How are the new wave of Chinese researchers shaping up in scholarly communication terms?

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ABSTRACT
The study investigates the attitudes and practices of Chinese early career researchers (ECRs) in regard to all scholarly aspects, providing the findings in the context of the academic assessment policies change in China over the last decade. The data were gathered by means of an online questionnaire survey, which obtained 263 Chinese ECRs' responses. The main conclusions are: (a) journal-based indicators (e.g. journal reputation, Journal Impact Factor, Science Citation Index, etc.) are crucial when Chinese ECRs read and publish; (b) assessment policy plays a vital role when Chinese ECRs decide where to publish; (c) open access and open data have been widely recognized and warmly welcomed by Chinese ECRs, however, they will only publish in open access journals and open their research data if they get rewarded by the evaluation system; (d) most Chinese ECRs had good experience of peer review and they are in favor of double blind peer review; (e) Chinese ECRs are heavy users of social media, they are sophisticated in finding scholarly information online and communicating with peers and colleagues with social media tools.

Keywords: Early career researchers; Scholarly communication; Information behavior; Research evaluation; Research policy.

INTRODUCTION

Fueled by the rapid economic growth, China's scientific research and innovation landscape has undergone a steady process of development. In research and scholarly communication terms, China has undeniably made huge strides and become a significant player on the international stage. The proportion of Research and Development (R&D) expenditure in China's Gross Domestic Product (GDP) has increased from 1.42 percent in 2006 to 2.1 percent in 2016 (China Power Team 2018). In 2016, China's total number of researchers and scholarly articles published surpassed that of the USA, making it the largest source of published research in the world (Tollefson 2018). And in 2017, the total citation of papers authored by Chinese researchers ranked the second in the world (Xinhua 2017). China is

becoming an essential part of the global research community and Chinese researchers are more and more engaged in international scientific research. The number of international collaboration publications rocketed from 2006 to 2015 and the number in 2015 was 4.4 times that in 2006 (National Center for Science & Technology Evaluation and Clarivate Analytics 2017). Springer's Nature Index (2017) stated that by 2016, over 50 percent of China's high-quality research involved international co-authors. At the same time, in order to drive this growth and bring about the required changes, China has introduced a whole range of significant policy changes, a total of 29 policy documents published from 2006 to 2020, which are documented in detail in the section following. The important question we seek to address in this paper is whether this has appeared to shape the attitudes and behaviors of early career researchers (ECRs) and how the "new model army" (Nicholas et al. 2020a) of researchers is generally shaping up. This is not only because ECRs are going to be tomorrow's leading professors, influencers, and decision makers, but also because they make up over three-quarters of all science and technology human resources in the country (Zhou 2019).

BACKGROUND: CHANGING RESEARCH EVALUATION POLICIES IN CHINA

In China, the historically and institutionally rooted practice of governance and administration severely affects R&D development and scientific communication. The Government's leading role influences academic research through the investment money into designated areas and by its method of rewarding research outputs. The government financial investment is allocated according to the rankings of universities and disciplines, and all these ranking systems are based on metrics in which scientific publications, especially from scholarly journals, play a vital role. For many years in China there has been a phenomenon called "SCI-worship" (Zhang and Sivertsen 2020) in the scholarly evaluation system. Publications indexed in Web of Science (WoS) and WoS-based indicators (e.g., the Journal Impact Factor and Essential Science Indicators Highly Cited Papers) have become the core indicators for research evaluation, staff employment, career promotion, awards, university or disciplinary rankings funding and resources allocation (Zhang and Sivertsen 2020). Even individual cash incentives for WoS publications are widespread (Quan, Chen and Shu 2017). "SCI-worship" phenomenon has been intensively criticized for its negative influence on boosting inferior quality paper production, making researchers slaves of metrics, and leading to research misconduct in the past two decades (Xu 2020).

In 2006, the State Council of China announced a policy document titled *Guidelines for the Medium- and Long-Term National Science and Technology Development Program (2006-2020)*. In this document, a goal was set for China to rank as one of the top five most-cited countries. From then on, usage metrics such as citations, have been taken into consideration. In June 2010, the Communist Party of China (CPC) Central Committee and the State Council jointly published the *Guidelines for the Medium- and Long-Term National Talent Development Program (2010-2020)*. It clearly stated in this document that the talent evaluation system should not rely on papers only, professional titles only, or education qualifications only. Then, in 2011 and 2012, the Ministry of Education (MoE) published two policy documents in quick succession to push universities away from their strong focus on WoS-based indicators towards a more balanced combination of qualitative and quantitative research evaluation.

