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The Chinese scientific publication system: Specific features, specific challenges

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Abstract

By introducing new policy initiatives, China is trying to change the evaluation of scientific research, shifting the focus from counting publication output to stressing high-quality research, with the objective of achieving excellent science. Against this background, the scientific publication system itself is important for safeguarding high-quality publications and high-quality journals. However, the Chinese scientific publication system has some specificities and unique features, which also create particular challenges. This article describes the scientific publication system in China. It covers the Chinese ex-ante journal licensing examination, the triple ownership management structure and provides an overview of the editorial process of Chinese scientific journals. It analyses how difficulties in the Chinese scientific publication system relate to concerns over research quality and integrity. We conclude with an agenda of the crucial issues facing the current Chinese attempts to promote quality in scientific publications.

INTRODUCTION

China's science has displayed extraordinary growth rates, and its share in global science is increasing (National Science Foundation, 2018; Xie & Freeman, 2019). R&D expenditure and paper output are growing rapidly as China's scientific development is catching up with the USA and Europe. Between 2000 and 2015, China was responsible for about one-third of the global R&D spending growth. Meanwhile, the number of science and engineering papers increased almost fivefold since 2003 (National Science Foundation, 2018), making China the world's largest producer of scientific articles (Tollefson, 2018).

However, the rapid growth of Chinese science comes with growing pains, such as concerns about research quality and integrity. Despite the large volume of Chinese publications, the average number of total citations per article is lower than the global average (Huang, 2018). Meantime, research integrity issues also question the quality of publications by Chinese researchers. Science has exposed a veritable academic black market, involving shady agencies and corrupt scientists trading authorships and ghost-written papers (Hvistendahl, 2013). The number of Chinese retractions is up (W. Chen, Xing, Wang, & Wang, 2018; Lei & Zhang, 2018), while there are more reports of scientific scandals and concerns expressed publicly by scientists, especially concerning ghost authorship (Qiu, 2015).

Facing such problems of research quality, several ministries have taken measures. In 2016, the Ministry of Education approved a document stipulating the definition, precautions, and dealing procedures of academic misconduct in institutions of higher education (Ministry of Education, 2016). The China Association for Science and Technology distributed a document on self-discipline and moral behaviour of scientific researchers in 2017 (China Association for Science and Technology, 2017a, 2017b). Recently, two government documents were issued shifting the evaluation of scientific research and higher education from quantity-oriented to quality-oriented criteria, with an explicit attempt to improve research quality and integrity (Ministry of Education, 2020; Ministry of Science and Technology, 2020). The new policy also shifts the focus from international publications as assessment criterion: one of these documents defines three types of high-quality publications, including as a first priority a list of Chinese domestic journals (Ministry of Science and Technology, 2020).

These initiatives are aimed at changing individual behaviour of researchers or at improving research organization evaluation policies, but the Chinese research publishing system itself has not attracted enough attention. Some scholars have researched problems in the journal licensing system (Lin, 2013a, 2013b; Lin & Zhan, 2014), shortages of journal administrative resources (He, Chen, & Shen, 2012; J. Xu & Wahls, 2012), or the initiatives to make journal peer review more effective (Lin, 2013a, 2013b; X. Zhang, 2012; Y. Zhang, Yuan, & Jiang, 2003). However, the Chinese publication is developing quickly and also national research policies are gone through significant modifications.

This article provides an overview and update on the state of the Chinese scientific publishing system by identifying three of its crucial features, which are essential to understand its management and editorial operation. This includes the journal licensing system for ex-ante examination of new journals, a hierarchical, three-layer management model under state control, and the particular way its editorial policies were adopted from international peer review practices, but incompletely and based on its own antecedents. The main objective of this analysis is to identify the key challenges for the administration of a reliable, high-quality Chinese publication system.

Key points

- China's scientific publishing is built on a triple ownership structure, based in its own political system and a former practice of triple review.
- The accommodation of international peer review practices into China's own scientific publishing tradition has created some tensions.
- Resources for Chinese journals are allocated in the context of a planned research economy, in which journal licences play a key role.
- China is attempting to move away from output-oriented research evaluation but this is introducing challenges for quality guarantees.
- This article identifies crucial challenges for quality improvement in Chinese scientific publishing in the context of recent policy changes.

