Supported by China Association for Science and Technology (CAST) (2019KJQK004)
Results of "Research on the Comprehensive Evaluation Method of
World Science & Technology Journal Impact"

World Journal Clout Index Report
(2020 STM)
Research Description

Project research units

Institute of Scientific and Technical Information of China

China Academic Journals (CD Edition) Electronic Publishing House Co., Ltd.

Tsinghua University Library

Wanfang Data Co., Ltd.

Society of China University Journals

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Peking University Library

Capital Medical University Library

China Agricultural University Library

CrossRef

Digital Science

Contents

1 Objective and significance

(1) Conducting global STM journal evaluation to fairly reveal the current innovation situatiaon worldwide

In the context of advancing scientific and technological revolution and industrial transformation, the input and output of emerging economies such as China, India, Brazil and Russia are constantly growing, profoundly shifting the global innovation map and facilitating the global innovation and economy development. In the publishing field of STM journals, the total number of STM journals in the world and the number in non-native English speaking countries/regions are both increasing.

International major journal databases traditionally and mainly include English journals and Western journals in a long period, and pay insufficient attention to the journals in those from emerging economies, especially those from non-native English speaking countries/regions and developing countries/regions. With a limited coverage of journals, these databases can hardly give an authentic presentation of the sci-tech innovation in those countries/regions in the era of rapid scientific and technological development. In China, for example, there are 5,062 STM journals, of which only around 200 are included in the WOS database and around 600 in SCOPUS database. A large number of journals published in China, especially Chinese-language journals are not included, and millions of STM papers fail to catch the world's attention every year.

In order to panoramically show the current situation of global sci-tech innovation and reflect the true contribution of emerging sci-tech powers, the study of "World Journal Clout Index (WJCI)"is carried out to objectively evaluate the publishing and communication services and academic impact of STM journals on current global sci-tech innovation activities.

(2) Improving academic evaluation when using existing databases

The SCI and SCOPUS are useful tools for journal retrieving and had being applied to research evaluation as its derived functions. The two databases mainly focus on English journals and Western journals from the aspects of cost, user market, positioning and main functions, in which the point is to make the best use of resources available in their own database. However, they pay little attention to establishing a comprehensive evaluation system for global academic journals. Moreover, they only provide single index ranking such as cites or impact factor (IF), and do not comprehensively evaluate the academic impact of journals.

However, with the expansion of the scale and influence of the two databases, the bibliometric index of journals based on citation data has gradually been recognized by the academic circles and used for scientific research evaluation, and even evolved into the only academic evaluation tool in some scientific research institutions, resulting in problems of "SCI fever" and "IF-centered." The single index evaluation is doubted by many scientific

and technological circles and publishing circles due to its limitations and many professional institutions are constantly intending to introduce new evaluation indexes. Therefore, it is necessary to establish a comprehensive evaluation index of journals on scientific and reasonable basis which can change the negative tendency of using the IF and other single evaluation indexes by academic circles, and reveal the journal academic impact more broadly and effectively.

To sum up, there is no scientific and comprehensive evaluation method for academic impact of journals in China and abroad. Thus, it is essential to establish an open and pluralistic evaluation system from current journals worldwide to correctly evaluate the true development level of academic journals in China and other non-English speaking countries/regions. For this purpose, China Scientometrics and Bibliometrics Research Center (CNKI) and other journal evaluation centers jointly conduct the "Research on the Comprehensive Evaluation Method of World Science & Technology Journal Impact" under the commission of China Association for Science and Technology (CAST), with a view to offering a more objective and reasonable method for journal evaluation and provide more objective statistical data for the evaluation of academic impact of journals in the world.

2 Research methods

The project team consists of the evaluation and research departments of China Academic Journals (CD Edition) Electronic Publishing House Co., Ltd., Institute of Scientific and Technical Information of China, Tsinghua University Library, Society of China University Journals, and Wanfang Data Co., Ltd. Literature information professionals from Peking University Library, Capital Medical University Library, China Agricultural University Library and other institutions were invited to participate in the joint research. This project also received data support from CrossRef and Digital Science. On the basis of full investigation of journal databases and journal evaluation results in China and abroad, our research focuses on four aspects: selection of statistical source journals, design of evaluation index system, discipline classification of journals, and construction of the World Citation Database.

2.1 Selection of statistical source journals

2.1.1 Proportion of statistical source journals from different countries/regions

The project team investigated comprehensive databases including Ulrich's Periodicals Directory, SCI database and SCOPUS database, six professional databases including EI (for engineering technology), MEDLINE and PMC (for biology and medicine), Chemical Abstracts (CA, for chemistry), MathSciNet (Mathematical Reviews, MR, for mathematics),

GeoRef (for geoscience), and CABA (for agriculture), as well as international databases such as RSCI (Russia), JSTAGE (Japan), KCI (Republic of Korea). The inclusion standard, discipline classification system, and journal directories of each database were summarized and analyzed, based on which a total of 63,000+ continually publishing STM journals worldwide were sorted out. A quarter of the journals (about 15,000 journals) were selected as the source journals for statistics, and the finalists were confirmed through primary quantitative selection and expert review.

