Scholar is able to be an alternative source of citation data instead of Chinese citation databases. The Average Citation is a useful metric in the evaluation of Chinese journals with data from Google Scholar to provide a comprehensive reflection of journals' impact. Overall, Google Scholar is useful and worthy of attention when evaluating Chinese journals.
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1 Introduction

Journal evaluation is an important application realm of Bibliometrics and Scientometrics with citation analysis as its main method. Many citation-based metrics have been widely applied in journal evaluation including Impact Factor (IF), Total Citations and H-index. Since the Science Citation Index (SCI) was created and developed in 1963, which is now a part of Web of Science (WoS), citation database has gradually become the main source of citation data. Importantly, these databases include articles of various journals and provide bibliographic references for each of them.

However, the limits of citation database are exposed gradually as the academic environment changed and new publishing ways appeared. Thus, it is getting more difficult for the citation data from traditional citation databases to satisfy the demands of journal evaluation (Lange 2002; Agrawal 2005; Mueller et al. 2006). Taking IF as an example, this indicator, which is strongly related to WoS could be a limitation for non-English authors and scientific journals, and neglected that Internet was an approach for the diffusion of knowledge (Gonzalez-Alcaide et al. 2012). One of the main reasons is that the coverage of these citation databases mainly focuses on journals and less on other means of scientific knowledge diffusion (e.g., books, proceedings and reports) (Mongeon and Paul-Hus 2016). Besides, since journals indexed in citation databases are selected, these databases rely more on elite journals rather than all journals can be found. Citation databases have obvious limitation of coverage, while the measure of journal influence is limited by data sources since the citations to non-source publications could have a significant effect on rankings (Butler and Visser 2006). Another reason with stronger impact comes from the Internet. It provides more platforms and approaches for articles and other scientific outputs to be published and disseminated. Journal is no longer the sole carrier of scientific output since websites, blogs, academic communities and

social media in the Internet can be alternative options (Barjak 2006; Rowlands et al. 2011; Shema et al. 2012). Both of the limitations mentioned above require an extension of data source.

Google Scholar (GS) provides a data source with wider range of collections for journal evaluation. It varies from the main data sources today including WoS and Scopus. GS not only extends the scope of the formal publication (Delgado-López-Cózar and Cabezas-Clavijo 2013), but also allows the scientific outputs existed in the Internet to be indexed (Norris and Oppenheim 2007). Serving as a database with its extended coverage of academic resources, GS currently provides citations for each article included (GSC) and Google Scholar Metrics (GSM). To make it clearer, the GSC in this study only refers to the citation data provided by Google Scholar, not the product for authors to keep track of citations to their articles. Considering GS as a citation database, GSC expands the citation network from the one in a citation database to the one in the whole Internet. Correspondingly, the nodes of the citation network are switched from the limited articles to the enormous scientific outputs in the Internet. Hence, GSC could be useful for identifying and correcting under-citation problems in WoS and Scopus (De Sutter and Van Den Oord 2012). The Internet profoundly changes how scientific outputs are spread and used. Therefore, GSC could be conducive to reflect comprehensive academic influence, in order to improve the evaluation of journals. Based on GSC, GS launched GSM, which is a bibliometric product. GSM provides journal rankings for different languages with H-index including the ranking of Top 100 Chinese Journals.

It is noteworthy that GS is an academic search engine with English as its main language. As a result, its performance of non-English service might be inferior to that of English. This difference is mainly derived from three aspects. First, GS services primarily with English. Second, its services provided for different languages are not the same. Third, the resources of different languages collected by GS are dissimilar. In January 2006, Google announced the expansion of Chinese articles in GS. At present, GS has already collected non-English articles of various languages, including Portuguese, German and Spanish. Language bias is considered as one of the most serious barriers in information transmission (Large 1983) and in the use of citation analysis for the evaluation of national science system (Van Leeuwen et al. 2001). The collecting strategy of GS not only tries to break the language barrier by providing better services for the retrieval and utilization of multilingual scientific outputs, but also facilitates outstanding non-English journals playing their value and influence.

Particularly, the Chinese scientific community is relatively limited due to the language barrier. Chinese scientific output is difficult to be spread worldwide. Many research tools and services in English are not applicable either. Currently, the evaluation of Chinese journals mainly depends on the citation databases. However, it is confusing which Chinese database should be chosen since they have different features but are of similar importance. Also, there is no international database applicable. In such a case, GS as a citation data source might be a promising alternative choice for Chinese journal evaluation.

2 Chinese Journal Evaluation System

Chinese journal evaluation began following western countries. The theoretical study began with the translation and introduction of western theories in 1970s, and the evaluation practice began with its application in libraries in 1980s. Qualitative analysis, which mainly includes expert review and peer review, and quantitative analysis are always adopted together in Chinese journal evaluation. Citation analysis is the most commonly used method in quantitative analysis with single metric or multi metrics. Along with the development of the Internet, metrics measuring the influence in the Internet are also applied to the practice of Chinese journal evaluation.

Two main data sources are used in Chinese journal evaluation. The first one is citation database, which can be accessed publicly generally. There are three most popular Chinese citation databases: Chongqing VIP (VIP), China National Knowledge Infrastructure (CNKI), and Wanfang Data (WF). All of them provide a series of academic services and products. Nevertheless, these three databases greatly overlap

with their resources while their coverages are significantly different. Thus, none of them can be the sole data source for Chinese journal evaluation. The second data source is the dataset collected by organizations working on journal evaluation, which mainly include scientific evaluation institutions, universities and the government. However, these datasets are hidden from public view, and even their sources and collecting methods are kept secret. It raises problems about the fairness of the evaluation results and the selection of evaluation products.

At recent decades, the study of journal evaluation gains increasing attention in China. Plenty of Chinese journal evaluation systems are created and developed, and there are dozens of Chinese journal rankings. Two types of journal rankings are common. The first type focuses on a particular scientific field, such as the Chinese Social Sciences Citation Index (CSSCI) and the Chinese Scientific and Technical Journal Citation Reports (CJCR). The second type is multidisciplinary and comprehensive, including the Report on Chinese Academic Journals Evaluation of Research Center for Chinese Science Evaluation (RCCSE), the Chinese Academic Journals Comprehensive Citation Report and the Chinese Science Journal Evaluation Report (CSJER).

Similar to the Journal Citation Reports (JCR), a part of Chinese journal rankings are provided by the database owners with their own citation data. More commonly, citation data from the third-party database is adopted by other Chinese journal rankings, such as CJCR. However, the fairness question will always be raised due to the coverage limitation of databases, no matter what kind of the relationship is between the ranking and the data source.

Thus, academic search engine seems to be a good alternative source of Chinese resource. A number of Chinese academic search engines are under development, of which the most potential one is Baidu Xueshu launched in June 2014 by Baidu. Since Baidu Xueshu is a new product, it needs time for more improvement to catch up with GS. Wu (Wu et al. 2004) believed that China should have its own academic database to promote its academic development. Nevertheless, if GS achieves a satisfactory performance in non-English academic services including Chinese, it might become an effective tool for journal evaluation with its stable performance and sufficient resources. If so, GS will be able to promote the academic development in non-English speaking countries such as China.

Therefore, the purpose of this study is to explore the usefulness of GS with its GSC and GSM in the evaluation of Chinese journals. Since GS can be considered as a database, it is fundamental to figure out whether its Chinese coverage is satisfying. GSM is a product presenting journal rankings provided by GS with its data, so it is necessary to understand if this product can be put into use for Chinese journal evaluation. Also, it is meaningful to get further understanding of GSC in order to apply it better. Consequently and specifically, this study aims to answer the following questions:

a) Does GS cover enough academic resource for Chinese journal evaluation?
b) How effective is GSM for Chinese journals?
c) Is GSC useful for Chinese journal evaluation?