THREE PARTICULARITIES OF THE CHINESE SCIENTIFIC PUBLISHING SYSTEM

The journal licensing system

China's centralized government system implements top-down control in the field of media and publishing. Chinese scientific journals also are state-controlled, supported by central, regional, or local governments (Jinxiu, 2004). Hence, the establishment, management and operation of scientific research journals are highly regulated.

The state press regulator awards new journals the legal right to publish through a journal licence (Wang, 2018). After approval, the new journal can obtain a China standard serial number, which includes a China Number (CN) and an International Standard Serial Number (ISSN) (China State Bureau of Technical Supervision, 1989). Each CN number approved by the General Administration of Press and Publication (GAPP) allows an institution to publish one journal (Lin, 2013a, 2013b). Digital publishing requires a similar but specific digital publishing licence (GAPP, 2016).

Applications for a journal licence must meet rigid requirements and be approved by different administrative levels (see Fig. 1). In addition to a legal journal publishing unit, the establishment of a journal requires a competent authority and a sponsor that meet GAPP's conditions. Together, these three organizations are the owners of a journal. The approval process involves an examination of the new journal's name and publishing scope, the publisher's name and regulations, its financial guarantees, the working place, whether the editors passed the State's professional accreditation test, and whether the competent authority and sponsor meet GAPP's requirements (GAPP, 2011). Apart from these official application procedures, conditions for journal applications are strict. Not all institutions and competent authorities meet the requirements to assume political responsibility for a new journal (Lu, 2010). In addition to initial journal licensing applications, the periodic revision of these licences also requires the approval of different administrative levels (Cao, 2018).

The journal licensing system is an ex-ante examination that serves three ends. The first is ideological censorship. The licensing system secures that academic aims and scopes are in line with the national ideology, as examined by GAPP (GAPP, 2005). All the examinations and approvals from the different administrative levels ensure that journals comply with the national ideology. In addition, GAPP, local administrative departments, and the competent authorities carry out a monitoring process after journal publication, also to guarantee the political correctness of the published content.

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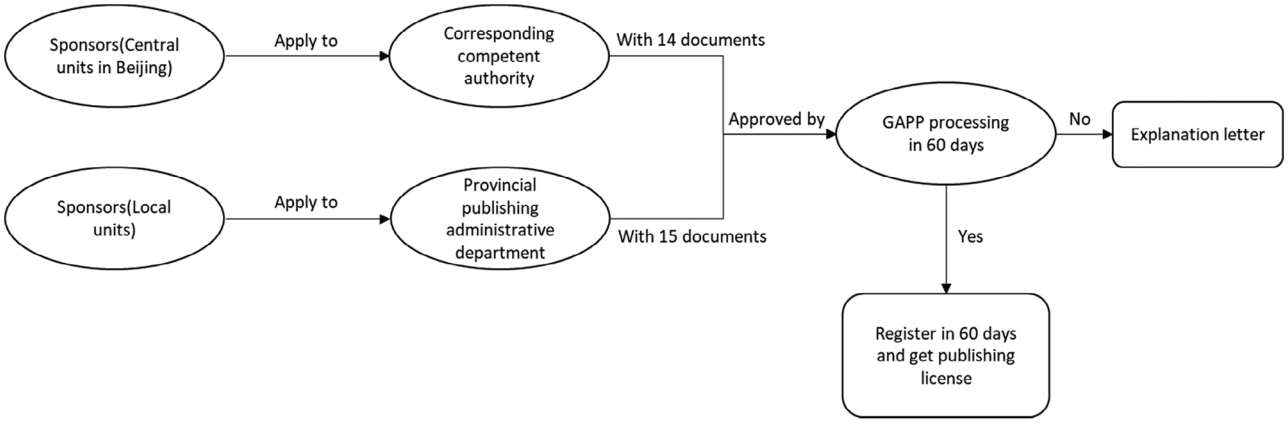

FIGURE 1 Simplified representation of journal licensing procedures.

The second end is to allocate resources to planned priorities. Since the availability of the required CN numbers is restricted, the CN number is 'a scarce resource' (X. Zhu, Song, & Zeng, 2010). Unlike the international journal registration system in the market economy, the Chinese journal licensing system is subject to a state planning model developed during the planned economy period (Liang, 2011).The publication department of The State Council plans the overall number, structure and distribution of journal publishing units across the country as a whole, and guides and coordinates the development of the publishing industry (The State Council, 2016). It aims to use the government's hand to allocate publication resources, control the number of journals, and regulate academic journals to cover various disciplines, which is intended to make journals run efficiently and orderly (Lin, 2013a, 2013b). Scientific journals can only be started if state planning has identified the research field involved as a priority and has allocated resources accordingly.

