Editing Practice

REVIEW ARTICLE

Editors of sci-tech journals should know something about the science of science

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ABSTRACT

The purpose of this paper is to promote sci-tech journal editors to improve their literacy of science of science and provide a reference for creating first-class sci-tech journal editors. By introducing the connotation and denotation of science of science, this paper analyzes the significance of science of science knowledge to editors of sci-tech journals, and puts forward some suggestions to improve editors' literacy. The study of science of science knowledge is helpful for editors to understand the function of sci-tech journals, to clarify some mistakes and vague ideas, to improve the quality and efficiency of running journals, and to expand their research horizons and ideas. To study the knowledge of science of science, it is necessary to understand the classic works and related journals of science of science, understand the basic contents of science of science, deeply understand the position of journal research in science of science, learn to use the tools and software of scientometrics, and actively pay attention to the relevant strategic planning and policy of science and technology.

Key words: science of science, editor of sci-tech journal, sci-tech journal study, scientometrics, sci-tech policy, editorial quality

In July 2019, the China Association for Science and Technology, the Publicity Department of the CPC Central Committee, the Ministry of Education, and the Ministry of Science and Technology issued *Opinions on deepening reform and cultivating World-class Sci-tech journals* (hereinafter referred to as the opinions),[1] calling for "comprehensively enhancing the ability of sci-tech journals to gather global innovative ideas and first-class talents". This not only clarifies the key tasks of sci-tech periodicals in China, but also puts forward more stringent requirements for editors. First-class journals need first-class editors, and first-class editors create first-class journals. Many scholars propose the comprehensive qualities and abilities that editors of sci-tech journals should possess considering various aspects, but these qualities and abilities are often restricted to the level of "technology", with minimal concern with "Tao" or "principle".[2–5] As sci-tech periodicals originate from the development of science and technology, and in turn support its progress, it is natural to find the basic principle of sci-tech periodicals related to the law of development of science and technology. As a basic subject to explore the law of science and technology development and guide the practice of such development, the science of science undoubtedly has a such inherent endowment. This concept may be unfamiliar to most editors, so few people discuss how to improve the comprehensive ability and professional quality of editors from this perspective, and most focus on the development law of the publishing industry. As an important construction subject of the scientific society, sci-tech journals have their contents, service objects, and communication rules deeply rooted in the scientific community. Without scientific understanding and research of this community, it is difficult to solve the fundamental problems of the development of sci-tech journals. Sci-tech is a composite of "science and technology". Only by grasping the common law of science and technology or its own discipline can periodicals play their roles and

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add value. This is the relationship between "purpose" and "tool", between ontology and object, and only from the perspective of science of science can we better understand and grasp this dialectical relationship. The knowledge science of science can help the editors deeply understand the social function of the journal, clarify the aims and scope, improve the efficiency of editing and review, expand the research horizon, and so on. It is a basic principle and skill knowledge that the editors of sci-tech journals should understand and master. Based on the above, this study briefly introduces the connotation and extension of the science of science, explains the importance of imparting science knowledge to journal editors, and puts forward some suggestions to improve science literacy, to provide some enlightenment to science journal editors and make a contribution to the construction of first-class journals.

CONNOTATION AND EXTENSION OF THE SCIENCE OF SCIENCE

The science of science that takes modern science and technology as the research object reveals the essential characteristics of modern science and technology and the law of its development.[6] As an interdisciplinary subject, it exists and develops in various forms of disciplines.[7] In 1926, Polish sociologist Znanecki initiated the creation of a discipline called the science of science. In 1939, the British physicist Bernard published *The Social Function of Science*,[8] which is the first basic theoretical and founding work in this field, and has had a wide and far-reaching impact on the later development of the science of science. Bernard is thus recognized as the chief founder of the science of science.[7] According to Price, the science of science can be referred to as "history, philosophy, sociology, psychology, economics, political science, operational research, *etc.*"[9] After the Second World War, it entered a period of stable development, with a gradual increase in the number of researchers and increasingly diversified research methods, and then exhibited a trend of differentiation and development.[7]