3 Literature Review

Several studies focused on the coverage of GS. Meho and Yang (2007) presented a comparison of citation data and ranking of scholars in the field of Library and Information Science across WoS, Scopus and GS. Their results showed that GS had the most extensive coverage of conference proceedings and non-English language journals at that time. They concluded that the use of GS and Scopus in addition to WoS was conductive to a more accurate evaluation of authors' impact. A. W. K. Harzing and van der Wal (2008) found that GS provided a more comprehensive approach to calculate the IF in the management and international business areas, because the data sources included the unpublished articles. Orduna-Malea et al. (2015) applied three empirical methods in order to estimate the size of GS and to determine its validity, precision and reliability. They estimated that the size of GS is at around 160–165 million documents.

However, all the methods show considerable limitations and uncertainties due to inconsistencies in the GS search functionalities.

Citation data of GS has also been studied. Kousha and Thelwall (2007) compared traditional and Web-based citation patterns across multiple disciplines with Web/URL citation and GS based upon a sample of 1,650 articles. They found that there were significant correlations between ISI citations and both GS and Google Web/URL citations for each discipline except psychology, while there were large disciplinary differences in the percentage overlap between ISI and GS citation sources. They suggested GS is more comprehensive for social sciences and perhaps also when conference articles are valued and published online. However, replacing traditional citation sources with the Web or GS for research impact calculations would be problematic. Franceschet (2010) concluded that GS compiled significantly higher indicators' scores than WoS. However, rankings based on citations data from both databases are not significantly different. Huang and Yuan (2012) made a comprehensive analysis on the citation data of GS, and believed that GS was a powerful data source for citation analysis. Michayluk and Zurbruegg (2013) also found that using GS as a citation source provided congruent results to using citations from articles published in ISI-listed journals. Nevertheless, GS provided additional benefit being timelier potentially since it included wider citation sources, inclusive of working and conference papers.

Orduña-Malea and López-Cózar (2013) analyzed journal indicators provided by GSM and made a comparison between the November 2012 version and April 2012 version. They found that the bibliometric figures grew significantly but the growth rates were very different depending on the language in which the journal is published. They also suggested that Google should upgrade its rankings at least semi-annually. López-Cózar and Cabezas-Clavijo (2013) compared GSM, JCR of Thomson Reuters and Scimago Journal rank of Scopus from various aspects. They believed that GSM was a useful tool on the identification of core journals. Martín-Martín et al. (2014) analyzed the GSM updated in 2014 and summarized that GSM was a closed and simple information product with few features, while its stability in bibliometric indicators supposed its ability to measure and track the impact of scientific publications.

The shortcomings of GS as a data source were discussed in several studies. Bar-Ilan (2010) took a computer science book as a sample, and found that GS lost nearly 30% of citations included in WOS and Scopus and had 35% of citations which were not included in the other two databases. Mingers and Lipitakis (2010) studied on some of the scientific outputs of the business schools in the UK, and found that the amount of citations in WOS only occupied 29% of GS. However, some of the citations in GS were repeated. Orduna-Malea and Lopez-Cozar (2014) studied on the h-index of 1000 journals provided by GSM. They pointed out that GSM should shorten the update period, and adjust the number of journals in different language rankings in proportion. Lopez-Cozar et al. (2014) performed an experiment to analyze GS's capacity to detect citation-counting manipulation. They found that it is very easy to manipulate citation counting in GS and anyone could do it, which they believed was the main shortcoming of GS Citations and Metrics.

Applying GS into the evaluation of multilingual journals received a few concerns. Orduna-Malea and Lopez-Cozar (2014) found that there was a distinct difference in the growth rate of h-index in journals of different language in GS. The study found that using GS for journal evaluation would produce problems of unfairness. With the same evaluation system, the journals of different countries might have evaluation results interfered by local academic environment, language and other factors (Mueller et al. 2006; Gonzalez-Alcaide et al. 2012). From the current relevant research, non-English journals would have disadvantages in international evaluations (Liang et al. 2013; Fanelli 2013). The main reasons included the language barriers and the lack of non-English journals collection in databases.

In China, there are also studies focusing on Google Scholar in the use for Chinese language. Feng (2008) compared the search function between GS and Chinese citation database. She presented a retrieval result of papers with the highest citations in each of the 17 Chinese core journals of Library and Information

Science (LIS) discipline, and concluded that GS could be used for the search of citations of Chinese articles, while its quality of retrieval was inferior to the Chinese citation database. Xin et al. (2010) presented a comparison between journal indicators obtained by GS and Chinese citation database with 18 LIS core journals as example. They concluded that GS played a role in citation analysis and quantitative evaluation. However, its shortcomings came from the self-citation data, limitation of the result number and its cooperated Chinese databases. Qiu and Wen (2011) selected top 10 LIS journals as example and searched their citations between 2007 and 2008 from Google School and Chinese citation database. They found that due to the coverage limitation and poor retrieval quality, GS was much inferior to Chinese citation database in the citation statistics of Chinese journals. Nevertheless, they pointed out that GS would be a promising tool representing the development trend of citation databases. Yang et al. (2013) compared the H-index from GSM and CNKI of Top 100 Chinese Journal provided by GSM. The statistical results showed that the two H-indexes had weak correlation. The Google H-index and CNKI H-index are exponential correlation. For the same journal, 90% of the H-index from GSM were higher than the H-index from CNKI.

4 Methodology

4.1 Sample

The sample of this study consists of all 150 journals listed in the Report on Chinese Academic Journals Evaluation of RCCSE (2013-2014) across two disciplines, including 78 of Library, Information & Documentation Science (LIDS) and 72 of Metallurgical Engineering & Technology (MET). The complete list of journals can be found as the Sample A in Table 8 and Table 9. RCCSE's report includes one of the most recognized Chinese journal ranking updated annually. Journals listed in RCCSE's report were employed as our sample despite of their rank. As a result, it allows our sample to cover active journals with recognized academic value. This helps us to observe the performance of different data sources more objectively. Constraining our sample to LIDS and MET makes it more likely to provide a reliable comparison across disciplines concentrating on the differences between data sources, since both LIDS and MET are the first-class disciplines with similar numbers of journals listed, while they have large differences because LIDS belongs to the Social Science and MET belongs to the Natural Science.

4.2 Data

The data sources involved in this study are the GS[1], WoS[2], Scopus[3], VIP[4], CNKI[5] and WF[6]. Both WoS and Scopus are well-established English academic databases with great popularity and adoption. VIP, CNKI and WF are the most popular Chinese citation databases, and all of them have been used to provide Chinese journal rankings respectively. These five databases remain today the main sources of English or Chinese citation data. Therefore, this study provides a comparison of resources coverage between GS and these five data sources, as well as a comparison of citation data and journal ranking between GS and one of the three Chinese databases, which turned out to be the VIP because of its complete coverage and good accessibility of data.

We searched all the six data sources in their native interfaces for all journals listed in Sample A with their Chinese titles manually. Since some Chinese journals have an English version, only the data of articles or journals published in Chinese is adopted in this study. We verified that 6 journals in Sample A

[1] http://scholar.google.com/
[2] http://apps.webofknowledge.com/
[3] http://www.scopus.com/
[4] http://www.cqvip.com/
[5] http://www.cnki.net/
[6] http://www.wanfangdata.com.cn/

had changed their titles before. Thus, the data collected with the current title and with the previous title had been integrated before the analysis.