In 2016, China's total number of STM (Scientific, Technical and Medical) articles published surpassed that of the USA, making it the largest source of published research in the world.

The country is ahead of the schedule set by the *Guidelines for the Medium- and Long-Term National Science and Technology Development Program (2006-2020)*. And in this year, President Xi Jinping called for reform towards a more comprehensive evaluation system for individual researchers (Zhang 2016). He said that the evaluation of professional titles should not be based on publications only and then announced a reform of the personnel system in universities and research institutions during the 29th Meeting of the Central Leading Team for Comprehensively Deepening Reform. Following this up in 2017 and 2018, a series of new policy documents on metric-driven scholarly systems were released. The State Council and the General Office of the CPC Central Committee announced the *Instructions on Promoting the Reform of Talent Evaluation System by Classification*. The document (Ministry of Science & Technology 2019a) mentioned that "talent evaluation system should abandon relying on papers only, professional titles only, education qualifications only or reward records only." To follow this up, implementable policies were released by individual universities and institutions. For instance, some universities started to adapt qualitative approach such as peer review when evaluating and recruiting researchers rather than rely too much on their publication and journal-based metrics. However, at the national level, the executable policy documents are yet to come. Looking back over the past decade, a total of 29 policy documents on scientific assessment have been released from the central government. The changing research evaluation policies (Table 1) are analyzed as the background of this paper, and their influence on Chinese ECRs' scholarly communication attitude and behaviors will be discussed along with the survey results.

LITERATURE REVIEW

ECRs, widely recognized as the most creative and energetic researchers, can play a vital role in a nation's scientific research and technological innovation (Friesenhahn and Beaudry 2014). With their new experience and ideas, ECRs are imaginative and enthusiastic researchers who assume a great part in an information-driven economy (Abrizah, Shah and Nicholas 2019). ECRs typically constitute the largest body of researchers in the higher education sector (Jones 2014) and in some countries, such as China, can be counted in the tens of millions (Ministry of Science & Technology 2019b). ECRs are recognized as being among the most creative and energetic researchers, and they have millennial beliefs about openness, sharing, and transparency (Anderson and Rainie 2010; Taylor and Keeter 2010), which apply across all nationalities (Schewe et al. 2013).

However, on an individual level, the ECRs' life is often described as challenging that render it a difficult, vulnerable, and perilous experience (CIBER 2016a). ECRs endeavor to build themselves in a perpetually focused scholarly community while attempting to tackle the demand of other aspects of teaching and institutional commitments are evidently of principal significance (CIBER Research Ltd 2018). A survey conducted by the Chinese Academy of Science (CAS) on Chinese ECRs reported that most of them work at least 50 hours per week and the biggest pressure was from applying for research grant (Qiu, Su and Cai 2017). Most of the respondents in the survey agreed that the academic research system and related policies is the most pivotal factor that influences their career development (Qiu 2017). The pressure is also rooted from the need of universities and higher education institutions to attain good standing in ranking systems such as the "world-class universities and first-class disciplines" (Jiang 2017), Quacquarelli Symonds (QS) World University Ranking and the Times Higher Education (THE) World University Ranking. As a young researcher said in an interview: "University ranking is the base for resources allocation, if

the ranking system and appraising criterion don't change, we early career researchers' slavish situation will not change." (Deng 2013)

Table 1: Changing Research Evaluation Policies and Their Possible Impact on Chinese ECRs

