20. The Relevance of National Journals from a Chinese Perspective

Zheng Ma

The process of of journal evaluation began in the 1930s when the famous British scholar S.C. Bradford published his study of geophysics and lubrication, which presented the empirical law now known as Bradford's law of scattering, as well as the concept of core area journals. The citation indicator system and citation analysis theory system were founded in the middle of the twentieth century, and now have extensive influence. In the 1960s, Garfield carried out a large-scale statistical analysis of citations in journal literature. Generally speaking, the journal evaluation system has been gradually improved over time, producing an evaluation result that meets the development needs of science and technology. As one of the countries producing important science and technology outputs, China has ranked second according to the statistics of the number of scientific articles in recent years. At the same time, China has over 5000 scholarly journals, however, only 4% of them have been indexed in Web of Science and 10% of them in Scopus. A similar situation is found in Russia, Japan, Korea, and other non-English-speaking countries. Therefore, China has a lot of research and practice in the field of journal evaluation with which to explore more applicable and effective ways of assessing and improving national academic journal development. We will review the development situation of scientific, technical and medical (STM) journals in China to understand the demand for a national journal evaluation system. According to the comparative study on international and national evaluation systems and indicators of academic journals in China, we can find the characteristics of national journal evaluation under a framework of their respective evaluation purposes, evaluation methods, key features, and evaluation criteria. We introduce two cases of China's STM journal research and evaluation work: the development of the boom index and its monitoring function, and the definition and application of comprehensive performance scores (CPSs) for Chinese scientific and technical journals. English-language science and technology journals in China are more similar to international journals but are developing along a particular path. Therefore we also introduce three other cases: statistics and analysis of English-language science and technology journals in China, the communication value of Chinese-published English-language academic journals according to citation analysis, and the atomic structure model for evaluating English-language scientific journals published in non-English countries.

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Scientific and technological research activities in the field of natural science and scholarly communication and publication activities all show significant trends of globalization. The driver of this development comes from two sources. The first is the academic language, English, which plays an increasingly important role. Although Yuasa's idea on the shift of the global science center seems to predict that the world's science research center will leave the United States sometime in the future, the international research community seems to rely more and more on English as the sole de facto language of communication. Second, following large-scale trends, the massive volume of output from academic publishing continues to increase. Furthermore, mergers between science and technology publishing enterprises have become the norm. In this context, the *national belonging* of academic journals is itself a controversial and widely discussed topic.

In English-speaking countries, most academic journals are published in English. These English-language journals constitute the world's most extensive academic peer services, and generally they cannot be strictly defined as national or international journals. At the same time, the publishing of non-English-language journals seems to be walking in the shadow of English-language journals. Of the former, especially those from non-English-speaking developing countries, very few journals are included in international indicator systems. These journals can be viewed as *typical* of national academic journals.

In view of globalization trends, national academic journals could claim their value from four aspects. The first is at the academic resource level. In some research fields, including those with unique geographical and geological characteristics, such as traditional medicine among others, national academic journals tend to cover the most important academic research faster and more comprehensively and systematically. Second, at the methodology level, national journals might have unique and rational arrangements in terms of information organization and information architecture. For example, international journals usually provide research funding information in an acknowledgment section at the end the article. Most Chinese journals include funding information as a standalone annotation in the manuscript. Thus, the article funding ratio is a key indicator of a journal's quality. Inspired by this concept, the Science Citation Index (SCI) and other international search systems are beginning to include additional funding annotations. Third, regarding the efficiency of scholarly communication and behavior analysis, a huge number of national journals are an integral part of a country's scientific and technical output. China has over 5000 scholarly journals published in Chinese, 20 times that of English-language journals. A similar situation is found in Russia, Japan, Korea, and other non-English-speaking countries. Scientists, at the beginning of their careers, often publish important papers in national journals, which can be seen and confirmed by looking at the profiles of a number of Nobel Prize winners from China and Japan. Finally, in many countries governments provide substantial support for research and development activities, and therefore many achievements result from government-funded research and development. Thus, national researchers need to utilize this support as much as possible. Papers published in national journals are undoubtedly a rapid and effective way to achieve this. Furthermore, the readers and authors of national journals understand each other's scientific and social background, enabling the public supervision of academic ethics.

20.1 Journal Evaluation

20.1.1 The Origins of Journal Evaluation

Research on journal evaluation originates from philology [20.1]. Regarding the emergence of journal evaluation, scholars such as *Qian Ronggui*, *Qiu Junping*, and *Lai Maosheng* [20.2–4] noted that Western journal evaluation began in the 1930s. In 1934, the famous British scholar S.C. Bradford (b. 1878), in the study of geophysics and lubrication, presented the empirical law now known as Bradford's law of scattering. His research shows that

> if scientific journals in the size of the number of papers published in a certain subject, to reduce the order, then can be divided into a special subject for the core area of the discipline and the core of the same number of papers in several areas. At this time, the core area and successive districts of the number of journals into A1 A2 .... [20.5]

Based on this distribution, Bradford proposed the concept of *core area* journals, that is, many articles on a subject are published in the core area. The theory of foreign journal evaluation originates from this law.

Eugene Garfield was a famous American linguist. He helped to establish the Institute for Scientific Information and was one of the founders of scientometrics. The citation indicator system and citation analysis theory system were founded in the middle of the twentieth century, and have had extensive influence [20.6]. In the 1960s, *Garfield* carried out a large-scale statistical analysis of citations in journal literature, with the conclusion that many citations were concentrated in just a few journals and that a small number of citations were disseminated in many journals [20.7]. Subsequently, Garfield created the Institute for Scientific Information (ISI), and successively published the SCI, Social Science Citation Index (SSCI) and the Art and Humanities Citation Index databases.

Following the development of Western journal evaluation, efforts in journal evaluation are now emerging in China. In 1964, a number of Chinese scholars began to translate and use the SCI [20.8]. Gaining the attention of scholars, the theory of bibliometrics was soon introduced and disseminated in the 1970s. In the early 1980s, Chinese scholars translated and introduced several bibliometric laws. This included Bradford's law (1934) and Garfield's Law of Concentration (1955). These were followed by the literature aging index and citation peak theory in 1971 [20.2, 9]. These three laws are considered to be the theoretical basis for the quantitative evaluation of journals.

China's journal evaluation system was gradually established beginning with the introduction of foreign journal evaluation theory. In 1987, the Institute of Scientific and Technical Information of China (ISTIC) (commissioned by the Ministry of Science and Technology—formerly the National Scientific and Technological Commission) began to analyze the number of citations of Chinese scientific and technical researchers at home and abroad, and used statistical data to establish the Chinese Scientific and Technical Papers and Citations Database (CSTPCD) [20.10].

Based on research in the literature, this paper reviews the development of journal evaluation, the evolution of Chinese journal evaluation indexes from single indexes to composite indexes, and the change from object-oriented journal evaluation. The theory of journal evaluation has been developed over time, as has the establishment and development of various evaluation systems.

20.1.2 Development Trends Within the Evaluation System

An evaluation index typically involves two key methods of journal evaluation—a direct comparison according to the index of journal literature, and the evaluation of a composite evaluation index. The determination of core journals is ascertained from the initial single-index method to the production of a comprehensive composite index method. Furthermore, the journal evaluation system is gradually improved over time, producing an evaluation result that meets the development needs of science and technology.

When journal evaluation first began, a single index was used to determine core journals. With the development of evaluation work and the appearance of the composite index, evaluation work has become more scientific and reliable. According to the deviation of the function of each single index, the index can be divided into different categories such as evaluating the quality of journal papers or evaluating the performance of the journals [20.11].

The most common indicator for evaluating the quality of journal papers is Garfield's impact factor. Other indicators based on citation analysis include a journal's total citations, the rate of citation in other journals, and the percentage of deviations (as used by SCI and China's Citation Report for Chinese STM Journals) [20.12]. They also include the method of citation analysis of core journals proposed by *Garfield* [20.13], and the statistical method of the evaluation of core journals by means of important documents or indexes containing the number of journal papers [20.14]. In the evaluation of the volume of journals, this chapter proposes a method to determine Bradford's law of core journals. In general, these methods are used to measure the influence of academic journals as an alternative to the academic quality of academic journals. These methods include the annual index, the range of citations, citation rate, whether the full text of the article is reproduced in the journal, and the download rate. The index of the academic content in evaluating the ability of published journals includes the regional distribution of authors, the ratio of funded papers, and the number of citations [20.15].

Using a composite index to evaluate STM journals avoids narrow perspectives and the limitations of single-index evaluation. Furthermore, a composite index can comprehensively and objectively reflect the quality level of journals and is more suitable for the full evaluation of journals. Thus, this method has been widely used. Based on the principle of structural equations, an analytic framework of journal influence was devised by *Yue* and *Wilson* [20.16]. Previous studies state that the evaluation of Chinese humanities and social sciences journals is typically achieved using the indicator system [20.17]. Furthermore, a three-dimensional hierarchical structure of the journal evaluation indicator system was proposed, and the grey relational method was used to evaluate that system [20.18]. Others have used an analytic hierarchy process (AHP) to evaluate journals [20.19]. In addition, some scholars combine two or more evaluation methods. For example, the composite method is used to evaluate weights according to the AHP, and the weighted technique for order of preference by similarity to ideal solution (TOPSIS) method is one such evaluation method. Although the composite evaluation method has only one evaluation result, it can still be regarded as a multiple index comprehensive evaluation method in essence. The multi-index comprehensive evaluation of academic journals is a complicated system that involves many aspects including evaluation principle, index selection, data standardization, and evaluation method selection. Data standardization is used as a basic method of statistics. It should be no surprise that there have been few in-depth studies on the matter. It is necessary to point out that different methods of data standardization have had a considerable influence on evaluation results, and this chapter proposes a new standardization method of reverse index data based on the features of several common data standardization methods. A number of methods have been developed: *Luo Shisheng* prosed the comprehensive appraisal method [20.20], Suk the weighted synthesis method and the fuzzy linear weighted transformation method, and *Qin Lifu* looked at journal cost [20.21]. This chapter puts forward an appropriate selection method for core journals. Furthermore, Ma Wei devised the fuzzy comprehensive determination method, which looks at journal information density, intelligence reliability, and intelligence reporting speed. Lastly, *Wang Genbin* prosed the principal component analysis method from a mathematical perspective [20.22].

Composite indexes have been applied in the current evaluation system, and the citation reports of Chinese STM journals published by the China Institute of Science and Technology Information have been adopted as comprehensive evaluation scores. That is, the comprehensive evaluation indicator system used for Chinese STM journals includes the following features: it calculates many scientific measurement indexes, uses AHP to determine key index weights, evaluates each journal, and calculates the total score of each journal. This current evaluation method is very effective.

China's current journal evaluation system includes the following indexes: ISTIC's *Statistical Source of Chinese Science and Technology Journal* (also known as *China's Science and Technology Core Journals*), which publishes the Chinese STM Citation Report (CJCR); the Chinese Science Citation Database (CSCD), a source journal list issued by Chinese Academy of Sciences (CAS); Peking University Library's *A Guide to the Core Journals of China*; Chinese Social Sciences Citation Index (CSSCI) from China Social Sciences Research Center of Nanjing University, which covering the core *Journals of China's Humanities and Social Sciences* [20.23].

Bradford's aim was to distribute research, and this could be achieved via core journals. Journal readers can find references in journal articles and this will help the reader to meet their own needs more efficiently. Advances in science and technology and the rapid growth of scientific research have meant a change in the evaluation of journals. Initially, such evaluations were reader-oriented, and later there was a greater focus on libraries and other organizations. Because of a shortage of library funding in China, foreign core journals were translated into Chinese and introduced to China to ensure a better use of available subsidies [20.24]. In 1992, Peking University Library created its first publication outlining China's core journals; it was intended for use by the staff of Peking University Library. The aim was also to reduce costs in establishing a wide choice of journals [20.25].

The standardization of the journal evaluation system seeks to reduce the gap between journals and core journals. Such efforts are made to aid the future development and quality of journals, and for guidance purposes. Authors can also better understand the requirements of different journals, so as to help them contribute to and improve the quality of their paper.

In addition, the publication and management of journals is also an important object of journal evaluation, and the evaluation of core journals is bound to have an important influence on the editorial direction of journal publications. To maintain the continuous development of academic journals, journal management staff carry out effective research on journal evaluation as well as supervision.

Through core journals, we can quickly understand the dynamics and development of each subject or field. The journal evaluation system is regarded as a reference foundation, enabling libraries to optimize their collections. Librarians offer reading-list guidance and provide reference services, and the journal evaluation system can be used in such a manner. The system can also provide reference for the evaluation of academic achievements. Furthermore, it can provide reference for authors who wish to submit contributions and for government departments to manage journals. Core journals also promote the study of bibliometrics to provide information for journal development and competition, and to promote the development of journals and improve their quality. Therefore, core journals are not only important for the end users but also for the development of journals and their quality.

Indexes of core journals provide empirical evaluation measures, such as access law, expert investigation methods, and the reader survey method. With the development of bibliometrics, more and more methods based on mathematics and statistics are being applied to the evaluation of core journals, gradually enriching evaluation methods. Three main laws, Bradford's law, Lotka's Law, and Zipf's law, provide the theoretical basis for evaluation. They use bibliometrics to measure core journals according to certain basic steps [20.26]. Citation analysis is the most commonly used evaluation measure of academic journal quality. The corresponding quantitative evaluation indexes are as follows: impact factor, citation frequency, reaction rate, average citation rate, journal citation rate, and journal citation half-life. The most intuitive evaluation index is the journal impact factor, which is synthesized by the statistical analysis of citations and the citation phenomenon.

Bradford's law is the theoretical basis of the core journals. Garfield and others looked at citation frequency to evaluate science and technology journals. The advent of this method in academia marked a milestone in the evaluation of the journal. However, there are some limitations in using the total citation frequency to evaluate a journal. Garfield revised his own research and proposed the impact factor index to evaluate journals. The impact factor is more reliable than the total number of citations, as it eliminates the influence of many uncertain factors. The impact factor has become a universal journal evaluation index, and the main measurement index to evaluate the academic influence of journals.

Total Citations: The total number of papers published by a journal since its inception and published in the year in which it was cited. The total citation frequency is a very objective and practical evaluation index, and can be used to measure the academic influence of journals. It can also be used to objectively explain the degree of use and attention of journals, and the position and function of journals in academic exchange. It does face the problem, however, where the impact factor will be low if there is an excessive volume of journals. The higher the frequency of citations, then the higher the value of the journal's utilization and academic level [20.27]. However, citation frequency is also subject to the publication of the journal, the number of papers published, and whether the publication is a professional journal or a comprehensive one [20.28].

Impact Factor: The number of citations received in that year by articles published in that journal during the two preceding years, divided by the total number of articles published in that journal during the two preceding years [20.29]. It reflects the overall academic level of the journal, generally in the same subject area: the larger the impact factor, the greater the impact of the journal [20.30].

Three basic factors are important when calculating an impact factor: the number of papers, time, and the number of citations. Furthermore, the peak period of a paper is dependent on the period of time. A scientific paper's peak citation period is claimed to be two years after publication, according to scientific metrology, so the current international practice is to set a period of two years.

Reverse Indicators: The index of reverse evaluation in journal evaluation concerns articles that received zero citations. This can be traced back to the 1960s, when Price, one of the fathers of scientific metrology, first looked at basic statistics regarding papers that received zero citations published in *Science*. He found that approximately 35% of the papers in any statistical time window had not received any citations [20.31]. Regarding zero citations, Chinese scholar Wu Yishan has proposed that we not forget the *Sleeping Beauty* phenomenon. A lack of citations may not necessarily mean poor quality research results, and zero citations may represent an excellent result from another perspective [20.32].

20.2 Development of STM Journals in China and Demand for Evaluation

20.2.1 The Status of STM Journals in China

In recent years, the number of published journals and the number of STM journals has remained stable. According to statistics from a *National Press and Publication Situation* report, China published 9867 journals in 2012, of which about half were natural science, with technical journals accounting for 4953. Since 2007, the annual growth rate of total journals and STM journals in China has been less than 1%.

The ISTIC has selected about 2000 high-quality and influential academic and technical journals as Chinese STM core journals. The institute uses quantitative indices to monitor the development level and trends of Chinese STM journals, and publishes the annual CHCR. China's core journals in science and technology published close to 500 000 papers in 2014, with an average of 260 papers published per journal each year.

Regarding journal evaluation, total citation frequency and impact factor are the indicators typically used to measure the absolute influence and relative influence level of journals. In 2012, the average citation frequency of Chinese STM journals reached 1023 citations per issue, 4.5 times that of the 2001 rate, and the average impact factor was 0.493, 1.7 times that of 2001. The article funding ratio index refers to the proportion of the results of provincial- and ministerial-funded projects published in a journal. This index reflects the ability of the journal to attract high-level research papers. The average value of the article funding ratio in China's journals was 52% in 2012, which means that more than half of the papers in the core journals were the research results of various nationally funded projects. The 2001 value of the fund thesis was 34%. The significant growth of the above indicators shows that China's STM journals play a significant role in the dissemination of knowledge and academic exchange.

The publishing cycle of China's STM journals has been gradually reduced. In 2007, the monthly ratio of China's STM core journals was 28.73%, rising to 35.79% in 2011. There was also a considerable shift from bimonthly publications to monthly, with a quarterly total of 13.22% in 2008 compared to 10.66% in 2011. The data show that China's STM journals are increasing in publication speed, reducing the journal publishing cycle and improving the timeliness of knowledge dissemination. At the same time, the total number of papers in Chinese STM core journals remains at around 500 000 a year.

Although the number of STM papers published in China ranks second in the world, the academic quality and influence of STM journals remains low. The SCI database is the world's most widely used science and technology literature retrieval system. Impact factors and other classical indicators are used to choose more than 8600 high-level scientific and technological journals worldwide (mainly English-language journals). According to the ranking of impact factors in corresponding disciplines, SCI journals are divided into four main categories: the impact factors determine whether a journal is classified as Q1, which indicates that the journal is a leading publication in that particular discipline, followed by Q2, Q3, and Q4. In 2015, 152 Chinese journals were covered in SCI, accounting for less than 2% of all journals published in China. Twenty journals were considered to be at the fore of their particular subject area, and were thus classified as Q1 journals, representing just 8% of Chinese STM journals. A total of 40 journals were classified as Q2, just 15% of all Chinese journals.

The world's largest scientific and technological publishing organization, the Elsevier Scopus database, is an important multilingual document retrieval database. It uses SCImago Journal Rank (SJR) and other indicators to assess and collect more than 12 000 major global scientific and technical journals. The SJR index also ranks journals from Q1–Q4: a journal considered a Q1 journal in the subject category ranking indicates that the journal is a leading journal in that particular subject area, followed by Q2, Q3 and Q4 journals. According to Scopus data, there are 554 journals from various areas in China, representing less than 5% of all Scopus journals. It is very difficult for Chinese journals to achieve a Q1 ranking, with just 27 journals considered Q1 journals, accounting for 5% of China's Scopus journals, with 152 (27%) ranked as Q2 journals. Thus, the majority of journals do not achieve such positive rankings.

20.2.2 The Main Evaluation Methods of National Science and Technology Organizations

China's Ministry of Science and Technology

Our government ministries have always attached great importance to the quality management of academic journals. Furthermore, it is common for third-party organizations to evaluate such journals. The journal evaluation system, which has had a considerable influence on the evaluation of STM journals, is a comprehensive evaluation indicator system of Chinese STM journals developed by the China Science and Technology Information Research Institute (CITIC Institute). The CITIC Institute has been developing evaluation indexes for Chinese STM journals since 1987, and publishes an annual citation report, looking at three key levels: academic quality, international competitiveness, and sustainable development potential. To comprehensively reflect the quality and influence of academic journals through more than 20 academic indexes of STM journals, the evaluation results are widely used by the General Administration of Press and Publication, the Ministry of Science and Technology, the Ministry of Education, the National Natural Science Foundation Committee, the CAS, and other industry departments and institutions of academic journal evaluation. This system has achieved good results. Since 2000, the CITIC Institute has been commissioned by the Ministry of Science and Technology to conduct pioneering work in the research of high-level STM journals. The institute has helped to outline a strategy of high-quality Chinese STM journals, develop an evaluation indicator system of such journals, and construct a service and guarantee system for these publications. Furthermore, every three years it publishes a list of China's high-quality STM journals (starting in 2008). The CITIC Institute is considered impartial and authoritative. Aside from these evaluation activities, it also plays a guidance role for STM journals. Under the promotion of the evaluation system of CITIC's STM journals, the overall level of our country's STM journals has improved. Journal cataloging has been standardized and internationalized, and the quality of journals has improved correspondingly.

In 2012, the CITIC Institute launched the *Leader of the 5000—China's top-level academic paper platform* (F5000). The F5000 project is the continuation of the high-quality STM journal project that annually selects 5000 outstanding articles from the top journals to further promote the brand image of *Chinese quality STM journals*. It is also important to promote the improvement of the overall academic level of Chinese STM journals and quality scientific research in China. Further aims include improvements to academic communication and the dissemination of knowledge, and the development of our academic influence and international competitiveness.

Ministry of Education

In 2006, the Ministry of Education published the results of the first *High-quality Chinese University STM Journals* report. STM journals from universities and colleges were classified according to the professional attributes of the organizers and journals, and in accordance with the needs of the development strategy for national quality STM journals. It established a model for university STM journals, and identified the desired characteristics of such journals.

China Association for Science and Technology

With the aim of promoting the innovation and development of Chinese STM journals and enhancing the core competitiveness of STM journals, the China Association for Science and Technology aims to continue to promote quality STM journals in China, under a project to cultivate quality STM journals, the international promotion of STM journals, and the development of science impfaction. In this way, English-language STM journals in China will be further developed. Additionally, a national service innovation system will be created. This will work to strengthen China's position in the international science and technology arena, and our cultural soft power. The China Association for Science and Technology, the Ministry of Finance, CAS, the Ministry of Education, and the China Institute of Engineering will work together to achieve *The Plan to Promote the International Influence of China's Scientific and Technological Journals*. The funding for the project is 100 million yuan, which represents the full support of China's ministries.

Chinese Academy of Sciences

CAS established the Science Publishing Fund of the Chinese Academy of Sciences in the early 1990s to support quality and important scientific and technical publications, advance scientific and technological publications, and promote the development of science and technology. The scope of the funding is to help key science and technology journals in various fields of natural science and technical sciences. The focus of funding on national key projects reflects the results of many papers, domestic and foreign high-frequency citations, impact, and the quality and efficiency of high-level science and technology journals.

20.2.3 The Demand for a Journal Evaluation System for Journal Development

Is it possible to evaluate a reasonable result under the same evaluation system in different stages of development? For the evaluation of academic journals based on different stages of development, such as the current evaluation system for the selection of *core journals* or *source journals*, the comprehensive journals of colleges and universities and CAS social sciences journals are classified as separate *comprehensive categories*, in parallel with the major journal categories. The evaluation of these two major journal types in the comprehensive category adopts the same method as the evaluation of professional journals. That is, the various disciplines of a comprehensive journal are regarded as a discipline, and the data of the whole journal is accumulated. This evaluation method has played an important role in improving the influence of university journals and comprehensive social science journals in the initial development stages. However, because of the emphasis on each subject, the difference between citation frequency and the impact factor of different subjects can sometimes be substantial, making the evaluation problematic [20.33]. For example, the following five categories are applied to China's STM journals: policy journal, academic journal, application journal, abstract journal, and popular science journal. These five categories of journal are all very different to each other, and so the assessment criteria system for each category of journal should be unique from all others [20.34]. In the evaluation of different types of journals, only one quantitative index or influence factor is used, and this practice has proved unsuitable.

SCI, founded in 1964 by the Institute for Technology Information, is one of the six largest retrieval systems in the world. In recent years, China has been attaching greater importance to SCI, which is often regarded as the main index to evaluate the level of scientific research of a unit and an individual. SCI includes journals with a high impact factor and a high level of scientific research. SCI can be used to evaluate the level of scientific research indicators, and can well reflect the scientific level of researchers. At the same time, low-level staff, if seeking the evaluation of scientific research, use SCI to evaluate the level of scientific research indicators. There will be a clear evaluation of what is inappropriate and not applicable.