Publish or Perish (PoP) is a software program that can obtain raw citations from GS and present metrics after analysis (A. W. Harzing 2007). In the Journal Impact module of PoP, we manually retrieved journals in Sample A respectively with their Chinese titles from GS with the restriction of the publication year between 2011 and 2013. Then for each journal, PoP returned the article records and provided the total number of articles and the total number of citations. Besides, we retrieved all sample journals in GS and obtained the H5-index and H5-median directly provided by GS. Specifically, H5-index was the H-index for articles published in the last 5 complete years, and H5-median was the median number of citations for the articles that made up its H5-index.

We downloaded the webpage of the latest Top 100 Chinese journal ranking of GSM[7] and converted the data into a table, as shown in Table 10. This ranking provided by GSM listed 100 Chinese journals with the highest H5-index despite of their disciplines.

We searched the online version of CSJER[8], of which the citation data is provided by VIP, for all journals listed in Sample A to collect their metrics. Since CSJER does not provide its report in a spreadsheet and its discipline classification is different from that of the report of RCCSE, we had to search for the journals respectively.

4.3 Procedures

The coverage of GS, WoS, Scopus, VIP, CNKI and WF was calculated as the ratio of the number of journals indexed in each data source and the number of journals in Sample A. We also calculated the coverage for the two disciplines separately. In addition, the number of articles published in the journals in Sample A and indexed in GS was totaled.

With regard to the journal ranking, we compared the Chinese journal ranking provided by GSM and the Chinese journal ranking provided with IF by CSJER. We also discussed the representation difference of each discipline in GSM's ranking in addition.

In order to make a comparison between the citation data of journals from GS and VIP, considering the accessibility of data, citation data from GS was computed into two journal metrics: the Total Citations and the Average Citation. The Total Citations was the sum of citations of articles published from 2011 to 2013 in each journal. The Average Citation was the ratio of the Total Citations and the number of articles published from 2011 to 2013. Combined with H5-index and H5-median, there are 4 metrics from GS used in this study in total. From VIP, the Total Citations and IF of journals were extracted from the CSJER. We aimed to analyze with the data of all the journals in Sample A. But due to the limitations of the Publish or Perish, it failed to completely obtain data of journals with excess amount of articles. Meanwhile, some journals had missing values. Hence after the exclusion of journals with incomplete data, 126 journals left were adopted as Sample B for the analysis of citation data and metrics. Sample B includes 62 LIDS journals listed in Table 8 and 64 MET journals listed in Table 9.

5 Result

5.1 Google Scholar Coverage of Chinese Resource

In our study, we found that currently the Chinese data sources of GS at least included Chinese academic citation databases, web sites of academic publishers, professional societies and universities. Specifically, the Chinese citation databases mainly includes the three major databases: VIP, CNKI and WF.

[7] http://scholar.google.com/citations?view_op=top_venues&vq=zh

[8] http://lib.cqvip.com/evaluation/index.aspx

Figure 1**Error! Reference source not found.** shows the proportion of journals in Sample A covered by GS, WoS, Scopus, VIP, CNKI and WF. Both GS and VIP have the highest coverage at 100% covering all the journals in Sample A. A large coverage difference appears among English data sources, with GS reaching 100% while WoS at 0% and Scopus at less than 10%. The coverages of the three Chinese data sources are relatively similar. VIP achieves the highest coverage and includes all of the journals in Sample A indexed by CNKI and WF. Therefore, VIP was selected as the representative of Chinese data source for the further comparison with GS in this study. Compared with the three Chinese data sources, GS is not inferior to any one of them in terms of coverage.

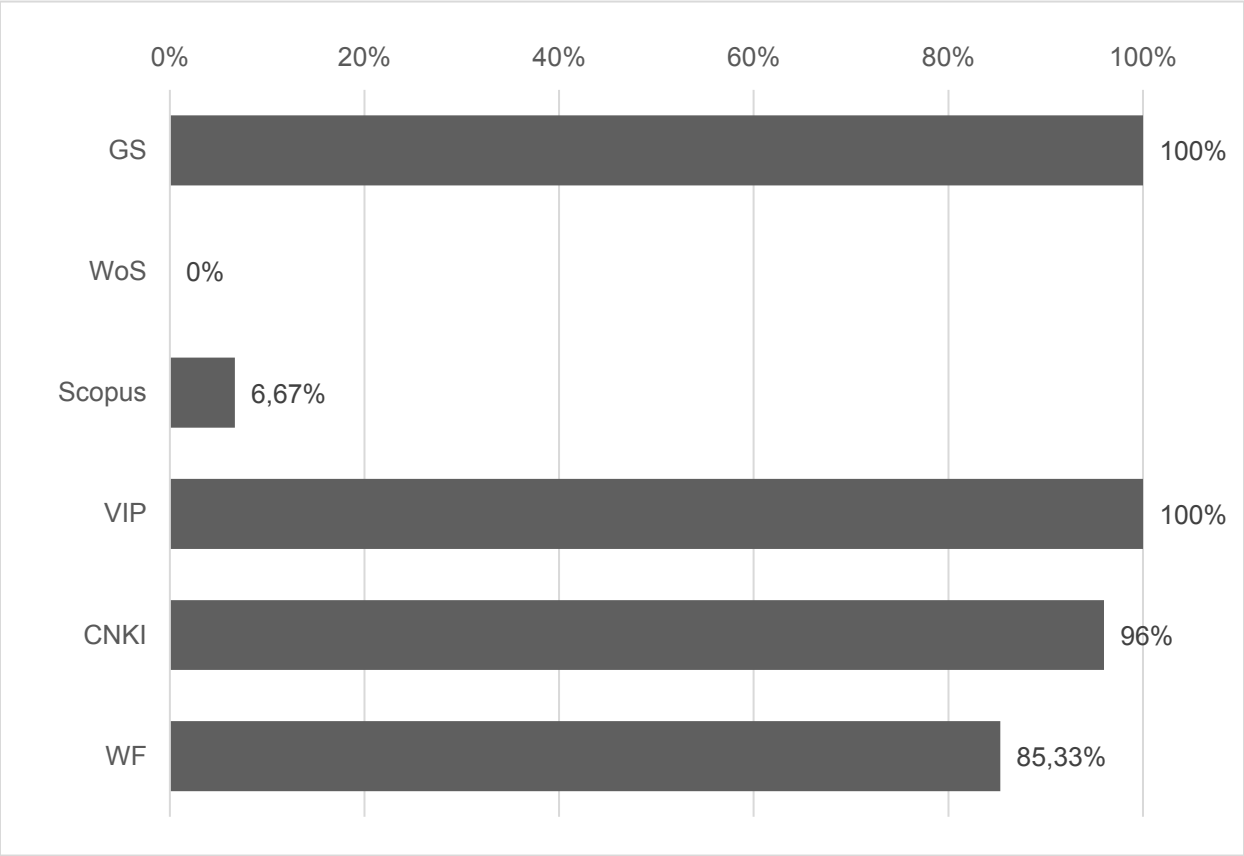


Figure 1. Proportion of journals indexed by six data sources

Figure 2 shows the coverage of journals by discipline in each of the data sources. Generally, the coverage of MET is higher than LIDS. The number of data sources achieving 100% of MET is more than that of LIDS. Similarly in the six data sources, all of the MET coverage are not less than LIDS coverage respectively. Moreover, in English data sources, the coverage of MET journals is larger than LIDS, since all the ten journals indexed in Scopus are MET journals and no LIDS journals were found in WoS or Scopus.