In order to comprehensively evaluate the development status of science and technology and STM journals in each country/region on scientific basis, the number of statistical source journals from different countries/regions is determined from 4 dimensions: (1) R&D input; (2) output of scientific papers; (3) number of scientific researchers; and (4) the scale and level of journals. The distribution of statistical source journals is shown in Table 1.

Table 1 Number and selection basis of statistical source journals from different countries/regions

Country/ Region	**R&D input (%)**	**Journal papers (%)**	**Researchers (%)**	**Journals (%)**	**Selected journals (%)**	***n* of journals selected**
Total	-	-	-	-		14,000–15,000
USA	27.6	20.1	22.9	19.4	20–28	3,000–4,100
UK	2.5	5.2	4.6	9.8	3–10	450–1,500
China	26.3	24.7	27.8	8.0	9–11	1,400–1,700
Germany	6.7	5.1	6.7	6.8	5–9	800–1,300
Japan	8.1	4.6	10.8	6.3	4–8	630–1,200
Russia	2.0	3.1	6.5	4.7	3–5	380–730
India	-	4.5	-	4.6	2–5	280–700
Netherlands	1.0	1.8	1.3	4.4	4–8	550–1,200
France	3.3	3.4	4.7	2.1	2–4	330–530
Switzerland	0.9	1.4	-	2.0	1–3	220–500
Italy	1.7	3.5	2.2	1.8	2–3	230–500
Brazil	-	2.3	-	1.7	1–2	110–360
Spain	1.1	2.8	2.1	1.7	1–3	210–440
Poland	0.7	1.4	1.8	1.6	1–2	100–240
Korea (Republic of)	4.7	3.4	6.1	1.6	2–3	250–400
Others	13.4	12.7	-	23.7	11–14	1,600–2,100

Note: (1) Data of R&D (scientific research input) and number of researchers are derived from the official data released by the

Organisation for Economic Co-operation and Development (OECD). (2) The output of scientific papers is based on the proportion of scientific papers published in 4 databases. The 4 databases and the total number of papers are detailed as follows: WoS (2,290,000), Scopus (2,110,000), EI (1,600,000) and Biosys (880,000).

2.1.2 Selection method and results

After determining the number of source journals from different countries/regions, we need to select high-quality journals of "region- and discipline-representative" from all STM journals in each country/region. The selection method is illustrated as follows:

(1) Preliminary selection using the citation-based WAJCI index

The statistical source journals are preliminarily selected using quantitative evaluation indexes based on citation. We counted the cites of all journals cited by Crossref in 2019, calculated the number of papers in the journal, IF and total cites (TC), and then calculated the World Academic Journal Clout Index (WAJCI) by discipline. On this basis, the statistical source journals in each country/region were determined according to the target number of journals.

(2) Ensuring high-quality journals are included in source journals

The 3 journal lists of the WAJCI Annual Report 2019 (Q1&Q2), JCR-SCIE 2020 (Q1&Q2), and Scopus 2020 (Q1&Q2) were compared with the journals selected in the previous step. Results found a total of 1,674 journals were not included. Then, this list entered the source journals to replace those ranked at the bottom in the first step.

(3) Special adjustments

After analyzing the source journals selected in the above two steps, it is found that the journals selected from some countries are not ideal. Therefore, we made the following adjustments. By reference to the evaluation results of the 3 core journal lists in China (CSCD, ISTIC, Core Journal of Peking University), 1,605 Chinese journals were selected, of which 133 were excluded due to low IF (not included in Q1 of the Annual Report for Chinese Academic Journals Impact Factors). For Russian journals, 489 were selected on the ground of Clout Index (CI) values calculated by the evaluation indexes released by RSCI. The number of journals in the UK was adjusted to be 2,853 as there are many journals included in various databases and a large number of journals with high evaluation indexes.

On a selective basis, the quota assigned to Japan, France, Italy, Spain and other non-native English speaking countries is not fulfilled, which will be further supplemented and improved in future cooperation with local publishing institutions or academic groups in each country.

(4) Excluding journals with large quantity and low quality

Totally 51 journals included in Q3 and Q4 of WAJCI and with Journal Mass Index (JMI) at the bottom of the ranking were excluded. The JMI is calculated by IF divided by the number of articles published in the journal, which can effectively reveal those journals with large article quantity and low quality.

(5) Excluding journals with low quantity

Totally 273 journals were excluded, whose average number of citable documents in 2017–2019 is equal to or less than 5.

(6) Adjustments according to the expert advice

After expert review and recommendation, 298 low-quality journals were excluded, and 68 journals were added.

Finally, 14,287 source journals were included (Table 2).

