ISSN 2616-7433 Vol. 5, Issue 17: 6-13, DOI: 10.25236/FSST.2023.051702

Research Hotspots and Prospects of Domestic Sci-tech Journals from 2002 to 2021—Visual Analysis of CSSCI Journal Papers Based on CNKI

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Abstract: *This study explores the geographical distribution of publishing institutions and the trends in scientific research projects within the field of editing and publishing, with a particular focus on the development of sci-tech periodicals. The research reveals the concentration of publishing institutions in Beijing, attributed to its status as a political and cultural hub boasting numerous high-level academic institutions and abundant resources. Similarly, the impact of scientific research institutions in Henan Province is closely associated with the activities of the Henan Scientific Periodical Research Center, encouraging interdisciplinary synergy. An analysis of article publication trends demonstrates fluctuating patterns from 2002 to 2014, followed by substantial growth from 2016 to 2018, influenced by factors such as "digitalization", "core journals", "new media", "big data", and "media convergence". However, a decline post-2019 suggests an impending stable phase or emerging trends necessitating sustained attention. Furthermore, emergent keywords like "new media", "media convergence", and "knowledge service" underscore primary developmental trends in sci-tech periodical research, emphasizing the integration with other disciplines and the stimulation of new research areas. The study also highlights the imperative to bolster the organization and declaration of scientific research projects in editing and publishing. Despite the pivotal role of scientific research projects in discipline development, our analysis reveals a lack of attention to these projects in editing and publishing science. Therefore, it is recommended to encourage heightened scientific research efforts and to organize research personnel to engage in areas with strong scientific research strength, thereby enhancing project declaration levels and scientific research abilities, ultimately contributing to the development and prosperity of editing and publishing. This research offers valuable insights into the dynamics and trends within the publishing and scientific research landscape, emphasizing the proactive measures necessary to adapt to these changes and advance the field of sci-tech periodicals.*

Keywords: *Sci-tech periodicals; Research hotspots and prospects; CSSCI; Visual analysis*

1. Introduction

By combing and integrating the high-quality literature published in China from 2002 to 2021 with the theme of "sci-tech journals", we can understand the research hotspots and basic characteristics of the literature in the past 20 years, and look forward to the future research development trends and hot topics.

2. Research implications and approaches

2.1 Research importance and goals

On May 18, 2021, the Propaganda Department of the CPC Central Committee, the Ministry of Education and the Ministry of Science and Technology jointly issued the Opinions on Promoting the Prosperity and Development of Academic Journals, which emphasized that academic journals are an important platform for academic exchanges and an important position for spreading ideology and culture, play an important role in China's scientific and technological development and upgrading the international scientific and technological level, and are also an important force for promoting theoretical innovation and scientific and technological progress. [1] According to the statistics of "Basic Situation of National Press and Publication Industry in 2020" and "Analysis Report of Press and Publication Industry in 2020" issued by official website of the State Press and Publication Administration, there are 5,088 kinds of natural science and technology journals in 2020, with an average print run of 17.32 million copies, accounting for 49.92% of the total varieties of journals.

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Compared with the previous year, the types increased by 0.51%. It can be seen that sci-tech periodicals are an important part of academic periodicals. In a sense, sci-tech periodicals are the direct embodiment of the scientific and technological level of a country or region. Facing the complicated international situation, strengthening the construction of sci-tech periodicals plays an important role in enhancing national scientific and technological competitiveness and building Chinese spirit, Chinese value and Chinese strength.

Scientific research content is the soul of a paper, which determines the quality and development level of sci-tech journals. Therefore, the development of sci-tech periodicals can not be separated from high-quality scientific research content [2]. The content of scientific research is also the topic of the papers published in sci-tech journals, which is mainly reflected by the theme of the articles. Therefore, through the analysis of the selected topics, we can understand the development direction and research focus of sci-tech journals.

2.2 Research Methodology

Scientific knowledge map uses visualization method to visually present the frontier fields or commanding heights of disciplines that have attracted much attention in knowledge and information, which is convenient for researchers in different disciplines or fields to quickly grasp the overall situation of the discipline progress, core author groups and research hotspots. [3] This paper takes CNKI as the data source, selects advanced retrieval, selects "sci-tech periodicals" as the topic in the retrieval conditions, selects 2002-2021 as the publication time limit, and limits the literature source to CSSCI. A total of 9792 catalogues of literature have been retrieved. Because of the large number of research samples, the influential samples with the top 1000 cited frequency are selected in the analysis of literature author characteristics, publishing organization characteristics, strategic coordinates and frontier evolution.