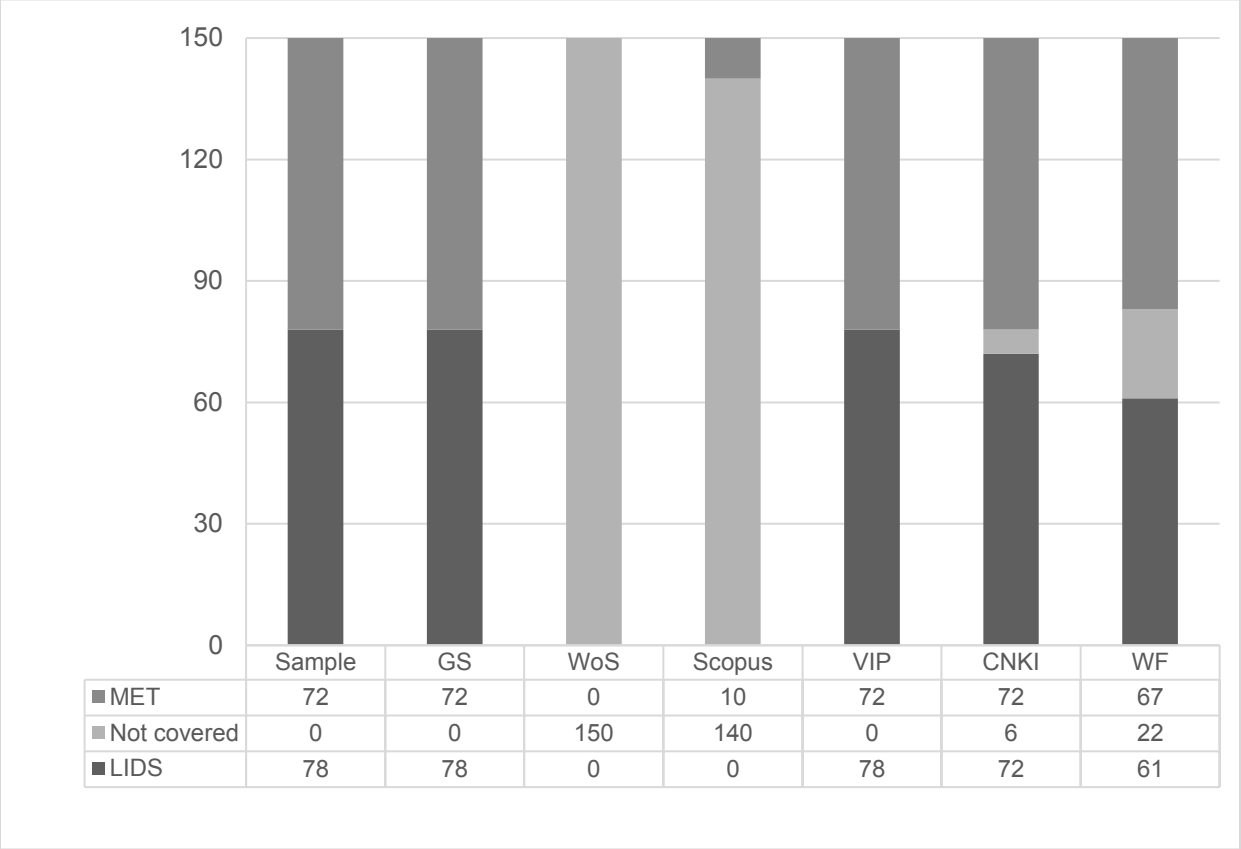


Figure 2. Coverage of journals by discipline in six data sources

Focusing on the articles published in Sample A journals from 2011 to 2013, Table 1 shows the total number of articles indexed by GS, the total number of articles published provided by CSJER as well as their ratio. For both LIDS and MET, the total number of articles indexed by GS is roughly 20% higher than the number of articles published. More precisely, it is at 20.6% for LIDS and 25.7% for MET. Same as the case of journal, MET is more likely to be indexed in GS than LIDS in terms of articles.

Discipline	Number of articles indexed by GS	Number of articles published	Number of articles indexed by GS /Number of articles published
LIDS	1515856	1256562	1.206
MET	373369	297128	1.257
Total	1889225	1553690	1.216

Table 1. Number of articles published and indexed by GS

5.2 Chinese Journal Ranking of Google Scholar Metrics

In the 150 journals of Sample A, there are only 8 journals listed in the Top 100 Chinese journal ranking of GSM. Table 2 shows their ranks in the GSM ranking and their ranks among the 78 LIDS journals in Sample A according to VIPIF. All of the 8 journals are LIDS journals. No MET journal was listed in the GSM ranking.

In the 8 journals, great differences were found between the ranks in GSM ranking and ranks in VIPIF ranking. According to the GSM ranking, the 8 journals are the top 8 Chinese LIDS journals. However, only 5 of them ranked top 8 in VIPIF ranking, and the other 3 journals ranked following 15. Some journals with high VIPIF failed to make the top 8 in GSM ranking, such as the Documentation, Information &

Knowledge (VIPIF = 1.3080) and the Information and Documentation Services (VIPIF = 1.2616). The Pearson correlation coefficient of GSM ranking and VIPIF ranking of the 8 journals was 0.458, indicating a great difference between the two rankings.

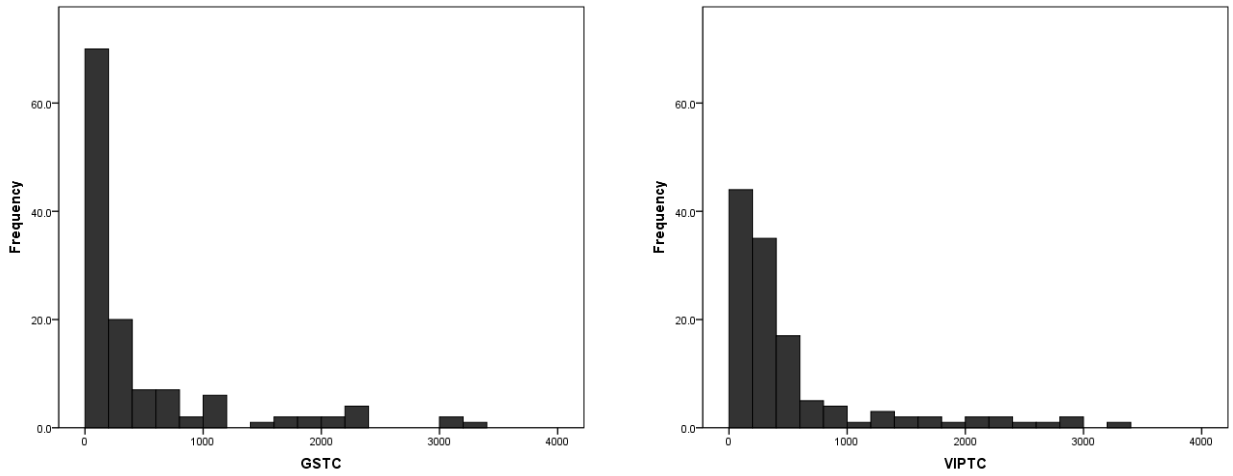
No.	Journal	Discipline	GSM Rank	GSM Rank (LIDS)	VIPIF	VIPIF Rank (LIDS)
L13	Journal of Academic Libraries	LIDS	35	1	2.6774	2
L10	Journal of Library Science in China	LIDS	41	2	3.8537	1
L01	Library and Information Service	LIDS	54	3	0.9199	16
L25	Library & Information	LIDS	60	4	1.8232	3
L07	Research on Library Science	LIDS	73	5	0.8670	18
L37	Library Work and Study	LIDS	76	6	0.7883	20
L04	Library Journal	LIDS	80	7	1.0853	8
L34	Library Development	LIDS	88	8	1.1584	6

Table 2. Sample A Journals listed in the Top 100 Chinese journal ranking of GSM

5.3 Google Scholar Citation for Chinese Journals

As mentioned in the methodology section, six citation metrics were used to compare the citation data from GS and from VIP, which were the Total Citations (GSTC), the Average Citation (GSAC), H5-index (GSH5) and H5-median (GSH5m) from GS and the Total Citations (VIPTC) and the Impact Factor (VIPIF) from VIP.