Core journals are widely applied to the performance evaluation of scientific research. Although these have a certain evaluation function in scientific research work, their present function in research performance evaluation is exaggerated. It is not scientific to substitute the quality of a paper for the journal quality in the evaluation process. The aim of the core journals is to optimize the collections of library and information departments and to provide a reading service for readers. This has a certain objective reference effect on the performance evaluation of scientific research. When the scientific research management department carries on the scientific research performance evaluation, whether the scientific research results are published in the core journals, is often a key reference factor. However, other excellent scientific and comprehensive journals exist outside the core journals. Usually core journals are selected and other outstanding journals are ignored. Thus, the core journals should not be used to evaluate the performance of scientific research.

The existing evaluation criteria and evaluation indicator system (usually from journals, citations, and third-party evaluations of three dimensions to build an evaluation indicator system) along with people's understanding of the evaluation work has been deepened. The evaluation method has made great progress; each evaluation institution has adjusted the direction of their evaluation and has optimized its evaluation index. Evaluation in China has become even more refined. Furthermore, it has expanded from two or three initial indexes to nearly 20, although the evaluation indicator system adopted in each published evaluation report has changed or expanded from the original foundation. Some problems, however, have not been solved, including political quality, academic quality, editorial quality, and publication quality. These are important quality standards of journals, but the current evaluation of *core journals* based on impact does not directly embody political quality, and the evaluation indexes related to journal quality (e. g., editorial, institution, printing, and binding) are not considered [20.35]. As an important evaluation index in the evaluation system, impact factors (because of abnormal interactions among journals) suffer human interference, and the effect of download rate, click rate, and the academic ecological environment is destroyed. Therefore, the evaluation of academic journals faces great difficulties and problems. It is then necessary for the evaluation indicator system to be constantly adjusted and improved.

The evaluation of academic journals in China is currently facing a number of challenges such as the time lag in journal evaluation and the opacity of the evaluation process. When the evaluation results of core journals are applied to the evaluation of scientific research, many problems arise. The name-publication effect of the evaluation system has greatly tightened the environment of noncore journals and has essentially destroyed the academic environment. The premise of scientific evaluation results is the existence of a healthy academic environment. Once this environment is damaged, the good evaluation index also becomes flawed. Thus, China's system of journal evaluation has many problems including the situation concerning systematic evaluation results and the Matthew effect of core journals, which influences academic environment, and so on.

20.3 Comparative Study of International and National Evaluation Systems of Academic Journals in China

20.3.1 Overview of the Major International Journal Evaluation Systems

The international journal retrieval and evaluation system was developed and continues to be developed following the concept of Bradford's core journals and the development of bibliometrics. The process of journal evaluation is a standard measure of academic quality and the overall level of journals, with one aim being the reduction of disputes. At present, the widely recognized journal evaluation system comprises SCI and the Engineering index (Ei) published by Elsevier.

SCI, founded in the 1960s, is a citation database that was originally used for retrieval and was then developed to determine the international influence by journals. The Journal Citation Reports (JCR) established in 1975, are a tool for the quantitative evaluation of SCI-indexed academic journals. Because of the influence of SCI, the journals or papers included are generally considered to have higher academic level and greater influence.

Ei was established in 1884, and mainly contains engineering and technical journals, conference papers, and science and technology reports. As a widely recognized abstract retrieval tool, Ei has considerable authority in the field of engineering technology.

Scopus is the world's largest digest and citation database, developed by Elsevier. It concerns the fields of science and technology, medicine, and social sciences in peer-reviewed academic literature and high-quality network resources. Scopus also provides visual intelligence tools, aimed at providing tracking and analysis of research service results.

The MEDLINE database covers biomedical and life sciences topics vital to biomedical practitioners, educators, and researchers. This database covers publications from 1966. The literature represents the highest level of global medicine and provides the latest biomedical research results and trends.

J-STAGE is an academic journal network platform founded by Japan's Science and Technology Agency in the late twentieth century. It mainly includes Japanese science and technology journals in fields such as physics and computing.

SCI

SCI is a citation database launched in 1964 by the ISI. The SCI CD-ROM database was established in May 1988. Since 1975, ISI has published the annual worldwide JCR based on SCI. JCR is an effective tool for the quantitative evaluation of academic journals. SCI has a wide range of disciplines, academic influences, and extensive coverage. Thus, the journals and papers included in SCI reflect a high academic level and significant international influence. SCI is the most powerful tool in the evaluation of scientific research, science and technology, scientific research institutions, science publications, and science subjects themselves. SCI is the authoritative retrieval system of scientific and comprehensive engineering papers from all over the world. In addition to scientific evaluation, SCI's unique role has been widely recognized worldwide. Garfield stated: "A valid index must strictly limit the scope of its inclusion, only to collect information useful to the researcher." Therefore, we should look at and use the authoritative citation data of SCI.

Main Features. Looking at the external features, the main features of SCI are obvious, and include science and technology journals in the field of natural science as well as many journals from many countries. That is, it has a wide international scope, with an impressive and comprehensive number of journals covering many decades. Furthermore, it has a relatively short renewal cycle, resulting in excellent information timeliness.

Producer. ISI merged with Thomson Reuters in 1992. It is currently owned by Clarivate Analytics.

Target Journals. SCI covers all natural science disciplines, with a total of 273 categories. It is an improtant Journal Abstracts Index as it covers the most important journals in almost all science field specially in those subjects of basic theory of natural science. It can be used to retrieve journals in the following areas: mathematics, physics, chemistry, astronomy, biology, medicine, mechanics, optical engineering, science and technology, power engineering and thermal physics, electrical engineering, electronic science and technology, computer science and technology, civil engineering, aerospace science and technology, control science and engineering, environmental science and engineering, food science and engineering, management and education, materials science and engineering, and information and communication engineering. It has been providing important academic achievement information since 1945.

Purpose of Evaluation. It is convenient for researchers to conduct a comprehensive literature search to understand the historical evolution, the influence, and the development trends with the subject area. Furthermore, scientific research management departments can use SCI statistical analysis data as a quantitative basis for the performance evaluation of scientific research institutions and personnel.

Evaluation Method. Evaluation moves from qualitative evaluation to quantitative evaluation. Every year Chinese journals are audited, with approximately 200 selected. The selected journals will also be audited to ensure that they maintain their high level of quality. Each journal is subject to a broad evaluation process before being selected or eliminated. The editors responsible for the evaluation work have an appropriate educational background and professional experience and training in the relevant fields. Experts from various fields may be brought in where necessary.

Selection Criteria. From the perspective of requirements and procedure, SCI focuses on the quality of journal content editing, academic quality, and academic integrity. It also pays attention to the international and academic level of authors and editorial boards, and emphasizes sustainable development.

Evaluation Index. SCI mainly uses impact factor and citation frequency.

According to the upper introduction and study materials about SCI, we separat those raw materials into deconstruction items and re-organize them as reconstruction item as similar structure in order to comparative study different evaluation system. See Tables 20.1 and 20.2.

Ei

Ei (now Ei Compendex) was first published in 1884 by the United States Engineering Information Corporation, which publishes journals, conference papers, and scientific reports on engineering and technology disciplines. The literature contained in the database covers almost every field of applied engineering technology. Ei is a comprehensive and abstract retrieval tool in the field of engineering technology. It does not generally report on science literature focusing on pure theory, nor does it pursue a massive collection. Instead, attention is paid to the quality of the literature. Ei Compendex is the world's oldest database of engineering abstracts.

Main Features. Ei includes literature covering all engineering fields. The database contains 3639 of the world's leading engineering journals from more than 70 countries. It has been a respected provider since 1884, and 90% of the literature is in English. Ei retrieves weekly updates.

Producer. Elsevier.

Target Journals. Ei concerns engineering technology and covers more than 190 disciplines such as power, electrical, electronics, automatic control, mining and metallurgy, metal technology, machinery manufacturing, management, civil engineering, water conservancy, and education projects. The Ei retrieval system has a high level of comprehensiveness, a wide data source, extensive geographical coverage, wide coverage, high quality, and strong authority.

Purpose of Evaluation. To provide professional and practical online data and information services for scientific researchers and engineering technicians.

Selection Criteria. The Ei profile program consists of five main areas:

A. The primary criterion is journal subject, with Ei largely focusing on chemistry, computer engineering, and software. However, journals in the fields of agriculture, industry, textiles, applied chemistry, mathematics, and atmospheric science are included. More general fields may also be included if it is a very important publication; the value of the article determines whether it is included within the scope of Ei. Excluded journals are those in the areas of biology and astronomy.
B. Ei journal information generally includes journal name, ISSN, fax, e-mail, and similar information.

Table 20.1 SCI features and requirements

Raw materials	Deconstruction	Reconstruction
(1) SCI focuses on the field of natural science (2) SCI contains more than 80 countries (3) SCI contains more than 12 000 world-leading STM periodicals (4) SCI covers more than 250 disciplines in the field of key academic results since 1900 (5) SCI database update frequency is once a week	(1) The field of natural science (2) Digest index database (3) Basic theory (4) Involving national journals (5) Covering disciplines (6) STM periodicals (7) Update frequency (8) Academic achievements (9) Areas of focus (10) Time range	(1) Subject characteristics (2) Database properties (3) World influence (4) Efficiency and timeliness (5) Journal attributes

Table 20.2 SCI requirements and process

Raw materials	Deconstruction	Reconstruction
(1) SCI believes that periodical publication is one of the most important indexes to measure periodicals, and it is very important to publish periodicals on time according to the publication cycle. Timely publication allows readers to obtain the latest information and reduces the collection of published early or outdated periodicals. Before completing the periodical evaluation, the editors usually follow three contiguous issues of the publication. (2) Sci-indexed periodicals require journal editors to conform to international editorial conventions, such as full number of addresses (3) English titles, abstracts, headings, keywords, etc. (4) SCI will peer review as an evaluation index, and to some extent it can be considered that through peer review, journal paper quality is also guaranteed (5) The periodicals included in SCI need to publish moral statements and practices that do not to accept falsehoods and academic misconduct (6) The periodical publication format printing or electronic format (XML) is qualified to participate in the evaluation (7) SCI will consider whether periodicals are the new research results published in new periodicals, and if they can enrich the contents of the database they can be considered included (8) SCI will examine the degree of internationalization of periodical authors, editorial boards and editorial boards, while at the same time, SCI will strive for the balanced collection of different disciplines and regions (9) Based on citation database, SCI analyzes the importance and influence of different periodicals to realize the dynamic management of the database (10) For the new periodicals, analyze the journals of the main authors and members of the editorial board before publication in other journal papers to see whether there is a reference record. For the existing periodicals, the calculation of the impact factors. New journals will be selected every year to eliminate the use of less old journals	(1) Timeliness (2) International editorial practice (3) Full-text English (4) Peer-review process (5) Publication of moral statements (6) Publication format (7) Edit content (8) International diversity (9) Discipline and regional balance (10) Dynamic management	(1) Publication cycle (2) Editorial standardization (3) Academic integrity (4) Academic quality (5) International influence (6) Editorial quality (7) Capacity for sustainable development

C. English-language journals are prioritized, followed by journals published by European countries and the major journals of other countries.
D. Further key Ei requirements include the timeliness of journal publication and the degree of internationalization. Journals need to show academic contribution and original research.
E. Dynamic management: Ei follows a dynamic management model where journals are reviewed annually. Low-quality journals are removed and replaced by higher-quality journals.

Scopus

Scopus is a relatively new index, but it has a wide application including more than 2000 universities and research institutes around the world. Those students and researchers using Scopus are typically engaged in study and research work. Nearly all of the world's top laboratories, research institutes, and ranking agencies use Scopus for evaluation. Scopus is also used by innovation leaders in various industrial sectors for research and development. The database is accredited by the British government, and England's top four universities use Scopus as the only bibliometric tool under the 2014 Research Excellence Framework (REF) to assess the quality of research in higher education institutions. The Australian Scientific Research Council (ARC) uses Scopus to provide assessment support for national research and evaluation work.

Main Features. The Scopus database contains data from more than 100 countries, 5000 international publishers of more than 20 000 peer-reviewed journals, and covers all fields of science and technology, medicine, social sciences, and the arts and humanities. It contains 32 million abstracts from 1996 to the present, and 21.3 million abstracts from 1823 to 1996. Approximately two million records are added each year by means of daily additions. It represents the comprehensive integration of STM web page resources: 545 million science and technology web pages from the five largest patent organizations in the world and 25.2 million pages of content with a wide geographical distribution. More than half of the content comes from Europe, Latin America, and Asian countries.

Producer. Elsevier.

Target Journals. Scopus covers 313 subjects in 27 subject areas including medicine, physics, and mathematics.

Purpose of Evaluation. Scopus provides a fast and accurate retrieval of the full text and referenced information in real-time tracking. It offers the latest results from related research fields, hot topics, and institutions. Scopus aims to enhance the academic impact of individuals and institutions to promote global academic exchange. It also provides customized services for the data and analysis needs of government and evaluation agencies.

Evaluation Method. The Scopus Content Selection and Advisory Committee (CSAB) is an international and independent committee operated by a group of experienced international peer-review journal editors. It also includes publishing, bibliometric, and library science experts; these members were invited based on their desire to improve Scopus. At the same time, a key objective of CSAB is to ensure the recording of high-quality journals.

Selection Criteria. Stage One: Preselection criteria:

a. Timeliness
b. International editorial practices
c. The process of peer review
d. Author declarations
e. Reference specifications.

Stage Two:

1. Standard characteristics:
   a. Journal policy, journal operation
   b. The level of the peer-review experts
   c. The internationalization and diversity of editors and editorial boards, the internationalization and diversity of authors
   d. Geographical diversity of journals.
2. Content quality of journals:
   a. Academic influence
   b. The text is readable
   c. Publication history of at least two years.
3. Online availability of journals.

Evaluation Indicators. Scopus indicators include SJR, SNP, IPP, etc.

MEDLINE

MEDLINE is the bibliographic database of the National Library of Medicine (NLM) in the United States. It covers biomedical and life sciences topics critical to biomedical practitioners, educators, and researchers, and abstracts databases based on biomedical science. It includes the Medical Index (Index Medicus), Dental Literature Indexing (Indexes to Dental Literature) and the International Nursing Index. MEDLINE includes articles from 1966 to the present day, and the collected documents represent the highest quality in the global medical field. They also reflect the latest development and research results in biomedicine.

Main Features. The MEDLINE collection includes articles from more than 70 countries and regions, and includes more than 3400 different subject areas. Since 1946, close to 21.6 million records have been added, and it includes weekly updates and has a high proportion of English-language articles.

Producer. National Library of Medicine.

Target Journals. Core biomedical topics.

Purpose. To meet the needs of the world's researchers, healthcare workers, educators, managers, and students.

Evaluation Method. A technical review committee for the selection of documents was set up in 1988 to evaluate the content of journals, to co-opt new journals, and to include journals that do not conform to usual standards and requirements.

Selection Criteria.

A. Biomedical-oriented
B. Focuses on the quality of journal content, editing, and publishing
   - The content quality of journals: the academic level of journals is the primary factor of MEDLINE journals. The scientific aspects, timeliness, originality, and contribution of the article content are the important aspects.
   - Editorial quality: selection, method, and process of manuscript review, ethical and moral declarations, proof of conflict of interest, chart of production, corrections, and comments.
   - Publication quality: publication layout, printing, illustrations, and binding quality are also important aspects of the evaluation of journals.
C. Readers
   The focus is on the study of health professionals, including general researchers, caregivers, educators, managers, students, and other readers interested in healthcare.
D. Non-English journals
   Non-English journals and English-language journals have a consistent standard of assessment. Non-English journals should include English-language abstracts, and subject, author, unit, and chart following acceptable English-language standards.
E. Other
   Good quality journals will be included wherever they are published. Special attention is given to epidemics and endemic diseases. The diversity and internationalization of journal authors and the aca-

demic status of editorial commissioners will affect the collection of journals.

J-STAGE

J-STAGE (Japan Science and Technology Information Aggregator) was created by the Japan Science and Technology Agency in October 1999. The aim was to provide a network platform for academic journals. As the core agency responsible for Japan's Science and Technology Basic Plan, J-Stage undertakes the electronic and international internationalization of Japanese science and technology papers. J-STAGE focuses on Japanese science and technology papers, from their submission to their online publication. It aims to create a smooth process, from electronic submission to the publication processes and electronic special issues. J-STAGE not only contains submitted papers, but also other articles linked to the citation data, including video and audio, and appendices. The development of the J-STAGE database has networked the publications of Japanese academic and journal circles, and exemplifies the advantages of data integration. It helps to disseminate the achievements of Japanese science and technology and STM journals worldwide via this network. Thus, it aids in their effective use.

Main Features. J-STAGE was founded at the end of the last century, and focuses on scientific and technical journals, conferences, and reports. There is open access to all documents, with full access to the full text of science and technology journals. The J-STAGE is now in its 1808th issue, and 19% of the content is Japanese-language papers, 40% are in English, and 41% a mixture of the two.

Producer. Japan Science and Technology Agency.

Target Journals. The J-STAGE database includes the detailed categorization of journals. According to their respective disciplines, these are divided into 18 topics, covering, for instance, the natural sciences, humanities, social sciences, medicine, and engineering. Life science journals account for approximately 70% of the total.

Purpose of Evaluation. J-STAGE aids the electronic and networked processes of Japanese STM journals. The speed of the database is convenient for the publication of related papers, and the network of papers helps to accelerate the circulation of Japanese scientific and technological success. It contributes to the worldwide spread of Japanese scientific and technological achievements.

Evaluation Method. National institutions and other professional academic groups have developed the main approach.

Selection Criteria. Generally, important academic journals are recommended for entry into the database. Regular adjustments are made (these are generally small). The abstracts and titles of most of the papers included in the journal are in English. J-STAGE's selection criteria for journal content include:

- Reflect innovative viewpoints from particular fields
- Logically rational scientific papers that accord with scientific culture and ethics
- Real and reliable research resources and data
- High-quality writing skills.

20.3.2 Major National Evaluation System of Academic Journals in China

China's current evaluation system of journal retrieval includes the following databases: CSTPCD, Journal of Chinese Core Periodicals, Chinese Humanities and Social Sciences Core Periodicals, Chinese SSCI, and CSCI.

The CSTPCD indexes the *China's Science and Technology Core Journals*. CSTPCD includes Chinese publications (but excludes those from Hong Kong, Macao, and Taiwan) and currently references 2312 Chinese and 71 English-language journals. It contains 2383 core Chinese STM journals (i. e., Chinese STM source journals), which are classified into two or three subjects according to 153 subjects in 10 fields (e. g., natural science synthesis and neo-Confucianism).

A total of six editions of CSTPCD were published between 1992 and 2014. Selected journals were assessed and qualitatively evaluated, and nearly 2000 core journals were selected from journals published in China. The database contains seven sections (excluding interdisciplinary repetition) and the 2014 edition contains 1983 journals. The database has a great influence on the society via its provision of a reference for the evaluation and ordering of journals for information departments and the management policy of administration departments.

The 2014 edition contains 733 journals concerned with humanities and social sciences. The journals are distributed in 23 categories and are divided into authoritative journals, core journals, and extended journals in different subjects.

The CSSCI was first established in 1998 and four editions have been published. The latest version (2014–2015 edition) concerns, for example, management, Marxism, and another 25 disciplines. It contains 533 journals, including the largest number of comprehensive journals. Furthermore, it includes comprehensive social sciences and 120 efficient comprehensive journals, accounting for 22.5% of the total number of journals.

Table 20.3 CSTPCD features and structure

Raw materials	Deconstruction	Reconstruction
(1) CSTPCD mainly includes national, provincial or regional outstanding periodicals in the field of natural science (2) The classification of 153 subjects and 10 subjects including natural science synthesis and CSTPCD (3) The citation report of Chinese STM periodicals started in 1988, with the latest edition in 2014, and a yearly report (4) CSTPCD includes Chinese publications (excluding Hong Kong, Macao): 2312 Chinese periodicals and 71 English periodicals, a total of 2383 ...	(1) The field of natural science (2) STM periodicals (3) Academic achievements (4) Involving national science (5) Interdisciplinary (6) Update frequency (7) Time range ...	(1) Major disciplines and interdisciplinary classifications (2) Domestic influence (3) Journal attributes (4) Update efficiency and timeliness

The CSCI 2015–2016 includes 1200 source journals, referencing Chinese (1006) and English-language (194) journals.

China Scientific and Technical Papers and Citations Database (CSTPCD)

Main Features. CSTPCD includes science and technology journals in the field of natural science, with a large number of journals and covering a wide time span. It includes interdisciplinary journals for multidisciplinary evaluation.

Producer. ISTIC was commissioned in 1987 by the Ministry of Science and Technology to undertake statistical work.

Target Journals. State-level academic journals, CAS journals, academic journals from key universities, and all natural and social sciences journals.

Purpose of Evaluation. CSTPCD was first published in 1998, with two versions: the core edition and the expanded edition. The latest edition was published in 2014. It is a journal evaluation tool for a vast number of scientific and technical personnel, journal editors, and scientific research managers, enabling them to quickly, accurately, and scientifically select and use journals.

Evaluation Method. Mainly uses a multiple index evaluation system, a combination of quantitative and qualitative methods, and quantitative methods (using a series of bibliometric indexes) to appraise journals.

Selection Criteria. The journals covered by CSTPCD should be peer-reviewed academic journals that have been published for more than 2 years, and whose indicators ranked in the forefront of the discipline. They should be in line with academic publishing norms and meet the publishing integrity and ethical requirements.

Evaluation Indicators. The CSTPCD uses two evaluation methods: single-index evaluation and comprehensive-index evaluation. Specific indexes include citation frequency, impact factor, important database collection, and comprehensive evaluation score.

According to the upper introduction and study materials about CSTPCD, we separat those raw materials into deconstruction items and re-organize them as reconstruction item as similar structure in order to comparative study different evaluation system (Tables 20.3 and 20.4).

A Guide to the Core Journals of China

Main Features. *A Guide to the Core Journals of China* (2014) contains 1982 core journals, published every four years from 1992 to 2011, and then again in 2014.

Producer. Developed by Peking University Library.

Target Journals. Covers a wide range of disciplines (Table 20.5).

Purpose of Evaluation. To provide reference for the library's journal purchases and Chinese journal collection, and to facilitate readers' access and authors' contributions.

Evaluation Method. Quantitative and qualitative comprehensive analysis and evaluation, based on bibliometrics, the use of evaluation indicators for the domestic publication of Chinese journals for statistical analysis, and the use of expert opinion.

Selection Criteria.

A. Indicator system: according to the law of Brinell, bibliometric statistics are used to screen the list of core journals from different disciplines.
B. Division of disciplines: overview using the medium-map method to divide the subject, based on subject size, number of journals, journal quality, and other factors that constantly modify the discipline.
C. Core journals are selected based on three aspects: the journal is considered a core journal, it is representative, and it is practical.

Table 20.4 CSTPCD description and structure

Raw materials	Deconstruction	Reconstruction
(1) CSTPCD includes mathematics, physics, medicine and other fields (2) CSTPCD includes STM and technical periodicals reflecting the development of scientific and industrial technologies (3) CSTPCD requires the periodical to conform to the description specification, such as the unified CN number, complete bibliographic information, etc. (4) The publication of CSTPCD from the peer-review process (5) Strict publication cycle of CSTPCD Source Journal (6) CSTPCD will consider whether the periodicals are indexed in SCI, SCIE, Ei, CA, and so on, as well as famous large-scale search systems (7) The social influence and academic status of the source periodicals. Academic reputation can attract high-quality papers at home and abroad. Excellent academic research journals at the local level (8) CSTPCD-included periodicals need to follow the international and domestic editing practices, and need to meet the normative requirements of the journal: complete bibliographic information and so on (9) Academic content should reflect the latest achievements in the field of science and research projects of major research funds. Should have the national authoritative expert composition of the editorial committee. Rigorous academic accreditation of periodicals (10) The evaluation principle must be a combination of qualitative and quantitative (11) To ensure the balanced collection of periodicals in different disciplines, especially new disciplines or high technology disciplines, and to take care of the new development area periodicals to ensure the integrity of the area	(1) Subject area (2) Domestic and international editorial practice (3) Editorial authority (4) Timeliness of publication (5) Domestic and foreign retrieval system included (6) Academic quality (7) Comprehensive assessment (8) Special consideration (9) Discipline and regional balance (10) Dynamic management	(1) Subject-biased (2) Editorial standardization (3) Editorial quality (4) Academic quality (5) International influence (6) Capacity for sustainable development

Table 20.5 The distribution of journals in *A Guide to the Core Journals of China*

Volume	Field	Number of periodicals
1	Philosophy, sociology, politics, law	274
2	Economics	155
3	Culture, education, history	311
4	Natural science	344
5	Medicine, health	250
6	Agricultural science	135
7	Industrial technology	514
	Total	1983

Evaluation Indicators. The seventh edition (2014) is based on 12 evaluation indicators such as the amount of article Full-Text requested in library system, the amount of article covered by important databases, the citation index of paper, the index of mutual citation etc.