Since the end of the 1970s, the study of the science of science has flourished due to the participation of Chinese scholars. Tsien Hsue-shen was the initiator and founder of the science of science in China.[10] He argues that it belongs to social sciences, and it is the theoretical basis for scientific research and system engineering. It is at an intermediate level of technological science in the social science system, and it takes all human scientific knowledge as its research object, including three branches of science and technology systems, science capability, and political science. Other Chinese researchers of this area come from different disciplines with different knowledge backgrounds and different understandings of the science of science. Zhao *et al.*[11–13] argue that scientometrics is a basic branch of science of science, and the birth of the science of science lies in using quantitative methods of science itself to study science; the science of science is scientometrics in a certain sense. According to the difference of theory or application degree, Wang posits that all branches or marginal branches of science (except general science) can be divided into three groups, namely theoretical, specialized, and applied science of science.[7] Liu suggests that the basic framework of the theoretical system of science of science in the 21st century can be constructed from three dimensions (science, technology, and innovation) and their relationship as the object dimension, science branch disciplines and adjacent disciplines as the subject dimension, and science theory, application, and method as the research dimension.[9]

Based on the above studies, the extension of the object of the science of science can be extended to all scientific and technological knowledge and its related carriers (people, things, organizations, *etc.*). Sci-tech periodicals are a carrier of sci-tech knowledge. Such periodicals and their related elements should be important research objects and problems in the science of science. Bernard devoted a chapter in *The Social Function of Science* to "scientific publications" and "scientific communication".[8] Lu suggested that sci-tech periodicals are both tail and leader of the dragon, and play an important role and position in the scientific communication system and scientific research ecology.[14] As an important bridge between science and society and as a means of scientific communication, with the development of the times, sci-tech periodicals are increasingly presenting complicated content and trends. Their functions of serving science are also expanding and extending, and it is necessary for them to constantly evaluate themselves. Since sci-tech periodicals are an important research object of the science of science, they should also be considered an important branch of science.

SIGNIFICANCE OF SCI-TECH JOURNAL EDITORS LEARNING THE SCIENCE OF SCIENCE

As mentioned in the literature, editors of sci-tech journals need to master not only the knowledge of journal editing but also the knowledge of related disciplines. Such editors should not only master the natural science knowledge related to their discipline, but also know more about the relevant social science (psychology, language, rhetoric, sociology, aesthetics, logic, ethics), comprehensive interdisciplinary (science, information theory, system theory, control theory),

communication and other related discipline knowledge, using the related discipline theory, methods, and practice to enrich their theoretical knowledge and literacy and applying them in the practice of running journals. Specifically, sci-tech periodical science is an important branch of the science of science and should pay more attention to its own discipline and development. It is of great significance for editors of sci-tech journals to learn the theories, methods, and applications of the science of science to improve their own theoretical self-restraint and ability to run the journal.

Promote editors to have a deep understanding of the functions of sci-tech journals

The function of sci-tech periodicals refers to the role that they can play in future trends. The core function of sci-tech journals is to authenticate, refine, disseminate, and preserve knowledge. With the development of science and technology and social progress, sci-tech periodicals have gradually derived a variety of new functions, such as promoting innovation, training talents, scientific research evaluation, ethical evaluation, national think tanks, and so on. The Opinions suggested that sci-tech periodicals inherit human civilization, gather scientific discoveries, and lead the development of science and technology. They not only directly reflect the country's scientific and technological competitiveness and cultural soft power, but also emphasize the strategic value of sci-tech periodicals at a macro level.[15] Gaining knowledge of the science of science is of great help to understand these functions of sci-tech periodicals and to give full play to the function of periodicals. *The Social Function of Science*, for example, discusses the role that science now plays and the role that science can play in some detail,[8] in which, the chapters on "scientific publications" and "scientific communication" can help the editors to gain a deeper understanding of the role of sci-tech periodicals in the scientific communication at that time, and also make some predictions about their future role. These functions all revolve around how to better serve scientific communication. Especially in the new situation, the rapid development of open science, data science, and new technology is a new challenge to the development of science and technology and sci-tech journals. The transformation of paradigm has enriched the connotation and extension of sci-tech journals. Under these challenges, how can such periodicals stay true to their original aspiration? How can they do what sci-tech periodicals should do well? How can they better reflect the national competitiveness in science and technology and the soft power of the country? All these answers need to be found from the theory of science of science. No matter what changes will take place in the form of sci-tech journals in the future, editors must pay attention to the functional needs of the scientific community.[16]