Figure 3 presents the frequency distribution of the six citation metrics. Obvious differences are found between the distributions of the Total Citations from two data sources. The distribution of GSAC is similar to VIPIF. In addition, the distributions of GSH5 and GSH5m vary from other four metrics significantly.



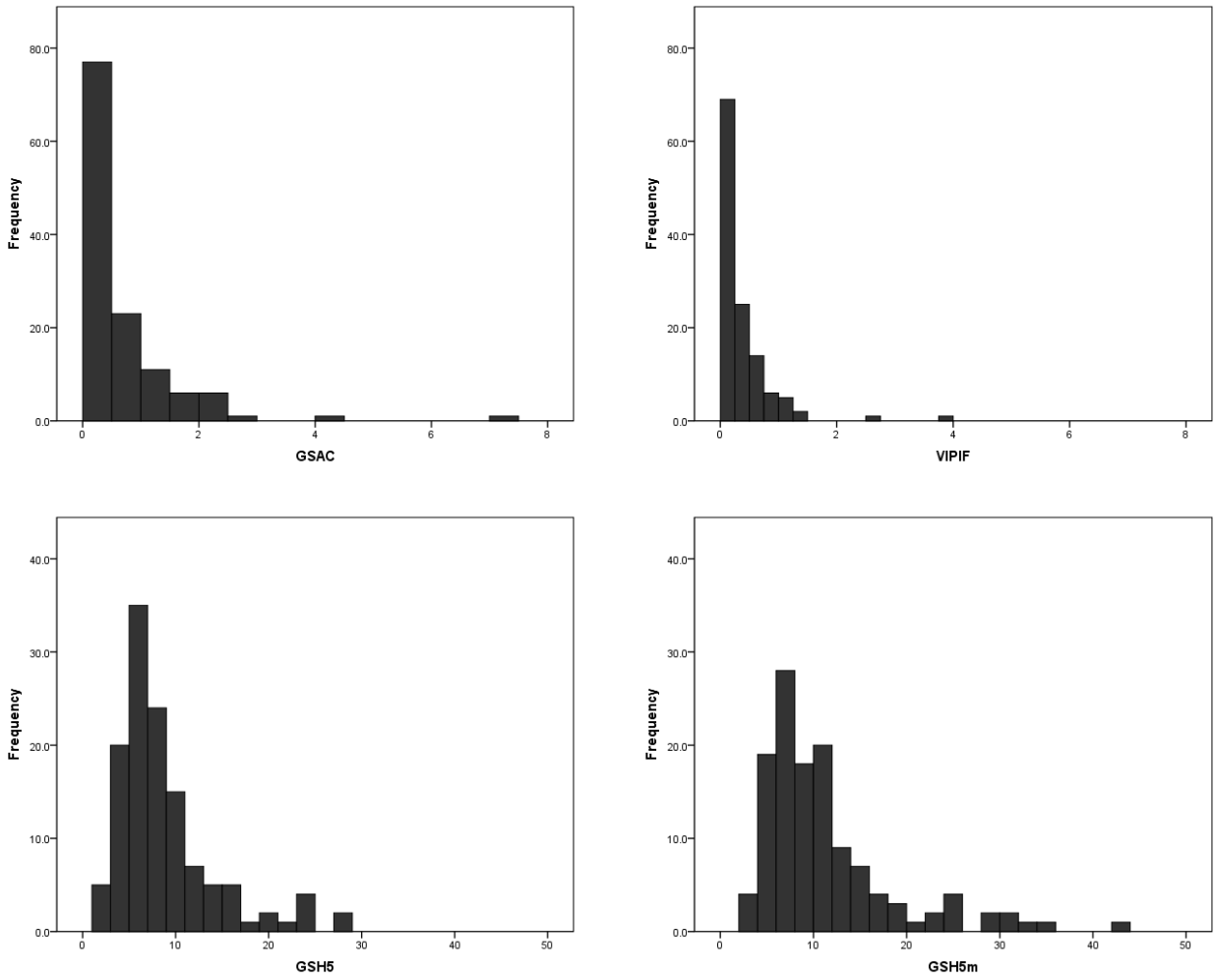


Figure 3. Frequency distribution of six metrics

Descriptive statistics of the six citation metrics were calculated as shown in Table 3 and Table 4. Generally, both metrics from GS and metrics from VIP have higher means in LIDS than in MET. Meanwhile, metrics in LIDS are more volatile than in MET. It shows that there are obvious differences between disciplines in GSC, and this is similar to traditional citation data.

	GSTC	GSAC	GSH5	GSH5m	VIPTC	VIPIF
Mean	781.403	0.993	10.371	13.871	765.722	0.507
Std. Deviation	907.068	1.168	6.797	8.985	884.770	0.647
Skewness	1.352	2.959	0.980	1.071	1.334	3.049
Kurtosis	0.846	12.709	0.248	0.772	0.626	12.641

Table 3. Descriptive statistics of six metrics in LIDS

	GSTC	GSAC	GSH5	GSH5m	VIPTC	VIPIF
Mean	191.797	0.370	6.297	7.844	314.403	0.230
Std. Deviation	220.781	0.232	2.083	2.698	225.394	0.155
Skewness	3.230	1.420	0.438	0.407	2.255	1.228
Kurtosis	11.781	2.695	-0.108	-0.406	8.214	1.042

Table 4. Descriptive statistics of six metrics in MET

Table 5 and Table 6 shows the correlation coefficient of the six metrics. Generally, it shows high correlation between GS metrics and VIP metrics. It also shows the difference between disciplines since the correlation coefficients are higher separately in LIDS than in MET. It has more differences between GSC and traditional citation data in MET than in LIDS. Comparing the correlation coefficients between VIPTC and GS metrics, GSH5 and GSTC have the highest and the second highest coefficients, indicating that these two metrics are relatively more related to the accumulation of citations. Comparing the coefficients between VIPIF and GS metrics, GSAC has the highest coefficient and GSTC has the lowest. Among the GS metrics, GSAC presents the result most timely and most closed to the VIPIF result. Compared with GSAC, GSH5 tends to provide cumulative impact of journals because of its time span and computing method, but it is inferior to GSAC in academic impact since it might be affect by the publication scale of each journal.