Table 2 Number of WJCI source journals by country/region

Country/Region	*n* of journals (target)	*n* of journals (final)	Coverage ratio (*vs* SCIE)	Crossref-based WAJCI threshold	Reference		
					n of journals (SCIE)	*n* of journals (SCOPUS)	*n* of English journals
Total	14,000-15,000	14,287	86%		9393	18,214	34,649
USA	3,000-4,100	3,806	91%	0.719	2,792	4,560	11,572
UK	450-1,500	2,717	90%	2.114	2,237	3,734	5,956
China	1,400-1,700	1,426	94%	——	213	669	365
Netherlands	800-1,300	1,054	92%	1.673	895	1,451	2,464
Germany	630-1,200	775	80%	1.244	718	1,191	1,381
Switzerland	280-700	443	87%	1.438	321	541	849
Russia	380-730	414	28%	——	101	345	202
Japan	550-1,200	329	89%	0.349	207	459	574
India	330-530	261	59%	0.527	98	402	2,797
Korea (Republic of)	220-500	245	86%	0.732	131	282	316
Brazil	230-500	220	92%	0.427	108	289	82
Poland	110-360	207	71%	0.504	128	327	379
France	210-440	183	72%	0.601	177	373	173
Canada	100-240	156	82%	0.498	95	191	477
Italy	250-400	150	68%	0.633	114	330	305
Others	1,600-2,100	1,901	72%	0.498	1,058	3,070	6,757

Note: The journals published in China in this table have CN numbers, the same below.

2.1.3 Language analysis of statistical source journals

(1) Table 3 shows the WJCI source journals in English and non-English.

Table 3 Statistics of English and non-English journals by country/region

No.	Country/Region	*n* of English Journals	*n* of non-English Journals
1	USA	3,747	59
2	UK	2,639	78
3	Netherlands	989	65
4	Germany	637	138
5	Switzerland	399	44
6	China	262	1,164
7	India	260	1
8	Japan	229	100
9	Korea (Republic of)	173	72
10	Australia	146	1
11	Poland	145	62
12	Canada	114	42
13	Singapore	106	0
14	New Zealand	99	0
15	Italy	98	52

(2) Table 4 shows the total of 3,011 journals in multilingual and non-English language from different countries.

Table 4 Country distribution of non-English journals

No.	Country/Region	*n* of non-English journals	n of English journals
1	China	1,164	262
2	Russia	319	95
3	Brazil	178	42
4	Germany	138	637
5	France	105	78
6	Spain	100	37
7	Japan	100	229
8	UK	78	2,639
9	Korea (Republic of)	72	173

10	Netherlands	65	989
11	Poland	62	145
12	USA	59	3,747
13	Italy	52	98
14	Indonesia	51	21
15	Turkey	45	44

（3）Tabel5 shows that non-English journals, mainly in Chinese, French and Russian, accounting for 21.08% of the total source journals.

Table5 Language statistics of non-English journals

No.	Language	*n* of journals	Proportion (%)
1	Chinese	1175	8.22%
2	French	366	2.56%
3	Russian	316	2.21%
4	Spanish	264	1.85%
5	German	139	0.97%
6	Portuguese	133	0.93%
7	Japanese	81	0.57%
8	Italian	60	0.42%
9	Korean	53	0.37%
10	Indonesian	48	0.34%

2.2 Evaluation index——World Journal Clout Index (WJCI)

In order to achieve the aim of reflecting the journal impact more comprehensively and objectively, the project team developed a new evaluation index——World Journal Clout Index (WJCI), considering the World Academic Journal Clout Index (WAJCI, weight of 0.8) based on citation data and Web Impact (WI, weight of 0.2) based on web usage data.

The World Academic Journal Clout Index (WAJCI) was first proposed by CNKI in its Annual Report on the Impact Factor Index of World Academic Journals (2018), and it is a comprehensive index for evaluating the citation impact of journals with the CI standardization in disciplines.

The Web Impact (WI), first proposed in this study, is a new evaluation index based on the usage data of international web users and the download data from journal full-text databases in China.

2.2.1 Academic impact indexes based on citation data (CI, WAJCI)

(1) Clout Index (CI)

It is generally believed that the most influential journals in a field should be those with both the highest total citationa (TC) and impact factor (IF) in the subject, such as the position of *The New England Journal of Medicine*. CI is a value calculated by vector equal weight after linearly normalizing the IF and TC of journals in a group in a statistical year. It represents the similarity between a certain journal and the journal with the highest impact in the field. The greater the CI value, the closer the impact of the journal is to the best position. CI is a comprehensive index that takes into account TC (representing the effective impact of a journal's article quantity and history) and IF (a representative index of the average article quality). To a certain extent, it can correct the one-sided evaluation of journals brought about by single use of IF or TC.

Definition 1: Journal impact ranking space

The IF and TC of journals in the same discipline are mapped to a two-dimensional space, which is called "journal impact ranking space." The two values are divided by the maximum of the discipline and normalized to obtain A and B. The "journal impact ranking space" is a plane orthogonal coordinate system, where the abscissa is the normalized IF, and the ordinate is the normalized TC. According to (A, B), each journal corresponds to a point in this space (Figure 1), and the best position is (1,1).