Chinese Humanities and Social Sciences Core Journals Database (CHSSCD)

Main Features. The CHSSCD includes more than 700 journals on humanities and social sciences, and was established in 1996.

Producer. Chinese Academy of Social Sciences (CASS) Literature Information Center.

Target Journals. Humanities and social sciences journals (Table 20.6).

Purpose of Evaluation. To optimize the use of journals and literature resources for scientific research, to provide reference for journal evaluation, scientific research performance evaluation, scientific research management, and talent selection in scientific research.

Evaluation Method. Combination of quantitative evaluation and expert qualitative evaluation.

Selection Criteria. The 2014 report on the indicator system of journal evaluation creates three categories: attractions, management power, and influence. These are described below:

- *Attractions*: Academic reputation (award status, peer review), the inclusion of other domestic databases, the diversity of authors, and the quality of papers
- *Management power*: Journal orientation, academic ethics, editorial staff quality, editorial standardization, publishing norms, and networking.
- *Influence*: Academic quality of journals, internationalization of editorial board, social and international influence of journals, etc.

Table 20.6 Grade distribution for China's humanities and social sciences journals 2014

Rank	Field	Number of periodicals				
		Total	Top	Important	Core	Extend
1	Law	32	1	2	19	10
2	Management	25	1	2	12	10
3	Environmental science	5	0	1	3	1
4	Pedagogy	33	1	2	20	10
5	Economics	109	1	3	63	42
6	Archeology	18	1	2	9	6
7	History	32	1	2	21	8
8	Marxism	14	1	2	8	3
9	Ethnology and cultural studies	27	1	2	15	9
10	Human geography	12	0	1	7	4
11	Sociology	15	1	2	6	6
12	Physical education	14	0	1	7	6
13	Statistics	4	0	1	2	1
14	Library, information and archival science	31	1	2	16	12
15	Literature	24	1	2	14	7
16	Psychology	7	0	1	4	2
17	Journalism and communication science	11	1	1	5	4
18	Art	16	1	1	9	5
19	Linguistics	32	1	2	19	10
20	Philosophy	15	1	2	7	5
21	Politics	68	1	2	42	23
22	Religion	2	0	0	2	0
23	Comprehensive humanities and social sciences	187	1	4	120	62
Total		733	17	40	430	246

Evaluation Indicators. The 2014 edition uses citation frequency, the difference between the two-year and five-year impact factors, the article funding ratio, article downloads, and so on. This database is able to determine the current situation of journals in China.

Chinese Social Sciences Citation Index (CSSCI)

Main Features. The CSSCI (2014–2015) contains 533 humanities and social sciences journals; these have been selected four times since 1998.

Producer. Nanjing University.

Target Journals. Humanities and social sciences journals, divided into 25 fields (Table 20.7).

Purpose of Evaluation. It provides reference and help for academic evaluation, performance, management, and research on humanities and social sciences.

Evaluation Method. A combination of quantitative and qualitative methods.

Selection Criteria.

A. Principles of inclusion: the principle of prioritizing quality journals, the control of the total number of journals, and the use of quantitative and qualitative evaluation for regional and discipline balance, and dynamic high and low management.
B. Editorial specifications: full information provided with the academic norms of reference and literature notes.
C. Time and timeliness of the publication: Publishing frequency, deadlines met, published continuously for five years, the extension of more than two months of published journals belonging to the editors (journals that do not follow publishing norms are not selected).
D. Disciplines and sources of publications: a main focus on humanities and social sciences academic papers, academic reviews, and other original academic literature. The number of source journals is limited to 20% of the total academic journals of humanities and social sciences in China.
E. Citation factors, total citation frequency and other indicators, with different weights given to each for the quantitative evaluation of journals.

Evaluation Indicators. A Chinese Social Sciences Research Evaluation Center, Nanjing University, (2016–2017) publication outlines the quantitative evaluation of journals by citation quantity and other factors.

Table 20.7 The subject distribution of CSSCI

Field	Number of periodicals
Management	29
Marxism	16
Philosophy	12
Religion	3
Linguistics	23
Foreign literature	6
Chinese literature	16
Art	21
History	26
Archeology	7
Economics	73
Politics	32
Law	21
Sociology	10
Ethnology and cultural studies	14
Journalism and communication science	15
Library, information and philology	20
Pedagogy	36
Physical education	10
Statistics	4
Psychology	7
Comprehensive social sciences	50
Humanities, economic geography	7
Environmental science	5
Comprehensive Journal of Colleges and Universities	70
Total number of periodicals	533

China Science Citation Database (CSCD)

Main Features. The CSCD includes journals in the following areas: natural science, engineering technology, medicine, and other fields of science and technology. It includes thousands of journals, ranging from 1998 to the present day, and includes 300 000 articles, and nearly 17 million citations. Source journals are selected every two years.

Producer. Chinese Academy of Sciences Document Information Center (now known as the CAS National Library).

Target Journals. The CSCD focuses on basic scientific research in the field of natural science.

Purpose of Evaluation. It provides the basis for selecting source journals and evaluating STM journals for Chinese scientific citation databases.

Evaluation Method. Comprehensive evaluation method combining quantitative statistics and expert evaluation.

Selection Criteria.

A. Theoretical basis: based on literature concentration and the discrete law of Brinell.
B. Editing and publishing norms: has both an ISSN and CN, two standard publication numbers, and the journals must conform to standard journal descriptions.
C. Scope of disciplines: covering the fields of mathematics and physics, while paying attention to the collection of basic research, academic, theoretical, and leading-edge journals.

Evaluation Indicators. The index uses more than ten factors including impact factor, quality index, thesis utilization index, and mutual index.

20.3.3 Comparison of International and Chinese Journal Evaluation Systems

By summarizing the data of different journal evaluation systems, we can outline and refine the different attributes of various domestic journal evaluation systems (Table 20.8).

Main Features

The characteristics of the systems and the target journals can be divided into five categories: subject, country, the number of journals, the time span, and updating efficiency (Table 20.9). From the point of view of the distribution of disciplines, foreign journal evaluation systems contain major areas of difference. For example, SCI, the major areas of Ei, Scopus, MEDLINE, and J-STAGE concern natural sciences, social sciences, engineering technology, and biomedicine. Furthermore, foreign journal evaluation systems focus on those jour-

Table 20.8 Key characteristics of the main domestic and international journal evaluation databases

	Owner	Headquarters
SCI	Thomson Reuters	United States
Ei	Elsevier	United States
Scopus	Elsevier	Netherlands
MEDLINE	National Medical Library of America	United States
J-STAGE	Japan Science and Technology Revitalization Agency	Japan
CSTPCD	China Institute of Science and Technology Information	China
GSJC	The Library of Peking University	China
CHSSCD	Literature Information Center of Cass	China
CSSCI	South Social Science Research Center	China
CSCD	National Library of CAS	China

Table 20.9 Key features of international and national journal evaluation databases

	External features	Key disciplines	Number of periodicals	Operating since	Update time
Main international evaluation system	SCI	Natural science	>12 000	1900	Yearly
	Ei	Engineering technology	3639	1884	Weekly
	Scopus	Social	>20 000	1823	Daily
	MEDLINE	Medical	>3400	1946	Weekly
	J-STAGE	Natural science	>1000	1999	
Main evaluation system in China	CSTPCD	Natural science	2383	1987	Yearly
	GSJC	Wide range of disciplines	1982	1992	Three years
	CHSSCD	Human society	>700	1996	Yearly
	CSSCI	Human society	533	1998	Biennially
	CSCD	Natural science	>1200	1998	Biennially

nals that embody the characteristics of the subject and contribute to journal focus. For example, Ei focuses solely on engineering, and includes all journals with an engineering technology scope. From an evaluation perspective, the foreign evaluation system is discipline-oriented, which is helpful to find suitable data for analysis and research in different disciplines. Therefore, the distribution of journals reflects that the foreign journal evaluation system and databases pay attention to the subject matter and the specialty of the journals. The field of focus of the journal is an important aspect of foreign evaluation databases. China's journal evaluation systems include major areas of difference: CSTPCD and CSCI focus on natural science, CHSSCD (CASS) and CSSCI include humanities and social sciences, and GSJC (Peking University) journals are covered extensively. From the perspective of journal discipline, the foreign evaluation system places a greater emphasis on the subject characteristics of journals, and it focuses on the journals with academic contributions and clear characteristics.

Regarding the scope of coverage, SCI, Ei, MEDLINE, and Scopus cover more than 70 countries and regions, and significantly more than than J-STAGE's 3400 journals (mainly from Japan). Furthermore, SCI, Ei, and MEDLINE focus on Western countries. Scopus' content is more balanced in terms of geography, with more than half of the content coming from Europe, Latin America, and Asia. Thus, Scopus attracts more countries and regions to use and search the index. The journal evaluation system for different journals will consider the balance of the region and the subject. China's journal evaluation system only contains important journals from China. Because its geographical scope is narrow, the number of journals within China's journal evaluation systems is obviously less than that of the foreign journal evaluation systems. Therefore, it is worth considering whether it is necessary to enlarge the scope of China's journal evaluation system and to enhance its international influence.

Regarding the history of the various systems, international evaluation systems such as SCI and Ei have been operating for some time now. Ei has a long history of 130 years, while SCI was established 60 years ago. In contrast, China's index database and evaluation system were established just 30 years ago. The period of operation reflects the maturity degree of the journal evaluation system: the longer the history of the system, the greater the verification of the system's practices, and the greater the opportunities to improve and fine-tune the process. This can also occur via international influence and use. Therefore, China's journal evaluation system may be able to draw lessons from the development process of overseas journal evaluation systems, and provide a reference for the healthy development of its journal evaluation systems.

Regarding the frequency of updating, foreign journal evaluation systems are updated frequently. For example, SCI, Ei, and MEDLINE data are updated weekly, and Scopus data are updated daily. These updates are quick, ensuring the data remain relevant. Regarding the publication of citation reports or core journals in the journal evaluation system at home and abroad, JCR and CHCR publish once a year and *A Guide to the Core Journals of China* is now published once every three years. The CASS humanities and social sciences database is published annually. Thus, regular updates occur in both the domestic and foreign journal evaluation systems, as well as the dynamic management of the data and core journals, which reflects the continuous increase in user demand. The evaluation system continues to update the data, and reflects the sustainable development ability of the evaluation system. Therefore, China's journal evaluation system can also be combined with its own resources to provide users with more comprehensive search and data services to promote the sustainable development of journal evaluation.

Subject Characteristics

The main evaluation systems include ten domestic and international evaluation systems from three companies, three libraries, and four research institutions. Sixty percent of the foreign evaluation systems are owned by companies. In contrast, China's main journal evaluation systems include three scientific research institutions, and two universities or research institutions. Thus, China's journal evaluation systems are concentrated in research institutions and libraries.

As stated above, international journal evaluation systems are mainly owned by companies, while China's are mainly owned by scientific research institutions. Corporate enterprises are profit-oriented, so pay greater attention to user needs. Scientific research institutions generally have a clear direction and aim (i. e., academic research), and pay more attention to academic results and so on. Both ownership styles have their advantages and disadvantages.

Objective and Method of Evaluation

The index results are largely read by scientific research personnel, management departments, and librarians. For scientific researchers, the results of the journal evaluation provide a standard for evaluating the performance of scientific research. Furthermore, managers will use the evaluation results for performance appraisals and the development of management journals. Librarians will use the results of journal evaluation to determine which journals they will stock in their collections. Therefore, from the reader level, the use of the journal evaluation results regarding the extent and degree of accreditation can also reflect the results of the journal evaluation in terms of rationality, scientific merit, and influence.

The evaluation method of the journal appraisal system is based on quantitative evaluation and expert qualitative analysis, which is based on bibliometrics. That is, objectivity, the measurement and comparability of scientific research results from different perspectives are useful in the objective, fair, and reasonable evaluation of academic journals.

Selection Method

Based on the descriptions and standard main evaluation system at home and abroad, we continue to process the content of the various systems. Table 20.10 shows our results. Overall, the foreign evaluation systems pay more attention to, for example, journal content, edition, publication quality, and degree of internationalization. This can be seen in the fact that the foreign journal evaluation systems largely request the paper to have an English title, abstract, and so on. Similarly, other import factors include the journal's internationalization and diversification requirements, the nationality of the author, and the degree of internationalization of the editorial board and international evaluation experts. In China, the main evaluation systems pay attention to the categorization of the journal's subject range, the number of journals included in key domestic and foreign retrieval systems, editorial authority, and the influence of the journals. A further important point includes whether the journals conform to national standards (e. g., has a CN).

Based on the criteria and principles of the evaluation systems, we will identify the criteria and principles of the different evaluation systems, and summarize the evaluation systems of various journals in combination with their key characteristics (Table 20.11).

On the whole, foreign journal evaluation systems pay greater attention to the following aspects: journal influence, academic quality of journals, standardization of journal editors, timeliness of journal publication, author declarations, originality, dynamic management, editorial and author diversity and nationality, English-language content, discipline and regional balance, and peer reviews. In contrast, Chinese journal evaluation systems focus on: journal influence, academic quality of journals, the standardization of journal editors, timeliness of journal publication, and dynamic management. It can be seen that the domestic and foreign journal evaluation systems attach great importance to journal

Table 20.10 Purpose of evaluation of domestic and foreign journal evaluation databases

	Purpose of evaluation (object-oriented)	Evaluation method
SCI	Research personnel, management, etc.	Qualitative and quantitative combination
Ei	Scientific researchers, engineers and technicians	Qualitative and quantitative combination
Scopus	Academics, researchers, government administrations, etc.	Content Selection & Advisory Committee (CSAB)
MEDLINE	Nursing staff, healthcare providers, educators, researchers, academics and administration	Technical Review Committee on Document Selection (LSTRC)
J-STAGE	Researchers, academics, etc.	National Society and other professional academic groups recommend
CSTPCD	Technicians, editors and managers	Qualitative and quantitative combination
GSJC	Librarians, readers, research workers	Qualitative and quantitative combination
CHSSCD	Journal reviewers, researchers and management	Qualitative and quantitative combination
CSSCI	Provide reference for evaluation, performance appraisal, management and research	Qualitative and quantitative combination
CSCD	Provide basis for periodical evaluation	Qualitative and quantitative combination

Table 20.11 Selection criteria standards and principles included in domestic and international journal evaluation systems

	Standards and principles
SCI	Timeliness, editorial specification (English abstract, etc.), full text English, peer review, publishing moral statement, author and editorial board international diversity, discipline and regional balance, dynamic management, etc.
Ei	Editorial standards (English abstracts, etc.), priority of English-speaking countries, timeliness, internationalization, originality, academic contributions, dynamic management, etc.
Scopus	Timeliness, editorial standardization (English abstracts, etc.), peer review, moral statement, journal policy, academic level of the accreditation committee, international diversity of editorial board and authors, regional and discipline balance, journal influence and quality, etc.
MEDLINE	Academic level, timeliness, originality and contribution degree of the periodical, moral statement, editorial norm, editorial board and author's international diversity, regional and discipline balance
J-STAGE	Take recommendations as the main basis
CSTPCD	Editorial norms, authoritative editorial board, timeliness, the collection of important retrieval systems at home and abroad, the social and academic influence of periodicals, the balance of regions and disciplines, etc.
GSJC	Based on the quantitative selection of the core list, the use of middle-map method to divide the size of the subject; periodicals are representative and practical
CHSSCD	Academic quality of periodicals, collection of other domestic databases, diversity of authors, academic ethics, editorial norms, academic level of editorial board and international diversity, periodical influence, etc.
CSSCI	Journal quality, regional and discipline balance, editorial norms, timeliness, original innovative academic literature, etc.
CSCD	Editorial standardization, focus on basic research, academic and theoretical frontier periodicals, etc.

influence, academic quality, the standardization of journal editors, and the timeliness of publication. It can also be seen that dynamic management is key. It is only via dynamic management that an evaluation system will have the vigor to constantly develop, and to meet the increasing user demand.

There are also some differences in journal evaluation systems. For example, compared with China's journal evaluation systems, foreign systems pay more attention to author declarations and originality, the diversity and internationalization of the editorial board and author, English-language content, and peer-review processes. Regarding author declarations and originality, the governing principles of the journal evaluation systems in foreign countries concern the issue of academic ethics and ethical publishing. Thus, articles will be removed from the relevant database should they breach any ethical standards. That is, users can see an article has been revoked. Regarding ethics and conflicts of interest, in 2013 MEDLINE introduced stricter requirements for journals (in terms of application and after acceptance). Regarding the internationalization and diversification of the editorial board and authors, the foreign evaluation systems basically stipulate the international diversity of editorial board and the authors. The diversity of the authors is beneficial to the global influence of journals, and the international diversity of the editorial board is more advantageous when checking the quality of journal papers and improving academic quality. Concerning journal abstracts, it is generally required that the journals need to have English-language abstracts, which is not only beneficial to the unification of data form, but also to the use and dissemination of knowledge. With regard to expert review, foreign evaluation systems generally consider peer review to be an important guarantee to ensure journal quality. In addition, foreign systems have a high degree of network and computerization, and for MEDLINE, journal publication quality is an important selection factor. Generally speaking, foreign journal evaluation systems have a high quality guarantee in their journal selection, and fully embody internationalization. These systems pay close attention to information dissemination, and seek consistency.

Consistent with the key features outlined above, Ei and MEDLINE require that journals have the desired subject characteristics and the necessary academic requirements. At the same time, it can be seen from the standard of journals, both the subject and journal subject are prerequisites for Ei, and all the journals are engineering technology journals. Furthermore, the features of Ei and the selected journals are notable. For interdisciplinary journals, different journal evaluation systems have different ways of dealing with them, including SCI and CSTPCD (2015 edition). These databases calculate the journal index under different disciplines and highlight the subject characteristics of the journal.

In terms of selection criteria, the standards and principles can be divided into four categories: journals, editors, authors, and judges (Table 20.12). China's journal evaluation systems and those abroad attach great importance to the journal's core value, including the journal's influence, academic quality, editorial quality, and ethics. As journal editors and managers, the editorial board of foreign systems evaluates the internationalization and academic level of the editorial board.

Table 20.12 Summary of standard principles of journal evaluation systems

Standards and principles	SCI	Ei	Scopus	MEDLINE	J-STAGE	CSTPCD	GSJC	CHSSCD	CSSCI	CSCD
Journal influence	✓	✓	✓	✓		✓	✓	✓	✓	✓
Academic quality	✓	✓	✓	✓		✓	✓	✓	✓	✓
Editing specifications	✓	✓	✓	✓		✓	✓	✓	✓	✓
Timeliness	✓	✓	✓	✓		✓	✓	✓	✓	✓
Moral statement and originality	✓	✓	✓	✓				✓	✓	
Dynamic management	✓	✓	✓	✓		✓	✓	✓	✓	✓
Editorial international diversity	✓		✓	✓		✓				
Diversity of authors	✓	✓	✓	✓						
English (title, abstract, etc.)	✓	✓	✓	✓				✓		
Regional discipline balance	✓		✓	✓		✓			✓	
Other important retrieval systems		✓	✓			✓		✓		
Peer review	✓	✓	✓		✓	✓				
Degree of contribution to the discipline		✓		✓						✓
ISSN or CN	✓	✓	✓	✓		✓	✓	✓	✓	✓

Additionally, the editorial board is an important factor in a journal's core value. The author is the main contributor to the content of the journal, but unlike the editorial board, the author is not fixed. To a certain extent, the author is also the factor that affects the journal's value, so foreign journal evaluation systems will also consider the diversity of the journal authors. The evaluation is more like foreign aid to the journal—it provides professional guidance and recommendations for the editorial board. Furthermore, it is advantageous to safeguard the journal quality. It can be seen both in the database descriptions in China and abroad that the journal, editorial board, and other actors are investigated and evaluated. Thus, it is worth considering whether these tasks could be performed by other *evaluators*.

Summary

From the above-mentioned domestic and foreign journal evaluation systems, we can see that any journal evaluation and screening system is based on bibliometrics. Through the deep discussion of Bradford's laws, we can see that the selection and evaluation of source journals is carried out under a framework of their respective evaluation purposes, evaluation methods, key features, and evaluation criteria, each with applicable scope and evaluation characteristics.

Foreign evaluation systems (e. g., SCI, Ei, and Scopus) are located all over the world, and include the key journals from many countries. Thus, the journals included in the evaluation systems of foreign major journals reflect the international influence of the journals to some extent. For Chinese journals, many of these journals with Chinese characteristics (e. g., differences in language and editing norms) have not been included in the key evaluation systems. To some extent, this can be explained by the fact that ranking of China's STM journals in the international arena still needs to be improved. Therefore, certain aspects of the foreign evaluation systems are not completely suitable for China. At the same time, the foreign systems offer considerable experience from which China can learn from in developing its own evaluation system.

Based on the induction and refining process of the domestic and foreign journal evaluation systems, we find that the journal evaluation systems are largely concerned with the following issues:

1. The key characteristics of journals (professional characteristics or academic contributions)
2. Influence of journals
3. Dynamic management of journals (sustainable development)
4. Academic honesty and morality in publishing
5. Diversity and internationalization of editorial board
6. Diversity of authors
7. The balance of areas and disciplines
8. Standardization of editors
9. Readability (e. g., English-language abstract).

20.4 Comparative Study of International and National Evaluation Indicators of Academic Journals in China

20.4.1 Popular Evaluation Indicators of International Academic Journals: JCR

Comparatively speaking, foreign journal evaluation systems adopt a periodical journal evaluation index that is based on Garfield's citation analysis to statistically appraise citation data. Using bibliometrics and a combination of qualitative and quantitative methods to evaluate and select journals, JCR evaluations mainly include the annual number of published documents, citation frequency, and the calculation of impact factors. JCR has recently introduced evaluation indexes for feature factors and influence scores. Generally speaking, JCR is considered an authority on citation data.

The JCR index, providing a statistical and comparative analysis of Chinese journals and other major journals, includes country of origin data (Tables 20.13–20.15). The total number of journals included in the JCR (Science Edition) increased considerably between 2012 and 2014; so too has the number of Chinese journals. In contrast, there has been a decline in the number of journals from France, Russia, Japan, and India. The number of journals from the United States, Britain, and Germany is significantly higher than those from other countries. The number of Q1, Q2, and Q3 journals from China increased in the 2012–2014 period. Furthermore, China enjoys the highest growth rate for journal number, followed by South Korea, while France has largest decline.

A journal can focus on many subjects, and the impact factor may be different for different disciplines. If some journals have multiple subject areas, then the impact factor is calculated for each subject area. Thus, makes the number of journals in four sections of the table more likely than the total number of journals. The term *China (Exclude Duplicates)* means that if a journal focuses on multiple disciplines, only the best area is considered, at which time, the sum of the four areas equals the total number of journals.

Regarding the distribution of impact factors, the distribution of the number of journals in the four regions is more balanced, and the division of German journals represents the global situation. The distribution of U.S. and English journals differs from that in other countries, with the number of journals in the two countries decreasing with the increase in the number of partitions (e. g., Q1 and Q2 journals, Q3 journals, and Q4 journals). The opposite is true for the distribution of journals in other countries, including China. The proportion of Q1 journals in Britain, the United States, and Germany is much higher than that of other countries, and China's Q1 journals are second only to those three countries.

Regarding the number of English-language journals, the number of English-language journals from India remained stable, and the number of English-language journals from Japan decreased. The number of English-language journals from other countries increased. Furthermore, the number of English-language journals in the Q1, Q2 and Q3 divisions increased between 2012 and 2014. The three countries with the increase highest rate of English-language journals are South Korea, Brazil, and China; Japan shows the fastest decline.