Time	Department	Policy Title	Main Content	Possible Impact on ECRs
2006 May	The State Council	*Guidelines for the Medium and Long-Term National Science and Technology Development Program (2006-2020)*	A goal was set for China to rank as one of the top five most-cited countries.	Attach importance to usage metrics and take citation numbers into account. Try to publish good paper rather than more paper.
2010 Jun.	The CPC Central Committee & The State Council	*Guidelines for the Medium and Long-Term National Talent Development Program (2010-2020)*	The talent evaluation system should not rely on papers only, professional titles only, or education qualifications only.	Peer review and qualitative indicators were used when hiring, promoting, and evaluating ECRs.
2011 Dec.	MoE*	*Suggestions on Further Improving the Evaluation of Philosophical and Social Science Research in Institutions of Higher Learning*	Understanding and using SCI, SSCI, A&HCI and CSSCI correctly and reasonably in academic evaluation. Do not only rely on these indicators when evaluating talent and research.	Researchers from social sciences and humanity studies should not only pursue publishing in WoS indexed journals. Good quality China's journals (published from China and have CN numbers†) should be an ideal publishing outlet.
2012 Mar.	MoE	*Guidelines for Third-round National Academic Discipline Assessment*	Multiple criteria should be used for evaluating, non-self-cited rate and ESI‡ citations are recommended.	Publishing ESI most cited/hot papers and in top journals started to be rewarded when publishing in SCI/SSCI journals became very common.
2017 Dec.	MoF, MoST & MoHRSS§	*Interim Measures for Performance Evaluation of Research Institutions at the Central Level*	Classified evaluation system will be established and improved. Publishing papers cannot be used as the only criterion for judgement.	For applied science and social science, the social influence and usability should be considered when evaluating.
2018 Feb.	State Council & General Office of the CPC Central Committee	*Instructions on Promoting the Reform of Talent Evaluation System by Classification*	China to streamline the mechanisms of evaluating research programs and academic performance of researchers and research institutes. The talent evaluation system should abandon relying on papers only, professional titles only, education qualifications only or reward records only.	The saying of "Four Onlys" was widely spread and against "Four Onlys" became a movement. University level implementable strategies were made and peer review was more frequently used.

Notes:
* MoE=Ministry of Education.
† CN number means China standard periodical number which is consisted of international standard periodical number and civil periodical number marked with CN.
‡ ESI refers to essential science indicators is a compilation of science performance statistics and science trends data based on journal article publication counts and citation data from Thomson Scientific (now Clarivate Analytics) databases.
§ MoF=Ministry of Finance, MoST=Ministry of Science and Technology, MoHRSS=Ministry of Human Resources and Social Security.

Producing publications is increasingly important for ECRs, and they need to publish more often in more prestigious journals than their senior counterparts do (Nicholas et al. 2015). Unsurprisingly, ECRs resolutely hold the traditional peer-reviewed journal with a high impact factor to be the most sought-after outlet for publishing papers (Nicholas et al. 2015; Tenopir et al. 2016). Publishing in indexed journals is a priority for Chinese ECRs, especially journals indexed in the WoS with higher impact factors. The impact factor of journals is an important consideration in China's academic evaluation system, which determines recruitment, contract renewal, promotion, and tenure (Deng et al. 2015). Publishing papers in SCI/SSCI indexed journals is becoming increasingly important in China (Nature Publishing Group 2015). The government and research policy makers realized that only focus on journal-based metric would bring negative influence on the country's scientific research development. So a serials of new policies were released to make a change, as have been presented in the background part of this paper.

Information-seeking behaviors follow a steady trend, with only subtle changes from the past, particularly in the use of social media and networking sites (Nicholas et al. 2020b). In searching for general scholarly information, Chinese ECRs commonly use scholarly search engines such as Google Scholar, Baidu Scholar, and Microsoft Academic, although they need to go through proxy servers to use Google in mainland China. For accessing full-text papers, ECRs turn to digital libraries or databases such as the China National Knowledge Infrastructure (CNKI) (Xu et al. 2018).

With the emergence of Science 2.0, new approaches to science have enabled ECRs to work in a more democratized environment through collaboration-centered, web-based socio-technical networks (Nicholas et al. 2015). Younger researchers assign the greatest importance to utilizing academic social networks for keeping up with relevant scholarship, the differences among the age cohorts are not marked (Blankstein and Wolff-Eisenberg 2019; Spezi 2016). Chinese ECRs are very enthusiastic to use social media and mobile applications to follow and share scholarly information (Xu et al. 2018). Previous studies have shown that Chinese ECRs, in comparison with their foreign peers, are more likely to use social media for scholarly communication (Xu et al. 2015; CIBER 2016b). Chinese ECRs like to use WeChat (the most popular mobile application for social media among Chinese people) to follow and disseminate scholarly content, and they access academic literature from ResearchGate just like their foreign peers.