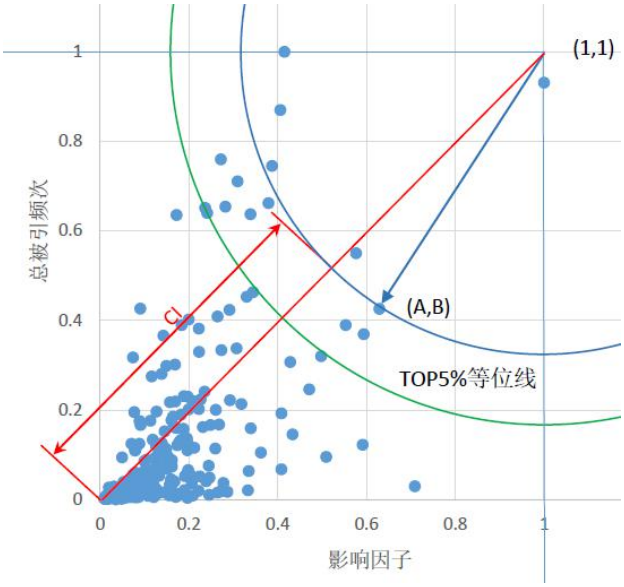

Figure 1 Schematic diagram of clout index (CI) and equipotential line

影响因子：Impact factor　总被引频次：Total cites　TOP5%等位线：TOP5% equipotential line

Definition 2: Equiimpact line of journals

In the "Journal impact ranking space," the journal with the highest clout is defined as (1, 1). The line formed by the points with equal distance with point (1, 1) is the equiimpact line

of journals. Obviously, the equiimpact line is an arc centered on (1, 1).

Definition 3: Clout Index (CI)

The Clout Index (CI) is the distance from the intersection of the equiimpact line where the journal is located and the connection between (0, 0) and (1, 1) to the origin (0, 0). The calculation formula is as follows:

$$CI = \sqrt{2} - \sqrt{(1-A)^2 + (1-B)^2}$$

$$\text{where} \quad A = \frac{IF_{journal} - IF_{min}}{IF_{max} - IF_{min}} \qquad A \in [0,1]$$

$$B = \frac{TC_{journal} - TC_{min}}{TC_{max} - TC_{min}} \qquad B \in [0,1]$$

(2) World Academic Journal Clout Index (WAJCI)

The World Academic Journal Clout Index (WAJCI) is the ratio of a journal's CI to the median CI of the worldwide journals in this discipline. This value reflects the multiple of the CI of a journal relative to the CI of the journal ranked in the middle in this discipline, and can be used for discipline ranking and cross-year comparison of the journal.

WAJCI = Journal CI/Median CI of journals in the discipline

When WAJCI = 1, the CI of a journal is equal to the median of journals in the discipline. A larger WAJCI value indicates a higher level of the journal. The WAJCI reflects the relative position of academic impact of a journal in the discipline, which can be applied to cross-disciplinary and cross-year comparison.

2.2.2 A bibliometrical index based on web usage: WI

Network communication and mobile internet have brought about new formats of scientific research and publishing, such as open science and open access. Citations do not reflect the impact of academic research results in a timely and complete manner due to certain lag and limitations that they must be cited by users in published articles. Therefore, it is necessary to find new indicators to supplement it. This study is a preliminary attempt to introduce the statistical results of users' mention and usage data of the latest published articles of journals on the Internet to reflect the comprehensive impact of the latest academic results of journals in the academic community and society.

For the usage data of international network users, the index of "total mentions" for 2019 journal articles in **Altmetric** provided by **Digital Science & Research Solutions** is introduced through collaboration.

Due to the particularity of Chinese language and network environment, the usage of Chinese journals can hardly be illustrated now in Altmetric. Under this context, we introduce CNKI downloads and Wanfang database downloads as alternative measures to show the function of Chinese journals for Chinese scholars (accounting for 27% of the global total). In this study, the sum of downloads of journal articles published in 2019 by CNKI users and Wanfang users in 2019 is used as the original index.

Statistics show that the web usage data vary greatly among journals, with a large number of mentions and downloads in several leading journals, while extremely low in most journals. Taking "total mentions" as an example, the maximum is 13,506 times the median value and 1,225 times the average value. For most journals, this index is approximately equal to 0 if the conventional normalization method is used. For this reason, we adopt a segment assignment method for both data and set the weight of "total mentions" and domestic downloads to be 0.8 and 0.2, respectively, in the calculation of WI.

Taking "total mentions" as an example, the specific segment assignment method is as follows: The source journals with "total mentions" are sorted by size and divided into ten equal segments after removing the low-scoring journals at the bottom 20%. The WI of journals in each segment is obtained by backward induction from the weight corresponding to the average WAJCI value of journals in each segment. All journals in the same segment have the same WI score.

2.2.3 World Journal Clout Index (WJCI)

$$WJCI_i = WAJCI_i + WI_i$$

2.3 Discipline classification system

2.3.1 Design principle

(1) Practicability——classification oriented toward scientific research activities.

(2) Novelty——in response to the rapid development of disciplines in recent years, emerging and interdisciplinary disciplines forming a certain scale are independently set into one category.

(3) Internationalization——compatible with the classification systems of international libraries and databases as much as possible, and fully learn from international standards and achievements.

(4) Rationality of scale——disciplines with a large quantity are split and highly interdisciplinary disciplines are merged.

2.3.2 Design method

On the basis of thorough research on the classification systems and journal directories of 8 international index databases (WOS, SCOPUS, MEDLINE, EI, JST, KCI, CABA and RSCI), the project team innovatively re-compiled the discipline classification system containing 279 disciplines (STM), following the general outline of the *Classification and Code Disciplines of the People's Republic of China* (CCD), with reference to *Chinese Library Classification* and *Catalogue of Degree Granting and Talent Training Disciplines*. Table 6 shows the discipline comparison of the CCD with WoS and Scopus, using Physics as an example.