The third end is to assess whether publishers are adequately equipped, such as whether they have sufficient financial support, available working place and qualified editors. Essentially, Chinese academic journals are social, public goods under the shelter of the planned economy. They mainly operate as non-profit organizations and are funded by the government (China Association for Science and Technology, 2011), although some now have the status of state-controlled companies. The state funding system provides the basic operational conditions. In principle, this assessment can have positive effects on journal quality, as this system promises to oversee whether resources are adequate. However, its practical implementation is often formalistic and the stress is more on ideology and censorship (Lin, 2013a, 2013b), at the expense of its function to ensure journal quality.

Triple ownership

In addition to the restrictive journal licensing system, administrative control over publishing also runs through journal ownership and management. At the top level, GAPP is responsible for examining and approving new journals, overseeing all journals published in China. Below this administrative level, each institution that publishes journals is required to adopt a hierarchical, three-layer management mode to manage journals. The three-layer system consists of a competent authority at the top, a sponsor, and a publisher. The multiple layers and the hierarchy of authority over scientific journals distinguish the Chinese scientific publishing system from its American or European counterparts, in which the key partners are a publisher (commercial or academic), an editorial office (which may or may not be appointed by the publisher), and an editorial board (represented by an editor-in-chief).

To qualify as competent authorities of journals, institutions need to have an eligible administrative level (GAPP, 1993), which are mainly ministries of the government, research institutes, or scientific associations. The sponsor is the subordinate institution of the competent unit, such as universities regulated by the Ministry of Education, and some professional societies supervised by the China Association for Science and Technology. The publisher is generally an editorial office for the daily operation of a journal, set up under the sponsor. Publishers are not allowed private ownership, although some now have private shares. Figure 2 shows the management structure of three Chinese scientific journals, *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, *Acta Chimica Sinica*, and *Scientia Silvae Sinicae*.

GAPP regulations clearly stipulate the triple owners' responsibilities (GAPP, 1993). In China, a publisher must specify the exact competent authority and sponsor in charge and these have great power over journal management (Lin, 2013a, 2013b). The competent authority has political supervision on policy implementation and publishing content examination in principle. The sponsor is the direct superior of the publisher, supplying the necessary conditions for starting a journal and financial security. The publisher (editorial office) is basically in charge of practical editorial procedures, including organizing submissions, editing and the review process. The editorial office itself has no right to select an editor-in-chief or even editorial board members (Lin, 2013a, 2013b). After the publishing unit reform of 2012, some publishing units became companies, but with state institutions as majority shareholders.