Most of the journals entering the Q1 division in China are English-language journals. A total of 18, 19, and 21 Chinese STM journals were included in the JCR in the above three-year period, respectively, and the number of journals has increased gradually in recent years. Our analysis of these journals also shows that a number of Chinese STM journals have made it into the Q3 and Q4 divisions; 94.4% in 2012, 94.7% in 2013

Table 20.13 Number of journals included in JCR 2012

Geographic region	Number of periodicals	Q1	Q2	Q3	Q4
Global	8471	2287	2646	2616	2582
United States	2825	1046	1002	888	546
United Kingdom	1710	631	655	523	282
France	195	20	36	52	109
Germany	564	139	179	163	200
Russia	150	3	9	22	123
Japan	239	18	54	100	105
Korea	90	7	15	37	42
Brazil	102	0	8	25	73
India	105	1	7	22	82
China	156	11	33	60	71
China (excluding duplicates)	156	11	31	53	61

Table 20.14 Number of journals included in JCR 2013

Geographic region	Number of periodicals	Q1	Q2	Q3	Q4
Global	8539	2309	2649	2661	2592
United States	2875	1021	982	906	610
United Kingdom	1747	672	654	520	288
France	186	20	39	43	101
Germany	563	143	183	171	181
Russia	149	2	6	27	122
Japan	236	18	48	96	108
Korea	91	1	16	46	40
Brazil	108	0	11	29	73
India	98	0	8	23	74
China	167	14	42	59	78
China (excluding duplicates)	167	14	36	51	66

Table 20.15 Number of journals included in JCR 2014

Geographic region	Number of periodicals	Q1	Q2	Q3	Q4
Global	8618	2354	2670	2679	2638
United States	2894	1040	982	900	619
United Kingdom	1784	672	649	514	323
France	174	18	46	43	89
Germany	578	150	195	167	194
Russia	148	3	5	32	117
Japan	234	15	50	94	114
Korea	102	4	20	51	46
Brazil	106	0	4	34	73
India	97	1	5	17	77
China	179	23	44	69	71
China (excluding duplicates)	179	23	38	57	61

and 90.5% in 2014. However, these rates show that the citation rates of Chinese STM journals are not considered influential. The reasons for this include the language of the journals, the fact that the main readers and citations of Chinese journals are concentrated in China (which results in a domestic rather than an international influence), and that it is difficult to get the attention of (and hence citations from) international academia.

20.4.2 National Journal Evaluation Systems in China

The comparison results of the evaluation methods of various systems show that the current journal evaluation systems generally use a comprehensive evaluation method that combines both qualitative and quantitative approaches. Regarding quantitative evaluation, each evaluation system has a set of indicators. This chapter focuses on the different indicators, highlighting similarities and differences. Looking at the different indicators, we will identify design principles, algorithm design, and the applicability and limitations of the indicators via comparative analysis. We have already identified the key characteristics, standard profiles, main principles, and evaluation indexes for the main evaluation systems in China and elsewhere. Thus, we have analyzed these systems based on various system-level indexes. We continue the analysis of these evaluation systems in Table 20.16.

The evaluation indicators used for the academic journals include impact factors and the total frequency of citation. These indicators directly reflect the academic quality of the journal papers cited and the level of influence. The article funding ratio, web downloads, and annual index are further evaluation indicators in many evaluation systems. At present, the journal evaluation systems basically select journals by looking at their overall reputation and long-term practices, as well as their level of authority and representation. Both qualitative and quantitative methods are used to conduct journal evaluations. Influenced by foreign journal evaluation systems, Chinese journal evaluation indexes have been revised to some extent from traditional evaluation indexes. That is, the impact factor index has produced further evaluation indexes for journal evaluation.

Table 20.16 Main evaluation indexes of Chinese journal evaluation systems

Evaluation system CSTPCD Evaluation indicators	GSJC	CHSSCD	CSSCI	CSCD
Overseas papers rate	Web downloads	Two-year and five-year impact factors	Citation amount	Article influence score
Number of institutions distributed	The amount of article Full-Text requested in library system	Cited frequency	Impact factor	Eigenfactor score
Funded papers rate	Cited quantity	Funded papers rate	Total cited frequency	Index of mutual indexing
Year indicator	Total quoted times	Year indicator		Diffusion factor
Source literature quantity	Quoted paper rate	Paper download		Paper use index
Average number of citations	Indexed by important retrieval systems	Subject expansion indicators		Other cited frequency
Average number of authors	Index of mutual indexing	Subject impact indicators		Other influencing factors
Other citation	Funded papers rate	Important databases		Excellent index
Rate of document selection	Paper cited index			
Quote half-life	Other cited			
Impact factor	Other influencing factors			
Important databases	Impact factor			
Total cited frequency				
Total score of comprehensive and evaluation				

The impact factor index includes a two- and five-year impact factor. The impact factor and the impact of its peak period are based on the impact factor in the computation process difference and different calculations.

The total score of the comprehensive evaluation of Chinese STM journals (hereinafter referred to as the *comprehensive evaluation score*) is based on the comprehensive evaluation indicator system of Chinese STM journals. The relative position score of each journal in the discipline is calculated according to the extreme value of each journal index in each subject category. The annual CHCR (core edition) of the *China Science and Technology Journal* published by CSTPCD regularly publishes the scientific measurement indexes of the statistical source journals of Chinese STM papers [20.6, 7]. Based on this index, a comprehensive evaluation indicator system for Chinese STM journals was implemented in 1996 and further developed. Each index in the evaluation indicator system is not given equal weight when calculating the total score; that is, different indexes are given different weights. The initial index weight distribution was determined by Delphi expert investigation and AHP. Subsequently, based on further research and feedback, new measurement indexes were continuously added. To ensure that feedback on the evaluation results can be properly given and received, ISTIC has held more than 20 expert seminars for scientific metrology experts, scientists, science and technology and journal management experts, and scholars to participate in evaluation, establish indicators, and to determine the weight of updates and adjustments. Thus, they contribute to the creation of the current set of scientific and technological journals to improve evaluation systems and methods.

The total score of comprehensive evaluation is based on the principle of scientific metrology, carefully considering the indexes of the evaluated journals. On the basis of widely solicited opinions, a comprehensive evaluation indicator system for Chinese STM journals is used to classify, divide, and assign different weights to journal indexes. The weighted scores of each index are collected to obtain the total score of the evaluated journals and the ranking within the scope of the subject and in the range of journals: the higher the value of the comprehensive evaluation index, the higher the comprehensive academic quality and impact level of the journal in its subject area.

Because the evaluation aim, scope, and perspective differ among journal evaluation systems, the index range and corresponding weight distribution are frequently adjusted. Taking the 2015 CHCR (core edition) as an example, the total score of the comprehensive evaluation, looking at the core of the main citation frequency (TC), the core impact factor (IF), the core six indexes of this index (OT), the article funding ratio (NT), citation rate (RE), and open factor (OP), is based on the relative position of the evaluated journal in its subject. These indexes are integrated according to certain weight coefficients.

20.4.3 Indicator Design Method for Academic Journals

Based on the statistics of the evaluation index distribution of the main evaluation systems at home and abroad, the indexes of three or more evaluation systems are summarized. Among them, indexes can be merged; for example, the citation index and mutual index are merged to create citation frequency, and the two-year and five-year impact factor become the impact factor index. The most commonly used indicators in the different evaluation systems are as follows: citation frequency, impact factor, the annual index, the thesis funding ratio, download volume, and the key retrieval system. Among them, the traditional evaluation indicators include citation frequency and impact factor. Citation frequency and impact factor are widely used, appearing in all evaluation indicator systems, and reflect the practice that traditional indicators are more reliable. However, this is also reflected in new emerging indicators. Overall, both domestic and foreign evaluation systems share similar evaluation indicators. A number of indexes—annual index, the ratio of funded papers, and key retrieval systems—are included in three or more of the evaluation indicator systems.

Based on the results of the evaluation indexes of domestic and foreign journals, we summarize and refine the design principle, algorithm design, and the applicability and limitation of citation frequency, impact factor, annual index, the article funding ratio, and key retrieval system (Table 20.17).

Design Principle

Among the main indexes used to evaluate journals, the majority relate to citation rate. This stems from Garfield's citation evaluation with citation frequency and impact factor. The main evaluation index of the domestic and foreign journal evaluation system is based on the relationship among citation frequency, influence factor, and annual index. The impact range, depth, and efficiency of the journal are measured separately. The article funding index originated from China, and ISTIC was the first to adopt this index in the selection of Chinese STM journals, thus promoting the extensive influence of the article funding ratio. The article funding ratio is based on whether an article has received government funding; it is generally believed that funding indicates research trends in the field of research. To

Table 20.17 Evaluation index attributes

Property	Total citation	Impact factor	Immediacy index	Funded papers rate	Information important for the retrieval system
Design principle	Journal citation relations	Based on the citation relationship, combined with the volume of postings and the cited batches	Journal citation relations	Is the paper funded?	The information of the retrieval system
Algorithm design	In a statistical source, the total number of papers published by a particular periodical since its inception has been cited in the journal of statistical sources	The average citation rate of journal papers, that is, the ratio of citation quantity and number of journal papers	Papers published in the year of the journal that were cited	The proportion of papers funded by national, provincial level and other important funds in periodicals	Statistics on the number of times a periodical is retrieved
Applicability	The total cited frequency is applicable to the evaluation of basic research results, showing the extent to which the journal has been used and valued, and the breadth of the measures affected	The influence factor is suitable for periodical comparison in the same subject, and the influence factor is helpful to measure the periodical's knowledge communication ability and academic influence	Immediate reaction rate of periodical measure in the period of annual index	The fund thesis is advantageous to highlight the output of the project	The recognition degree and influence of periodical evaluation system by domestic and foreign periodicals
Limitations	Without considering the subject area, publication time and so on, the difference of the citation opportunity is not considered; the importance of the paper in the citation network is not considered	It is easily influenced by human factors, and the influence factors can be increased by self-citation	The measure time span is small, and can be influenced by the discipline and so on.	It is easily influenced by human factors, and the proportion cannot reflect the difference of different funds; unreasonable evaluation of nonfunded papers	The evaluation angle is single; it is not easy to quantify; it is more suitable for reference index of evaluation results
Application	Widely used, domestic and foreign periodicals to evaluate the influence factors of SCI, CSTPCD, etc.	Widely used, domestic and foreign periodicals to evaluate SCI, CSTPCD, etc. are selected cited frequency	Widely used in the evaluation of domestic and foreign periodicals by SCI, CSTPCD, etc.	Mainly used in the evaluation of Chinese periodicals CSTPCD and GCHC	Widely used, by Ei, Scopus, CSTPCD, etc.
Data sources	JCR etc.	JCR etc.	JCR etc.	CJCR etc.	webpages

study the scope or focus of research, the article funding ratio can reflect the academic quality of journals. The inclusion of a key retrieval system concerns statistics on whether the journals are included in key domestic and foreign retrieval systems. For example, if a journal is included in an authoritative and respected system such as SCI, this reflects the high academic quality and international influence of the journal.

Algorithm Design

The total citation frequency is the cumulative sum of citations and impact factor refers to a certain time span, based on either two-, three-, or five-year impact factors. That is, the annual index is cited in CSTPCD, and the funded papers and the active papers mean all papers are accounted for. It can be seen here that there are differences in the perspectives of various index measures, which can be used to evaluate the journal by the accumulated degree of impact and different time periods.

Applicability and Limitations

Regarding applicability and limitations, total citation frequency is a cumulative approach that is more appropriate for basic research subjects regarding the impact of the measurement. The timeliness of the subject is not very applicable. However, the publication of the impact factor of journals with an early publication time provides a larger window for publication, and therefore a greater chance of citation. There is less evaluation of the total citation frequency compared with journals that were published later. Garfield, based on the optimization of the total citation frequency index, stated that the influencing factors are a combination of time, the volume of journals, and citation rate. Impact factors have their limitation in that they are only applicable to the comparison and evaluation of the influence and communication ability of journals under the same subject. The annual index reflects a journal's annual efficiency, and the effect factor is only applicable to the comparison of journals within the same subject area. In view of the above index only applying to the same discipline under journal evaluation, the journal evaluation system has continued with its unceasing optimization and consummation of subject classification. Interdisciplinary journals can include a range of disciplines under the index evaluation.

Application and Data Sources

Citation frequency, impact factor, and the annual index are evaluation indexes used by JCR. These are widely used in most evaluation systems, with the continuous improvement and optimization of traditional indexes. In this chapter, we propose derivative indexes and composite indexes for evaluation, which provide a new perspective for the rational and scientific evaluation of journals. The article funding index was first used in the selection of STM journals in China. The 2001 citation report and the 2008 core journal index have increased the number of indexes they use; journals are usually included in the systems' official websites, which is mainly used in the journal evaluation system, and is an important reference index for evaluating journals.

The main indicators of Chinese and foreign evaluation systems are citation frequency, impact factor, annual index, article funding ratio, and key retrieval system. These measure the impact of the scope of the journal, depth of influence, the rate of reflection and influence, the measure of the journal, the time frame of different measures, and the difference of measurement content, and are widely applied to the main journal evaluation systems at home and abroad. Therefore, the index of citation frequency influences the journal and academic quality in the rational and scientific assessment of different dimensions.

20.5 China's STM Journals: The Development of the Boom Index and its Monitoring Function

20.5.1 Introduction to Chinese STM Journals

In 2013, a total of 9877 periodicals were published in China; that is, the average quantity of printing for each issue is 164.53 million copies, and the quantitiy of printing for total issues is 3.272 billion copies. Total quantity of impression is 19.47 billion pieces, costing 25.335 billion RMB Yuan. Compared with 2012 rate, this represents an increase of 0.1% in new titles, and the average quantity of printing for each issue droped by 1.87%. Furthermore, the quantitiy of printing for total issues showed a 2.26% reduction, the total quantity of impression was down 0.67%. However, the costs increased by 0.26%.

During the period 2009–2013, the number of Chinese journals increased slightly in 2011. However, there was a decline in the total number of journals for 2012–2013, and the average period of Chinese journals declined continuously. Regarding total prints and total sales, these showed a decrease in 2013, while the cost of journals increased.

Compared with the publication numbers of other Chinese journals, STM journals in 2009–2013 have shown periods of growth and decline (Table 20.18).

Table 20.18 Publication of Chinese journals in 2009–2013

Indicator of China's periodicals	2009	2010	2011	2012	2013
Number of natural science and technology periodicals (A)	4926	4936	4920	4953	4944
Number of periodicals (B)	9851	9884	9849	9867	9877
A/B (%)	50.01	49.94	49.95	50.20	50.06

The number of journals decreased in 2012 and 2013, whereas previously the number had increased by 0.18%. The total number of STM journals in China has accounted for about 50% of the total of journals for many years. The values for STM journals in 2013 are as follows: the total of 463.44 million copies printed with total 3.7941 billion units of printing paper. Compared with the previous year, the number of total copies printed was down 4.58%, and the number of total units of printing paper decreased by 0.01%. Thus, in 2013, while the content of Chinese STM journals remained basically unchanged, there was a decrease in the printing volume of journals and the price increased.

20.5.2 Core Chinese STM Journals

The ISTIC was set up by the Ministry of Science and Technology, and since 1987 it has engaged in the statistical analysis of Chinese STM papers. This then led to the development of the CSTPCD. The data from the database is used to annually classify and analyze the status of Chinese scientific research output. The statistical analysis results are regularly published in the public arena in the form of annual research reports and press releases. A series of research reports have been published to provide decision-making support for government departments, universities, and research institutions.

Journals of Chinese STM papers and citation databases are called Chinese STM journals. Selected Chinese STM core journals (the statistical source journals of Chinese STM papers), after rigorous peer review and quantitative evaluation, represent quality research in the field of Chinese science and technology, and they reflect the level of development in that subject area. Furthermore, it has established a dynamic exit mechanism for the selection of Chinese STM core journals. To study the scientific indexes of Chinese STM core journals, we can determine the development of Chinese STM journals, and outline the research power of various disciplines in China. The data source of this chapter's journal index is core Chinese STM journals. The 2013 CSTPCD includes the core Chinese STM journals. There were 1989 core STM journals, five less than in 2012. The number of core Chinese STM journals has declined for the second consecutive year (Table 20.19).

The distribution of the subject area of the 1989 Chinese STM journals in 2013 is as follows: industrial technology (37.31%), medical and health (33.32%), basic science category III (15.03%), agriculture, forestry, and fishery (7.83%), and other categories (6.52%). Compared with the past five years, the total number of journals has declined slightly, and the proportion of the total number of journals in the five major categories has changed little. However, compared with 2012, the proportion of basic science and agriculture, forestry and fishery has increased, the proportion of medical and health journals has declined, and the proportion of industrial technical journals has increased.

In the selection of core Chinese STM journals, the proportion of industrial technical journals and agriculture, forestry, and fishery journals is smaller than that of other journals. This indicates that the overall level of industrial technology and agriculture, forestry, and fishery journals requires some improvement, and we should pay more attention these journals in the future.

According to the statistical analysis of the 2009 Urich's International Journal Guide, the world's STM journals make up 30% of all journals, and comprehensive STM journals account for just 3%. Compared with the number of Chinese STM journals, the proportion of comprehensive journals in China is larger than that worldwide, and the proportion of medical and health journals is consistent with the world trend.

20.5.3 Citation Reports of Chinese STM Journals

In 1997, the China Scientific and Technical Papers Statistics and Analysis project group published the first *China Science and Technology Journal Citation Report*. The research group has published a new edition of the scientific and technological journal indicators. The data used in the citation reports of Chinese STM journals (core editions) are taken from ISTIC's CSTPCD. The database includes the most important scientific and technological journals in China, thus journals become statistical sources, subject to annual dynamic adjustments. By 2014, there were 1989 statistical sources of scientific papers in China. This represents the statistical analysis of the overall situation of Chinese STM papers, as well as the development of tracking research in Chinese STM journals. This has formed an annual report on China's core STM journals outlining the measurement indicators of the system. In addition, it promotes the development of Chinese STM journals and provides an evaluation basis for journal and journal management.

Table 20.19 Core Chinese STM journals 2009–2013

Year	2009	2010	2011	2012	2013
Number of science and technology core periodicals (A)	1946	1998	1998	1994	1989
Number of natural science and technology periodicals (B)	4926	4936	4920	4953	4944
A/B	39.51%	40.48%	40.61%	40.25%	40.23%

To select the core Chinese STM journals, the institute also began publishing its *Citation Report of Chinese STM Journals* (full edition) in 1998. From 2007 onwards, an expanded version of the citation report has been jointly published by ISTIC and Wanfang Data–Digital Periodicals, covering more than 6000 Chinese STM journals.

Index Analysis of Chinese STM Journals

To ensure the comprehensive, accurate, impartial and objective evaluation and use of journals, the ISTIC's citation reports are consistent with the international evaluation system. Based on the actual situation affecting Chinese journals, the *2013 Citation Report of Chinese STM Journals' Citation Report* (core edition) selected 23 measurement indicators, and the 2014 report (core edition) added a further measurement index: core open factors. These indicators basically cover and describe the various aspects of the journal. Indicators include:

(1) The journal's citation-based indicator of measurement: the core total citation frequency, core impact factor, core annual index, core citation rate, core citation number, core diffusion factor, core open factor, core authority factor, and core citation half-life.
(2) Journal source measurement index: source literature, document selection rate, reference volume, average citation rate, average number of authors, region distribution, mechanism distribution, overseas thesis ratio, article funding ratio, and reference half-life.
(3) Index of journal measurement in subject classification: total score, subject diffusion index, subject impact index, deviation ratio of the core total citation frequency, and the deviation of the core impact factor.

Among these, the journal citation measurement index mainly shows the journal's degree of use and value by readers, as well as its position and function in scientific communication, which is an important basis and objective standard to evaluate the influence of journals.

Through the statistical analysis of source literature, this chapter comprehensively describes academic level, editorial status, and degree of scientific communication of the journal, which is also an important basis for evaluating journals.

The comprehensive evaluation score is a comprehensive description of the overall position of the journal.

Table 20.20 shows the changes in the main measurement indicators for STM journals from 2001 to 2013. Since 2001, the important indicators of Chinese STM journals (except those pertaining to foreign journals) have remained unchanged. Furthermore, the values of the remaining indexes are increasing. The total citation frequency and impact factors have improved every year, of which the average citation frequency of 2011 Chinese journals finally exceeded 1000, reaching 1022 citations. This rate was 1023 in 2012 and 1180 in 2013. The 2013 rate is 5.2 times greater than the 2001 rate, and the core impact factor rose to 0.523 in 2013, twice that of 2001. These two indicators are important indicators reflecting the impact of STM journals. The annual index, that is, the citation rate of the paper in the year since 2001, has gradually increased, reaching 0.072 in 2013. The article funding ratio shows the proportion of all papers in China's core STM journals that receive state/provincial-level funding or from other key funding areas. This is also an important index to measure the academic quality of journals. From 2001 to 2013, core Chinese STM journals with funded articles show an annual increase. This rate was 0.056 in 2013. That

Table 20.20 Core Chinese STM journals: average statistics of measurement indexes

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Core total citations	227	278	362	434	534	650	749	804	913	971	1022	1023	1180
Core impact factor	0.264	0.294	0.348	0.386	0.407	0.444	0.469	0.445	0.452	0.463	0.454	0.493	0.523
Core immediacy index	0.045	0.048	0.056	0.053	0.052	0.055	0.054	0.055	0.057	0.06	0.059	0.068	0.072
Funded papers rate	0.34	0.36	0.38	0.41	0.45	0.47	0.46	0.46	0.49	0.51	0.53	0.53	0.56
Overseas papers[a] rate	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.023	0.02	0.02
Author number of articles	3.26	3.27	3.34	3.43	3.47	3.55	3.81	3.66	3.71	3.92	3.8	3.9	4.0
Number of references	7.36	8.21	8.81	9.27	9.91	10.55	10.01	11.96	12.64	13.41	13.97	14.85	15.9

[a] Paper with at least one author affiliated with an organization outside mainland China

is, of the 1989 core STM papers published, more than 50% of the papers are funded by the state. One of the indicators showing the international level of the journals, the rate of overseas papers, remained the same, staying between 0.01–0.02 (0.01 in 2007 and 2008). The average number of authors and citations have increased annually, from 3.26 and 7.36 in 2001 to 4.0 and 15.9 in 2013, respectively.

Regarding core citation rates, these show almost linear growth by 2011. The 2012 core average citation rate represents a significant slowdown, almost the same as the 2011 rate. However, in 2013, the core average citation rate increased to 1180. Table 20.20 shows the average core impact factor and the average core annual index for 2001–2013. The growth in the average core impact factor peaked in 2007, and after five years of decline, it increased again in 2012–2013, higher than the 2007 rates (0.493 and 0.523). The average core impact factor for 2001–2013 shows a steady upward trend, peaking in 2003. This was followed by a five-year decline, a three-year fine-tuning period, and then an increase in 2012–2013 to a high of 0.072. This shows that despite the fluctuations in the citations of the core Chinese STM journals, they now enjoy a steady increase.

At the same time, the average number of core Chinese STM journals has continued to increase, while the growth of average core influence factor in 2001–2013 has slowed. The core average of total citation frequency and the core average impact factor peaked in 2003, slowing from 2004 onwards. The growth of the average total citation frequency between 2004 and 2013 experienced three troughs, in 2004, 2008 and 2012. Interestingly, each trough is followed by three years of growth, but then falls again. The growth rate during the nadir period shows a gradual decrease. The 2012 growth rate is almost 0, while the growth rate of the core journals in 2013 increased again, reaching 0.153 for the first time in nearly four years. The average core impact factor experienced three troughs between 2004 and 2013 (i. e., in 2005, 2008 and 2011), and the growth rates of the average core factors in 2008 and 2011 were 0.05 and 0.02 respectively. The 2008 rate is the lowest for the period (−0.05), the average core impact factor did not increase, and the average core factor increased in 2012–2013, with a growth rate of 0.086 in 2012.

According to the index analysis of papers published by STM journals, the number of key funding grants and papers published in STM journals reflects the academic quality and the level of journals. For academic journals especially, this index appears to be very important. The publishing of foreign articles is an important index of a journal's level of internationalization. The article funding ratio increased from 0.34 in 2001 to 0.47 in 2006, and then experienced a slight decline for 2007–2008. It enjoyed an increasing trend during 2009–2011 reaching 0.56 in 2013. Thus, more than half of the papers published are supported by funding or grants from provincial and ministerial-level government departments.

In recent years, China has worked hard to increase its investment in scientific research. The success of the 11th Five-year Plan has meant that a large number of scientific research projects have produced many scientific papers. Overseas papers have remained at 2% since 2001–2006, falling to 1% in 2007–2008, and climbing to 2% in 2013. This shows that the international volume of Chinese STM core journals has been hovering at 1–2%, and therefore Chinese journals have a low level of internationalization.

The average citation index refers to the average reference quantity of each paper in a journal. It is a relative index to measure the degree of scientific communication of STM journals and the ability to absorb external information. Furthermore, the standardization of reference documents is also an important index that reflects the standardization degree of Chinese academic journals and the integration of international scientific research. The average citation number of core Chinese STM journals increased between 2001 and 2013, with a slight decrease in 2007 (however, 2007 also represented the first time the rate rose above 10, reaching 10.01). The average citation rate in 2013 was 15.9, 2.16 times that of the 2001 rate.