Table 6 WJCI discipline classification vs WoS and Scopus classifications (Physics)

No.	Discipline code	CCD	WoS	Scopus
1	O140	Physics	Physics; Physics, Multidisciplinary	Physics and Astronomy (miscellaneous); General Physics and Astronomy
2	O1401550	Quantum Science and Technology	Quantum Science and Technology	
3	O14015	Theoretical Physics	Physics, Mathematical (merged)	Mathematical Physics (merged)
4	O14020	Acoustics	Acoustics	Acoustics and Ultrasonics
5	O14025	Thermodynamics	Thermodynamics	
6	O14030	Optics	Optics	Atomic and Molecular Physics, and Optics (split)
7	O1403025	Spectroscopy	Spectroscopy	Spectroscopy
8	O14035	Electromagnetism		Electronic, Optical and Magnetic Materials (split)
9	O14045	Electron Physics		
10	O14050	Condensed Matter Physics	Physics, Condensed Matter	Condensed Matter Physics
11	O1405030	Crystallography	Crystallography	
12	O14055	Plasma Physics	Physics, Fluids and Plasmas (split)	
13	O14060	Atomic and Molecular Physics		Atomic and Molecular Physics, and Optics (split)

14	O14065	Atomic Nuclear Physics	Physics, Nuclear	
15	O14070	High Energy Physics	Physics, Particles and Fields (split)	Nuclear and High Energy Physics (split)
16	O14080	Applied Physics	Physics, Applied	

2.3.3 Research results

On the basis of preliminarily compiling the classification system by referring to the classification of 8 international databases, the research group divided about 14,000 source journals into different disciplines, followed by soliciting opinions from 85 experts and inviting the classification experts from 4 library and information institutions (Tsinghua University Library, Peking University Library, Capital Medical University Library and China Agricultural University Library) to review the classification list of journals. Afterward, the final meeting of experts on classification system was held. The final WJCI discipline system consists of 5 Level-1 categories, 45 Level-2 categories and 279 Level-3 categories (Figure 2). For details, please see the Discipline Classification System of World Journal Clout Index Report (2020 STM).

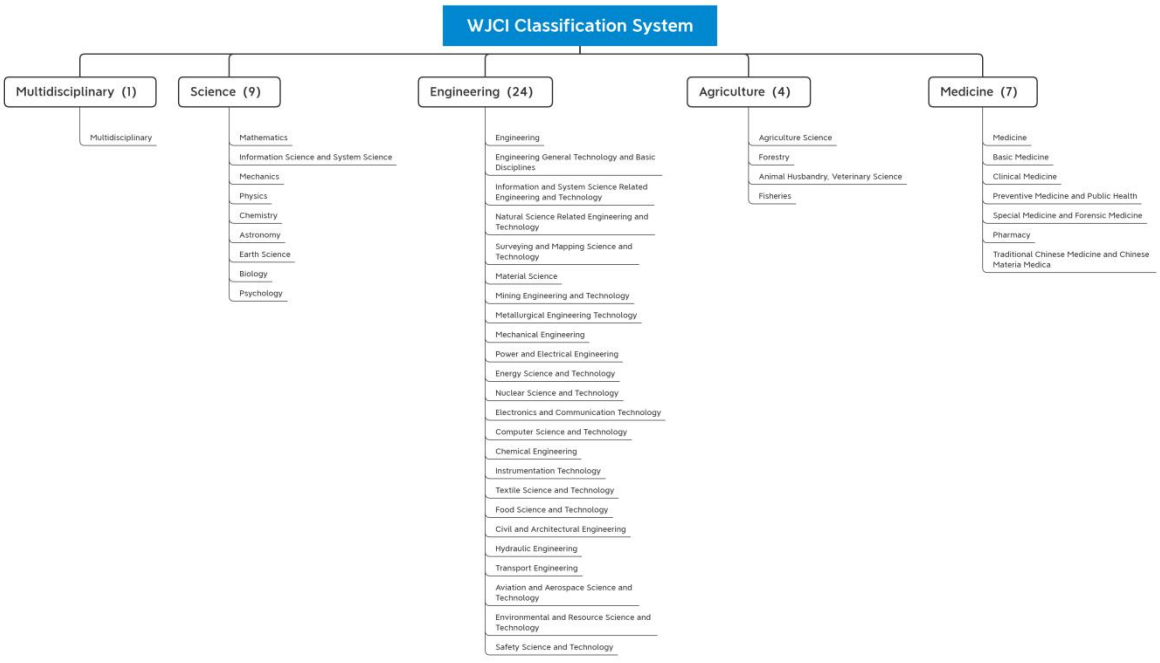

Figure 2 WJCI discipline system

2.4 World Citation Database

The objective and rational evaluation of STM journals based on citation data is guaranteed under the premise of high-quality statistical source literature and citation database.