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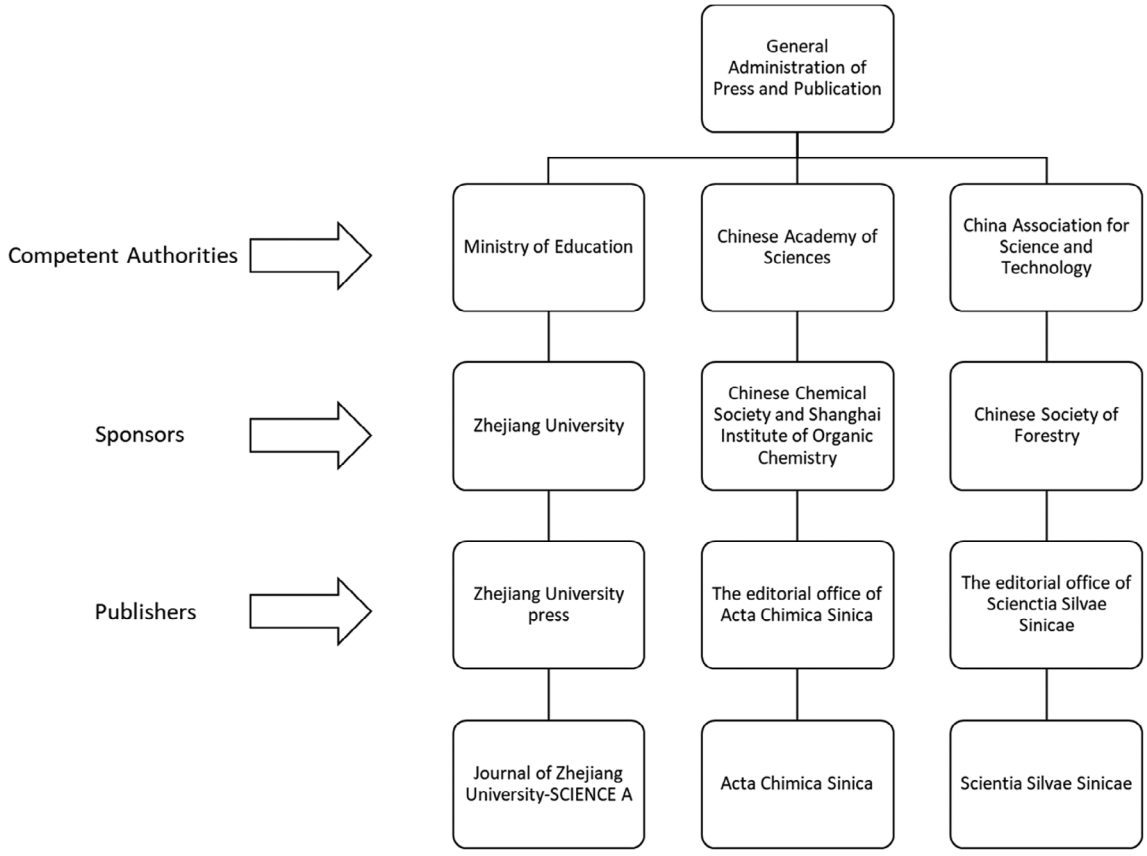

FIGURE 2 The management structure of three scientific journals in China.

While the scientific publishing system is centrally controlled, its implementation is highly distributed. By the end of 2016, 5,020 scientific journals were controlled by 1,375 competent authorities and 3,232 primary sponsors (many journals have more than one sponsor). Competent authorities in charge of the most journals in the top three were the China Association for Science and Technology (459), the Ministry of Education (414), and the Chinese Academy of Sciences (277) (China Association for Science and Technology, 2017a, 2017b). However, there are only eight publishers with more than 10 published journals. The top two publishers are China Science Publishing & Media Ltd. (143 journals) and National Medical Journal Ltd. (117 journals). There are 4,205 publishers publishing only one journal (China Association for Science and Technology, 2017a, 2017b). Among the top two publishers, China Science Publishing & Media Ltd. is owned by the Chinese Academy of Sciences, and National Medical Journal Ltd. belongs to the Chinese Medical Association.

This distribution of scientific publishers in China is quite distinct from the international giant publishers, which have formed an oligopoly in global scientific publishing. In 2013, the top five international publishers owned 53% of the journals in the natural and medical sciences globally. The top five natural and medical science publishers include four private firms (Reed-Elsevier, Wiley-Blackwell, Springer, Taylor & Francis) and only one society, the non-profit American Chemical Society (Larivière, Haustein, & Mongeon, 2015). Thus, the Chinese academic publication system is both markedly more distributed, but also in public hands, in contrast to the international academic publishing system.

Editorial procedures in Chinese scientific journals

Reviewing manuscripts is a critical function of the academic publishing process and especially meant to safeguard the quality and integrity of the published research (Horbach & Halffman, 2018). Editorial assessment, including peer review, has developed into a rich and diverse set of practices in international scientific publishing, including innovations such as open review or post-publication review. In contrast to the large-scale publishing offices that dominate internationally, the distributed Chinese system consists of smaller facilities. A large part of scientific journals in China work with small editorial offices, with a few editors, simple staff structure and little task specialization, in contrast with big international publishers and their highly specialized division of labour and long procedural production chain (Horbach & Halffman, 2020).

International peer review practices have progressively become the mainstream manuscript reviewing format in Chinese scientific journals since the 1990s (Fang, Xu, & Lian, 2008), but in

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the context of its specific features and tensions. In particular, peer review has modified the three-level review system that China originally copied from the Soviet Union to safeguard censorship over the press (X. Sun & Dong, 1999; Yin, 2013). Since the foundation of new China, this three-level review system was employed in all publishing units, including books and journals (Cai, 1994; G. Chen, 1991; K. Liu, 1995). The three-level review layers reviews in the editorial office with a first review by editors, a second review by the director of editors, and a final review by editor-in-chief of the journal (Fang *et al*., 2008; W. Zhang, 1989).