Over the past 20 years, there has been a noticeable development within the statistical and analytical research contained in Chinese STM papers. Furthermore, with the extensive publicity of the evaluation system of STM journals and with more and more Chinese and international researchers, researchers now pay greater attention to the completeness and standardization of articles. Aware of the importance of bibliographic references, a vast number of STM journal editors are acknowledging that the preservation of the objective of reference documents is an important channel for journals and academic exchanges. Therefore, the average number of citations has gradually improved. From 2001–2012, the average number of authors in Chinese STM journals hovered between 3.26 and 3.92. In 2013, the average number of authors reached 4.

The Status of Core Chinese STM Journals

In 2013, there were a total of 1989 core Chinese STM journals. They published 502 393 papers, a 1.49% decrease since 2012. On average, for each core journal, there are 252.59 source articles.

The quantity of source literature, that is, the quantity of the journals, refers to the amount of information contained in the journal, specifically the number of papers published in a journal year. It should be noted that Chinese STM papers and citation databases in the collection of papers refers to the choice of journal papers. We refer to the volume of papers that are in academic journals of scientific papers and research bulletins. These present research findings on new technologies, materials, processes and new products, and include research papers on basic medical theories in medical journals and important clinical practice summary reports as well as literature reviews.

In 2013, there were 623 journals that included more sources of literature than the average number of Chinese journals (in 2012 there were just eight). There were five journals with more than 2000 documents, with one including 2367 articles. There were journals with more than 1000 papers.

Between 2004 and 2013, the propotion of the journals whose number of publishing paper each year is no more than 50 showed a steady decline. Papers published in 100–200 journals accounted for the highest proportion. These show an overall slight downward trend. In ten years of core Chinese STM journals, 40% of all journals were included in 100–200 journals; the proportion of published articles in 50–100 journals has declined since 2004. The proportion of other journals is increasing, which shows that the information capacity of China's core STM journals is expanding and the volume of journals is increasing.

In this chapter, we also use statistics to determine the relation between subject classification and the region of article numbers of a journal. The percentage of basic subjects journals is 61.3% in regions where the volume of article is less than or equal to 50, which is much higher than that of the other four categories (engineering, agriculture, medicine, others). With an increasing volume of papers, the proportion of basic subject journals declined sharply, and the proportion of basic subject journals fell to 5.76% in regions with a volume of more than 500. Regarding the category of agriculture, forestry fishery, and husbandry compared with other three subject clusters (basic science categories, medical and health categories, industrial technology categories), the proportion of journals varies little in each region where the amount of papers is distributed. Journals in the medical and health categories show a decrease in volume and the proportion of journals obviously decreased. In regions where the volume is less than 300, the proportion of journals shows a near-linear decrease. Industrial technology journals in regions with a volume greater than 50 have a small distribution, between 36.55% and 39%, and the proportion of journals in regions less than 50 is sharply reduced to 18.75%. This shows that industrial technology and medical and health journals are distributed in larger areas, and basic science journals are distributed in more regions but in smaller volumes.

Subject Analysis of Core Chinese STM Journals

Compared with the previous version, the *2013 Citation Report of Chinese STM Journals* (core edition), shows considerable changes to the journal subject classification. The 2013 version is the latest implementation of the Discipline Classification and Code (national standard Gb 113745). We will use core Chinese STM journals to redefine the subject. The original 61 disciplines have been expanded to 113 disciplines. The 2014 edition of the citation report was further adjusted, adding two new subjects. Furthermore, the subject classification of journals was adjusted and divided, and interdisciplinary journals were classified as two or three subjects. The new subject classification system embodies the development and evolution of scientific research disciplines, which is more in line with the overall situation of the development of science and technology in China and the actual distribution of Chinese STM journals. In 2013, 1989 core Chinese STM journals covered various disciplines. *The Journal of Engineering Technology University*, the *University Journal* and the *Journal of Medical Universities* occupy the top three rankings, and the *Journal of Engineering and Technology University* is 108th. In all core journals, as the top proportion part, there are 13.68% of them are the academic transactions or journals of universities (including comprehensive universities, polytechnic universities and medical universities). For example there are 108 journals of polytechnic universites in all 1989 core journals. As a China characteristics, big number of journal of universities is a major force of Chinese STM journals.

The average impact factor and citation frequency of core Chinese STM journals in 2013 was 0.523 and 1180, respectively. A total of 58 subjects have impact factors higher than the average, representing 11 more than in 2012. Furthermore, there are 52 subjects with higher-than-average citation frequencies (ten fewer than in 2012). The top three impact factors were in grassland, atmospheric science, and geography, and the top three citation frequencies were ecology, nursing, and civil engineering. The influence factor has a strong correlation with the subject field, and the impact factors of different disciplines show clear differences. Because of the significant difference among subjects, we focus on the subjects' 2013 values.

For all 115 subjects in 2013, the midian value of total citations is more than 1000 times in 34 subjects. Among these, medical and health journals accounted for 50%, industrial technical journals accounted for 20.59%, basic science journals accounted for 17.65%, and agriculture, forestry, and fishery journals accounted for 8.82%. The top three subjects were ecology, nursing, and ecology. Geography, atmospheric science, and ecology are among the higher values of the 2013 discipline factors. Subjects with lower impact factors include comprehensive, metallurgical technology, and mathematics. Therefore, it is necessary to compare the impact factors of STM journals with the average level of the subject.

A Regional Analysis of Core Chinese STM Journals

The regional distribution number refers to the number of regions covered by the author of the source journal, which is calculated according to China's 31 provinces (municipalities).

Generally speaking, the geographical distribution of a journal can be used to determine whether the journal is a more widely covered journal, its influence in the whole country, and whether the regional distribution covers more than 20 provinces (cities). Journals meeting these criteria are considered national journals.

After 2004, the number of journals in China's core STM journals was more than or equal to the 30 provinces (cities), with 2011 having the largest number of journals, 106 in 2012, and an increase of 5% in 2013.

The regional distribution of more than 20 provinces continues to increase, with more than 64.23% of all journals. That is, in 2013, more than 64% of the journals are national STM journals. Moreover, the proportion of journals with a regional distribution of less than ten continues to decline.

Publishing Cycle of Core Chinese STM Journals

Because the speed of publication is an important basis of scientific discovery, the shorter the journal publication period, the stronger the ability to attract excellent manuscripts, and the higher the impact factor. Research shows that the publishing cycle of China's STM journals is reducing annually.

In 2013, the publishing cycle of China's core STM journals was further reduced, and monthly publications rose from 28.73% in 2007 to 37.45% in 2013. Additionally, bimonthly publications decreased from 52.49% in 2007 to 48.82% in 2013, as more bimonthly journals became monthly journals. Quarterly journals fell from 13.22% in 2008 to 9.6% in 2013. Compared with journal publication periods in 2012, the number of journals remains basically unchanged in all other periods. While the overall publication cycle of STM journals has been shortened, close to 50% of journals are published bimonthly.

From a classification perspective, basic science journals and those on agriculture, forestry, and fishery and comprehensive journals have relatively long publishing cycles, and quarterly and bimonthly ratios account for about 70%, which shows that in these three categories, journals are mainly published as quarterly or bimonthly journals. The publication cycle of basic science journals is:

- Quarterly: 22.54%
- Bimonthly: 49.21%
- Monthly: 26.98%
- Others: 1.27%.

For industrial and technical journals: 58.18% are published as either quarterly or bimonthly journals, up from 57.83% in 2012. In other words, more than 50% of the journals in industrial technical journals are quarterly and bimonthly, and this is 10% higher than the proportion of basic science, agroforestry, and other journals. The distribution for medical and health journals is: 46.63% of journals in this field are published as quarterly and bimonthly journals, and 53.37% are published monthly. Thus, more than 50% of the medical and health journals are monthly. 2012 data does not contain information on fortnightly and weekly publications, so no comparison can be made.

The world's largest journal directory guide, the Ulrich Journal Guide, surveyed 50 443 academic journals and found that quarterly journals accounted for nearly 30% of the total number of academic journals. Furthermore, quarterly, biannual, bimonthly, annual, and monthly publications accounted for 80.9% of the five publication cycles. Thus, for academic journals around the world, the quarterly journal is the most important publication cycle, accounting for 29.5% of all journals; this is followed by semiannual, bimonthly, and annual editions. Unlike in China, bimonthly publication is not the most common format.

In 2013, the JCR included a total of 8194 journals, with a diverse range of publication cycles. There were 37 types of publication cycle, with a maximum number is 60 issues per year and a minimum number is 1 issue per year. To facilitate our comparison with Chinese journals, we will include JCR journals according to the publication period, reducing the number of categories. We will merge weekly and more than weekly journals as a weekly comparison with Chinese journals. For example, 26 kinds of JCR journals are published weekly, whereas there is only one weekly journal in China. Sixty are published annually. The weekly journal and the 26 other more than weekly journals are merged into 27 weekly journals to aid in our comparison with Chinese journals.

It is clear that the 2013 JCR includes the largest proportion bimonthly journals (33.72%), followed by quarterly (28.08%), monthly (27.29%), and then triannual, semiannual, and annual (6.73%). Regarding China's

2013 core STM journals, the largest percentage are bimonthly publications. The JCR includes bimonthly, quarterly, triannual, and annual publications (68.53%). China's core STM journals published bimonthly and quarterly make up 58.43% of such journals (there are no triannual, semiannual, and annual journals). Therefore, the publication cycle of core Chinese STM journals is shorter than that of the journals in the JCR.

The 2013 content of SCI includes the distribution of 139 Chinese STM journals. The publication of journals has also diversified. In contrast to 2012, the proportion of monthly journals in 2013 (35.97%) exceeds bimonthly publications (34.53%). These two formats are followed by quarterly journals (26.62%), which has declined since 2012. Despite the increase in the monthly ratio, the ratio of bimonthly and quarterly journals is still high, at 61.15%, in line with the publication cycle of journals in the JCR.

20.5.4 An International Comparison of Chinese STM Journals

We now compare the average citation frequency, average impact factor, and average annual index of core Chinese STM journals and JCR journals for 2011–2012. The values for these three indicators have increased for JCR journals, which is consistent with the growth of China's core STM journals. However, our absolute value is not at a comparable level to international journals. International journals enjoy much higher scores than core Chinese STM journals. The average citation frequency and the average impact factor are four times higher than the annual index, which is six times higher.

In the issue of number of articles, China's core STM journals and journals covered by JCR are very different. In the region of volume of articles of more than 100, the percentage of core Chinese STM journals is obviously higher than JCR journals. The percentage of China's core STM journals are significantly lower than that of JCR journals when we look at the proportion of the journal in areas where number of papers is less than 100. Regarding areas where the paper number is less than 50, the gap is particularly obvious. China's core STM journals account for 1.61%, and JCR journals account for 33.35%, 31.96%, and 32.26%. China's core STM journals published more than 100 papers, accounting for more than 82% of the total number of journals. The total number of JCR journals publishing more than 100 papers is less than 44%. The number of journals with less than 100 papers accounts for more than 60% of the total number of journals. This shows that the number of papers published in Chinese STM core journals is higher than the number of papers published by JCR.

In 2013, the SCI database included 139 Chinese journals (Table 20.21). The main evaluation indexes of JCR include total citations, impact factor, immediacy index, current number of papers, and article half-life (citation life). One of the most important indicators is the ranking of the journal in this discipline according to its impact factor (journal rank in categories). The impact factor is used to determine whether a journal is considered a Q1 journal. A Q1 award shows that the journal is a top-ranked journal in that particular discipline and it can also be called the top academic journal in that subject area. Based on the impact factor, a journal will be either a Q1, Q2, Q3, or Q4 journal.

The influence factors of JCR-selected Chinese journals in 2013 concern various subjects. A total of eight journals gained a Q1 ranking (compared with seven in 2012), and 34 are Q2 journals (six in 2012). There were 42 Chinese STM journals in 2013 ranked in the middle of the subject (and only nine in 2012). According to data from 2009 and 2011–2013, we note a gradual increase in the number of Chinese journals entering their corresponding disciplines.

In 2013, the following retrieval systems included Chinese STM journals: SCI, 139 journals; Ei, 216; MEDLINE, 106; SSCI, 2, and Scopus, 776.

The quality of Chinese STM journals has also undergone a process of development and change. In 1987, SCI selected only 11 Chinese journals, accounting for 0.3% of journals worldwide, and Ei selected 20 Chinese journals. For more than 20 years, the ranking of Chinese STM journals has been improving, and their influence in the world retrieval system has become greater. The number of China's STM journals is slowly growing, and have now passed the stage of quality improvement. Our aim is for these journals to move towards a stage of comprehensive revitalization.

20.5.5 Development Survey of Chinese STM Journals

Development Policy of of STM Journals

The relevant policies of management departments at all levels regarding STM periodicals play an important role in the development of these journals. A question-

Table 20.21 The number of Chinese STM journals included in SCI and Ei 2002–2013

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
SCI	69	78	78	78	78	104	108	115	128	134	135	139
Ei	108	119	152	141	163	174	197	217	210	211	207	216

naire on impact factors and the development of Chinese STM journals has investigated concerns relating to the development policy of STM journals. Of the 541 questionnaires collected, 66.17% of respondents expressed great concern, 26.5% expressed concern, 5.5% said they were aware, and only 2.03% answered that they were not sure. The investigation shows that the relevant personnel of STM journals pay attention to "the relevant policies of the development of STM journals".

In the survey respondents were given the following statement: "The existing policy adapts to the development of your journals". A total of 348 (64.33%) respondents stated "basic adaptation" had occurred, indicating that the majority of respondents affirmed the policy of STM journals. In contrast, 193 respondents selected "further promotion required", accounting for 35.67%, indicating that the relevant policies for the development of STM journals still need to be improved and upgraded. Finally, 193 respondents answered that the existing policies have not adapted to the development of STM journals' specific performance. This mainly relates to evaluation system, management system, system reform, policy guidance, and support efforts. Additionally, 74 respondents mentioned the issue of scientific evaluation, accounting for 193 responses of "concrete performance" (38.34%). This largely refers to the establishment of the evaluation of STM journal targets, a STM journal evaluation body to address negative journal development, as well as scientific research personnel, organizations, research results, and so on. The contrary of direction between appraisal targets cause the disadvantageous influence for STM journal development. Forty-one respondents (21.24%) regarded the specific performance of STM journals as a "concrete performance". This includes the strengthening of funds, manpower, technology and other support issues. It also refers to the support for Chinese journals, English-language journals and others. Support also needs to come from the director, as well as sponsorship support. Thirty-three (17.09%) respondents answered "concrete performance" regarding reform efforts. This includes the specific issues of autonomy and marketization. Furthermore, 23 (11.91%) respondents answered "concrete performance" in the management of STM journals. This referred to the issue of examination and approval, academic journal identification, and other specific issues. Seventeen (8.9%) respondents also stated "concrete performance" regarding the unclear policy orientation of STM journals. A further five respondents mentioned the quality of science and technology journals, new media applications, digital issues, and other specific problems.

In recent years, the State Administration of Radio, Film, and Television (SARFT), the Ministry of Science and Technology, CAS, and other competent departments involved in STM journals have proposed a number of policies to promote STM journal development. In 2000, the Ministry of Science and Technology, through its *Strategic Study of China's Fine Science and Technology Journals* and *China through the Service and Guarantee System of Fine STM Journals*, proposed the concept of *Quality Chinese STM Journals* and sought to promote the construction of quality STM journals. In 2011, the Central Committee of the Communist Party of China and the State Council aimed to "deepen the reform of the nonpolitical publishing system", and implement the reform of the publishing system governing nonpolitical newspapers and journals. In 2013, the Chinese Association of Science and Technology, Ministry of Finance, Ministry of Education, the General Administration of Press and Publication, SARFT, CAS, and the China Institute of Engineering made efforts to implement the *Program to Promote the International Influence of China's Scientific and Technological Journals*. The aim was to promote the internationalization of STM journals. This is the largest and most far-reaching financial aid project in this area to date. On 14 April 2014, SARFT reported intentions to standardize the publishing order of academic journals to promote their healthy development. On 11 September 2014, plans were announced to carry out the accreditation of academic journal qualifications, and on 18 November, the first list of identified academic journals was publicized. On 15 May 2014, CAS and the Natural Science Foundation issued a policy statement: public funds would be made available for scientific research projects to promote open access to scientific research. On 18 August 18 2014, at the fourth meeting on the comprehensive and deepening reform, the Central Committee considered the adoption of guidance regarding the promotion of the integration of traditional media and emerging media, and the wave of convergence between traditional media and new media. This was an issue of general concern and received many responses from STM journals.

In the questionnaire survey on impact factors in the development of Chinese STM journals, 541 respondents responded to the statement about "the influence of the existing STM journal policy on the impact of your journal". Of the six listed responses, the respondents answered as follows: speeding up the integration of new media, 52.68%; the transformation of nonpolitical journals into enterprises, 29.94%; the examination and identification of academic journals, 41.96%; the promotion of international influence of journals, 54.71%; the construction of quality journals, 57.86%; and the proportion of open acquisition of scientific papers funded by public funds, 27.36%. In addition, 24 respondents suggested other specific policies, which relate to the evaluation of STM journals and their impact.

The questionnaire also investigated the role of the relevant policies and measures of management at all levels. According to the results for multiple selection, 409 (75.6%) respondents considered that the relevant policies and measures of the organization level had a great effect on the development of STM journals. Furthermore, 344 (63.59%) and 343 (63.4%) respondents selected "national and local press and publication management departments" and "the competent departments and units of journals", respectively, for the development of STM journals. A total of 172 respondents considered that the relevant policies of "social groups such as society" had a great effect on the development of STM journals.

The Competitive Environment of Chinese STM Journals

The questionnaire survey also investigated the competitive environment of Chinese STM journals. When replying to a question concerning "the number of similar journals in your subject", 60.44% of respondents considered that there was an "appropriate" number, indicating that the subject distribution of Chinese STM journals is largely reasonable. At the same time, it should be noted that 31.05% believe that the number of similar journals in the subject is too large, which indicates that the homogeneity of journals in some subjects is a serious problem, raising issues of strong fierce competition and an oversupply of resources. In addition, 8.5% of respondents thought that there were "too few" journals in the same subject area, indicating that there is only a small supply of resources in that discipline. Furthermore, in response to a question on the "competitive strength between your journal and the same subject", 112 (20.7%) replied "very strong", 253 (46.77%) answered "intense", and 166 (30.68%) answered "average". The results show that there is strong competition among Chinese STM journals.

The questionnaire also investigated the main aspects of competition among Chinese STM journals. According to the survey results, 95.19% of the respondents stated there was competition regarding "author and manuscript". At the same time, competition between Chinese STM journals and other journals was reflected in readership, funding, reporting speed, reviewers, and editors (34.38%, 29.57%, 24.77, and 20.33%, respectively).

When responding to a question about the "management policy of the same kind of journal", 416 (76.89%) respondents indicated that "guiding the construction of characteristic journals and reducing the degree of homogeneity" were important. A total of 348 (64.33%) respondents considered that "controlling quantity, supervising quality, and maintaining a healthy competitive environment" were effective policies. A total of 276 (51.02%) and 267 (49.35%) respondents selected "focus on helping the strong colleagues to eliminate low-level duplication of the journal" and "decentralization, encourage the innovation of scientific and technological journals", respectively. These results are very similar.

20.5.6 Development of the Chinese Science and Technology Boom Index

The Compilation of the Boom Index of STM Journals

The boom index of STM journals refers to the creation of a synthetic index (CI), the index of a comprehensive STM journal industry that includes demand, supply, policy, cost, and income. These features make up the boom index of STM journals. The boom index of STM journals is a dynamic and comprehensive industry index that can reflect the prosperity of the industry. It also monitors and predicts fluctuations in the STM journal market.

The index compilation method adopted by the industrial boom index is a synthetic index method used by the US Department of Commerce. The National Housing Boom Index is another method that can be used to calculate a synthetic index. The China Purchasing Manager index adopts the diffusion index method, and the development of the Yangtze River Industry index is a comprehensive use of the boom questionnaire and diffusion index.

In this chapter, using the above compiling method for the boom index, we use the synthesis index compiling method of the US Department of Commerce, which will reflect the health of the STM journal industry. The boom indicator system for STM journals includes a synthesis index, a consistent synthesis index, and a lag synthetic index. These will identify any recessions, recovery, expansions, and contractions within STM journals. Furthermore, the boom index has monitoring and forecasting functions.

The Classification of a Prosperity Index for STM Journals

Advance Index (Leading Indicators). The first index refers to the index of peaks or valleys before the macroeconomic fluctuation reaches the peak or trough. The general antecedent index should meet the following conditions: The peak (or valley) point of each special cycle of the sequence is at least three months prior to the reference cycle. This first relationship is stable; that is, there is not much difference between the super prophase and the sequence in the last two cycles. The peak (or valley) of the special cycle should remain ahead, and the lead time is more than three months. The economic nature of the index has a definite and clear antecedent. The first index has an antecedent character. There are are two reasons for this. First, some advance indicators act as forecast indicators of business trends, such as "predicting business conditions". Second, future economic activities will result in business changes; for example, such indicators include hiring new staff, new construction areas, and new residential areas. In many countries, the advance index is regarded as an important basis for short-term forecasts.

There are four leading indexes for STM journals: economic index, policy index, academic environment index, and technical progress index. Scientific research and experimental development funds can be used as an index to evaluate the input, scale, and intensity of science and technology in a country or region. These will reflect the future economic index of the STM journal industry. The policy index mainly determines which policy will be applied to the STM journal industry; for example, the journal quality project and the project for journals with international influence.

Consistent Indicator (Coincident Indicators). The consensus index (also known as the synchronous indicator) of STM journals measures the peaks and troughs and the date of the benchmark economic cycle fluctuations. Therefore, the consistent indicators reflect the current situation of the boom.

The consistent index of STM journals mainly includes:

(i) Sequence overall operation level: the publication scale of journals in the news publishing industry
(ii) Journal group level: based on the point of view of citation networks, the paper extracts the monitoring index of journal group level from the aspects of journal subject, publishing language, and adopting new media technology
(iii) Journal level: reflecting the operation index of STMjournal industry from individual journal level
(iv) Thesis level: to reflect the operating index of STM journal industry from a single thesis level.

Lagging Indicator (Lagging Indicators). The lagging indicator refers to the benchmark turning point, lagging behind the economic cycle fluctuations. The effect of the lag index is that its peak or valley appearance can confirm that the peaks or troughs of the economic fluctuations are indeed appearing.

A lagging index of STM journals includes the following features: qualitative index: a qualitative index that can be used to measure the development level of STM journals, including the status of major international retrieval systems; quantitative index: including the average citation number and reference number of journals; and the liquidity index: refers to the flow of the pyramid structure in the journal hierarchy. At the top of the journal pyramid is the journal sequence of TOP100, followed by quality STM journals, core STM core journals, and general journals.

A lagging index of STM journals includes the following features:

(i) Qualitative index: a qualitative index that can be used to measure the development level of STM journals, including the status of major international retrieval systems
(ii) Quantitative index: including the average citation number and reference number of journals
(iii) And the liquidity index: refers to the flow of the pyramid structure in the journal hierarchy.

The Intrinsic Mechanism of the Consistent Prosperity Index

The consistent prosperity index of STM journals is derived from the statistic index of the STM journal industry. This index of prosperity is compiled by the consistent index of prosperity. According to the selection principle of the boom index and the compilation methods of other boom indexes, the index of the industry prosperity of STM journals is composed of demand, supply, policy, labor, cost, and income.

(i) Production index of STM journals: publication quantity of STM journals; policy indicators of STM journals: quality journals, international influence, funded journals
(ii) Input index of STM journals: scientific research and experimental development outlay
(iii) And employment index of STM journals: number of editorial staff and number of journals. All indexes of STM journals are monthly or quarterly indicators, and the monthly indices are more timely and suitable for use in the boom index. However, statistical indexes are very difficult to obtain for STM journals, and the monthly data collection is very important. Therefore, the index of STM journals uses annual STM journals to meet the requirements.

Indicator System of Boom Index of STM Journals

Principles of Construction. The evaluation index concerns certain characteristic of the evaluation object and its quantitative performance, which not only identifies particular characteristics of the evaluation object (i. e., nature), but also the quantity of the evaluation object and the dual function of qualitative and quantitative cognition. According to the needs of the evaluation task and target, the evaluation indicator system, which comprehensively and systematically reflects a series of evaluation objects, has a relatively complete and structured relationship. The evaluation index and indicator system is a reflection of the whole or part of the subject, and the evaluation index and indicator system accurately reflect the true degree of certain matters. This is the basic guarantee of scientific and technological evaluation results.