Clarify editors' vague understanding of sci-tech journals

As the editor of the *Chinese Journal of Scientific and Technical Periodicals*, we found some editors had some vague and wrong understanding in the daily process of manuscript processing and communication with the authors. For example, it is not clear what role editors play in academic exchanges and how they should position themselves. Is their role just to service specialists? From the viewpoint of the science of science, a first-class subject editor must be a subject expert, a part of the scientific community, and an important builder and practitioner of the national innovation system. The establishment of a journal should be a spontaneous act in the heart of scientists. It is naturally established when science has developed vigorously to a certain extent, scientific communication has reached a certain degree, and scientists are increasingly demanding the right to voice their opinions. Only with the support of a certain number of experts in the field can it be established. The establishment of journals is for the better development of the scientific community; thus, editors must be clear about their role positioning. On the other hand, many authors do not know the difference between core and non-core journals, and believe that the former are of good quality, while the latter are of poor quality. In fact, according to the principle of the science of science, the so-called "core journals" means that 80% of the papers published in these journals are the mainstream research of a certain discipline. Therefore, it is challenging to judge which core and non-core journals are of better caliber. In addition, there are questions as to why there is peer review, why journal impact factors cannot be compared within different subjects, why references cannot be cut, what kind of authors can be acknowledged in the papers, and whether the Matthew effect is present in the publishing of scientific papers, *etc.* These questions can be addressed by looking for answers from the science of science.

Improve the quality and efficiency of editors and periodicals

The main daily work of sci-tech journal editors is to plan topics, solicit contributions for review, and communicate with scientists. Therefore, it is necessary for editors to understand the past and present trends of the discipline, so as not to lose their direction in the development of the discipline, and to more accurately evaluate the significance, status, and role of the latest progress and new achievements of the discipline.[6] If the editors understand the theories of "should be applied" and "spectrum structure of scientific knowledge", they can efficiently carry out topic selection planning, and

investigate rich mining areas of their own disciplines. It would also be easier to uncover innovative and subversive achievements. If we understand the theory of "cross-discipline", novel topics can be put forward at the intersection of cross-discipline. If we understand the rule of "the optimal age for scientific discovery", we will pay attention to those scientists of the appropriate age and provide talent support for soliciting manuscripts for review. If we understand the true meaning of priority confirmation, we should accelerate the manuscript processing and improve the efficiency of review. If we understand and skillfully apply the methods and tools of scientometrics, we can easily find the latest research hot spots and trends of this discipline in the mass of information, so as to plan topic selection, find the most suitable reviewer and author, and promote academic exchange and dissemination.