3. Basic characteristics of literature

3.1 Annual distribution of literature

The annual number of published articles is one of the important indicators to measure the research status and development trend of a certain kind of literature. Through the analysis of 9792 documents retrieved according to the annual change law, we can clearly and intuitively see the annual change law of this subject research.

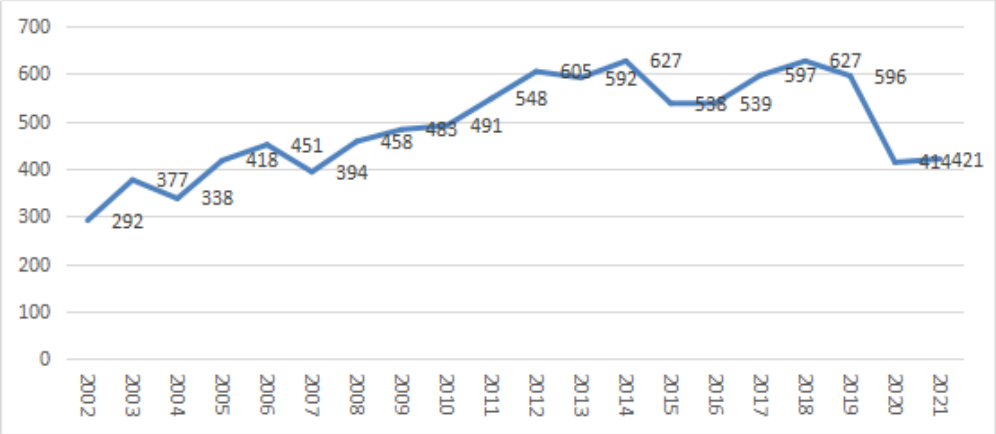

Figure 1: Number of articles in sci-tech periodicals over the years

It can be seen from Figure 1 that the number of articles published from 2002 to 2014 showed a steady upward trend in fluctuation, and the number of articles published in 2014 increased by 114.7% compared with 2002, indicating that sci-tech journals received continuous attention during this period; Compared with 2014, it decreased significantly in 2015, but showed an obvious growth trend in 2016-2018. Looking back at the literature, we can find that the concepts of "digitalization", "core journals", "new media", "big data" and "media convergence" were put forward one after another in this period, which caused widespread concern and heated discussion. However, after 2019, it showed an obvious downward trend, and the number of articles published in 2020 decreased by 30% compared with that in 2019.

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3.2 Characteristics of literature authors

If the author publishes more papers in a certain field and has great influence, the author is called the core author in this field [4], and the core author leads the development trend and direction of his subject field and is the backbone of his field [5]. Chinese Social Science Citation Index (CSSCI) is a database developed by China Social Science Research and Evaluation Center of Nanjing University, which is used to retrieve papers and citations in the field of Chinese social sciences. [6] CSSCI selects academic journals with strong editorial standards as source journals in various disciplines according to the classification of disciplines and referring to the method of combining quantitative and qualitative evaluation. As an important project in the field of humanities and social sciences evaluation in China, its journals are the most influential journals in the field of humanities and social sciences in China, and the corresponding authors have high academic level and certain academic influence. Through the collective analysis of these principal authors, we can gain a more comprehensive and profound insight into scholarly activities within this domain, which is beneficial for the administration, structuring, coordination, and direction of such scholarly endeavors. [7]

The samples selected in this paper are the top 1000 citations, among which the highest citation frequency is 353 times and the lowest is 21 times, all of which have high academic influence. By analyzing the authors of this part of the literature, we can grasp the development trend of this field and the level of cooperation between authors, thus promoting academic exchanges and teamwork in this field.

In this paper, authors who have published more than or equal to 3 articles are selected to generate the knowledge map of author cooperation network, and the network is simplified. There are 448 nodes and 832 connections in the author's cooperative network map, and the author's population density is 0.0083; It can be seen from Table 1 that 63.2% of the samples were completed by two or more authors. Combining these two parts of data, it can be found that the authors of different institutions have less cooperation and scattered contacts, and have not yet formed a cohesive scientific research group, but the authors in a certain group have closer cooperation. This shows that the cooperation between researchers of sci-tech periodicals in China is not wide, and the cooperation in various fields should be continuously expanded and deepened.