In the context of Open Science movement, open access has begun to reshape the landscape of scholarly publishing (Morrison 2017; Zhao 2014) and is often predicted to be the future of scholarly communication (Joseph 2013; Lewis 2012; Schonfeld 2015). ECRs have been found to hold much more positive views of open access than their senior counterparts (Nicholas et al. 2015; Tenopir et al. 2016), although they believed that articles published in open access journals (OAJs) are of lower quality than those published in subscription-based journals (Tenopir et al. 2017). Chinese ECRs used to mix up open access journals with predatory ones, which comes without peer review or not published by reputable publishers (Xu et al. 2016). However, a questionnaire survey conducted in 2018 showed that Chinese ECRs read and cite OAJs frequently and have experience of publishing in OAJs. Previous studies have shown that Chinese ECRs do not prefer to publish with open access journals unless they are indexed (Xu et al. 2020). Compared to their peers from other countries, Chinese ECRs have struggled under the dominance of the SCI and Journal Impact Factor (JIF) system (Xu 2020), although the policy of scientific assessment is now changing as mentioned earlier. Significant differences can be seen among disciplines, while researchers in humanities and social science (HSS) areas using OAJs less frequently than

researchers from other disciplines, although they have the same positive attitudes and are equally well informed about them (Xu et al. 2020).

The published literature broadly tells us about ECRs' attitudes and behaviors towards scholarly communication in general with a few studies dealing specifically with Chinese ECRs' information behavior patterns on a selected aspect, such as their knowledge about open access and publishing practices. There is an absence of literature which covered all the scholarly aspects, particularly in the Chinese context. Therefore, this paper aims to provide a unique perspective for deeply understanding Chinese ECRs' scholarly communication attitudes and behaviors from all aspects. It focuses on two related issues:
(a) what are Chinese ECRs' scholarly communication attitudes and behaviors in a national research assessment policy changing environment, and
(b) how they perceive changes in the light of the emergence of new forms of scholarly communication, such as open science (e.g. open access, open data, open peer review, etc.), altmetrics, and social media.

METHODS

The origin of the study is informed by a 3-year-long qualitative longitudinal project conducted from 2016 to 2018. Thirteen Chinese ECRs purposively sampled participated in all three years. Their answers to open ended questions were recoded, coded, and analyzed. Based on this previous qualitative research (Nicholas et al. 2019), a questionnaire survey (see http://ciberresearch.eu/download/ECR-questionnaire-for-website-20191129.pdf) was developed , pilot tested, and distributed online via Survey Monkey and available in June 2019. The questionnaire, developed in English language for collecting answers from international ECRs and comparing data, was also translated into Chinese language and widely disseminated via WeChat, the most widely used social media in mainland China and one of the most popular smart phone applications among Chinese researchers (Xu et al. 2016).

For ethical reasons, respondents could skip any question and leave the questionnaire at any point if they wished. As a result, different number of respondents completed the various parts of the survey questions. Therefore, in the process of data analysis, only the counts and its percentage of each statements is worthy to pay attention to. Answers to open-end questions will be quoted and compared too.

Since the focus of the study was on ECRs, a screening question was presented in the beginning of the questionnaire. All respondents were invited to answer the question: "Are you an early career researcher?" If the answer was not, they could not go on with the rest questions. Alongside the question, the definition of ECRs used by this research was showed for participant to check. In this study, ECRs are defined as follows:

> "Researchers who are generally not older than 35, who either have received their doctorate and are currently in a research position or have been in research but are currently doing a doctorate. In neither case are they researchers in established or tenured positions."

There are two main types of questions in the questionnaire. The first is an attitudinal survey based on Likert scale, which is presented in the text as a stacked histogram in order of level of recognition with different colors for different tendencies and detailed numbers and percentages. The second is a single-choice question with a fixed number of options,

presented in the text as a table that lists each single choice and the number and percentage of ECRs who chose the option.

More than 2000 ECRs responded to the international questionnaire survey. The full results were published in Jamali et al. (2020). The survey administered in Chinese language received a total of 382 respondents, but 119 were not ECRs[1]. Among all 263 ECR respondents (see their demographics in Table 2), 249 of them submitted the questionnaire via mobile phone. Although all respondents were from China, nine (3.42%) of them worked or were affiliated to universities in other countries, including the United States, Singapore, and Spain. The Chinese respondents comprised 49.81 percent males and 43.35 percent females and a balance of sciences (38.4%) and non-sciences (52.55%). Most Chinese respondents aged 26-35 (76.43%), completed their doctoral degrees (86.69%) and worked as either academic researchers, assistant professors, or lecturers (63.12%).