Broaden your horizons of editing research

Nowadays, the trend of science and technology crossing and merging presents higher requirements for periodical editors. The times call for a large number of high-level compound editorial talents with solid professional foundations, a wide range of knowledge, and strong adaptability. In the process of communication with us, some often lament that "there is no problem in writing papers of their own discipline, but they are not good at writing papers related to sci-tech journals". They do not know what topics to choose and what methods to use to conduct research on such journals. Many editors of sci-tech journals have the same problem. After all, the daily work of each editorial department is similar and there are few topics to explore. As an important research object of sci-tech science, sci-tech journals can use the theories, methods, and applications of science of science to expand the research field and open up new research and journal running ideas. For example, the law of knowledge evolution and dissemination can be found by using sci-tech journals of the discipline. Furthermore, they can study the knowledge structure and knowledge system of the discipline, re-understand, and position the periodical of the discipline, study the impact of scientists' actions on journals, use the methods and theories of history, philosophy, and sociology of science and technology to study the history, culture, and social relations of sci-tech periodicals and related elements, and use the widely applied research of the science of science to carry out the policy research of sci-tech periodicals, the evaluation research of social benefits of sci-tech periodicals, the formulation of ethical norms, the reform of sci-tech periodicals system, and so on. Through systematic theoretical research, we can better guide the practice of running periodicals, reform the idea of doing so, and innovate the operation mechanism.

SOME SUGGESTIONS FOR SCI-TECH JOURNAL EDITORS TO STUDY THE SCIENCE OF SCIENCE

Since knowledge in the science of science is of great significance to sci-tech journal editors, they should work hard to learn related content. We hold that to do sci-tech periodical editing well, it is necessary not only to know the research trends and progress of related disciplines, but also the classical works and relevant knowledge of sci-tech, especially to have a deep understanding of the orientation of sci-tech periodical research in the science of science, and to learn to use the basic methods and tools of sci-tech metrology.

Understand the classical works and related journals of the science of science

The most direct way to acquire knowledge of science is to read the classics and relevant journals. The classics of science of science are Bernard's *The Social Function of Science*[8] and his 25th anniversary corpus *Science of Science*,[17] Kuhn's *The Structure of Scientific Revolutions*,[18] and de Solla Price's *Science Since Babylon*,[19] *Little Science*, *Big Science*,[20] Latour's *Laboratory Life: The Social Construction of Scientific Facts*,[21–23] *Science in Action: How to Follow the Scientists and Engineers in Society*,[24,25] and so on. Chinese scholars have written a number of monographs or textbooks on the science of science, such as *The Outline of Science of Science: Science Theory* by Guan,[26] *Science Foundation* by Xia *et al.*,[27] *Science Course* by Tian *et al.*,[28] Zhao's *Introduction to the Science of Competence*,[29] *Theory of Science and Technology* from Yang *et al.*,[30] Xia's *Social Science*,[31] *Scientometrics Methodology* by Pang,[32] and *Mapping of Scientific Knowledge: Methods and Applications* by Liu *et al.*[33]

The related journals in China include: *Studies in Science of Science*, *Science Research Management*, *Science of Science and Management of S.& T.*, *R&D Management*, *Forum on Science and Technology in China*, *Studies in Dialectics of Nature*, *and Studies in Philosophy of Science and Technology*, among others. Foreign journals include *Social Studies of Science*, *Science Technology & Human Values*, *Scientometrics*, *Journal of the American Society for Information Science and Technology*, *Research Policy*, *R&D Management*, *Journal of Informetrics*, and *Research Evaluation*, among others.

Understand the basic content of the science of science

Since there are many differences in the system structure of the science of science, the current study cites Liu's viewpoint,[9] which roughly divides the theoretical system of the science of science into three levels or fields: theoretical, methods, and applied research of the science of science. The theoretical study includes meta-study

of science of science and its branches, law of science and technology development, science and technology knowledge systems, scientific research organization and related scientific community, knowledge alliance and technology alliance, and scientific research team and academic team. Methods of the science of science include science and technology index, science and technology evaluation and evaluation index system, information search technology, network metrology, atlas and visualization of scientific knowledge, and information metrology theory. The applied research mainly includes the formulation and strategic planning of science and technology policy (research and development and technological innovation, technological innovation policy), knowledge management, science and technology system, policy and management, cooperation, and so on.