Through statistics, it can be found that the author with the largest number of articles is You Suning, who has published 155 papers on CSSCI with the theme of "Sci-tech Journals" and appeared 44 times in the top 1000 cited documents; Ren Shengli ranked second, publishing 52 papers on CSSCI with the theme of "Sci-tech Journals", and appearing 32 times in the top 1000 cited documents; Liu Xueli ranked third, publishing 77 papers on CSSCI with the theme of "Sci-tech Journals", and appearing 27 times in the top 1000 cited documents. Through the theme analysis of the papers published by the collective groups with You Suning as the center, Ren Shengli as the center and Liu Xueli as the center, we can find that the topics of the papers pay attention to a wide range, mainly including periodical evaluation and analysis, brand building, digital publishing, editorial group's own development and so on, but they are all hot issues closely related to the social development at that time.

Table 1: Cooperation level of author group

Project	Factor				
Number of signatures (bits)	1	2	3	4	5 and above
Number of literatures (articles)	368	222	173	100	137
Single type cooperation level	0.368	0.222	0.173	0.1	0.137

3.3 The characteristics of the issuing organization

The issuing institution refers to the unit to which the author belongs and is the base for the author to carry out scientific research. The development of sci-tech periodicals is closely related to the nature of their regions and publishing institutions. The discipline construction and development of the publishing institution, the level of foreign exchange and cooperation, the level of resource sharing and information mutual assistance, and the academic research atmosphere have a very important influence on the author's research direction and research level.

Run CiteSpace, and select "Organization" as the node type to get the knowledge map of the issuing organization. There are 882 nodes and 641 connections of publishing institutions, and the group density

ISSN 2616-7433 Vol. 5, Issue 17: 6-13, DOI: 10.25236/FSST.2023.051702

of publishing institutions is 0.0016, which is far lower than the group density of literature authors. This shows that the links between publishing institutions are scattered, the cooperation between different institutions is less, and a cohesive scientific research group has not yet been formed. This is consistent with the conclusion obtained in the author group analysis that "author group cooperation is more cooperation within the same organization". From the statistical results, it can be seen that the magazine of Chinese Medical Association has the largest number of articles, with a total of 43 articles, followed by China Institute of Science and Technology Information, with a total of 23 articles. The editorial department of New Progress in Ophthalmology of Xinxiang Medical College Journal and the Literature and Information Center of Chinese Academy of Sciences are ranked third, with a total of 21 articles, and the fifth is the Literature and Information Center of Chinese Academy of Sciences, with a total of 19 articles, which are the core research institutions of sci-tech journals.

A total of 880 issuing institutions were obtained by searching, except for 2 foreign institutions, and the remaining 878 institutions were counted according to their geographical distribution. It can be found that the issuing institutions are mainly concentrated in 7 provinces (municipalities directly under the Central Government) such as Beijing, Jiangsu, Guangdong, Hubei, Shanghai, Shaanxi and Henan, and a total of 609 institutions are obtained, accounting for 69.2% of the total number of issuing institutions. The geographical distribution of issuing institutions is extremely unbalanced Among them, Beijing has the largest number, with a total of 288 institutions appearing 595 times, accounting for 32.7% of the total number, which has obvious advantages over other regions; Henan Province is second only to Beijing in the number of issuing agencies, with 42 issuing agencies appearing 121 times. The gap between different regions is related to the importance attached to the research of sci-tech periodicals in local areas. Henan Province ranks second in the number of publishing institutions, second only to Beijing, which is closely related to Henan Province's emphasis on the development of sci-tech periodicals and the establishment of a special research center for sci-tech periodicals. As early as 2007, Henan Province opened the first specialized research institution of sci-tech periodicals in China-Henan Sci-tech Periodical Research Center, which devoted itself to summing up the experience of running excellent sci-tech periodicals, studying the history, present situation, development law and existing problems of sci-tech periodicals at home and abroad, exploring the development law of sci-tech periodicals in Henan Province and even the whole country, and providing theoretical basis for promoting the development of sci-tech periodicals in Henan Province.

