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Understanding Chinese science: New scientometric perspectives

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1. INTRODUCTION

China's rise in science has aroused great interest in the research community and captured the attention of policy makers around the world. With its tremendous increase in research investment, fast growing SciTech workforce, and broadened access to international collaboration, China has become one of the most important contributors to global scientific knowledge. In 2016, China surpassed the United States as the largest producer of scientific articles indexed in Elsevier's Scopus database (Tollefson, 2018; NSB, 2018). In terms of scientific articles indexed in the Science Citation Index Expanded (SCIE), China surpassed the US as the number one knowledge producer in 2018 (Zhu & Liu, 2020).

China's gallop in science has a far-reaching impact on the global scientific enterprise (Shu et al., 2019; Tang, 2019; Zhou & Leydesdorff, 2006). Accordingly, the study of China's science is receiving a considerable amount of attention (e.g., Liu et al., 2015; Zhang, Shang, et al., 2021). Among various research methods for exploring China's scientific development, scientometric perspectives are becoming increasingly important in the era of evidence-based science policy. For example, in the journal *Scientometrics*, the number of research papers related to China was only 13 in the period of 1990–1999. The number of such papers grew to 82 in 2000–2009, and over the last decade, 311 papers in this journal explored different aspects of China-related scientific research.[1] The small number of empirical studies on China in the 1990s can be explained by both the limited influence of the country and the paucity of data at that time. With the aid of international publication databases (mainly Web of Science [WoS] and Scopus), the number of scientometric studies focusing on China has grown tremendously over the past decades.

These studies provide valuable insights into understanding the patterns, dynamics, driving factors and consequences of China's scientific development. Nonetheless, scientometricians outside China to date still have only limited knowledge on the Chinese science system, which sometimes leads to inaccurate interpretations of scientometric findings. This is partly due to the lack of detailed information on scientometric data sources and scientometric methods for studying Chinese science.

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[1] The WoS search query we used to retrieve records is: ((TI=(CHINA OR CHINESE) OR AB=(CHINA OR CHINESE) OR AK=(CHINA OR CHINESE)) AND (SO=SCIENTOMETRICS) AND (PY=(1990-2019))). The search, which was conducted on January 8th, 2021 through Fudan University Library, returned 406 hits. Only articles and reviews were considered.

To foster and bring together insights into China's scientific development, in June 2019 *Quantitative Science Studies* published a call for submissions to the special issue "Understanding Chinese science: New scientometric perspectives." We solicited papers studying the Chinese science system and research assessment in China. We were particularly interested in scientometric analyses of Chinese science and in contributions discussing the methodological challenges of such analyses.

2. CONTRIBUTIONS TO THE SPECIAL ISSUE

After several rounds of selection and peer review, eight contributions were accepted for publication in the special issue. These articles cover important and relevant topics, using rigorous methods and a variety of data sources.

The special issue covers a diversity of topics on Chinese science, ranging from scientometric analyses (i.e., Chinese social science in general, Sino-U.S. collaborative research, Chinese domestic publication in science, and China's research team size features and dynamics) to studies of the Chinese science system and research assessment in China (i.e., Chinese higher education system, Chinese university rankings, Chinese journal system and journal evaluations).

The contributions use both international and domestic data sources. Unsurprisingly, WoS (Clarivate Analytics) is the most applied global publication data source in this special issue. Six out of eight articles use WoS at least partially for their analyses. China's largest national bibliographic data source, the Chinese Science Citation Database (CSCD), and other data sources such as Nature Index, Technology Alert List, and various university indexes are also used in this special issue (Liu, 2021; Zhu et al., 2021).