The formation of an evaluation indicator system is a complex process because the indicator system itself is a complex system. Furthermore, it is an organic system composed of a series of interrelated evaluation indexes. Therefore, the design of a complete, scientific, and systematic indicator system is not a simple and random process, but a complex process of multiple interconnected features. The SMART (SMART) system is used by the World Bank and many national government departments and organizations as a guideline for the design of evaluation indicators. The SMART criteria essentially provides a description of the basic requirements for general evaluation index design.

It is a complicated task to comprehensively evaluate the prosperity index of STM journals. Therefore, the establishment of an indicator system of STM journals' prosperity index should follow the following principles.

Principle of Purpose. The selected index should be able to objectively describe the essential characteristics of the object and should serve the purpose of the evaluation. The construction of the boom index of STM journals should take any development trends and impact factors of STM journals into consideration.

Principles of Science. This is the basis to ensure that the evaluation structure is accurate and reasonable. That is, the meaning of the indicator system should be accurate and clear. The creation of an evaluation indicator system must be complete, so it can fully reflect the essential characteristics of the evaluation object. There must be a logical relationship between the indicators in the system, and the indexes should be adapted to the evaluation object and the evaluation target. In this way, the characteristics of the boom index of STM journals are reflected from different perspectives. Furthermore, the definition of the index should be clear and exact and the method needs to be scientific to ensure the credibility of the index.

Principles of Operability. All indicators should be able to reasonably quantify and have comparability and realistic feasibility.

The Principle of Completeness. The indexes in the evaluation indicator system must be fully understood and the ability of each cannot be evaluated in isolation. We need to focus on the characteristics of the boom index of STM journals and comprehensively evaluate the index of STM journals in different levels and to different degrees. To fully evaluate the prosperity index of STM journals, the indicator system should be comprehensive and objective, and able to reflect the overall situation of the evaluation object. The design of scientific and technical personnel evaluation indicators need to reflect the requirements of the introduction of scientific and technological journals. Furthermore, the evaluation indicator system should be able to comprehensively reflect the introduction of STM journals and evaluation objectives. The objective elements require comprehensive consideration to achieve the overall goal. Of course, the system should be kept as simple as possible, and this is conducive to the evaluation of the development and evaluation of the reliability of the improvement.

Construction Method. Generally speaking, the methods of scientific evaluation indicator system usually include the following processes:

A. *Evaluation indicator system-building methodology (primary method)*
   The construction of an evaluation indicator system is mainly based on questionnaire surveys, AHP, frequency statistical method, theoretical analysis method, and an expert investigation method (e. g., the Delphi method); thus, the primary indicator system is formed.
B. *Evaluation indicator system test method (preferred method)*
   The indicator system test mainly uses various qualitative and quantitative methods to detect the integrity, systematicness, accuracy, feasibility, reliability, scientificity, relevance, coordination, and redundancy of the indicator system. The method of expert judgment is generally based on quantitative testing.
C. *Evaluation indicator optimization methodology*
   The optimization of the evaluation indicator system structure mainly concerns the depth of the levels, the number of A levels, and the existence of a network structure. It can also be a combination of qualitative and quantitative analysis.
D. *Quantification and treatment of indicators of evaluation*
   Index quantification (i. e., the determination of the index attribute value) usually concerns the quantification of a quantitative index and a qualitative

index. Quantitative indicators are generally quantified and investigated. However, qualitative index quantification can be divided into two kinds: a direct quantification method and an indirect quantification method according to the features of the object. The direct quantification method gives a quantitative quantity (such as the direct scoring method) and a certain quality mark line. The indirect quantification law represents a set of all the possible values of the qualitative index. The value of each unit is converted to a quantity by registering the values of the variable and then quantifying the elements in the *qualitative index set* to that value.

Because the evaluation indicator system reflects the scale and level of the specific evaluation object from multiple perspectives and levels, the evaluation indicator system is an information system that reflects the subject of the evaluation. It also constructs an information system that reflects the whole picture or the important characteristics of the subject. The structure of the system generally includes the configuration of system elements and the arrangement of the system structure. In an evaluation indicator system, each index is the element of the system, and the interrelation of each index is the system structure. An important feature of the system is hierarchy; therefore, in the construction of a STM evaluation indicator system, AHP is generally used to establish the hierarchical structure model of the indicator system. Then, the index is used to filter and optimize the structure of the indicator system.

AHP is a practical multiattribute evaluation method developed by Professor Saaty in 1971. AHP is a combination of qualitative and quantitative analysis, and integrates qualitative and quantitative analysis. It is a simulation of human decision-making processes and can be used to solve complex multifactor systems, especially difficult-to-quantify social systems. Since 1982, the following processes have been applied in China: energy policy analysis, industrial structure research, STM achievement evaluation, development strategy planning, and personnel assessment.

Relying on qualitative analysis and decision-making based on experience, the results often lead to decision-making errors. A large number of mathematical methods rely solely on mathematical models to solve decision-making problems, which places an uneven emphasis on quantitative analysis. For many economic and social problems, it is difficult to rely solely on quantitative mathematical models. Although theoretically speaking a mathematical model seems appropriate, it is not always suitable for decision-making and the prediction of practical activities. Therefore, quantitative mathematical methods are not omnipresent. In addition, there are a number of factors that cannot be quantified in the decision-making process. It is necessary to rely on the experience and knowledge of the decision-maker to make a judgment even if the model is able to quantitatively describe the factors, in order to rationally use quantitative technology and establish the correct mathematical model. Furthermore, the analyst's personal experience and judgment cannot be completely removed and affect the whole process of decision-making. AHP is able to decompose the elements of decision-making into a target, criterion, scheme and so on, on the basis of which the author provides a quantitative description of human subjective judgment.

AHP decomposes a complex problem into several levels, and establishes an ordered hierarchy (i. e., a hierarchical structure model) in which the elements in each level have roughly equal status and have a certain connection with the previous level and the next level. In this way, people's experience and judgment can be expressed and dealt with as a quantity. That is, when comparing the importance of 22 factors, we use the results of 22 comparisons as the elements of the judgment matrix. To obtain each factor's relative importance in the sorting results, we construct the judgment matrix by solving the matrix of the largest feature roots and corresponding eigenvectors. A rigorous logical analysis and statistical test of the results of the comparisons and judgments ensure that the judgment elements and judgment matrices are consistent in the synthesis process.

The main steps of the AHP approach include the following aspects: structuring and systematizing the assessment of the problem, listing the related attributes, and establishing the target hierarchy. The goal-level architecture of AHP can make use of group decision-making or expert assistance, such as Delphi, brainstorming, or nominal group technology. The set of attributes within each level of the target hierarchy is based on the previous level of the target, and by repeatedly evaluating and correcting the selected attributes, the principles of integrity, deconstruction, scalability, repeatability, and minimization are ensured. The evaluation attribute and the paired comparison matrix of different schemes are established under each attribute. After constructing the target hierarchy, we will evaluate the relative importance of these two attributes to the upper level target, and then target any two of the attributes at a certain level. This method enables policymakers to focus on the judgments, and through the analysis of architecture and patterns, they will not lose control of the problem. The relative weights of each attribute and the relative evaluation values of each scheme are computed using eigenvectors. Consistency can be verified either by correcting the consistency requirement or by reopening the comparison matrix for the corresponding attribute.

Construction of the Boom Index of STM Journals

Investigation into the Influential Factors of the Development of Chinese STM Journals. To obtain more accurate and comprehensive indexes, we use surveys to investigate those factors that influence the development of Chinese STM journals. A total of 541 questionnaires were collected.

From the survey results, the existing policy of STM journals has a considerable influence on the construction of quality journals and the promotion of the plan to increase the international influence of Chinese journals. Another important factor is the acceleration of and integration with new media.

When questioned about the most important development aspect, 85% of respondents stated sufficient funding, while 80% responded stable staffing. Furthermore, 54.9% of the respondents thought that STM journals now enjoy a stable development pattern and that the development environment has little influence.

Constructing a Hierarchical Framework for the Boom Index of STM Journals. Based on the questionnaire analysis, this chapter identifies the boom index of STM journals and modifies and perfects the established evaluation indicator system using the expert consultation method. This mainly revolves around whether the evaluation index is reasonable, whether it can fully reflect the introduction of the boom index, and whether it is convincing enough to obtain the opinions of experts.

According to revised views to improve the evaluation framework and indicators system, the experts' feedback will be used to modify the index. After repeated discussions, the final formulation of a complete scientific and technological journals indicator system using a hierarchical structure model is described below.

Indicator description:

- III-1 Scientific research and experimental development funding: refers to the research and development funds provided by national science and technology funding into statistical journals.
- III-2 Chinese Journal Support Fund: selected by the Chinese Science and Technology Association led by the quality of scientific and technical journals to support the project.
- III-3 English Journal Support Fund: the selection of internationally influential journals funded by CAS.
- III-4 The number of new journals: the number of newly established journals approved by GapP each year.
- III-5 New financial support: refers to the increase of national financial science and technology allocations.
- III-6 Total number of journals published: the total number of STM journals published by the General Administration of Press and Publication.
- III-7 Average period in print: the average period of the annual publishing by the General Administration of Press and Publication.
- III-8 Citation frequency: the total average citation frequency of STM core journals.
- III-9 Impact factor: the average impact factor of STM core journals.
- III-10 Annual index: the average annual index of STM core journals.
- III-11 Literature sources: sources of literature.
- III-12 Size of editorial team: number of registered professional editors nationwide; national publishing industry practitioners.
- III-13 Citation average: the average number of citations per STM journal.
- III-14 Article funding ratio: the proportion of provincial and ministerial-funded papers in scientific journals.
- III-15 SCI journals: the number of Chinese journals included in the SCI database.
- III-16 Ei journals: the number of Chinese journals included in the Ei database.
- III-17 MEDLINE journals: the number of Chinese mainland journals included in the MEDLINE database.

The Determination of the Index Weight of the Boom Index of STM Journals. The basic principle of AHP is the principle of sequencing, which is the basis of decision-making. The goal and characteristics of the boom index of STM journals, and the comparison of each level of attributes, constructs a paired comparison matrix between the attributes of the targets. According to the construction of the judgment matrix, and the consistency of the test, the index weights can be determined.

An Empirical Study on the Boom Index of STM Journals

According to the indicator system and its weight of the boom index of STM journals, this section empirically studies the boom index by collecting the actual data from CTPCD.

The data sources used in the empirical study include the following:

- III-1 Scientific research and experimental development funds
- III-2 Chinese journal support
- III-3 English-language journal support: data source uses CAS to lead the Quality Science and Technology Journal Financing Project, the Outstanding

Table 20.22 Boom index of STM journals (1999–2013)

Year	1999	2000	2001	2002	2003	2004	2005	2006
CI	11.37	10.36	503.42	550.10	677.09	732.68	847.69	1000.00
Year	2007	2008	2009	2010	2011	2012	2013	
CI	1091.15	1215.36	1304.49	1227.66	1281.44	1270.49	1091.15	

International Journal Award, and the International Influence Journal Financing Project

- III-4 The number of new journals
- III-5 New financial support: data from the National Bureau of Statistics supporting the funding of research and development (1999–2013)
- III-6 Total number of journals
- III-7 Average period print
- III-8 Citation frequency
- III-9 Impact factor
- III-10 Annual index
- III-11 Source literature (quantity)
- III-12 Professional editors: data are from the General Administration of Press and Publication's annual statistical report (2005–2013)
- III-13 Average number of citations
- III-14 Article funding ratio
- III-15 Number of journals in SCI
- III-16 Number of journals in Ei
- III-17 Number of journals in MEDLINE: data sourced from ISTIC and Chinese Science and Technology Statistics and Analysis (2001–2013).

With 2006 as the benchmark, the remaining years of the boom index were multiplied by the weights of the index values of each level and the 2006 values. Thus, the 1999–2013 boom index of STM journals was calculated as shown in Table 20.22.

As can be seen, the boom index of Chinese STM journals showed a rising trend from 1999 to 2013 (Table 20.21). These results should be interpreted with care because there was a lack of data for 1999 and 2000, and because the index score itself is low, the calculation of the boom index is very small and can almost be considered an outlier.

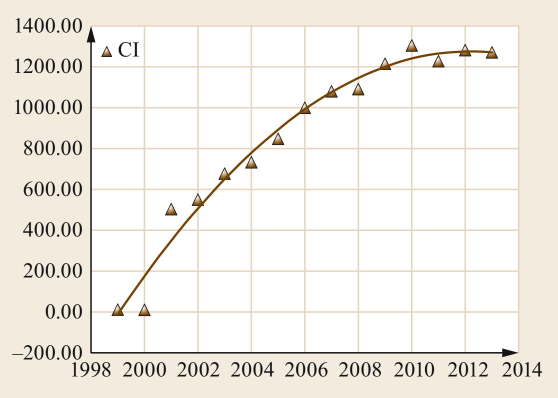

Fig. 20.1 Boom index of Chinese STM journals (1999–2013)

With the 2006 benchmark, the 2006 boom index was calculated at 1000. In the remaining years, the boom index was multiplied by the weights of the indices at all levels and by the 2006 benchmark.

As can be seen from Table 20.22, the 2001 boom index is 503.42, almost half the 2006 value. This result was obtained because prior to 2001, China's STM journals industry boom index was low. Between 2001 and 2006, the boom index maintained rapid growth, with the annual growth rate reaching 26.04%.

Since 2007, the Chinese STM journals industry has stepped up a level, with a boom index of more than 1200 points. Since 2009, the boom index has stabilized at 1200–1300 (Fig. 20.1). However, the pace of growth has slowed accordingly. The average annual growth rate in 2006–2013 was approximately 4.07%. From the above research, the boom index objectively reflects the development of China's STM journal industry.

20.6 The Definition and Application of Comprehensive Performance Scores (CPS) for Chinese Scientific and Technical Journals

STM journals play an irreplaceable role in scientific development and innovation activities, and the scientific progress and sustainable development of journals are the necessary guarantee and key link in the advancement of national science and technology. The research and evaluation results of STM journals are the basic guarantee of scientific decision-making in the management of STM journals and are effective tools to promote the development of STM journals themselves.

Because journal evaluation is a very complicated process that involves a wide range of fields, it is difficult to comprehensively and accurately evaluate the academic level and subject status of a single index. This needs to be evaluated by a comprehensive index, so as to make journal evaluation more objective, comprehensive, and accurate. In the past, the comprehensive evaluation of journals in a particular area was generally divided into two types. One type was experiments based on existing indicators, using mathematical statistical methods or mathematical models for numerical calculation. Methods include principal component analysis [20.36], normalization method [20.37], factor analysis method [20.38], and the rank-sum ratio [20.39]. The advantage of using these methods lies in the objective data that is based on the citation statistic or the literature measure method. The evaluation method is a mature mathematical statistical method. The evaluation process facilitates the public to accept supervision. There are also some limitations in the availability and sustainability of large-scale data. The second approach to the comprehensive evaluation of journals is to adopt AHP or other weighting methods and to summarize several indexes according to the method of normalized weighted calculation. This method has strong operability and applicability, and is often used in large-scale evaluation projects with a large evaluation range, longer time window, complex evaluation indexes, and many evaluation objects. It usually involves the design and creation of a comprehensive evaluation indicator system, using AHP, expert investigation, or other mathematical methods to determine the weights of each index. This is done to find the comprehensive index ranking value and finally to obtain the comprehensive ranking of journal indexes. In the practice of comprehensive evaluation of journals, it is a key technical point to realize interdisciplinary comparison, which is usually achieved by means of standardization [20.40].

20.6.1 Definitions

The comprehensive performance score (CPS) evaluation (hereafter, *comprehensive evaluation score*) of Chinese STM journals is based on the comprehensive evaluation indicator system of such journals. According to the value of periodical indicators in each subject category, the relative position score of each journal in its discipline is calculated, and the comprehensive evaluation score is made up by weighted value of all relative position scores of each indicator.

The annual Citation Report (Core Edition) of China Science and Technology Journals, published by the ISTIC (CSTPCD), regularly publishes measurement indexes of source journals of Chinese STM papers that are cited in other papers [20.41]. Based on that index, the comprehensive evaluation indicator system of Chinese STM journals was developed in 1999 [20.42]. Each index in the evaluation indicator system is not equal to the function of the journal when calculating the total score; thus, different indexes are given different weights. The initial index weight distribution was determined using a Delphi expert investigation method and AHP. Subsequently, with further research and the application of feedback in practice, the new measurement index is continuously supplemented. To assimilate feedback from all walks of life for the evaluation results in a timely manner, the CSTPCD has held more than 20 expert seminars. For those seminars, the institute invited scientific metrology experts, scientists, experts and scholars in science, technology, and journal management to participate. To improve the evaluation system and methods for the current set of scientific and technological journals, the CSTPCD established indicators and assessed weights and adjustments. CPS evaluation is based on the principle of scientific metrology; it comprehensively covers the indexes of evaluated journals. The comprehensive evaluation indicator system of Chinese STM journals is used to classify, divide, and assign different weights to journal indexes; the weighted scores of each index are collected to obtain the total score of the evaluated journals as well as the ranking within the scope of the subject area and within the whole range of journals. Generally speaking, the higher the value of the comprehensive evaluation index, the higher the comprehensive academic quality and influence level of the journal in its subject area.

20.6.2 Index Calculation

In line with the evaluation aims, scope, and angles of different journal evaluations, the index range and corresponding weight distribution are often adjusted when assessing STM journals. Taking the Citation Report of Chinese STM Journals in 2015 (core edition) as an example, the total score of the comprehensive evaluation is the score of the TC, the core impact factor (IF), and the score of six indexes (such as the index (OT), fund thesis ratio (NT), citation rate (RE), and open factor (OP)) according to the relative position of the evaluated journal in its discipline; these indexes are integrated according to certain weight coefficients. The specific algorithm is as follows,

$$\mathrm{CPS} = \sum_{i=1}^{n} \mu_i k_i ,$$

where n is the index quantity (six indexes) and the weight coefficient of the index, k, is the relative position score of an index of the appraised journal in its discipline. k is calculated as follows,

$$k = \frac{x - x_{\min}}{x_{\max} - x_{\min}} ,$$

Table 20.23 Calculation of total score of a chemistry journal

Indicator	Value x	Maximum value in chemical science x_{max}	Minimum value in chemical science x_{min}	Relative position score k	Weight μ	Weighted score $^{\mu}k$
TC	2541	4122	100	0.607	26	15.8
IF	1.057	1.954	0.177	0.495	26	12.9
OT	0.87	0.95	0.53	0.810	18	14.6
NT	0.91	0.93	0.24	0.971	10	9.7
RE	51.08	86.45	11.37	0.529	10	5.3
OP	29	60	2	0.466	10	4.7
CPS						62.9

where the value of an index of an evaluated journal is the maximum value of its subject, which is the minimum value of the index of the subject.

The total weight coefficient is designed to be 100; the total score of the comprehensive evaluation is from 0 to 100. The weight distribution of the six indicators adopted in the Citation Report (core edition) of China Science and Technology 2015 was determined using the Delphi expert investigation method. The specific weight distribution was as follows: TC, 26; IF, 26; OT, 18; NT, 10; RE, 10; and OP, 10.

An example appears in Tables 20.23 and 20.24. The index values of a particular chemistry journal in 2014 were compared with the extrema (maximum and minimum) of the corresponding indexes of all chemistry journals. The scores of relative positions of each index were obtained and the total score of the comprehensive evaluation of the journal was weighted.

The same method can be applied for all Chinese science and technology journals to calculate the total comprehensive evaluation score. For 2014, the total comprehensive evaluation score of 38 Chinese science and technology core journals was 62.9, which ranked them fourth in the world. By contrast for 1989, the ranking of all China's scientific and technological core journals was 231.

With respect to calculating the corresponding comprehensive evaluation score, some journals in Citation Report of Chinese STM Journals in 2015 (core edition) covered different disciplines.

Table 20.24 Top ten regions for producing English-language STM journals in China

Rank	Region	Number of English STM periodicals
1	Beijing	167
2	Shanghai	34
3	Hubei	13
4	Jiangsu	12
5	Sichuan	9
6	Zhejiang	8
7	Tianjin	7
7	Jilin	7
7	Guangdong	7
7	Heilongjiang	7

20.6.3 Application

The comprehensive evaluation score has been widely used. In 1999, the CSTPCD established the comprehensive evaluation indicator system of Chinese STM journals. This indicator system has been used to determine the total comprehensive evaluation score of Chinese STM core journals, and is a basis when selecting Chinese STM core journals. For Chinese science and technology core journals (statistical source journals), a dynamic adjustment mechanism—annual evaluation of journals—can be applied by combining quantitative and qualitative methods. Selecting more important or representative subjects can reflect the level of development of various journals. In that selection process, comprehensive journal evaluation is applied to assess new journals. The total score of a candidate journal can be entered into the final procedure by top-third subject ranking (which is exempt from expert inquiry). Alternatively, this approach may be used to eliminate existing core journals, where the elimination is based on the comprehensive score of the journal in its subject area.

The annual Citation Report (Core Edition) of China Science and Technology Journals features a chart, which covers various academic disciplines. The chart presents a comprehensive evaluation of the total number of journals and academic rankings in addition to their total citation frequency, impact factors, and distribution of comprehensive evaluation indicators. In a comprehensive evaluation within an overall ranking table, all journals are sorted according to total comprehensive evaluation score. The values of core influence factors and total citation frequency of each journal are listed. The ranking of all the journals can be used to determine their academic quality and relative position of influence in China. In 2014, the comprehensive evaluation index of science and technology core journals in China was 40.9; the number of comprehensive evaluation indexes amounted to 50 in 517.

In 2005, the National Science and Technology Department began promoting the quality of China's science and technology journals. One step it took was undertaking an overall evaluation and monitoring of those journals so as to stimulate scientific research in dominant disciplines. The department aimed to address problems in existing STM journals, take practical measures to enhance the overall quality and scientific level of STM journals, and promote independent innovation in science and technology in China. It also aimed to encourage the country's top academic journals to attain advanced world levels. The third session of China's top STM journals was published in 2014, and it included 315 publications. The evaluation of those quality journals involved classifying them according to subject area. Journals with higher total comprehensive evaluation scores were assessed more highly.

Since 2009, the CSTPCD has published the results that originally appeared in hundreds of outstanding academic journals in China. Those journals were selected as the most important in their various disciplines. In 2011, the comprehensive evaluation indicator system was used to assess changing trends and the current situation of academic journals in China; the indicator system for journals was modified and the index weights were approved. In 2014, 100 outstanding Chinese academic journals were identified from a total of 315 at the third session of China's top STM journals. With the classification system of Chinese STM core journals, there are 113 categories of disciplines in the natural sciences; thus, it is not possible for every discipline to produce hundreds of outstanding academic journals. During the selection process, the most important academic journals in each subject category are selected as outstanding, taking into account the nature of different disciplines and the size of the journals; an appropriate adjustment to the proportion is then made among the different disciplines.

In recent years, the China Science Association, CAS, Ministry of Health, national press, publications by the SARF, and other technical departments, as well as a number of top industrial associations and local science and technology management departments have made evaluations of academic journals using the comprehensive evaluation indicator system. In addition, journal publication departments and various research projects have made wide use of that indicator system. The total comprehensive evaluation score has emerged as an important indicator, including at the Citic Institute, for the development of scientific and technological journals in China.

In 2012, the CSTPCD and Istic-Elsevier Co., Ltd. established a research center for evaluating journals. One of the aims of that move was to promote China's outstanding STM journals to international data resources systems, such as Scopus and Ei. In selecting recommended journals for international data resources systems to evaluate those Chinese journals, the comprehensive evaluation score is regarded as one of the important objective evaluation bases [20.43].

20.6.4 Discussion

Quantitative indexes established using the citation analysis method can be employed to measure the attributes and distribution of papers published in STM journals. Such indexes can also be utilized to determine the influence and function of periodicals in scientific communication. The main purpose in evaluating and monitoring STM journals in the present study was to assess the evaluation indicator system of Chinese STM journals: it is important that the system accurately reflects the main characteristics of such publications from various angles. The indicator system has to reflect the overall development of STM journals and allow a comprehensive evaluation of each index to be accurately made. Journal editors and publishers may use the indicators to identify their own characteristics and deficiencies, which can assist them in developing the direction of their publications. Based on the quantitative index, the comprehensive evaluation score is an objective standard that reflects the influence level of journals. The score can be used to make an all-inclusive assessment of a journal's overall status with respect to various kinds of STM management.