4. Analysis of research coordinates and frontier evolution of domestic sci-tech periodicals

Keywords are the core summary of an article. Through the analysis of keywords, we can understand the theme and general content of an article. Usually, the more times a keyword appears, the higher the attention of the subject it represents in its field, and it is also a research hotspot in this field. Using CiteSpace tools, through the retrieved keywords and its source literature analysis, grasp the evolution of research hotspots and key frontier content.

4.1 Keyword sample characteristics

Running CiteSpace, the node type is selected as keywords. In order to describe keywords more carefully, the time slice is selected for 1 year, TOP N=10, and keywords with frequency greater than or equal to 5 are selected. Running the knowledge map of keywords, there are 320 keyword nodes and 492 connections. All keywords are closely around sci-tech journals (495 times). Because of the large proportion of sci-tech journals, other keywords cannot be displayed.

4.2 Strategic Coordinate Analysis

Strategic coordinate map refers to a two-dimensional coordinate system drawn with centripetal degree and density as parameters. Density represents the strength of the connection between keywords in a certain class, which is the ability of a class to maintain and develop itself; Centripetal degree represents the degree of mutual connection between one group and other groups. Usually we set the x axis to centripetal degree and the y axis to density. Generally speaking, the greater the centripetal degree, the more the group tends to the central position in the research of this discipline, and the higher the attention it receives. [8]

With the help of VOS viewer, the strategic coordinates of keyword samples are analyzed, and 14 clusters are obtained. Using strategic coordinates to interpret the key words of literature can identify the evolution trend and relationship among different thematic groups. [9] The average density is 16.90014038 and the average centripetal degree is 221.2857143. According to the dispersion level

ISSN 2616-7433 Vol. 5, Issue 17: 6-13, DOI: 10.25236/FSST.2023.051702

between the corresponding attributes of each cluster and the average value, all keyword samples are divided into four models, which are core type, potential type, edge type and germination type.

The first is the core type. The core type is cluster with centripetal degree > 0 and density > 0, including cluster 2, cluster 3 and cluster 5. The core cluster means that there are a large number of research topics, rich and mature research results, and a stable and mature research field has been formed.

The second is the latent type. The potential types are clusters with centripetal degree < 0 and density > 0, including Cluster 8 and Cluster 10. The topics contained in this cluster have not been fully paid attention to and excavated, but the topics with good research prospects are problems that need to be deeply excavated and paid attention to and studied in the future, and have a large research space. In addition, Class Group 8 is closest to the first quadrant except Class Group 10. "Editorial Work", "Editorial Board", "Sci-tech Journals", "Topic Selection Planning", "Academic Influence" and "Academic Quality" are closely related internally, and the trend of strengthening ties with other Class Groups is obvious, indicating that the research on this part of the topic is expected to become a new research core.

The third type is marginal. The marginal types are clusters with centripetal degree < 0 and density < 0, including Cluster 9, Cluster 11, Cluster 12, Cluster 13 and Cluster 14. The topic of this part has not been widely concerned, and only a few researchers have studied it. Their density and centripetal degree are relatively low, which shows that the keywords in these clusters are not closely related, and the research has not yet formed a fixed system. However, some researchers point out that new research hotspots often appear in marginal clusters [7], and these research topics have certain development potential and may become research hotspots over time. Therefore, more attention should be paid to these keywords.

The fourth type is germination type. The germination type is Clusters with centripetal degree > 0 and density < 0, including Clusters 1, Clusters 4, Clusters 6 and Clusters 7. On behalf of some scholars, this classification group has just started research, and further extensive and in-depth research needs to be carried out. It is found that the centripetal degree of Cluster 1 and Cluster 4 is higher, especially Cluster 1, which is the highest among all Clusters, indicating that the research on keywords in Cluster 1 is at the core position and active in the whole research field; However, the density is relatively low, only 16, and the average specific density is slightly lower than 16.90014038, which shows that the internal structure has not yet formed a strict system, and the research content and direction are more diversified.

4.3 Evolution trend of sci-tech periodical research

In order to better analyze the research hotspots, evolution process and future evolution trend of sci-tech periodicals, this paper analyzes the evolution trend of sci-tech periodicals by combining Time Zone view and emergent words index. The Time Zone view is formed according to the high concentration of the title information to the main theme of the literature, and shows the starting and ending time, overall intensity and evolution trend of a key concept research to a certain extent. "Emergent words" refer to keywords that appear frequently in a certain period of time. They can extract representative words in the time set in combination with the title information, and are mainly judged by the emergent degree, which is used to reflect the research focus and changing trend in this field in a certain period of time.