	GSH5	GSH5m	GSTC	GSAC	VIPTC	VIPIF
GSH5	1.000	.965**	.822**	.829**	.899**	.843**
GSH5m	.965**	1.000	.757**	.812**	.835**	.825**
GSTC	.822**	.757**	1.000	.879**	.852**	.777**
GSAC	.829**	.812**	.879**	1.000	.822**	.934**
VIPTC	.899**	.835**	.852**	.822**	1.000	.873**
VIPIF	.843**	.825**	.777**	.934**	.873**	1.000

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

Table 5. Correlation coefficient of six metrics in LIDS

	GSH5	GSH5m	GSTC	GSAC	VIPTC	VIPIF
GSH5	1.000	.936**	.644**	.644**	.828**	.787**
GSH5m	.936**	1.000	.539**	.615**	.780**	.736**
GSTC	.644**	.539**	1.000	.687**	.825**	.708**
GSAC	.644**	.615**	.687**	1.000	.731**	.841**
VIPTC	.828**	.780**	.825**	.731**	1.000	.835**
VIPIF	.787**	.736**	.708**	.841**	.835**	1.000

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

Table 6. Correlation coefficient of six metrics in MET

Journals in Sample B were ranked respectively according to GSH5, GSTC, GSAC, VIPTC and VIPIF. The differences between the rank of the first four metrics and the rank of VIPIF were calculated for each journal. Table 7 shows the statistics of rank differences. Again, great differences between disciplines are found. In LIDS, all of the GS metrics make decreases. GSAC brings the least change of ranks, while GSH5 obviously lowers the ranks of journals. On the contrary in MET, all GS metrics make increases. Instead of GSAC, GSH5 brings the least change of ranks. Figure 4 presents the means of rank differences for the four metrics. To evaluate journals with GSC, the ranks of MET journals will be raised and the ranks of LIDS will be lowered. Since LIDS journals are obviously superior to MET journals when ranked with citation data from

traditional citation databases, GSC can help to narrow the differences between these two disciplines with its expanded data sources.

Discipline	Metric	Mean	Minimum	Max	Std. Deviation
LIDS	GSH5	-8.92	-71	82	27.533
	GSTC	-7.33	-114	47	26.602
	GSAC	-3.82	-95	12	15.575
	VIPTC	0.34	-60	95	21.328
MET	GSH5	2.10	-37	38	16.759
	GSTC	8.79	-52	50	20.057
	GSAC	6.03	-40	44	14.750
	VIPTC	-0.37	-47	33	15.143

* Relative to the rank of VIPIF, the positive value means an increase, and the negative value means a decrease.

Table 7. Statistics of rank differences between four metrics and VIPIF

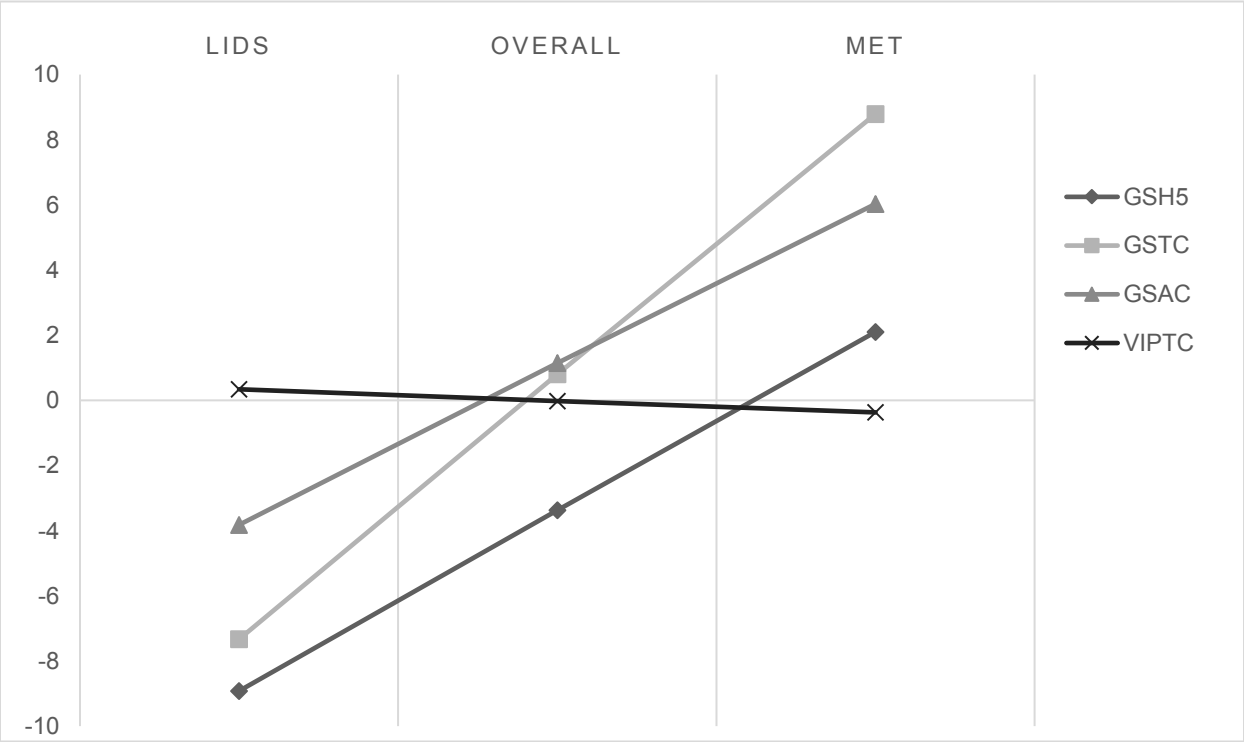


Figure 4. Means of rank differences between four metrics and VIPIF

6 Discussion

Based on a sample of 150 Chinese journals, we provided comparison of coverage, journal ranking and citation data for GS in order to discuss the usefulness of GS in the evaluation of Chinese journals. During the three steps, we also drilled down to the perspective of discipline to report the results.

With regard to the Chinese resource coverage, we found that GS had an impressive performance superior to other data sources. Specifically, GS shows its advantage in the coverage of scientific output with various types and languages compared with the traditional citation databases. Meanwhile, GS shows a good

performance in Chinese resource coverage with a relatively complete coverage of Chinese journals and abundant number of articles. It is important to note that its data sources contain the major Chinese databases, thus it might be a vital tool which helps to break the barriers between the Chinese databases and merge their resources. With these characteristics, GS is beneficial to provide a comprehensive platform with rich Chinese resources and an expanded citation network for Chinese journal evaluation.

However, the Chinese journal ranking of GSM is of little value. It is a great limitation for it to cover a variety of disciplines in one ranking. And it does not try to get rid of the difference between them caused by the characteristics of each discipline. Hence, the visibility of disciplines is unfair. On the other hand, for the Chinese journals in the same discipline, its ranking result is greatly different from the traditional evaluation result. Therefore, the Chinese journal ranking provided by GSM is not dependable enough and needs its evaluation method to be improved.

In terms of the Chinese citation data, GS is promising to be an alternative source of Chinese citation data. However, due to the limitation of it and of the tools, only a certain amount of simple citation data can be obtained. The GSC is similar to that from the Chinese database generally. Since GS has the advantage in coverage, its citation data might help to measure scientific impacts more comprehensively.

It is noteworthy that the difference between disciplines exists in both GSC and traditional citation data for Chinese journals. Although GS has outstanding coverage of MET journals and articles, none of MET journals is listed in GSM. It is opposite for LIDS. The evaluation result from GSC is more close to the traditional result in LIDS than in MET. Compared with traditional result, GSC might favor MET to the detriment of LIDS, which on the other hand will narrow the difference between these two disciplines.

GSH5 is the metric most valued by GS currently. Results indicate that GSAC and GSH5 are useful for the evaluation of Chinese journals, and GSAC is even better than GSH5 in some aspects. Both GSAC and GSH5 can provide certain reflection of journals' academic impact. Besides, they bring different change for journals in different discipline. Relatively speaking, GSAC is timelier and less affected by the number of articles in journal. Hence, GSAC can be a good supplement to the current GSM, which only includes GSH5 and GSH5m now.