Using the comprehensive evaluation indicator system of Chinese STM journals developed by the CSTPCD, the present study calculated a number of scientific measurement indexes. This study employed the AHP to determine the weights of important indexes; it evaluated each journal comprehensively and it calculated the total score for each publication. With the comprehensive evaluation indicator system, the total comprehensive evaluation score accommodates differences in the background value of the overall index among different subject areas; thus, it permits an appropriate comparison to be made.

If we assume the IF of physics journal A in 2014 to be 1.066 (average of the maximum (1.954) and minimum (0.177) values of the IF of the subject), the relative position of the journal in the IF index is 0.5. At the same time, the numerical value of the IF of mathematics journal B in 2014 is 0.341 (average of the maximum (0.602) and minimum (0.079) values of the IF of the subject), and the relative position score of the journal in the IF index is also 0.5. There is almost a three-fold difference in the IFs of journals A and B; however, their relative positions in their respective disciplines are the same.

Thus, based on the relative position score and index corresponding to weight, the scores of the two journals' IFs are the same. It is evident that regardless of the value of journal indicators, comprehensive evaluation of a journal permits an evaluation of its relative level within its own discipline; this allows an interdisciplinary comparison among different disciplines.

Some small journals that receive many citations often achieve the highest influence level: almost all the indicators of such journals are greater than those of their peers in the same subject area. The total comprehensive evaluation score signifies the relative level of a journal in its discipline. Accordingly, a single show journal will achieve a higher overall score. In the Citation Report (Core Edition) of China Science and Technology Journals 2015, 15 types of journals are listed, with a total score of over 90. However, with higher-ranked journals, a number of individual indicators (e. g., IFs, total cited frequency) often do not result in a high overall score. This is due to a number of other indicators being low, the degree of reference concentration in the subject being low, or the gap between performance indicators being small. For example, the first journal in a subject area receives a relative position of 1.0. If the second-ranked journal has a number of IFs that are close to those of the first, it will also receive a high score; however, if the difference in the IFs with the second-ranked journal is large, it may receive a relatively low position score despite its ranking.

With overall progress in science and technology and the development of academic publishing and research activities covered by STM journals in China, index selection and weight distribution with the total comprehensive evaluation score will undergo continuous improvement. The score system will be enhanced to meet the management needs of STM journals and various scientific and technological evaluation needs in the country. As part of that process, the CSTPCD will obtain valuable advice and suggestions from the editorial and management sections of scientific and technical journals. The aim of the CSTPCD is to develop a rational, objective operation-evaluation system and tools to provide effective support for the appropriate management of Chinese academic publishing activities and to guide the healthy development of Chinese STM journals.

20.7 Evaluation of English-Language Science and Technology Journals in China

20.7.1 Statistics and Analysis of English-Language Science and Technology Journals in China

The present study was based on a database survey of English-language science and technology (STM) journals in China; the database was created by the ISTIC. This study analyzed the impact indexes of 307 English-language STM journals that were formally published in China. We examined such factors as publication region, year, frequency, and subject area by analyzing the journals' impact in terms of impact indexes, such as impact factor and total number of citations. The number of English-language STM journals published in China has increased and their impact has grown. However, owing to operational resources being diverted elsewhere, English STM journals in China have not undergone large-scale development.

China produces a considerable number of papers in the area of science and technology papers, and the quality of those papers is increasing every year. As of September 2016, Chinese science and technology authors published 1.7429 million articles from 2006 to 2016. In 2015, China ranked second in the world in terms of the output of English-language STM papers; its output represented an increase of 10.2%. English-language STM papers produced in China during the period of 2006–2016 were cited 14.8985 million times—an increase of 15.7%. For that period, China ranked fourth in the world.

China is a major country in terms of producing STM journals; however, it has yet to become a powerful one [20.44]. According to the national press and publication statistics of the State Administration of Radio, Film, and Television (SARFT), China in 2014 published 9966 academic journals, of which 4974 were science and technology publications [20.45]. Compared with 2012, the number of STM journals in 2014 showed an increase of just 0.4%; thus, the number of STM journals in China appears to be reaching stable levels. Scientific and technological cooperation is an important part of research. Together with advances in science and technology and globalization trends, the internationalization of STM journals has become a major development in academic publishing. English-language STM journals have come to assume a very important role as the main platform for the exchange of science and technology information.

The area of China's English-language STM journals has not been extensively researched; when it has been studied, the focus has mainly been on editing, publishing, and distribution. One investigation conducted a statistical analysis of university English-language STM journals used in Chinese universities [20.46]. The study identified 73 journals, but it found that they were not fully representative of current China-produced English-language STM journals. Previous studies have determined that English-language journals published in China lack academic influence as international journals and have low academic indicators [20.47]. The number of English-language STM journals published in various subjects in China is not proportional to the output quantity of international papers covering various disciplines in that country [20.48]. It is imperative for China to publish STM journals in English, and it is necessary to make an accurate, comprehensive analysis of those journals.

In 2001, the ISTIC established a database for English-language STM journals published in China. That database is an important reference tool for management departments and it offers an international retrieval system for accessing the data in such journals. With the rapid development of science and technology and increasing globalization, China's English-language STM journals have likewise quickly evolved; in terms of global literature, the proportion of such journals is growing. As of June 2016, according to statistics of the ISTIC, its database covered 307 domestically published English-language STM journals (with uniform domestic issue numbers). Those journals accounted for 6% of the total number of national natural science and technical journals; that number showed a 1.1% increase over the previous year [20.49]. Compared with STM core journals in Chinese, the publishing frequency of those in English is longer. Among the 307 domestically published English-language STM journals, 123 (42.2%) were published quarterly; they were followed by bimonthly and monthly publications (33.2% and 21.3%, respectively). In 2014, 1989 Chinese-language STM core journals (natural sciences) were published in China; quarterly, bimonthly, and monthly publications accounted for 8.4%, 47.4% and 40.0%, respectively. Compared with Chinese-language STM journals, the number of those in English is low, the operating costs are high, and the publication frequency is low. However, the ISTIC and institutes of higher learning are a major force in establishing domestically published English-language STM journals. In all, 140 such journals are sponsored by the ISTIC, accounting for 45.6% of the total; 201 STM journals in English were supported by two or more organizations (65.5% of the total).

Regional Distribution

This section presents details regarding the regional distribution of English-language STM journals in terms of China's 31 provinces (cities and autonomous regions, excluding Hong Kong and Macao). In 2016, the 307 journals were distributed in 23 regions. Table 20.24 lists the top ten. The greatest concentration of such journals was in Beijing, which accounted for 167 (54.4%), followed by Shanghai, Hubei, and Jiangsu; those four regions accounted for 73.6% of STM journals in English. The number of such journals was related to regional academic exchange activity and also to the number and geographic distribution of scientific research institutions. Only six English-language journals were produced in provincial regions, reflecting the lack of science and technology development in such areas.

Publication History

Before 1949, only three English-language STM journals were published in China. Thereafter, just eight were added in the 30 years up to 1979. After China's economic reform, the number of domestically published STM journals in English developed rapidly. From 1980 to 1990, 79 such journals were established; since then, every decade a large number of those journals have come into being. As of 2011, there were 50 domestically produced English STM journals. The change in the number of journals reflects the progress in China's STM development and also the course of its economic reform.

To promote the international influence and core competence of domestically published STM journals in English, the Chinese Association of Science and Technology launched the International Influence Promotion Program in 2012. The plan called for the investment of almost a billion yuan to establish domestically published English-language STM journals over a three-year period. To further promote the internationalization of China's STM journals, the Chinese Association of Science and Technology, Ministry of Finance, Ministry of Education, SAPPRFT, CAS, and the CAE decided to continue to jointly implement the Chinese Science and Technology International Influence Promotion Program [20.50]. With the second phase of the International Influence Promotion Program (2016–2018), which continues to support new English-language journals in China, it is anticipated that the number of such journals will continue to grow over the next few years.

Interdisciplinary Distribution

With the development of science and technology, academic disciplines are in a state of flux—constantly converging, deriving, and changing. A number of journals cover interdisciplinary fields of scientific research. The database for English-language STM journals published in China and the Citation Report (Core Edition) of China Science and Technology Journals (natural science volume) adopt the same method, which is as follows. According to the main distribution field of each journal, multiple subjects and the interdisciplinary content of journals are classified into two or three subjects. Depending on the discipline, the classification and code (national standard GB/T 13745-2009) and Chinese Book Data Classification (fourth edition) are used for the subject classification; this takes into account the publication history of Chinese STM journals. The source journals are then classified into 113 subject categories [20.51].

According to statistics for 2016, 16 journals were classified into more than one subject category; they accounted for 5.2% of all English-language STM journals produced in China. The 307 such journals were categorized into 96 subject areas (85% of all such categories). The most widely distributed subject area was mathematics, with 19 journals (6.2% of all English-language STM journals); that was followed by physics and engineering, which accounted for 14 and 11 journals, respectively. The three most widely distributed subjects among China's STM journals were engineering and technology, natural science, and medicine.

Statistical Indicators

The source and citation data of English-language STM journals published in China originate from Wanfang Data–Digital Periodicals. Table 20.25 presents the main source indicators for such journals. In that table, *author number of articles* refers to the average number of authors of each paper in the source journal; it is an index of the scientific production capacity of journals. As indicated in that table, the average number of authors for 2014 was 3.98. That figure showed little change from the previous three years. The average number of authors of statistical source journals of Chinese scientific papers (natural sciences) was 4.1 [20.52]. In 2014, the average number of citations of English-language STM journals published in China was 29.9; that is a five-fold increase over 2011. Also in 2014, the average number of citations of Chinese-language STM core periodicals (natural sciences) was 17.1; lower than the figure for English-language journals by 12.8. Compared with statistical source journals, the papers published in China's English-language STM journals have more reference to previous ideas or research results; they are more in line with international standards with regard to bibliographic standardization.

The proportion of papers published by overseas authors in domestic publications compared to the total number of papers in overseas journals is a measure of the degree of internationalization of domestic journals. In 2014, domestically published English-language STM journals showed a slight decline in the number of papers from overseas compared with the previous three years. However, the number of overseas papers showed an increase of more than 50%. In 2012, overseas papers were published in 24 journals, which was less than 50% of the 49 for 2014. In 2014, five overseas papers were published in the following English-language journals: *Frontiers of Biology*, *Current Zoology*, *International Journal of Disaster Risk Science*, *Bone Research* and *Forest Ecosystems*. Attracting more manuscripts from overseas is a problem facing most domestically published journals in English. The proportion of papers that receive funding is an important index of the academic quality of journals. In 2014, the proportion of such papers in English-language STM journals was 65%, which is higher than the average for Chinese-language STM journals (natural sciences) for the same year.

Table 20.26 presents the main citation indicators of English-language STM journals published in China. It is evident that from 2011 to 2014, the total number of citations, impact factors, and the immediacy index

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Table 20.25 Main source indicators of English-language STM journals published in China

Indicators	Chinese Journal of English Science and Technology				China Science and Technology core
	2011	2012	2013	2014	CSTPCD 2014 (Natural science volume)
Author number of articles	3.9	3.9	3.8	4.0	4.1
Average number of citations	24.9	27.5	28.4	29.9	17.1
Overseas papers rate	0.23	0.25	0.22	0.16	0.02
Funded papers rate	0.71	0.64	0.44	0.65	0.54

Table 20.26 Main citation indicators of English-language STM journals published in China

Indicators	Chinese Journal of English Science and Technology				China Science and Technology core
	2011	2012	2013	2014	CSTPCD 2014 (Natural science volume)
Total citations	385	380	369	433	1265
Impact factor	0.391	0.370	0.371	0.467	0.560
Immediacy Index	0.092	0.115	0.107	0.132	0.070
Other citation rate	0.84	0.84	0.84	0.85	0.82

showed an increase. This indicates that the impact of such journals is rising. *Total citations* in Table 20.26 refers to the total number of papers of a journal that received citations since the journal's inception: it reflects the extent to which the journal has been used and valued as well as its influence in scientific communication. Owing to the language used in journals and other reasons, the total citation frequency of English-language STM journals is much lower than that of Chinese-language ones. In 2014, English-language journals were cited 433 times; that means a 64 times increase comparing with 369 times in 2013.

Impact factor (IF) refers to the number of citations that appeared in the two years prior to a journal's evaluation. It is a measure of the journal's academic impact. The change in the IF for 2011–2014 for English-language STM journals and the Chinese-language STM journals is indexed by CSTPCD. Noticeable is that the IF of Chinese-language STM papers displayed a gradual increase during that period, while the IF of English-language journals was relatively steady. In 2014, a major improvement occurred: the IF of English-language journals in that year was 0.467, which was 25.9% higher than the 0.371 in 2013.

The immediacy index refers to papers published the same year as a cited paper: it characterizes the rate of immediate response indicators. The annual index of English-language STM periodicals published in China in 2014 was 0.132. It is evident in Table 20.26 that the instant reaction rate of such journals was slightly higher than that of the *Journal of Statistical Sources* (natural sciences) among Chinese-language STM journals. The quoted rate refers to the total citation frequency divided by the number of other citations accounted for in the ratio. The Chinese English-language STM periodicals are relatively stable in this rate, maintained at about 0.85, slightly higher than China's scientific and Technological paper Statistical Source Journal (natural science part) of his cited rate.

International Impact

International cumulative citation data for English-language STM journals published in China were derived from the Web of Science (SCI) database of the Thomson Reuters Group for 1995–2016 (as of June 2016). As of June 2016, such journals published in 2013–2014 were cited more than five times in 19 different journals. In 2016, only seven of the indicators exceeded five times. The number of English-language journals has increased greatly since June 2016; this indicates that the international influence of such journals is rising. The number of journals cited more than 300 times in 2016 was 13; that figure was seven in 2014.

According to the 2015 Journal Citation Report (retrieved in June 2016), among the 307 English-language STM journals published in China, 133 (43.3%) were included in SCI. Nine of China's English-language journals appeared in the top 25% of SCI journals in 2015; that compares with six in 2012; among those, the *Asian Journal of Andrology* (medicine specific to men) ranked first. Among China's STM journals, 133 covered 86 subject areas; among those, three were classified into four categories, ten into three categories, and 37 into two categories.

Conclusion

With improvements in China's academic quality and international influence, domestically produced English-language STM journals have undergone rapid development. The number of such journals has achieved basic stability: it has shown an increase of 1.1% compared with the previous statistical year. As of June 2016, 307 English-language STM journals were being produced in China (with a uniform domestic issue number). Such journals are an important platform for demonstrating the level of China's science and technology development and also enhance international cooperation.

Producing English-language STM journals demands high resource costs. The production of half of such journals in China is concentrated in Beijing; the next highest areas of production are in Shanghai, Jiangsu, and Hubei. Some scientific papers originate in China's provincial regions; however, some economically developed regions do not produce an appropriate number of English-language STM journals.

The key to an English-language journal's success is that it should be an internationalized operation that is able to attract outstanding papers from overseas. In 2014, overseas contributions accounted for more than 50% of papers in the case of 49 journals published in China. Compared with the previous statistical year, that is an increase of 25 journals. However, the overall level did not improve, and there is considerable room for development.

Among the 307 English-language STM journals produced in China, 85% cover 96 subject areas. The most common subject area is mathematics. English-language journals need to develop a clear orientation. They need to expand their international audience, strengthen their international operations, shorten their publication cycles, and improve their quality. Currently, the publishing cycle of China's English-language STM journals is relatively long: 42.2% of such journals are quarterlies.

The total citation frequency and influence factor of English-language journals have improved compared with the previous statistical period. The international cumulative index of the journals has also improved. As of 2016, 133 English-language STM journals were included in SCI: nine featured among the SCI's top 25% of journals, which was an increase of three over the previous statistical period. That is an indication of the growing influence of English-language STM journals produced in China.

20.7.2 Communication Value of China-published English-Language Academic Journals According to Citation Analysis

Introduction

The Bible has been translated into more than 1800 languages, but there is no definitive figure as to the total number of languages in the world. People use thousands of different languages. The communication barriers posed by language differences clearly affect cultural exchange and information sharing among different countries and nationalities. For barrier-free exchange among nations, there would seem to be only two ways to design and create a world language for all to learn based on natural human language. In this regard, linguistics has created a specialized discipline, termed Esperanto linguistics (Interlingua). Many studies and attempts have been made towards that end, but it would appear to be a dead end. The second option is to make a natural language to fulfill the role of Esperanto and become the mother tongue or second language of all people [20.53]. In view of the current world situation with respect to language development, English is widely learned and clearly used as Esperanto was created to be used. Notably, in activities related to international STM research and exchange, English plays a central role.

Abram de Swaan describes the relationships of various languages in the world in terms of supercentral, central, and peripheral languages [20.54]. A supercentral language is analogous to a star surrounded by planets (central languages), and the planets have their own moons (peripheral languages). When native speakers of one language learn another language, they often choose a broader language within the system of languages. Each supercentral language is associated with a number of users of central languages. With time, a large number of central language groups become linked to an oversized language group among the supercentral languages as a result of multilingual users.

The importance and position of a language in the system of world languages can be quantitatively assessed by calculating the communicative Q value of a language by means of the popularity index and central index. One study found that 12 languages—Arabic, Chinese, English, French, German, Hindi, Japanese, Malay, Portuguese, Russian, Spanish, and Swahili—constituted the supercentral languages. With the possible exception of Swahili, the number of speakers of supercentral languages is over 100 million each.

Among the supercentral languages, English is at the very center of the entire linguistic galaxy. Accordingly, *de Swaan* refers to English as the world's only hypercentral language [20.54]. Globally today, English is the most common language in science and technology. Most STM journals—especially high-quality journals—are published in English [20.55]. With the broadening of the international vision of Chinese researchers and rapid development in linguistics research [20.56], a clearer, deeper understanding has emerged in China of the role of English in science and technology. From the growing number of English-language STM journals produced in China, it is evident that English is playing an increasingly important role in its publishing and exchange activities in STM.

According to the English-language STM journal database, developed by the ISTIC, 212 English-language STM journals were published in China in 2010. The number of such journals has increased annually; the subject areas covered by those journals has also grown. Table 20.27 presents the historical development of China's English-language STM journals. It is evident that the number of such journals was very small before 1980. Over the past 30 years, the number has surged and that growth trend has been maintained [20.57].

As a result of the increasing volume of English-language STM journals produced in China, overseas scholars have devoted greater attention to the development and study of such publications. Those authors have analyzed the role of those journals with respect to research and the exchange of information related to STM in China. However, the conclusions and opinions of those scholars are not wholly consistent. Some authors believe that only by producing quality English-language STM journals can China become truly internationalized in an academic sense. For example, some

Table 20.27 Historical trend of new English-language STM journals published in China

Period	Before 1949	1950–1960	1961–1970	1971–1980	1981–1990	1991–2000	2001–2009
Number of new Chinese and English STM periodicals	2	10	2	6	75	62	54

authorities view language as the greatest obstacle: they regard it as an impediment to the internationalization of Chinese STM and that in "the internationalization of STM periodicals, English periodicals should be first" [20.58].

Some scholars believe that the number of English-language STM journals published in China falls below the country's requirements. Those authors consider that China's journals need to compete with other STM publications produced around the world; they believe that China has the potential for vigorous development and that it has a great role to play [20.59].

A number of studies have suggested that although in China the circulation of English-language STM journals is often lower than that of their Chinese-language counterparts, the impact on the readership is quite similar [20.60]. One report identified 11 characteristics of a world-standard journal, the first of which was publication in English; the second was a fully internationalized peer-review system [20.61]. However, other studies have found that there appears to be no link between international journals that are successful in China and use of the English language. One investigation conducted a comparison of various indexes of Chinese- and English-language journals in the field of materials science using an international retrieval system. The study determined that such features as the impact factor of English-language journals did not offer any advantages; it identified weaknesses as small publication scale and narrow area of influence [20.62]. Some scholars believe that publishing in English is not necessary for an international journal. They consider that the use of English or Chinese in STM journals published in China constitutes a strategic choice; whether the use of English is expected to play a key role depends on whether the journal conforms to its anticipated development strategy [20.63].

The basis for China's STM journals and the main object of publication are the vast number of Chinese people engaged in STM; such workers blindly pursue the study of English and forget the original purpose of those journals [20.64]. Some scholars believe that Chinese-language journals have a strong regional characteristic: they come mainly from China. Thus, language alone does not determine the influence of Chinese STM journals or account for their weak international competitiveness [20.65].

From the above, it is evident that current research on the role of English-language STM journals produced in China has been based on qualitative analysis methods. No objective, unified quantitative evaluation system has been applied to the topic, and so different authors have arrived at different conclusions. To attain a more accurate judgment on the value of such journals and provide objective data support with regard to their future development, the present study applies the ideas of de Swaan. This study examines the Q value of language communication, and it defines a new evaluation index using the Q value of English-language STM journals published in China.

Calculation Method of Exchange Value of English-Language STM Journals

This study takes into account differences in the prevalence of English among different subject areas. It does so with respect to the level of academic influence of journals and their degree of internationalization. This investigation determines the exchange value of English-language STM journals using quantitative research methods; it demonstrates the function and position of such journals in their subject areas using those methods.

In determining the exchange value of these journals, this study makes use of two indexes related to popularity and centrality as defined by de Swaan with regard to the language communicative value index Q [20.66]. This investigation also takes into account factors related to the international influence of such journals. Studies have shown that the number and proportion of papers cited in Chinese journals are generally lower than in overseas journals; accordingly, the international academic influence of STM journals published in China is particularly important.

The exchange value of English-language STM journals produced in China consists of three parts: popularity of English in the subject area; center of academic influence; and degree of international diffusion. For journal j in subject area i, the exchange value indicator is defined as follows,

$$Q_{ij} = \sqrt{P_i^2 + C_{ij}^2 + D_j^2}\,, \tag{20.1}$$

where Q_{ij} signifies the exchange value of the journal, P_i the popularity of English in the journal's subject area, C_{ij} the academic influence center of the journal in its discipline, and D_j the degree of international diffusion with respect to the journal's academic influence.

With the aim of an index calculation with good feasibility and validity, the indicators adopted in the present study are defined and calculated using citation analysis in scientific metrology.

English Popularity of Subjects. A notable feature of language is that the more people who use it, the greater its exchange value [20.67]. As a result, we may conclude that the greater the popularity of English in a scientific research area or the wider the use of English as an academic communication tool, the greater the importance of English-language STM journals.

The prevalence of English in a discipline can be examined by measuring the extent to which papers in that field use English. In terms of research results, the higher the absolute number of papers in English and their relative proportion, the greater the need for the communicative language to be English—and the greater the role and exchange value of English journals in that field. For a subject i, the equation for the English prevalence index is as follows,

$$P_i = \frac{N_i(\text{Engl. Ref.})}{N_i(\text{Total Ref.})}\,, \tag{20.2}$$

where P_i denotes the English prevalence of subject i, N_i(Engl. Ref.) the number of references in papers published in the particular journal on subject i, and N_i(Total Ref.) the number of all references in all journals to subject i.

Academic Impact Center of a Journal in its Discipline. Irrespective of whether a journal is in Chinese or English, the more it is used in academic exchange, the more it will be regarded as authoritative and will assume a guiding position; this will be reflected in the number of citations in other journals. Thus, the academic influence of a journal signifies its authority and academic position among other journals in a particular subject area.

In a certain field, mutual citations among journals can be used to represent the relative position of each; mutual citations reflect the academic exchange relationship and status among journals [20.68]. To determine the authority and position of a journal, the present study calculated the number of citations of a journal by other journals in the same subject area as well as the proportion of the maximum number of citations in that subject area. For subject area i, the academic impact center of journal j is defined as follows,

$$C_{ij} = \frac{N_{ij}(\text{Citation from others})}{\max_{j=1\approx n} N_{ij}(\text{Citation from others})}\,, \tag{20.3}$$

where C_{ij} signifies the academic impact center of journal j within subject area i, n the number of journals in subject area i, and N_{ij}(Citation from others) the number of citations of journal j by other $n-1$ journals in subject area i.

With this index, when the academic influence of the journal is determined, the number of citations is not taken into account. A reasonable amount of self-citation by a journal is normal in academia; it also reflects a journal's influence. However, in the present study, the emphasis is on measuring a journal's exchange value: the journal's external influence. In addition, self-citation by a journal is often susceptible to human factors and it does not necessarily reflect the influence of a paper in an objective manner. As a result, self-citation is not included in the present statistical analysis.