By the 1990s, Chinese scientific journals were expected to 'internationalize' (L. Xu & Fang, 2013). Review by international peers became one key criterion to assess whether journals were internationalized (Y. Zhang, Yuan, & Jiang, 2003). In this context, international peers questioned the consistency of the old three-level review mode with international practices (L. Xu & Fang, 2013; Y. Zhang, Yuan, & Jiang, 2003). Specifically, it was doubted whether the three-level review system could compete with quality-control adopted in Western forms of peer review, which tends to rely more heavily on expert reviewers besides editors and on global rather than Chinese experts' reviewers.

International peer review was first practiced in some university journals (Fang *et al*., 2008; L. Xu & Fang, 2013). For example, the *Journal of Zhejiang University Science* introduced international peer review in January 2002, followed by *Tsinghua Science and Technology* and the *Chinese Journal of Oceanology and Limnology* (Y. Zhang, Wang, & Lin, 2003). These journals tried to modify the three-level review system by including international experts in the second level review. This implied a shift in the role of the editorial director to external peer experts, which in turn were no longer primarily from the same research organization and the same country, but also began to involve international experts (L. Xu & Fang, 2013; Y. Zhang, Wang, & Lin, 2003). By now, many Chinese English-language scientific journals cooperate with big international publishers, they share the big publisher's publication process (Y. Liu, Yang, & Tang, 2019), but these English-language journals account for only 6.7% of all scientific journals in China Mainland by the end of 2018 (China Association for Science and Technology, 2019).

As for peer review procedures, Chinese academic journals progressively integrated the anonymous review into manuscript review procedures since 2000 (Peng, 2011). Some data are available for the entire body of scholarly journals (rather than just the natural and medical sciences, on which we have focused). Based on an online search, Qing Fang (Fang, 2006) found that 103 of 122 Chinese academic journals claim they had implemented peer review, and he concluded that peer review as a basic mechanism for the review of manuscripts in academic journals had made an entry in China. Another researcher (Feng, 2016) surveyed 155 scientific journals in 2016 and found that 148 journals (95.5%) had adopted peer review and 7 journals (4.5%) had not. Among these 148 journals, 80 (54%) journals used double-blind peer review, followed by 42 (28.3%) single-blind peer-reviewed journals, and 20 (13.5%) open peer-reviewed journals. He concluded that peer review had become the main way of reviewing scientific journals.

In addition, new technologies assisting editorial assessment have also developed in China. Many electronic manuscript management systems are improving plagiarism scanning and reference cross-checking, combining automatic detection and peer recommendations into the system, and also in explore innovations to increase editorial transparency (Shi & Wu, 2011). Other studies have explored the role of new social media, such as Weibo, in assisting review of scientific journals (Sheng & Chen, 2013).

Still, some researchers criticized the Chinese peer review system for being only a partial innovation in the context of the three-level review system that hence still cannot be called a truly independent peer review system (Yin, 2013). Research in 366 economics journals found that in practice only 29 journals use anonymous review, which is quite a low rate of peer review adopted by Chinese economic journals (R. Liu & Zhao, 2017). At present, Chinese scholars' research on peer review focuses on case studies, improvement of the review process, and discussion of novel review methods (Fu, 2019). There is a lack of empirical and in-depth theoretical research on the overall status of peer review in Chinese academic journals. In contrast, international research on peer review is more extensive. A survey about peer review procedures of international journals showed that, since 2000, only 0.1% of the 833,172 articles published in 361 journals had not been peer-reviewed (Horbach & Halffman, 2019a, 2019b). In addition, peer review procedures of international journals have grown in diverse forms, with different timing of the review, various novel forms of interaction among authors, reviewers, and editors, and innovative technical supports (Horbach & Halffman, 2019a, 2019b).

In short, we notice that academic publishing in China increasingly seems to adapt itself to international standards (e.g. anonymous peer review) and developments (e.g. transparent review procedures, plagiarism scanning, etc.). As China adopts international peer review practices, it also adopts some of the variation in these practices. However, there is too little reliable evidence at this point to describe precisely how this variation compares to international practices. Compared to international journals, Chinese journals' reviewing procedures leave much to be desired.