The science of science is a developing subject. The frontier of the science of science can be developed from three aspects: theory, method, and application.[34] The first is the frontier of discipline theory, which is accompanied by the breadth and depth of interdisciplinary development and technology as its research object. The second is the frontier of disciplinary methods. The new visualization method of scientific knowledge provides new methods and means for exploring the law of scientific development, for researchers to choose research topics, and for science and technology management departments to carry out rational layouts and investment in science and technology fields. The third is the application of forefront issues. Government administration, science and technology, business, engineering, and philosophy are widely aligned. They jointly study science and technology policy, carry out technology evaluation and innovation, formulate ethical norms, and so on, which makes the decision of science and technology development more rational and scientific.

The editors of sci-tech journals can combine the direction they are interested in with the research of sci-tech journals to make theoretical and methodological innovations so as to guide the practice of running journals better.

Deeply understand the status of sci-tech journal research in the science of science

From the perspective of disciplines, the purpose of research is to explore the differentiation, derivation, and changing process of scientific knowledge system and its laws, grasp the growth point of new disciplines, so as to consciously guide the evolution path of some disciplines, and promote the perfection of each scientific department.[7] Sci-tech periodical research is also a process of continuous maturity and perfection. Such research can not only rely on the knowledge of science of science, but also enrich the theory and application of the science of science, and the two complement each other. According to the orientation of sci-tech periodical science, it belongs to applied science of science. Applied science of science is a group of branch disciplines with relatively high application degrees in the discipline system of the science of science.[7] It includes science forecasting, science information science, science creation psychology, science research methodology, science and technology talent science, science and popularization science, science and technology periodical science, and so on. These subjects mainly discuss various practical problems in the field of science, so as to guide and serve scientific cognition and social activities. The research object of sci-tech journals is the sci-tech journal itself and its related elements. Its branch disciplines include: the editing, carrier, management, evaluation, aesthetics, ethics, policy of sci-tech journals, and so on. It can be seen that with the development of new technologies, the research scope of sci-tech journals is becoming larger and larger, and more and more problems need to be studied, which greatly enriches the theoretical system of the science of science.

The relationship between sci-tech journals and other branches of science of science is also very close. They help to promote, develop, and enrich each other. It can be seen that sci-tech periodical science can make use of other parallel theories and methods of applying the science of science, such as information science, statistics, management science, talent science, and other methods to carry out the research of sci-tech periodical editing, management science and evaluation of sci-tech periodicals. We can use the theories and methods of science aesthetics, ethics, development strategy, policy, and communication for reference to carry out pioneering research on sci-tech periodicals.

Learn to use the basic methods and tools of scientometrics

To some extent, the science of science can also be called scientometrics. Therefore, mastering the methods and tools of scientometrics is particularly important for sci-tech journal editors. With the development of technology, scientometrics has integrated the methods of statistics, library science, philology and information science, graphics, information science, and computer science. At present, network, information, and document metrology can be used as the means and methods of scientometrics. Citation analysis is one of the specific methods, which has become the paradigm of scientometrics and bibliometrics.[35] The methods of citation analysis are not only limited to their own methods, but also absorb the essence of other disciplines, such as mathematical statistical, cluster, network, information visualization, citation

content, citation comparative, citation literature, case citation analyses, and so on. Editors of sci-tech journals can use citation analysis methods to analyze the vertical flow of their knowledge, trace the history of scientific development, and reveal the model of scientific development. They can use the horizontal flow of citation analysis knowledge to determine the influence and importance of disciplines, the structure of disciplines, the distribution of information sources of disciplines, and the determination of core journals. Citation analysis can provide decision support for scientific research management.