Table 2: Demographics of Respondents

Characteristics of respondents	Item	N	%
Gender	Male	131	49.81
	Female	114	43.35
	Prefer not to say	17	6.46
	No answer	1	0.38
Age	21-25	4	1.52
	26-30	87	33.08
	31-35	114	43.35
	36-40	51	19.39
	40+	4	1.52
	No answer	3	1.14
Subject	Health sciences	11	4.18
	Life sciences	15	5.7
	Physical sciences and engineering	86	32.7
	Social sciences	113	42.97
	Arts and humanities	25	9.58
	No answer	1	0.38
Highest degree completed	Bachelor's degree	2	0.76
	Master's degree	17	6.46
	Doctorate degree (PhD)	228	86.69
	Professional degree (MD, JD, etc.)	5	1.9
	Other/ prefer not to say	6	2.28
	No answer	5	1.9
Job position	Doctoral student	22	8.37
	Post-doctoral student/researcher	40	15.21
	Academic researcher	83	31.56
	Non-academic researcher	12	4.56
	Non-tenure track faculty	13	4.94
	Assistant professor/ lecturer	83	31.56
	Other	6	2.28
	No answer	4	1.52

[1] Because of this the questionnaire began with a screening question to filter out those respondents who did not broadly meet the ECR conditions.

RESULTS AND DISCUSSIONS

The results section is divided into seven parts. The first three part cover matters of general scholarly communication attitudes and behaviors in regards to the following typical scholarly activities: searching, reading, and publishing. The rest six parts look at the matters of: authorship and related policy; peer review; open access; open data; social media; and metrics.

General Scholarly Communication Behaviors

Searching

Searching for scholarly information is the most basic research activity that scholars do every day. Google is the start reference point for searching for scholarly information (Nicholas et al. 2017). Although Google has been blocked in China, Chinese ECRs were still able to find their ways to use Google or Google Scholar, using Virtual Private Networks (VPNs) for instance (see Figure 1). PubMed was less used by Chinese ECRs compared with respondents from other countries, one possible reason is that it is mainly related to health sciences and the number of Chinese respondents from health and life science were relatively low. Compared with the qualitative data that had shown that Google and Google Scholar were the key services used (Nicholas et al. 2017), not much appears to have changed in the course of the 3 years of study in this regard. Although smartphones had a relatively small role to play in searching for and retrieving scholarly content (Nicholas et al. 2020b), Chinese ECRs were more likely to search for scholarly material on a smartphone than ECRs from other countries. This is perhaps because of the high smartphone ownership (Silver 2019) and easy use of wireless network in China (Woyke 2018).

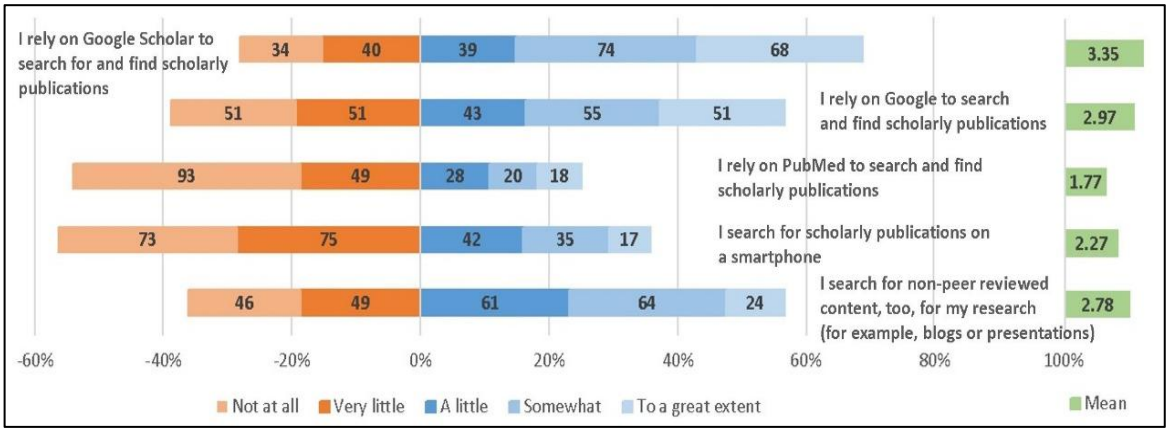

Figure 1: To What Extent Are the Following Statements True about How You Look for and Find Scholarly Material?