In sum, although there is some evidence to show that international peer review practices are being introduced in the Chinese publication system, we actually see a mixed situation. Both the Chinese three-level system and the Western peer review system continue to co-exist in various forms, raising concerns about the impartiality and quality of editorial assessment in Chinese research journals.

KEY CHALLENGES FOR THE CHINESE PUBLICATION SYSTEM

Currently, the Chinese research publication system is very much understudied and systematic information is lacking. Nonetheless, it is possible to identify key challenges, which seem paramount when it comes to increasing its reliability.

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Journal licensing

The journal licensing system is no longer a well-matched approach to regulate resources in the scholarly publishing area and instead it creates specific problems. First, the system is insufficiently selective to guarantee journal quality. The licence approval gives journals an entry card to the publishing system, but there are no processes to eliminate poor journals. As Lin asserts, the journal licensing system also legally endorses some 'trash' journals, effectively harbouring a range of China's version of questionable journals (Lin, 2013a, 2013b). In the light of huge publishing needs and the government's restrictive journal funding and licensing policies, some journal editors have found their own way to earn money, using their resources for rent-seeking purposes, that is, using their exclusive position to charge high page fees, regardless of published articles' quality (Liang, 2011). The quality of Chinese journals is hence variable and often contentious. According to critics, the state-regulated operation and restricted journal supply thereby endanger the pursuit of rigorous research.

Second, there are flaws in the government's planning for the types and the total number of journals available. The overall number of Chinese-language scientific journals is sufficient, but the composition of the set is skewed, with a large number of all-round scientific journals and a relatively large number of poor-quality Chinese-language scientific journals. Lack of specialization and focus may fail to meet the needs of newly developing or highly specialized fields (T. Liu *et al*., 2019). This may discourage scientific innovation. Besides, China has currently committed to developing Chinese English-language scientific journals (Lin & Zhan, 2016; J. Xu, Wang, Zhou, & Liu, 2019). However, some scholars believe these ambitions are hindered by the restriction of CN numbers in the journal licensing system (Lin, 2013a, 2013b; Lu, 2010; S. L. Ren *et al*., 2018). One of the reasons why domestic English-language journals choose to cooperate with international publishers is precisely because of the limited licensing of new journals, either printed or digital (China Association for Science and Technology, 2019). The main way for CN number approval to new English-language scientific journals is through the *Action Plan for the Excellence of Chinese STM Journals*, 10 new journals were approved per year among 2013–2015, 20 new journals were approved per year among 2016–2018, 30 new journals were approved from 2019 (S. Ren, Ning, Chen, & Cheng, 2020). Some researchers believed this speed still lags behind the rapid-growing science, a large scale of 1,000 English-language scientific journals is needed, and the administrative approach of licensing conflicts with the needs of academic development (Ning, 2020). Defects in state planning hinder the publishing venues supply in fast-growing research areas, which resulted in the 'disproportionate supply' in multi-disciplinary fields. As exemplified by the data of Journal Impact Factor Quartile in 2018 (one of the prevailing journal indicators used to assess the impact and quality of journals), among 240 research fields, there are 135 research fields that have no Chinese journals displayed in Quartile 1 and Quartile 2 (S. L. Ren *et al*., 2019). As the Journal Impact Factor and citation rates differ significantly between research fields, some researchers expressed their concerns about the 'repeated supply' of scientific journals in the same research field if these criteria are blindly used for further investment, which may result in homogeneous competition within limited financial appropriations (China Association for Science and Technology, 2019; He *et al*., 2012).

Third, the restriction of CN numbers for new journals does not meet the large publishing requirements of researchers. In terms of current academic evaluation, the promotion of researchers and the graduation of PhD students both require a certain number of publications. At least until recently announced policy reforms, Chinese research careers very much depend on publications, in a research evaluation system that heavily relies on quantified output standards. The need to publish articles goes far beyond the supply of state-managed journals, which results in increasing competition and pressure among researchers (Wang, 2018). This pressure may cause dubious questionable practices, like brokers selling papers and researchers purchasing authorship. Some publishers illegally use one CN number to run more than one journal to solve the publishing shortage (X. Zhu *et al*., 2010). These practices increase the risk of research integrity problems as well as poor-quality papers.