At present, international citation databases WOS and SCOPUS are developed for retrieval services, mainly including English journals, European and American journals, and there are few non-English journals. Database providers such as Crossref and Digital Science aim at building big data platforms and pay less attention to the quality of journals, which causes varying quality. The above two types of databases offer some reference for our research, but they are inappropriate to be directly used to calculate the academic impact.

On this basis, we independently establish the World Citation Database for project research to extract citation data in the scope of statistical source journals previously mentioned, and count the citation indexes of the optimized source journals, thereby ensuring the authority of WJCI. The research group needs to process the references of statistical source journals accurately and completely. The World Citation Database is the basis for the quantitative evaluation and analysis of STM journals.

The data sources used by the research group include:

（1）CNKI-Scholar data

CNKI has signed bibliographical cooperation agreements with 611 international publishers. At present, 100 million bibliographies and 280 million citations have been obtained.

（2）CrossRef data

By the end of March 2020, the project team has obtained 112 million bibliographies and 917 million citations from online open data with permission.

（3）Dimensions data

The project team supplements the data needed in the scope of statistical source journals but unavailable in CNKI-Scholar and CrossRef from Dimensions through the cooperation agreement.

（4）Chinese journal data

The data are derived from CNKI journal database and Wanfang data.

The World Citation Database is preliminarily formed for internal use in the research after data duplication removal, cleaning, citation linking and journal title standardization. This database contains 144 million citation data from 26,653 international journals (journals with references) in 2019, covering 12,854 WOS journals and 14,936 SCOPUS journals. Besides, 112 million bibliographies are available, with 5.31 million in 2017, 5.66 million in 2018, and 6.32 million in 2019. The accuracy of citation data has reached 99.4% after sampling inspection.

3 Evaluation result and data statistics

3.1 Global academic contribution: based on TC

On the basis of this report, the TC of STM journals in 2019 included in statistical sources amount to 70,198,000, of which 5,258,600 are from Chinese journals, contributing to 8% of the total. The TC of Chinese journals is 2,319,100, of which 556,700 are from international journals, accounting for 24%. The average citation rate of journals cited by other countries/regions is 69%, which indicates that the international impact of Chinese journals still needs to be strengthened.

3.2 WJCI analysis

3.2.1 Overall analysis

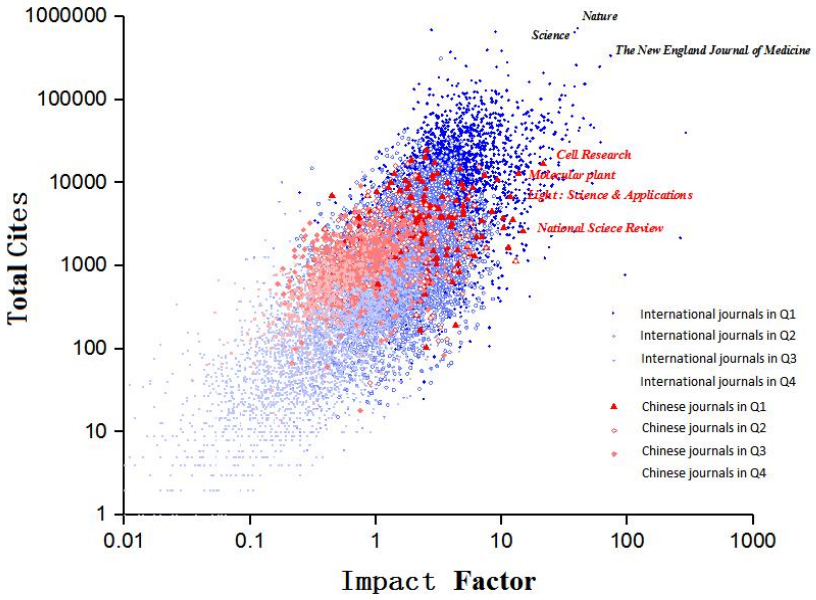

Figure 3 Log–log plot of impact factor and total cites of WJCI journals

In the above figure, the abscissa is the journal IF, and the ordinate is the TC of journals. Each point in the figure represents a journal. Red represents Chinese journals, while blue represents international journals. Obviously, Chinese journals have been well integrated into international journals, indicating that the selected Chinese journals have reached the equivalent level as international STM journals in terms of IF and TC.

3.2.2 Q1 and Q2 journals analysis by country

Table 7 shows the number of journals from different countries included in Q1 and Q2, as calculated by WJCI of statistical source journals. The countries with the most Q1 journals are the USA, the UK and the Netherlands. Other countries with Q1and Q2 journals accounting for more than 60% of their source journals include Germany and Switzerland.