The main limitation of this study comes from the small size of the sample. Due to the restrictions of tools and data sources, it is not convenient to collect the data from Chinese resource. Hence, it will be good if the English scientific tools and platforms consider the usability of non-English services more. This study has given a portrait of the usefulness of GS for the evaluation of Chinese journals across two disciplines. Further research could look at a wider scientific field with a larger sample in order to draw more definitive conclusions. Further research could also investigate between different non-English languages to provide more general conclusions. Moreover, it needs deeper insights to find out the degree of affect caused by existed problems of GS citation data to non-English scientific outputs. Additional, this study might bring some inspirations to facilitate the scientific communication and to improve the visibility of Chinese scientific outputs.

7 Conclusion

The findings of this study indicate that GS has sufficient Chinese resources for the evaluation of Chinese scientific journals. However, the current GSM fails to provide a good reflection of Chinese journals. GSC is useful for Chinese journal evaluation with its comprehensive citation data. It makes GS promising to be an important source of Chinese citations. But before that, GS needs to improve its evaluation method for GSM, and also to consider the fairness problem of citation across disciplines. In addition, GSAC can be a useful supplement to GSH5 for GSM to provide a better picture of journals' impact.

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9 Appendix

See Table 8, 9 and 10.

No.	Journal	ISSN	Sample A	Sample B
L01	Library and Information Service	0252-3116	√	-
L02	Journal of the China Society for Scientific and Technical Information	1000-0135	√	√
L03	The Documentation	1000-0437	√	-
L04	Library Journal	1000-4254	√	√
L05	Republican Archives	1000-4491	√	√
L06	Information Studies: Theory & Application	1000-7490	√	√
L07	Research on Library Science	1001-0424	√	√

L08	Archives Science Bulletin	1001-201X	√	√
L09	Sichuan Archives	1001-5264	√	√
L10	Journal of Library Science in China	1001-8867	√	√
L11	Science & Technology Information	1001-9960	√	-
L12	Information and Documentation Services	1002-0314	√	√
L13	Journal of Academic Libraries	1002-1027	√	√
L14	Beijing Archives	1002-1051	√	√
L15	Library Tribune	1002-1167	√	√
L16	Journal of Library and Information Sciences in Agriculture	1002-1248	√	√
L17	Library	1002-1558	√	-
L18	Archives Science Study	1002-1620	√	√
L19	Journal of Library Science	1002-1884	√	-
L20	Journal of Intelligence	1002-1965	√	-
L21	Shang Dong Library Quarterly	1002-5197	√	-
L22	The Library Journal of Henan	1003-1588	√	√
L23	Documentation, Information & Knowledge	1003-2797	√	√
L24	New Technology of Library and Information Service	1003-3513	√	√
L25	Library & Information	1003-6938	√	-
L26	Archives & Construction	1003-7098	√	√
L27	Journal of the Library Science Society of Sichuan	1003-7136	√	√
L28	Shaanxi Archives	1003-7268	√	√
L29	Library Work in Colleges and Universities	1003-7845	√	√
L30	Hubei Archives	1003-8167	√	√
L31	Guangzhou Archives	1003-9317	√	-
L32	Shanxi Library Journal	1004-1680	√	√
L33	Archives	1004-2733	√	-
L34	Library Development	1004-325X	√	√
L35	Sci-Tech Information Development & Economy	1005-6033	√	-
L36	Library World	1005-6041	√	√
L37	Library Work and Study	1005-6610	√	√
L38	Archives and History	1005-7501	√	-
L39	Information Research	1005-8095	√	√
L40	Library Theory and Practice	1005-8214	√	√
L41	Archives Management	1005-9458	√	√
L42	Shanxi Archives	1005-9652	√	√
L43	Journal of Academic Library and Information Science	1006-1525	√	√
L44	Archives World	1006-2459	√	√
L45	Zhejiang Archives	1006-4176	√	√
L46	Lantai World	1006-7744	√	-
L47	Shanghai Archives	1006-804X	√	√
L48	Hebei Library Journal of Science and Technology	1006-9925	√	√
L49	Electromechanical troop archives	1007-1970	√	√
L50	China Archives	1007-5054	√	√
L51	Information Science	1007-7634	√	-
L52	Yunnan Archives	1007-9343	√	√

L53	Journal of Modern Information	1008-0821	√	√
L54	Journal of Ancient Books Collation and Studies	1009-1017	√	√
L55	Journal of the National Library of China	1009-3125	√	√
L56	Archives Space	1672-3627	√	√
L57	New Century Library	1672-514X	√	√
L58	Shandong Archives	1672-5204	√	√
L59	E-Government	1672-7223	√	√
L60	Heilongjiang Science and Technology Information	1673-1328	√	-
L61	Digital Library Forum	1673-2286	√	√
L62	Aviation Archives	1673-3029	√	√
L63	Heilongjiang Archives	1673-9116	√	-
L64	The Urban Construction Archives Magazine	1674-0289	√	√
L65	China Science & Technology Resources Review	1674-1544	√	√
L66	Journal of Information Resources Management	2095-2171	√	√
L67	The Journal of the Library Science in Jiangxi	2095-5197	√	√
L68	Contemporary Library	Restricted Publication	√	√
L69	Competitive Intelligence	Restricted Publication	√	√
L70	Research on Library & Information Work of Shanghai Colleges & Universities	Restricted Publication	√	√
L71	Library work	Restricted Publication	√	√
L72	Library Forum	Restricted Publication	√	√
L73	Library Science Research & Work	Restricted Publication	√	√
L74	Newsletter of Library and Information Service	Restricted Publication	√	√
L75	Library & Information Science Tribune	Restricted Publication	√	√
L76	Library and Information Newsletter	Restricted Publication	√	√
L77	Library & Information Service of Zhejiang Universities & Colleges	Restricted Publication	√	√
L78	Chongqing Library and Information Science Research	Restricted Publication	√	√

Table 8. Sample journals in Library, Information & Documentation Science

No.	Journal	ISSN	Sample A	Sample B
M01	Chinese Journal of Rare Metals	0258-7076	√	-
M02	Iron & Steel	0449-749X	√	-
M03	Metal World	1000-6826	√	√
M04	Metallurgical Industry Automation	1000-7059	√	√
M05	Metallurgical Analysis	1000-7571	√	√
M06	Sintering and Pelletizing	1000-8764	√	√