Journal management

The advantage of the triple ownership for journal development is the potential financial support from different owners under the state-control situation. However, this advantage is largely unstable and unable to favour all scientific journals in practice. Instead, this complex and hierarchical management structure of Chinese scientific publishing has caused several problems.

Even though since 2012, The General Office of The State Council promulgated implementation measures on the reform of the editorial office of newspapers and journals, trying to motivate the market to play a productive role in the system and change the publishing units into market-oriented corporations. This reorganized some state-owned publishing units and transformed them into state-owned enterprises. However, the reformation was incomplete and the bureaucratic management approach still remains in effect until now (S. L. Ren *et al*., 2018). A survey of over 1,000 scientific journals of the China Association of Science and Technology showed that more than half of the journal publishing units chose not to take any initiatives to reform (L. Zhu, Liu, Liu, & Peng, 2017).

Hence, the most direct problem of this management style is the manoeuvring space for the publisher: as journals are cross-managed by multiple departments, ownership issues and final decision-making procedures are often unclear, which entails challenges for journal and editorial independence (L. Zhu *et al*., 2017). In addition, the funds for operating journals are dependent on administrative grants from different sponsors or the competent authority, adding complexity to financial management (Hou, Wang, Lv, Zhang, & Chen, 2013). As a result of this management and funding mode, the publisher has no clear sense of ownership. Publishers can get financial support without participating in

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market competition, so there is no incentive mechanism to stimulate publishers to innovate, and they often lack a competitive sense or initiative to improve their service (Lin & Dong, 2013). Hence editorial offices are generally inefficient, resulting in long review periods. Within this government-regulated hierarchical management system, the role of market-driven quality improvement is absent. Journal quality improvement highly relies on editors' individual efforts, top-down pressure, or government policy. Hence, the emphasis on journal quality 'varies from person to person, or from editor to editor' (Zhou & Ke, 2004).

Another problem caused by this management approach is 'organizational compartmentalization', due to publishing units closely affiliating themselves with their 'upper-level', because their funding and human resources are allocated by different organizations (J. Xu & Wahls, 2012). This has resulted in low publishing efficiency, high operating costs and difficulty in resource integration, which conflicts with the current journal policies of grouping journals together and increasing the scale of production in publishing (Cao, 2018; S. L. Ren *et al*., 2018).

Besides, the journal licensing system associated with triple ownership arrangements and the funding arrangements this implies, has resulted in both too much and too little space in the current publication system. Too much space, because the journal licensing system is insufficiently selective; and too little space because there is not enough editorial autonomy as a result of multiple ownership. That is to say, once journals get through the approval procedures, it is not quite clear how the management system supervises and guarantees the responsibility of journals. Hence, the journal licensing system and multi-layer management model does not guarantee the quality of journals.

Editorial assessment and peer review

In spite of widely adopted international peer review procedures, the actual practice not always lives up to common academic standards. A number of weaknesses have been signalled.

In the Chinese system, the details and criteria of the review process seem less clear than in international journals. One research project (P. Chen *et al*., 2016) provided an overview of the problems most often experienced by authors in China compared to international peer review. Respondents reported that long review cycles, an opaque process and sloppy review comments are among the most prominent problems experienced by authors. Interpersonal relationship factors, reviews provided by reviewers whose professional expertise does not match with the research field of the manuscript, and the absence of strict review cycle control were mentioned as important differences between the Chinese peer review and the international peer review experienced by the reviewers. In addition, a survey based on the reviewer database of the Society of China University Journals, found 69.6% of the reviewers had difficulty in determining the evaluation criteria of the manuscript's review (Hu, 2012). Besides, conflicts exist between editors and authors as a result of inadequate communication about the long review cycle and the competence and specialization of reviewers. Editors may also value reviewers' opinions at the expense of author needs (Chao & Hu, 2012).

The system also suffers from a lack of transparency. As some scholars have pointed out, the editorial office of academic journals often lacks a transparent operating system for the selection and management of reviewers (Fang, 2007; Yang, 2015). The review process in China to some extent differs from Western models, notably because the chief editors plays a more powerful role than expert peers (if consulted at all), which makes the system vulnerable to, for instance, practices of nepotism. This lack of transparency is especially a concern against the backdrop of the system's history, since it originated as an instrument for political censorship. Peer review entails that, in principle, submissions are assessed on the basis of quality criteria that are broadly accepted within a particular research community. This means that rejections or requests for revisions are based on scholarly considerations provided by expert reviewers, often allowing or inviting authors to improve their work. Moreover, in the international community, it is relatively easy for researchers dissatisfied with existing review practices to set up a journal of their own, compared to the Chinese system, where this is quite a challenge.