Table7 WJCI-indexed Q1Q2 journals by country

No.	Country	*n* of journals in Q1	*n* of journals in Q2	*n* of Q1Q2 journals	% of global Q1Q2 journals	*n* of source journals	% (Q1Q2) of national total source journals
1	USA	1342	1240	2366	32.05%	3806	62.17%
2	UK	1134	1054	1991	26.97%	2717	73.28%
3	Netherlands	447	448	792	10.73%	1054	75.14%
4	China	172	345	488	6.61%	1426	34.22%
5	Germany	218	297	479	6.49%	775	61.81%
6	Switzerland	155	181	302	4.09%	443	68.17%
7	Japan	26	81	101	1.37%	329	30.70%
8	Australia	27	57	79	1.07%	147	53.74%
9	France	24	59	78	1.06%	183	42.62%
10	Canada	20	53	69	0.93%	156	44.23%

3.2.3 Chinese journals with high impact——based on WJCI

From the perspective of WJCI, top-ranked journals in each discipline have high academic impact. It is assumed in this study that Top 5% journals have the impact of “world-class journals” for the convenience of further comparative studies in the following analysis. There are 720 WJCI-TOP5% journals in different disciplines, where 315 are from the USA, 231 from the UK, and only 8 from China. This indicates that China still needs to strengthen its efforts to catch up with world-class journals.

Table 8 WJCI-TOP5% journals in China

No.	Journal title	Discipline classification	TC	IF	WJCI	WJCI rank
1	National Science Review	Science and Technology (General)	2594	14.795	32.692	5/246
2	Science Bulletin	Science and	12189	7.338	18.742	8/246

		Technology (General)				
3	Cell Research	Cell Engineering	16834	21.41	11.208	2/46
4	Engineering	Engineering General	2206	6.309	9.446	4/158
5	Molecular Plant	Botany	12860	13.626	9.225	8/202
6	Scientia Agricultura Sinica	Agriculture Science General	9442	1.843	8.090	4/134
7	Journal of Integrative Agriculture	Agriculture Science General	6007	2.382	7.211	5/134
8	Fungal Diversity	Mycology	3570	12.295	3.976	1/34

Table 9 WJCI-TOP20 Journals in China

No.	**Journal title**	**Discipline classification**	**WJCI**
1	National Science Review	Science and Technology (General)	32.692
2	Science Bulletin	Science and Technology (General)	18.742
3	Science China Physics, Mechanics & Astronomy	Astronomy General	12.313
4	Cell Research	Cell Engineering	11.208
5	Research	Science and Technology (General)	10.325
6	Science China Information Sciences	Information Science	10.102
7	Engineering	Engineering General	9.446
8	Molecular Plant	Botany	9.225
9	Scientia Agricultura Sinica	Agriculture Science General	8.090
10	Chinese Journal of Computers	Computer Science and Technology General	7.824
11	Journal of Integrative Agriculture	Agriculture Science General	7.211
12	Frontiers of Medicine	Medicine General	6.725
13	Computer Engineering and Applications	Computer Science and Technology General	6.638
14	Science China Technological Sciences	Science and	6.637

No.	Journal title	Discipline classification	WJCI
		Technology (General)	
15	Science China Life Sciences	Biology General	6.296
16	Transactions of Nonferrous Metals Society of China	Metallurgical Engineering Technology	6.261
17	Computer Science	Computer Science and Technology General	6.139
18	Application Research of Computers	Computer Science and Technology General	5.709
19	Journal of Control and Decision	Engineering General Technology	5.532
20	Light: Science & Applications	Optics	5.458

3.2.4 WJCI statistics by country/region

The statistics of WJCI index by country/region can suggest the overall level of journals in a country/region. There are 1,426 journals in China, with an average WJCI of 1.184, which is lower than that of the UK, the Netherlands, the USA, Switzerland and Germany, and higher than that of Japan, Republic of Korea and other BRICS countries——Russia, India and Brazil.

Table 10 WJCI statistics by country/region (number of journals > 50)

No.	Country/Region	*n* of journals	Average WJCI	Average WAJCI	Average WI
1	UK	2717	2.959	2.551	0.408
2	Netherlands	1054	2.898	2.640	0.258
3	USA	3806	2.816	2.472	0.345
4	Switzerland	443	2.344	1.995	0.350
5	Germany	775	2.000	1.783	0.217
6	Australia	147	1.586	1.306	0.280
7	Egypt	50	1.552	1.515	0.037
8	Canada	156	1.370	1.176	0.194
9	France	183	1.355	1.209	0.146
10	Italy	150	1.257	1.110	0.147
11	New Zealand	99	1.196	1.031	0.165
12	China	1426	1.185	1.083	0.103
13	Japan	329	1.039	0.955	0.084

14	Korea (Republic of)	245	1.013	0.971	0.041
15	Singapore	106	0.995	0.969	0.026
16	South Africa	51	0.917	0.845	0.071
17	Spain	137	0.834	0.730	0.104
18	Poland	207	0.734	0.697	0.037
19	Czech Republic	63	0.729	0.719	0.010
20	Brazil	220	0.727	0.687	0.040
21	Iran (the Islamic Republic of)	108	0.717	0.686	0.032
22	India	261	0.665	0.596	0.070
23	Turkey	89	0.507	0.477	0.030
24	Indonesia	72	0.256	0.256	0.001
25	Russia	414	0.185	0.180	0.005

Note: The number of journals in the above table is the accumulation of journals of different disciplines, and the WJCI value of interdisciplinary journals takes the maximum value.