M07	Journal of University of Science and Technology Beijing	1001-053X	√	√
M08	Physics Examination and Testing	1001-0777	√	√
M09	Journal of Iron and Steel Research	1001-0963	√	√
M10	Metallurgical Equipment	1001-1269	√	√
M11	Research on Iron and Steel	1001-1447	√	√
M12	Ironmaking	1001-1471	√	√
M13	Energy for Metallurgical Industry	1001-1617	√	√
M14	Ferro-Alloys	1001-1943	√	√
M15	Steel Pipe	1001-2311	√	√
M16	Powder Metallurgy Technology	1001-3784	√	√
M17	Sichuan Metallurgy	1001-5108	√	√
M18	Shanghai Metals	1001-7208	√	√
M19	Steelmaking	1002-1043	√	√
M20	China Nonferrous Metallurgy	1002-8943	√	√
M21	Metallurgical Standardization & Quality	1003-0514	√	√
M22	Hunan Nonferrous Metals	1003-5540	√	√
M23	Special Steel	1003-8620	√	√
M24	Steel Rolling	1003-9996	√	√
M25	Chinese Rare Earths	1004-0277	√	√
M26	Precious Metals	1004-0676	√	√
M27	Nonferrous Metals Engineering & Research	1004-4345	√	√
M28	Shandong Metallurgy	1004-4620	√	√
M29	Iron Steel Vanadium Titanium	1004-7638	√	√
M30	Journal of Inner Mongolia University of Science and Technology	1004-9762	√	√
M31	Shanghai Nonferrous Metals	1005-2046	√	√
M32	Aluminium Fabrication	1005-4898	√	√
M33	Jiangsu Metallurgy	1005-6068	√	-
M34	Metal Materials and Metallurgy Engineering	1005-6084	√	√
M35	Yunnan Metallurgy	1006-0308	√	√
M36	Tianjin Metallurgy	1006-110X	√	√
M37	Jiangxi Metallurgy	1006-2777	√	√
M38	Henan Metallurgy	1006-3129	√	√
M39	Sichuan Nonferrous Metals	1006-4079	√	√
M40	Angang Technology	1006-4613	√	√
M41	Hebei Metallurgy	1006-5008	√	√
M42	Powder Metallurgy Industry	1006-6543	√	√
M43	Metallurgical Power	1006-6764	√	√
M44	China Metallurgy	1006-9356	√	-
M45	Guangdong nonferrous metals	1007-2470	√	-
M46	Nonferrous Metals(Extractive Metallurgy)	1007-7545	√	√
M47	Non-Ferrous Mining and Metallurgy	1007-967X	√	√
M48	Baosteel Technology	1008-0716	√	√
M49	Wuhan Iron and Steel Corporation Technology	1008-4371	√	√
M50	Energy Saving of Nonferrous Metallurgy	1008-5122	√	√

M51	China Tungsten Industry	1009-0622	√	√
M52	Hydrometallurgy of China	1009-2617	√	√
M53	Copper Engineering	1009-3842	√	√
M54	Science & Technology of Baotou Steel	1009-5438	√	√
M55	Wide and Heavy Plate	1009-7864	√	√
M56	Southern Metals	1009-9700	√	√
M57	Metallurgical Collections	1671-3818	√	√
M58	Shanxi Metallurgy	1672-1152	√	√
M59	Xinjiang Iron and Steel	1672-4224	√	√
M60	Gansu Metallurgy	1672-4461	√	√
M61	Journal of Hunan Metallurgical Professional Technology College	1672-7142	√	-
M62	Fujian metallurgy	1672-7665	√	-
M63	World Iron & Steel	1672-9587	√	√
M64	Special Steel Technology	1674-0971	√	√
M65	Journal of Wuhan University of Science and Technology (Natural Science Edition)	1674-3644	√	√
M66	Heilongjiang Metallorgy	1674-5183	√	√
M67	Foundry Equipment & Technology	1674-6674	√	√
M68	Jiangxi Nonferrous Metals	1674-9669	√	-
M69	Journal of Jiangxi University of Science and Technology	2095-3046	√	√
M70	Anhui Metallurgy	Restricted Publication	√	√
M71	Taigang Science & Technology	Restricted Publication	√	√
M72	Iron & Steel Scrap of China	Restricted Publication	√	√

Table 9. Sample journals in Metallurgical Engineering & Technology

Rank	Journal	H5-index	H5-median
1	Economic Research Journal	59	89
2	Chinese Journal of Nosocomiology	47	65
3	Chinese Journal of Nursing	44	54
4	Automation of Electric Power Systems	41	53
5	Accounting Research	40	55
6	Power System Technology	38	68
7	Xinhua Wenzhai	38	66
8	Management World	38	55
9	Acta Geographica Sinica	37	47
10	Transactions of the Chinese Society of Agricultural Engineering	37	43
11	Proceedings of the CSEE	36	55
12	Social Sciences in China	35	50
13	Laboratory Research and Exploration	34	40
14	Xinhua Monthly	33	67
15	Qiu Shi	33	56

16	Chinese Journal of Infection and Chemotherapy	33	54
17	Journal of Financial Research	33	42
18	China Higher Education	32	50
19	Power System Protection and Control	32	44
20	Journal of China Coal Society	32	39
21	China University Teaching	32	38
22	Chinese General Practice	31	40
23	China Industrial Economy	31	40
24	Chinese Journal of Practical Gynecology and Obstetrics	30	52
25	Chinese Nursing Management	30	51
26	China Population Resources and Environment	30	45
27	Experimental Technology and Management	30	37
28	Chinese Journal of Rock Mechanics and Engineering	30	34
29	Natural Gas Industry	29	58
30	China Legal Science	29	41
31	The Journal of Quantitative & Technical Economics	29	40
32	Chinese Journal of Computers	29	39
33	Chinese Nursing Research	29	37
34	Journal of Nurses Training	29	34
35	Journal of Academic Libraries	28	43
36	Petroleum Exploration and Development	28	43
37	Journal of Nursing Science	28	37
38	China Soft Science	28	37
39	China Higher Education Research	28	35
40	Educational Research	28	35
41	The Journal of The Library Science in China	28	34
42	The Journal of World Economy	28	33
43	Journal of Nursing Administration	27	39
44	Researches in Higher Education of Engineering	27	39
45	Sociological Research	27	38
46	Foreign Language World	27	37
47	Chinese Journal of Geophysics	27	33
48	Acta Ecologica Sinica	27	33
49	Animal Husbandry and Feed Science	27	32
50	Chinese Journal of Schistosomiasis Control	26	44
51	Journal of Software	26	39
52	Chinese Journal of Practical Surgery	26	37
53	Chinese Rural Economy	26	36
54	Library and Information Service	26	35
55	Chinese Science Bulletin	26	33
56	Journal of Higher Education	26	33
57	Scientia Agricultura Sinica	26	32
58	Geographical Research	26	32
59	Vocational and Technical Education	26	31
60	Library and Information	25	38
61	Urban Studies	25	38
62	Chinese Journal of Epidemiology	25	35

63	The Journal of Clinical Anesthesiology	25	35
64	Acta Petrolei Sinica	25	35
65	Journal of Practical Obstetrics and Gynecology	25	33
66	Acta Electronica Sinica	25	32
67	Journal of Anhui Agricultural Sciences	25	30
68	Acta Prataculturae Sinica	25	30
69	Economic Geography	25	29
70	Foreign Languages in China	24	38
71	Chinese Hospital Management	24	32
72	Problems of Agricultural Economy	24	32
73	Researches in Library Science	24	31
74	Finance & Trade Economics	24	31
75	CET China Educational Technology	24	30
76	Library Work and Study	24	30
77	Chinese Agricultural Science Bulletin	24	29
78	Earth and Environment	24	29
79	Journal of Electronic Measurement and Instrument	24	29
80	Library Journal	24	28
81	Education and Vocation	24	28
82	Attend to Practice and Research	24	27
83	China Economic Quarterly	23	37
84	Nursing Journal of Chinese People's Liberation Army	23	35
85	Chinese Translators Journal	23	34
86	Foreign Language Teaching and Research	23	34
87	Nankai Business Review	23	33
88	Library Development	23	32
89	Transactions of China Electrotechnical Society	23	32
90	Journal of Ideological & Theoretical Education	23	31
91	Disease Surveillance	23	31
92	Trends of Recent Researches on Higher Education Teaching in China	23	30
93	Chinese Journal of Minimally Invasive Surgery	23	29
94	Journal of Natural Resources	23	29
95	Chinese Journal of Public Health	23	28
96	Chinese Journal of Practical Nursing	23	28
97	Optics and Precision Engineering	23	28
98	Transactions of the Chinese Society of Agricultural Machinery	23	28
99	The Journal of Practical Medicine	23	28
100	Meteorological Monthly	23	28

Table 10. Top 100 Chinese Journals of Google Scholar Metrics