A more precise assessment of the quality of the Chinese system would require more evidence concerning actual practices and author experiences, but on the basis of the evidence currently available review procedures in the Chinese publication system seem at odds with the global plea for more transparency in academic review (ASAPbio, 2018). Lack of transparency, moreover, increases the unpredictability of review outcomes. This is especially a concern in light of the rigid reliance on quantitative performance indicators in research career assessment, notably for Chinese early and mid-career academics. If expectations are harsh while chances of publication are not transparent and unpredictable, this increases pressure on young academics, and this may increase the tendency to adopt questionable research practices (for instance, submitting more or less similar papers to multiple journals to increase your chances of success, rather than taking more time to improve your paper). While quantitative performance indicators are usually implemented to 'rationalize' the assessment system, the unpredictability of the review system also increases the unreliability of publication metrics as an assessment tool.

CONCLUSION AND AN AGENDA FOR THE FUTURE

Our overview of the Chinese scientific publication system identifies how its peculiarities and complexity generate some specific challenges to improve journal quality, in particular in the context of new research evaluation policies as well as open science trends.

With new policy initiatives shifting from quantity-oriented to quality-oriented assessment criteria, high-quality publications and high-quality domestic scientific journals are prioritized. The new policies meditate the room for China's domestic journal development, as one-third of papers by China affiliated researchers are

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expected to flow to Chinese high-quality journals, defined in a selective list of 280 journals (Ministry of Science and Technology, 2020). This provides both opportunities for Chinese scientific journal improvement, as well as challenges for the Chinese publication system. It is complicated and laborious to establish editorially rigorous and accurate journal quality (Scholarly Kitchen, 2020). In the current Chinese scientific publishing system with its defects and inefficiency, the question remains whether it has enough capacity to develop more high-quality journals and handle the increasing number of papers.

In addition, already new challenges are appearing, in particular with respect to new business strategies in the publishing industry. After an analysis of the Chinese publication logic, it is obvious that research journals in China operate differently from international publishers. For international publishers, there is no centralized administrative management. They are commercial entities with market strategies for selling products and services, dependent on the support from research communities. Their advantages are a well-developed production chain, clear division of labour, high efficiency and elaborated procedures of quality guarantee. In the Chinese publication system, with its state-controlled scientific journals, centralized resources are a strength, allowing coordinated efforts in the research system. With a lot of endeavours to improve the global competitive position of Chinese publishers, China turns to a more commercial model but still embedded in the state-control system. Questions remain as to how the business logic of international publishers will relate to the Chinese journal model.

By focusing on experiences in China, this overview of challenges may unintentionally suggest that, while Western systems serve as benchmarks, the deficiencies are at the Chinese side of the spectrum. Therefore, it is important to emphasize that mainstream international practices of journal ownership and peer review are facing multiple challenges as well. As indicated, private ownership of a significant number of academic journals by a limited number of private firms (the 'top five' mentioned above) has been questioned by critics and many alternatives by-passing established podiums are being explored. Rather than suggesting that China should strive to adopt Western models, the question rather is how a global academic publication system that is transparent, accessible and fair could be developed by learning from various practices in various socio-cultural settings. This is the goal to which this paper aims to contribute.

With the open science trend, the large international publishers are continually innovating their services to embrace open access and establish a position in academic infrastructure, which encompasses knowledge production, data storage, or research evaluation (Posada & Chen, 2018). Against this background, journals are not only conduits for research publications but may develop into expanded research information platforms. A key issue is who should own the enlarged journal platforms to benefit knowledge production most: research communities, centralized government, or commercial publishers. With this uncertainty, open science may be a challenge as well as an opportunity for China to change the landscape of global academic publishing. From the initiatives China has taken, it tries to develop its own platform and local infrastructure in scientific communication, which the strategic intent not to give away its local knowledge control to international publishers. This is ambitious and extremely challenging. Without long-term experimentation as well as extensive investment, it is unlikely to achieve considerable development of high-quality journals and academic infrastructure.

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