4 Qualitative evaluation of the project research process

This project establishes a bibliometrics-based check mechanism by combining quantitative and qualitative evaluation, insists on active communication with experts in every central link, such as inviting experts to review and listening to experts' opinions, and adjusts working ideas and methods in time to ensure the scientificity and rationality of the research methods and results. Experts' qualitative checks in the project process mainly include:

(1) Establishment of expert committee

The expert committee was constituted, the charter was drawn up, and many meetings (including offline meetings and network meetings) were held. The core expert team of the project adheres to the weekly meeting system, so that various tasks are carried out under the guidance of experts.

(2) Opening report meeting

Under the auspices of China Association for Science and Technology, an opening report meeting was held on March 13, 2020 to listen to the opinions of experts.

(3) Mid-term report meeting

Under the auspices of China Association for Science and Technology, a mid-term report meeting was held on July 9, 2020. The project team reported the research progress and received feedback from experts.

(4) Expert review of statistical source journal list

After the preliminary selection of source journals, the project team invited 85 experts (73 with the title of senior level, from 10 discipline clusters) recommended by first-level societies to participate in the review of journal list in September 2020, and adjusted the scope of statistical source by reference to the experts' suggestions. The following adjustments are made: excluding 298 journals with poor academic reputation, adding 68 journals and adjusting the discipline classification of 333 journals.

(5) Expert review of journal discipline classification

In October, 2020, the project team invited the literature classification experts from the libraries of Tsinghua University, Peking University, Capital Medical University and China Agricultural University to recheck the classification of source journals item by item. On the basis of 4,599 amendments put forward by experts, the project team adjusted the discipline classification accordingly.

(6) Expert review meeting on project results release

Under the auspices of the China Association for Science and Technology, an expert review meeting was held on October 27, 2020 before the release at the 2nd World Science and Technology Development Forum. Many academicians and periodical experts listened to the report, affirmed the research results of the project, and proposed optimization suggestions.

(7) Experts final review meeting

On November 30, 2020, the project team organized an expert final review meeting on the discipline classification system. Nine experts from the Evaluation Center of Institute of Scientific and Technical Information of China, Tsinghua University Library, Peking University Library, Capital Medical University Library and CNKI attended the meeting. The experts affirmed the innovative classification system of STM journals compiled by the project team and put forward optimization suggestions.

(8) Experts final review meeting on pre-release

Before the official release, the research group pre-released the World Journal Clout Index (WJCI) Report (2020 STM) to the network platform, and notified more than 1,400 Chinese journals included in the list to recommend experts for the final review. A total of 242 opinions were received, and the experts were mainly journal editors and professors, including 94 journal editors and 148 professors from various disciplines.

Ninety-five percent of the experts expressed approval, understanding and support for the project results. Among them, 19% (46) experts put forward specific revision opinions, which centered on discipline classification, such as additions, deletions, and adjustments.

In addition, several experts objected to the ranking of "predatory journals" with high quantity and low quality in the list, and argued that the TC of those journals through large

volume of publications has increased their academic impact and thus should be restrained. In this regard, the research group searched out 17 journals in the top 1% of global publication volume and the bottom 2% of global JMI, which basically covered the list of "predatory journals." The weight of the cites in CI of these journals was lowered (multiplied by 0.05).

5 Summary of project novelty

(1) The proportion of statistical source journals reflects the scientific research status of different countries/regions. The number is mainly determined by 4 dimensions: scientific research input, output of scientific papers, number of scientific researchers and the scale and level of journals, which takes into account the history, development status and journal quality level. Besides drawing on the research results of the international renowned databases WOS and SCOPUS on the excellent English journals in Europe and America, we supplemented a large number of high-quality journals in developing countries such as China and non-native English speaking countries. Therefore, the list of source journals is more in line with the scientific research and development, which is conducive to the future development of global STM journals. Compared with current databases, it has greatly improved the inclusion of journals from China, developing countries and non-native English speaking countries.

(2) A new China-based and world-oriented system for discipline classification of journals has been constructed. The new discipline classification system is based on the CCD, and incorporates the classification systems of international databases, which highlights the contribution of journals to discipline development, and reflects the evaluation of discipline impact.

(3) Evaluation indexes show the journal impact more comprehensively from different dimensions. The WJCI fully considers the "academic impact" by integrating TC and IF; the JMI and other alternative indexes are introduced as supplementary quantitative indexes. This avoids the limitation of journal evaluation based on single index such as IF.

(4) Big data full-sample system provides a panoramic view of STM journals worldwide. Using developed databases and data sharing mechanisms, we adopt the most complete and largest citation database as the basis for the preliminary selection of statistical source journals. The scope of source journals is dynamically managed by iterating and eliminating the bottom journals, and further verified by experts. This will avoid the bias caused by expanding the statistical sources on the basis of a small sample at the beginning.

6 Release and access

The project team completed the "Research on the Comprehensive Evaluation Method of World Science & Technology Journal Impact," and formed the Index of High Impact Journals and the Research Report by thorough evaluation of world STM journals, which is based on source journal selection, comprehensive evaluation index system, journal discipline

classification, and the research results of World Citation Database. The research results were released at the 2nd World Science and Technology Development Forum on November 8, 2020. The report was concerned and reported by many domestic media. The project was awarded the “Certificate by Innovation China.”

The research description of this report and the final WJCI Journal Directory are now available for free access at wjci.cnki.net.


中国发布科技期刊世界影响力指数研究报告

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