Because of the large number of samples, when forming the Time Zone view, we select the top 5 keywords with cited frequency in each year. According to the size and number of nodes, the research interval can be roughly divided into three stages.

The first stage is the basic research stage (2002-2010), which is more about the basic research of sci-tech journals such as journal evaluation, impact factors, academic quality, editing and academic journals. The second stage is the rapid development stage (2011-2014). During this period, the research mainly focused on new media and digital publishing, and "digitalization", "core journals", "new media", "big data", "open access", "WeChat" and "big data" came to us. This unprecedented technological change had a great impact on organizational decisions and business processes in various industries, forcing various organizations to start thinking about new business forms. There are more and more practical researches on the future publishing, service, management and editing forms of sci-tech periodicals in the era of big data.

The third stage is the stage of innovation and integration (from 2015 to now). This period of time is mainly about the related research of "media convergence", "media integration era", "emerging media", "open access" and "knowledge service". The focus of this stage of research is mainly on the dilemma of

ISSN 2616-7433 Vol. 5, Issue 17: 6-13, DOI: 10.25236/FSST.2023.051702

the development of Chinese sci-tech periodicals under the environment of media integration. By comparing and analyzing the advantages of traditional paper periodicals and the problems existing in the era of media integration, this paper puts forward some countermeasures, including the integration and development of Chinese sci-tech periodicals with emerging media, actively changing concepts and establishing the development thinking of media integration; Make full use of the technological advantages of emerging media, promote the reengineering of periodical publishing process, take the integration and development of innovative media as the driving force, enrich the content, and strengthen the breadth and depth of scientific and technological information reporting; Carry out cluster development, improve the operation level of periodicals, and build a professional and characteristic first-class sci-tech periodical brand to meet the development requirements of sci-tech periodicals in the era of media integration, [8] and so on.

At the same time, with the help of CiteSpace emergent detection algorithm, it is found that the emergent words from 2002 to 2010 are "peer review", "advertisement", "reference", "China", "influencing factors", "influencing factors" and "medical journals"; During the period from 2011 to 2014, the prominent words were "system reform", "preliminary examination", "cited frequency", "digitalization" and "core journals"; The emergent words from 2015 to now include "open access", "WeChat", "media convergence", "academic journals", "youth editors" and "knowledge service". The emergent level in the first two stages is not high, but the emergent level in the third stage is high, and the emergent words are basically consistent with the keywords extracted from Time Zone view. After analysis, it can be found that the emergence rate of three key words, "new media" (starting in 2013), "media convergence" (starting in 2015) and "knowledge service" (starting in 2017), has continued to this day, which shows that these three themes are the main development trends of current research in sci-tech journals.

5. Summary and prospect

With the help of CiteSpace knowledge map, this paper intuitively analyzes the research hotspots and development frontiers in the field of sci-tech periodicals from the perspectives of document quantity, document author characteristics, document organization characteristics, keyword sample characteristics, strategic coordinate analysis and emergent words.

5.1 Constructing the subject of diversified research forces

Through statistical analysis, it is found that the level of cooperation between publishing institutions is not high, and the authors in the same institution cooperate closely, but the links between different institutions are scattered, and a cohesive scientific research group has not yet been formed. With the development of discipline construction projects, the growth rate and increment of scientific research activities are developing rapidly. Scholars' exchange, institutional cooperation, resource sharing, information mutual assistance and knowledge dissemination among scientific research institutions have played an increasingly significant role. The original "building a car behind closed doors" is far from adapting to the rapid development of science and technology. To speed up the high-quality development of sci-tech periodicals and build first-class sci-tech periodicals, editors of sci-tech periodicals need to have high professionalism, professionalism, communication and planning ability and the ability to apply new technologies and new media, speed up the construction of talents and teams, and form a team or alliance of "leading talents + professionals". The diversity of research efforts and the coherence of research goals can effectively foster the multidimensional and in-depth expansion of research subjects. By accelerating collaborations and dialogues across various institutions, urban and regional boundaries, the standard of partnership can be continuously enhanced, promoting a trend towards interdisciplinary convergence.