The development of science since modern times shows that every significant improvement and reform in research methods and means often leads to new scientific discoveries, fields, and even a new scientific era. With the development of new technologies, scientometrics experts have developed a number of scientometrics tools and software, and many major publishers have adopted the best of these for knowledge services, the most famous of which is perhaps Science Citation Index (SCI). In addition to being a citation index database, SCI also comes with many analytical tools, such as Essential Science Indicators (ESI), Journal Citation Reports (JCR), InCites, and so on.[36,37] Scientific visualization technology is also developing rapidly. There is numerous software for mapping scientific knowledge, such as SPSS, CiteSpace,[38] and VOSviewer,[39] and many software for data processing, such as Perl, R, and so on. The map of scientific knowledge can be described as in intricate picture with many facets. We have also encountered editors of sci-tech journals who use some software to map knowledge, but it seems that the mapping effect is not very good. In fact, in addition to the application of software, we must also deeply understand the practical meaning and working conditions contained therein. These will become less relevant if we do not pay attention to them.

Actively pay attention to the relevant science and technology strategy and planning

As a member of the national innovation system, sci-tech journal editors should actively understand sci-tech policy and related planning, and deeply understand the innovation-driven development strategy. Relevant guidance documents are *Report of 20th National Congress of the Communist Party of China*, *Guidelines of the CPC Central Committee and The State Council on Deepening Institutional Reform and Accelerating the Implementation of the Innovation-driven Development Strategy*, *Opinions on Deepening the Reform of Project Evaluation*, *Talent Evaluation*, *and Organization Evaluation*, *Opinions of The State Council on Comprehensively Strengthening Basic Scientific Research*, *Circular of The State Council on Several Measures to Optimize Scientific Research Management and Improve Scientific Research Performance*, *Circular of The General Office of the State Council on Printing and Distributing Measures for the Administration of Scientific Data*, and so on.

At present, the most notable event in sci-tech periodical circles is the development and implementation of the *Excellent Action Plan of Chinese Sci-tech Periodicals*, the background of which is the proposal of the opinions. The publication of the opinions is a major event in the science and technology and periodical circles. If we read the opinions carefully, we find that these fully reflect the in-depth understanding and practical response of the policymakers to the national science and technology policies,[40] and many scientific theories, methods, and ideas are used in the opinions. It is a programmatic document for the development of sci-tech periodicals based on the science of science. It highlights the goal of the periodical industry and the specific task of periodical development in China. This document reflects the unrelenting efforts made by sci-tech journals to promote efficient academic exchange, open sharing, and achievement transformation in the construction of the national innovation system. The document also sends a signal that sci-tech journals need to cooperate extensively with science, technology, business, and government authorities to conduct joint research and achieve mutual benefit and win-win results, so as to truly achieve the goal of building first-class journals. The editor of a sci-tech periodical is an important part of this link. Mastering the necessary knowledge of science will be more effective for the editor to better implement the strategy and planning of sci-tech periodicals.

CONCLUSION

This study briefly introduces the meaning of the science of science, discusses the significance of scientific knowledge to sci-tech journal editors, and presents some suggestions on how to gain science of science knowledge. Against the background of constructing first-class journals, enriching the theoretical knowledge of sci-tech journal editors and improving their scientific literacy will play an incalculable role in redefining their role, giving full play to the social function of sci-tech journals and promoting the achievement of the goal of cultivating first-class journals. The science of science can be included in the strategic planning and top-level design of the development of Chinese periodicals, as a topic of all kinds of editing training, and included in all kinds of research topics related to editing and publishing. With the development of science and technology and society, the science of science, as a comprehensive and interdisciplinary subject, has a

good prospect of research and application. In fact, it is not only the editors of sci-tech journals who need to understand the knowledge of the science of science, but also the scientists and managers of scientific research in the scientific community. We hope that everyone can join in this research and contribute to the development of science and technology in China.

Finally, it should be noted that this study is only a superficial view of the application of science-based knowledge to sci-tech journal research. In the future, sci-tech journal classification research, evaluation research, strategic research, and other important topics will continue to be carried out based on sci-tech journal, and contribute to the improvement of the overall level of sci-tech journals.

DECLARATIONS

Secondary publication declaration

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Conflict of interest

Yongxia Liang is an editorial board member of the journal. The article was subject to the journal's standard procedures, with peer review handled independently of these members and their research group.

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