The contributions in this special issue primarily use quantitative analytic approaches, showing an impressive range of methods and techniques. Several articles adopt classical scientometric indicators such as coauthorship and citations, whereas some apply newly developed ranking indicators such as rank-biased overlap (Chen et al., 2021). Some combine bibliometrics and science visualization techniques such as science overlay maps, clustering, and heatmaps, whereas others develop innovative network analytics for identifying problems and solutions from scientific documents. Some apply solely quantitative methods, whereas others provide in-depth descriptions of the history of Chinese journal evaluation or the evolution of the Chinese higher education system (Huang et al., 2021; Shu et al., 2021).

Surveying the eight articles in this special issue also reveals a couple of interesting facts. On the one hand, seven articles are products of international collaboration, involving contributors affiliated to research institutes in the United States, Korea, Austria, Norway, the Netherlands and other countries. On the other hand, all primary authors, namely corresponding authors and first authors, have Chinese family names. This renders support to the internationalization of Chinese social sciences, and also seems to support the idea that native language matters in investigating and discovering country-specific knowledge.

3. INSUFFICIENT COVERAGE OF SOME TOPICS

While this special issue advances our understanding of the Chinese science system in various important ways, it leaves a number of vexing issues unsolved, such as name disambiguation for Chinese scholars and integration of national and global data sets. The problem of name ambiguity, which is in particular a challenge for Asian names, not only impedes rigorous studies on microlevel data involving Chinese scholars, but may also lead to inconclusive findings or even wrong policy recommendations. In a similar vein, the lack of glocalized (i.e., globalized

and localized) scientometric data sets creates an incomplete picture and thus leads to incomplete understanding of the research landscape of the country with the largest SciTech workforce. In addition, this special issue does not cover altmetric research based on popular Chinese social media. Research on the dark sides of China's rapid scientific advancement, such as the problem of fraudulent or flawed articles authored by Chinese researchers, is also missing in this special issue.

These important yet underinvestigated topics will hopefully be explored in future contributions published in *Quantitative Science Studies*, enabling scientometricians to further develop their understanding of the Chinese science system as well as China's scientific advancement.

4. LOOKING BEYOND

We hope that this special issue provides scientometricians, and other interested readers, with a deeper understanding of the Chinese science system and of scientometric approaches that can be adopted to study Chinese science. Undoubtedly, each paper has its merits as well as room for improvement. Some readers may find the methods—for instance those introduced by Zhang, Wu, et al. (2021) and Liu et al. (2021)—valuable, while others may find some arguments a bit strong without excluding alternative explanations (Liu et al., 2021). In a similar vein, some readers may appreciate the combined use of multiple data sources for profiling international collaboration (Zhu et al., 2021) and for funding agency name cleaning and consolidation (Liu et al., 2021), while others may question some of the methodological choices. Hopefully future articles in *Quantitative Science Studies* will further widen the application of scientometric methods to the Chinese science system and open up new perspectives. These findings will speak directly to research evaluation practices and science policy making.

Attracting high-quality submissions is always a challenge for newly launched journals. *Quantitative Science Studies*, launched in 2019, serves as the official journal of the International Society for Scientometrics and Informetrics (ISSI). The journal is fully open access, with a relatively low article processing charge (APC) that can be waived for authors that lack financial support. Despite the appealing profile of *Quantitative Science Studies*, the number of Chinese submissions to the journal has been quite limited so far. *Quantitative Science Studies* may have attracted more submissions from Chinese authors if *it had already been indexed in the Web of Science Social Sciences Citation Index (SSCI)*. This is particularly true for junior scholars in China, whose publications in SSCI-indexed journals weigh more than other journal publications in terms of promotion and award. However, this may change in the near future, since a radical reform of research assessment practices in China was launched in early 2020. The new policy seeks to replace a focus on WoS-based indicators with a balanced combination of qualitative and quantitative research evaluation (Zhang & Sivertsen, 2020). This may result in a systematic change in the Chinese science system in terms of research assessment, publication behavior, international collaboration and so on, although the actual effects still remain to be seen.

Finally, we would like to express our gratitude to all contributors and reviewers for their support in making this special issue possible. We sincerely look forward to strengthening communication and mutual understanding between China and the rest of the world.

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