International Diffusion Degree of Academic Influence of Journals. The present study conducted an analysis of the exchange value of English-language STM journals published in China. The analysis included the exchange value in domestic disciplines. This study also examined the international exchange value of those journals: it investigated the achievements of Chinese STM in international academic circles and the promotion of international academic exchanges. Therefore, in designing the index for exchange value Q, this study added a third part: the international diffusion degree of academic influence of periodicals, which is reflected in the number of citations in international journals and number of citations in domestic journals. The equation for determining the international diffusion degree of academic influence of a journal j is as follows,

$$D_j = \frac{N_j(\text{NIC})}{N_j\,(\text{NIC}) + N_j(\text{NDC})}\,, \tag{20.4}$$

where D_j signifies the international diffusion degree of academic influence of journal j, N_j (NIC) the number of citations of journal j in international retrieval systems (i. e., the number of citations in international journals), and N_j (NDC) the number of citations of journal j in domestic retrieval systems (i. e., the number of citations in domestic journals).

Calculation of Exchange Value of 45 English-Language STM Journals

The present study examined 45 English-language STM journals included in JCR 2010 and the Citation Report (Core Edition) of China Science and Technology Journals 2011. This study used the CSTPCD of the ISTIC and the Scientific Citation Index (SCI) database of Thomson Reuters in the United States, respectively for domestic and international citation statistics in calculating the exchange value Q of the sample periodicals [20.69, 70]. The classification of subjects was based on the classification of the Citation Report (Core Edition) of China Science and Technology Journals 2011. All the citation analyses and calculations were based on statistics for 2010. The results of the calculation appear in Table 20.28.

As shown in Table 20.28, the Q value of the 45 journals was 1.475; the minimum was 0.676, median 1.027,

Table 20.28 Exchange value Q for 45 English-language STM journals published in China in 2010

Title j	Field i	P_i	C_{ij}	D_j	Q_{ij}
Acta Biochimica et Biophysica Sinica	Biology	0.802	0.046	0.888	1.197
Acta Mathematica Scientia	Mathematics	0.837	0.853	0.464	1.282
Acta Mathematica Sinica English Series	Mathematics	0.837	0.717	0.732	1.323
Acta Mathematicae Applicatae Sinica	Mathematics	0.837	0.085	0.775	1.144
Acta Mechanica Sinica	Mechanical	0.597	0.272	0.625	0.906
Acta Metallurgica Sinica	Metallurgical engineering technology	0.645	0.095	0.879	1.094
Acta Pharmacologica Sinica	Pharmacy	0.574	0.203	0.731	0.951
Advances in Atmospheric Sciences	Atmospheric science	0.468	0.311	0.557	0.791
Asian Journal of Andrology	Clinical	0.578	0.111	0.736	0.942
Cell Research	Biology	0.802	0.074	0.842	1.165
Chemical Research in Chinese Univ.	Chemical	0.914	0.060	0.660	1.129
China Ocean Engineering	Marine science	0.599	0.067	0.457	0.756
Chinese Annals of Math. Series B	Mathematics	0.837	0.456	0.658	1.158
Chinese Chemical Letters	Chemical	0.914	0.156	0.747	1.191
Chinese Journal of Aeronautics	Aerospace science and technology	0.567	0.198	0.372	0.706
Chinese Journal of Cancer Research	Oncology	0.802	0.020	0.512	0.952
Chinese J. Chemical Engineering	Chemical engineering	0.583	0.181	0.617	0.868
Chinese Journal of Chemical Physics	Physics	0.898	0.014	0.552	1.054
Chinese J. Oceanology and Limnology	Marine science	0.599	0.116	0.618	0.868
Chinese Journal of Polymer Science	Chemical	0.914	0.037	0.721	1.165
Chinese J. Structural Chemistry	Chemical	0.914	0.107	0.626	1.113
Chinese Medical Journal	Medical synthesis	0.520	0.346	0.560	0.839
Chinese Optics Letters	Physics	0.898	0.093	0.490	1.027
Chinese Physics B	Physics	0.898	0.594	0.381	1.142
Chinese Physics C	Physics	0.898	0.047	0.390	0.980
Chinese Physics Letters	Physics	0.898	0.330	0.642	1.152
Communications In Theoretical Phys.	Physics	0.898	0.132	0.633	1.107
Insect Science	Biology	0.802	0.034	0.683	1.054
J. Computer Sci. and Tech.	Computer science and technology	0.665	0.056	0.227	0.705
Journal of Environmental Sciences	Environmental science and technology	0.498	0.180	0.674	0.857
Journal of Genetics and Genomics	Biology	0.802	0.166	0.191	0.841
Journal of Geographical sciences	Geography science	0.375	0.002	0.890	0.966
Journal of Integrative Plant Biology	Biology	0.802	0.353	0.306	0.928
J. Mater. Sci. & Tech.	Materials science	0.752	0.153	0.743	1.068
Journal of Molecular Cell Biology	Biology	0.802	0.030	0.286	0.852
Journal of Natural Gas Chemistry	Energy science and technology	0.350	0.005	0.732	0.811
Journal of Rare Earths	Materials science	0.752	0.302	0.650	1.039
J. Wuhan Univ. Tech. Mater. Sci. Edition	Materials science	0.752	0.068	0.746	1.061
J. Zhejiang Univ. Science A	Journal of universities	0.577	0.057	0.679	0.893
Molecular Plant	Biology	0.802	0.184	0.359	0.898
Particuology	Chemical engineering	0.583	0.048	0.618	0.851
Pedosphere	Agronomy	0.361	0.100	0.563	0.676
Res. in Astronomy and Astrophysics	Astronomical	0.988	0.294	0.618	1.202
Trans. Nonferrous Metals Soc. China	Metallurgical engineering technology	0.645	0.476	0.601	1.002
World Journal of Gastroenterology	Internal science	0.826	1.000	0.702	1.475

and average value 1.004. From the distribution of the Q value, it is evident that there were only four journals with a Q value of more than 1.2; 19 journals with a Q value between 1 and 1.2, accounting for 42% in 45 periodicals; 17 journals with a Q value between 0.8 and 1, accounting for 38% in 45 periodicals; and 5 journals with a Q value of no more than 0.8. It is clear from the distribution of the Q value of the 45 journals (Fig. 20.2) that the calculated results of the sample show approximately a normal distribution.

In terms of disciplines, the 45 journals cover basic research in life sciences and engineering technology. However, there is no obvious difference in the evaluation results among the various disciplines.

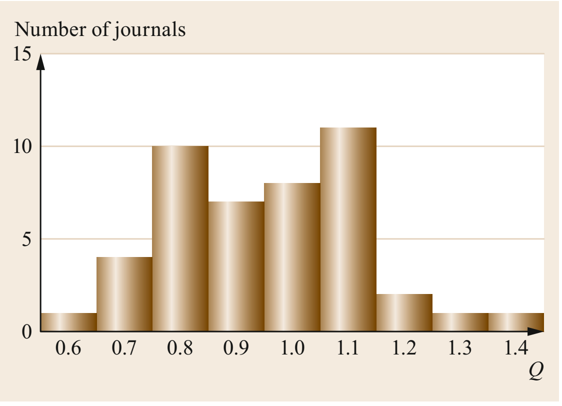

Fig. 20.2 Distribution of Q value of 45 English-language STM journals

It appears that journals in gastroenterology and cell research as well as other publications with distinctive characteristics and higher academic influence showed a good performance in terms of exchange value and Q value. At the same time, it is evident that the Q values of such journals as *Pedosphere* and *Chinese Journal of Aeronautics*, which have a clear regional bias and represent closed disciplines, are relatively low [20.71]. Therefore, it can be considered that the exchange value index Q of English-language STM journals published in China has a certain degree of accuracy; it may be used to characterize the actual role of such publications with respect to China's scientific research and publication exchange activities.

Conclusion and Discussion

Studies in linguistics have shown that English has become the only language in the world with the status of a hypercentral language. It is necessary to fully understand and use this communication tool in STM. The exchange value Q of English-language STM journals produced in China is a measure of the role of such publications in Chinese science and technology with respect to academic research and exchange activities. The exchange value Q can be used as an objective, practical quantitative analysis tool to track the development of such journals.

As evident in (20.1), the exchange value of a journal is expressed by the three coordinates of popularity (P), center (C), and international diffusion degree (D); the length of the vector formed by 0 points to the position of the journal. The relative differences in the results of those three coordinates can be likened to different angles produced by a journal in a three-dimensional coordinate space.

In subject areas where there is higher prevalence of English, Chinese STM journals are more likely to use that language for ease of communication. The prevalence of English (p) can be regarded as a measure of the international strength of a subject area. The prevalence of English can also be regarded as reflecting the demand for English-language journals as well as a reflection of the potential exchange value of such journals produced in China. The higher the proportion of Chinese researchers who access English-language literature, the greater the exchange value (potential exchange value) of English-language journals in China.

In designing the exchange value index, the difference between disciplines is considered a component. Thus, the data obtained using that index are not affected by differences in subject area. The exchange value Q of English-language STM journals can therefore be used for comparisons across disciplines.

The design of the exchange value index is based on the situation of English-language STM journals produced in China. It reflects the role played by Chinese scientific research activities. The domestic journal citation database of CSTPCD and international journal citation databases, such as SCI, are used to calculate Q. For other countries, especially non-English-speaking countries, it is impossible to use that index to calculate the exchange value of journals if they lack a complete domestic citation database like China's. Therefore, the exchange value index Q cannot be used in international comparisons. However, in a follow-up study, it will be possible to consider the value of Chinese-language STM journals and compare them with English-language journals produced in China.

The exchange value index reflects and evaluates the function of English-language STM journals produced in China from one aspect. The index cannot completely replace conventional measurement indexes of scientific journals, such as influence factor and total cited frequency. However, the exchange value index can be used as an extension to supplement the current comprehensive academic indicator system of English-language STM journals produced in China [20.47].

20.7.3 Atomic Structure Model for Evaluating English-Language Scientific Journals Published in Non-English Countries

Introduction

English-language scientific journals published in non-English-speaking countries account for only a small fraction of all scientific journals published in those countries. However, they play a particularly important role in connecting scientists whose native language is not English with their peers around the world and in improving international collaboration through scientific research. In China, for example, although over 5000 scientific journals are published (ranking it second after the United States in terms of number of journal titles published), its English-language journals amount to only about 4% of the whole [20.72]. As is well known, English is the most widely used language in almost all fields of science, technology, and current international economic and social affairs; there is a tendency to accept English as an official international language. Most scientific journals, especially the most outstanding ones, are published in English [20.73]. It is axiomatic therefore that international scientific communications and publications follow the existing trend. Accordingly, scientific journals published in English have become the major channel for international exchange and cooperation. Over 100 000 papers by Chinese scientists are indexed annually in Science Citation Index Expanded (SCIE); 14% of those papers appeared in English-language scientific journals published in China [20.74].

China aims to become a substantive member of the world scientific community. Thus, it has become important to make those few Chinese journals published in English better and more attractive to international scientists as places for publishing their academic findings. The same challenge is probably faced in other countries where English is not an official language.

In general, evaluating something is a good step towards improving it: the grades or marks accorded as part of a logical evaluation process and related to systematic indicators denote the advantages and disadvantages as well as the strengths and weaknesses of the matter under evaluation in a significant, precise, all-encompassing manner. Thus, evaluation is akin to the role of diagnosis, upon which prescription and amelioration are founded.

English-language scientific journals published in non-English-speaking countries have certain characteristics that make them different from most non-English journals. Those characteristics result in a lack of an accurate, suitable evaluation model and indicator system. Such English-language journals focus on international readers and authors; that is why their sponsors and editors made the decision to operate them in a country where English is not an official language. In China, it has been observed that international journals usually acquire more citations than domestic ones [20.75]. It is understandable why English-language journals in China do not attract many domestic authors and readers, who pay more attention to journals and articles in Chinese owing to the greater convenience of obtaining information and producing articles in their native language. Some scientific evaluation models or systems have been established for journals published in China, and English-language journals consistently obtain lower scores than most Chinese journals [20.76]. Most English-language journals deal with more peripheral fields, according to the mutual citation network, which groups journals by subject areas [20.77]; however, such evaluation results may not reflect the real academic level and impact of such English-language journals.

Most English-language scientific journals published in China are very new and limited in number and circulation; thus, they do not yet have sufficient strength to exert a wide influence and strong impact on the world scientific community. Established in 1887, China's first English-language scientific journal was entitled *China Medical Missionary Journal*. However, a recent survey conducted by W. Xu revealed that very few other English-language journals appeared in the almost 100 years that followed until the 1980s [20.78].

According to a comparison of the number of new English-language scientific journals published in China per decade, we can find that that the great majority have appeared in the last three decades; more than a quarter emerged after 2000. Those journals are so new that it would be inappropriate to evaluate them using the same standards that can be applied to other older Chinese-language journals.

More than half of China's English-language journals are not covered by SCIE. This means that most of them do not have an ISI impact factor or other indicators calculated by ISI JCR, the most popular international index of scientific journals [20.79]. Hence, neither the existing domestic evaluation system nor the normal international evaluation system is entirely appropriate for China's English-language journals.

It is possible that some of those journals may fall into a vicious cycle in the future if the current evaluation models continue to be adopted. That is because less influence leads to a lower evaluation score, a lower score leads to fewer submissions, and fewer submissions lead to less academic value and poorer impact of the journal. To address this problem, a new model, which resembles the structure of an atom, has been designed as described below to evaluate China's English-language scientific journals.

Atomic Structure Model

Characteristics of the Model. The most important achievement of John Dalton, a British chemist and physicist in the 1800s, was the atomic theory. Some scientists, including J.J. Thomson, Jean Baptiste Perrin, Hantaro Nagaoka, Niels Bohr, and Ernest Rutherford, conducted extremely fruitful research over a number of years in developing that theory and producing the universally acknowledged atomic model. As devised by Bohr and Rutherford, the atomic model is a structure

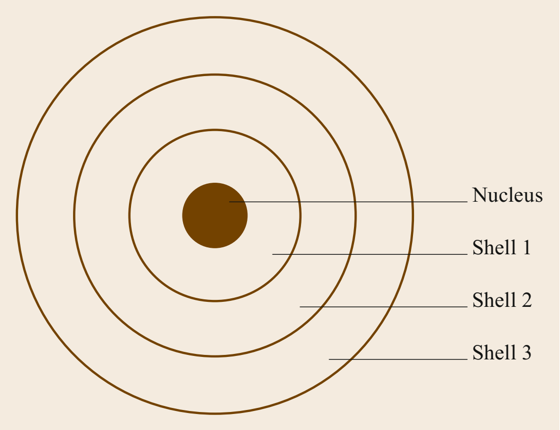

Fig. 20.3 Atomic structure model

that consists of various shells around the nucleus. In the present study, the atomic structure model (ASM) can be represented by the image shown in Fig. 20.3. There, three shells surround the nucleus, and the relationship (degree of interaction) between the shells and the nucleus gradually recedes with distance. The five characteristics of the ASM are as follows:

(1) There is only one nucleus in the system
(2) Three shells are located around the nucleus
(3) Each shell has a spherical surface
(4) Both shell–nucleus and shell–shell interactions occur
(5) The electrons on the three shells orbit around the nucleus.

Use of the ASM in Communication. Yongtao used the ASM in his study of an online communication model. According to his idea, the core of the model is human subjects, who actively push information [20.80]. All objects of information to be communicated by the subjects are distributed on the three shell layers; each shell corresponds to a different effect of communication or the environment of websites and human behavior. To maintain the balance of the whole system there are at the same time complex interactions among all elements in this model.

Scientific journals can be regarded as a branch of communication. Therefore, the ASM would appear to be useful in evaluating scientific journals.

Use of the ASM in Evaluating China's English-Language Scientific Journals. China's English-language scientific journals have some characteristics that match those of the ASM. The essential element determining a journal's academic quality is its core value. The core value is signified by the core (C). Around the core value, there are three classes of individuals located in order of decreasing relationship with the journal. They are somewhat similar to the electrons orbiting in three shells around the nucleus. As Fig. 20.4 shows, the three groups are the editors, authors, and readers. They appear, respectively, as Shell 1 (S1), Shell 2 (S2), and Shell 3 (S3) in that figure.

Editors, including chief editors, associate editors, and members of the editorial board, are those closest to the journal's core; thus, they are located in S1. In their work, they follow principles that are central to the production of a good journal, such as evaluating the quality of submissions and ensuring that the English is of an appropriate level. China's English-language journals are similar to those published overseas and are generally regarded as different from other journals produced in that

Part C | 20.7

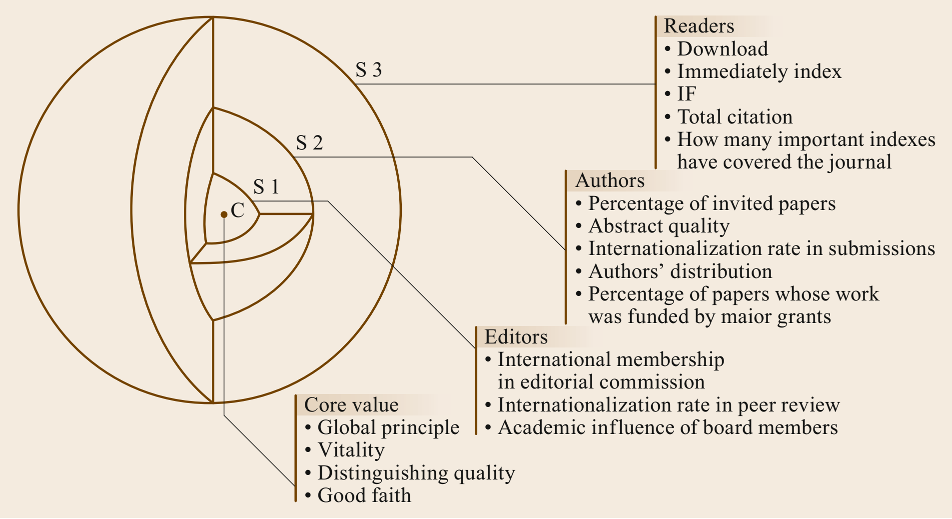

Fig. 20.4 Atomic structure model and indicators for evaluating China's English-language scientific journals

country. Therefore, to operate such English-language journals, it is a prerequisite that the editors have a global view and the capability for international exchange and collaboration. This point has to be examined in the evaluation.

S2 consists of authors whose articles are published in a journal. Clearly, a scientific journal's content mostly consists of academic articles from a large number of authors. Thus, the contact of each author with the journal may not be very frequent if they contribute only one or two submissions a year. The ability to claim a greater number of international authors is a positive attribute for international journals [20.81]. Therefore, it is necessary that the evaluation indicators reflect the quality of both authors and articles.

The most distant shell, S3, is that of the readers. Readers normally have a loose relationship with the journal's core, and direct communication between the two is ordinarily a one-way process. The evaluation of a given journal by readers offers an indirect way of observing the journal's quality by identifying and assessing its academic effect. Consequently, the following questions relating to citation analysis have to be answered to evaluate the response from readers to the journal in S3: how many readers have downloaded papers published in the journal, and what are the journal's citation indicators, such as impact factor and total number of citations?

Interaction between the shells and the nucleus occurs, just as it does among the various shells. A journal with a strong core value usually invests more resources in the journal, including human resources and financial support. In that way, the editorial team can be more effective in soliciting higher-quality submissions from good authors, and this in turn attracts more readers and more citations. This situation is similar to that of an electron's transition between shells in the ASM in that the status of all those involved with the journal changes according to the shell: a reader may become an author, and an author may become active as an editor of the journal. With a quality journal undergoing positive growth, there will be a good deal of transition from S3 to S2 and from S2 to S1: more readers will want to submit manuscripts and more editors will be required to deal with the increasing flow of manuscripts. Conversely, if a journal is not doing so well, some of its former authors will stop submitting new manuscripts, and the number of readers will also start to dwindle.

Based on the ASM for evaluating English-language scientific journals published in China, a series of tentative indicators was developed after dozens of information scientists and academic journal editors brainstormed the issue. Some of these tentative indicators were discarded owing to limited data availability or overlap with other indicators. Finally, 17 indicators were established for this evaluation model (Table 20.29).

Results

To test the usefulness of the ASM for evaluating China's English-language scientific journals, we selected 18 such journals as our sample (Table 20.30). First, we calculated the quantitative indicators for those journals, which are indicated by asterisks in Table 20.29; for the evaluation, we obtained print copies of the journals. Then, for each journal, a group of reviewers (consisting of three to five experts, including scientists in the journal's academic field and senior journal editors) were invited to make a conclusion according to the ASM indicator system. Each journal's core and three shells were rated as A (excellent), B (good), C (fair), or D (poor) through a combination of this quantitative and qualitative analysis. For example, *Journal of Computational Mathematics* was rated as A in S1, which means that editorially this journal is strong according to the three indicators listed in Table 20.29. Although the journal boasts an excellent performance, it scores only C in S2 and S3; this means that the journal's editors

Table 20.29 ASM indicators for evaluating English-language scientific journals published in China

ASM	Core value	Editors shell 1	Authors shell 2	Readers shell 3
Indicators	Global principle	International membership in editorial commission[a]	Percentage of invited papers[a]	Download times according to databases online[a]
	Vitality	Internationalization rate in peer review[a]	Abstract quality	Impact factor[a]
	Distinguishing quality	Academic influence of board members[a]	Internationalization rate in submissions[a]	Immediacy index[a]
	Good faith		Authors' distribution[a]	Total citations[a]
			Percentage of papers whose work was funded by major grants[a]	Number of important international indexes that have covered the journal[a]

[a] Quantitative indicator

Table 20.30 Evaluation of 18 English-language scientific journals published in China

Title	Core	S1 shell	S2 shell	S3 shell
Advances in Atmospheric Sciences	B	B	C	C
Biomedical and Environmental Sciences	B	C	D	D
Chinese Medical Journal	B	D	D	B
Chinese Physics C	B	D	D	C
Journal of Computational Mathematics	B	A	C	C
Journal of Environmental Sciences-China	B	C	C	C
Journal of Genetics And Genomics	B	C	C	C
Journal of Integrative Plant Biology	B	C	B	D
Journal of Iron And Steel Research Int.	C	D	C	D
Journal of Univ. of Sci. and Tech. Beijing	C	C	D	B
Science in China: Mathematics	C	D	B	C
Science in China: Chemistry	C	C	C	C
Science in China: Life Sciences	C	C	D	C
Science in China: Earth Sciences	C	D	C	C
Science in China: Technological Sciences	C	D	B	C
Science in China: Information Sciences	C	D	D	C
Science in China: Physics Mech. & Astronomy	B	C	D	C
World Journal of Gastroenterology	B	C	C	B

are unable to attract top authors and expand their readership. The publisher or editor-in-chief of this journal should perhaps consider this situation and take appropriate steps. Another example is the journal *Chinese Physics C*, which scored D in S1 and S2; this means that the combined power of its editors and contributing authors is very weak in terms of the indicators defined above. Therefore, from this evaluation result, it would appear that the journal needs to make great efforts to bolster the capacity of its editors so as to attract better authors and improve the quality of its submissions.

Conclusion

The primary innovation in the present research was the use of the ASM to evaluate China's English-language scientific journals. Both indicators and layers of indicators in addition to the relationship and transitions between indicators and layers were considered by means of the ASM, a concept adapted from the field of communications.

Another original feature of the present study was considering the interaction among the shells in the ASM: these signify the individuals working for or related to a scientific journal. The changes in a journal's editors, authors, and readers could reflect its stage of development and possible future trends. However, the lack of data from the journals themselves meant that there was no possibility of evaluating such details in the present study.

Unlike the situation in some countries around the world, all Chinese journals are managed by public academic organizations, such as universities, research institutes, and academic societies. As the sponsor—more often than not the only sponsor—of scientific journals, those organizations have the competency and absolute responsibility to formulate a vision for a journal's development and carry it out. This aspect of the sponsor, or perhaps owner, is an important element with regard to the quality of a journal published in China; however, it was not considered in the present study.

With necessary adaptations, the indicators designed for China's English-language scientific journals could also be used to evaluate English-language journals published in other countries where English is not an official language. For example, English-language scientific journals published in Japan face many similar problems to those produced in China [20.82].

The ASM evaluation idea could also be applied in evaluating all scientific journals irrespective of language or country of publication: all journals share the same essential elements of core value, editors, authors, and readers. Further study is required to optimize the indicator system used with the ASM and verify it in a large sample.

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