5.2 Organize the establishment of special research institutions for sci-tech periodicals

In the era of big data, discipline construction is developing rapidly, and scholars' exchange, institutional cooperation, resource sharing, information mutual assistance and knowledge dissemination among various scientific research institutions play an increasingly important role. Relevant scientific research institutions of editing and publishing should also take this opportunity to accelerate the integration and cooperation among scientific research institutions, so as to effectively promote the rapid development of scientific research institutions.

From the statistical results, we can find that the geographical distribution of publishing institutions is extremely uneven, and Beijing has the largest number of publishing institutions, which is closely

ISSN 2616-7433 Vol. 5, Issue 17: 6-13, DOI: 10.25236/FSST.2023.051702

related to the political and cultural center where Beijing is located. It has a large number of high-level institutions of higher learning and large-scale editing and publishing institutions, and concentrates a large number of high-quality resources in China. The number of scientific research institutions in Henan Province is second only to Beijing, which is due to the fact that Henan Province has a special scientific periodical research institution-Henan Scientific Periodical Research Center. Specialized research institutions of sci-tech periodicals are instrumental in uniting individuals dedicated to sci-tech periodicals research, who share common research aims and trajectories, thereby sparking the exchange of ideas and facilitating cross-institutional and interdisciplinary collaboration. By summing up the experience of running excellent sci-tech periodicals, this paper analyzes the history, present situation, development law and existing problems of sci-tech periodicals at home and abroad, and explores the development law of excellent sci-tech periodicals in this province, the whole country and even the whole world, so as to effectively promote the development of local sci-tech periodicals.

5.3 Pay attention to the key words in emergent words to show the future trend

From the perspective of the number of articles published, the number of articles published from 2002 to 2014 showed a steady upward trend in fluctuations, but it showed a significant growth trend in 2016-2018 and 2015, which was related to the concepts of "digitalization", "core journals", "new media", "big data" and "media convergence" in this period. However, after 2019, the number of published articles has shown an obvious downward trend. The emergence of this phenomenon indicates that the research on sci-tech journals has entered a relatively stable and calm period or there will be other new situations, which deserve our continuous attention in the later period.

By combing the emergent words, we can find that the emergent rates of three key words, "new media" (starting in 2013), "media convergence" (starting in 2015) and "knowledge service" (starting in 2017), have continued to this day, indicating that these three themes are the main development trends of the current research on the development of sci-tech periodicals, which deserve wide attention.

At the same time, sci-tech periodicals should speed up the exchange and integration with other disciplines, stimulate new research hotspots, effectively promote the new development direction of sci-tech periodicals, and realize the new mode of media integration and development of sci-tech periodicals. Realize the deep integration of sci-tech periodicals and new media, adhere to correct ideas, thinking and consciousness, build a three-dimensional network platform and an all-media industry chain, and form a media matrix; Use technology outsourcing to realize content innovation, and at the same time increase independent research and development of technology to grasp the initiative of deep integration; Management and operation should pay attention to top-level design, effective allocation of resources and maximum utilization, so as to promote the sustainable development of sci-tech periodicals.

5.4 Strengthen the organization and declaration of scientific research projects in editing and publishing

Scientific research project is an important form of academic research. It usually relies on a team to carry out scientific research activities with clear goals, complete and achieve certain results within a certain period of time, and is an important carrier and a powerful starting point for the development of editing and publishing, especially the top scientific research projects in China, such as the National Social Science Fund and the National Natural Science Fund, which represent the national standards for discipline development. [5] However, in the 9792 catalogues retrieved, there are 39 types of scientific research projects, with an average fund ratio of 7%. Among them, there are 224 articles funded by the National Social Science Fund, accounting for 2.29%, and 161 articles funded by the National Natural Science Fund, accounting for 1.64%. It can be seen that editing and publishing science pays insufficient attention to the organization and implementation of scientific research projects, and the promotion of scientific research projects to discipline development has not been fully exerted. Therefore, it is suggested that all sci-tech periodical units should pay attention to the organization and declaration of scientific research projects, encourage scientific research personnel to increase their scientific research efforts, and actively organize scientific research personnel with research potential to study and communicate in areas with strong scientific research strength, so as to improve the project declaration level and scientific research ability of editors and publishers and effectively promote the development and prosperity of editing and publishing.

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