Reading

What researchers read and how they read them could be different. Seven statements about academic reading were listed for respondents to rate when asked the question "To what extent are the following statements true about your current practices concerning reading?" (Figure 2). Chinese ECRs much relied on journal's reputation (M = 4.25, SD = 0.91). Rank and JIF seemed more important for Chinese ECRs to decide what to read (M = 4.08, SD = 0.99). And the ease of access is important for them too. Chinese ECRs seemed more easily to be influenced by social media recommendations, but they do not like reading full text academic papers on smartphone screens. This proved that they used smartphone to

search for and glance scholarly information but did not read papers on it (Zheng, Wu and Lv 2019). The importance of ease of access is further emphasized by the percentage (52.5%) of respondents admitting to the fact that they are influenced by it to a great extent or somewhat. As for social media, they are not big influencers in what is read (*M* = 3.15, *SD* = 1.12), although publisher and journals widely used social media platforms (e.g. WeChat official account) to promote. However, if compared the mean value with international respondents' data (*M* = 2.65) (Nicholas et al. 2020a), we can see social media has bigger influence when Chinese ECRs deciding what to read. The number of downloads and the authors affiliation seemed important to them too.

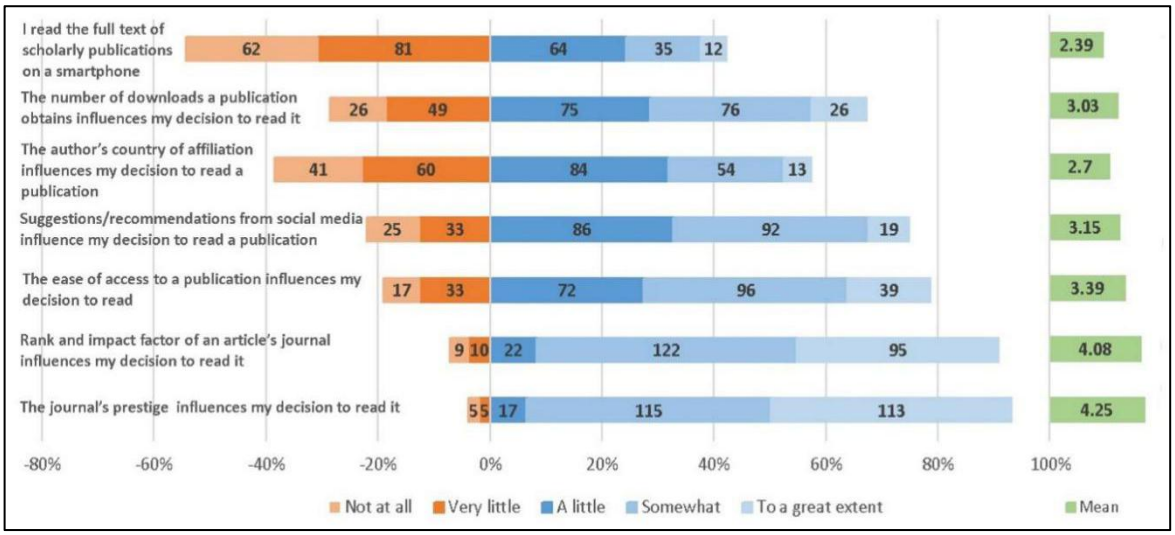

Figure 2: To What Extent Are the Following Statements True about Your Current Practices Concerning Reading?

Publishing

Publishing and disseminating research are crucial portions of the scientific process, as this the activity on which research careers and reputations are made. The most common practice among ECRs in China is to look to publish in journals perceived to be highly ranked in WoS (*M* = 4.45, *SD* = 0.79). This was followed by JIF-based metric driven decisions for choosing publication outlets (*M* = 3.8, *SD* = 1.02). The practice of embracing open science practices was not far behind (*M* = 3.52, *SD* = 0.96). The survey results also reveal that Chinese ECRs were reluctant to share research data/results before their publication. And the use of social media to promote research, sharing links to and news about publications on social media and posting peer-reviewed version of publications on social media were rated lowest by Chinese ECRs (See Figure 3).

Publishing behavior is closely related to academic appraisal system and rules. In China, for about two decades, researchers were encouraged to publish in WoS-indexed journals, especially in the highly ranked ones (Xu 2020). Universities and institutions even provide monetary incentives for researchers who publish in top journal. The motivation of promoting international indexed publication in China lays on the university ranking system. In all three wildly used world university rankings, namely the Shanghai Ranking (Academic Ranking of World Universities), Times Higher Education (THE) Ranking, or Quacquarelli Symonds (QS) ranking, WoS / Scopus index and JIF play important roles.

Research paper was a primary measuring stick used to determine funding and career advancement for many years. Key considerations have been the quantity of papers

produced, publishing those papers in journals listed in the SCI, and publishing in journals with high JIF scores. Institutions in China have tailored their practices to meet these criteria, putting pressure on researchers to publish as many papers as possible. This "SCI-worship" (Zhang and Sivertsen 2020) phenomenon may change with a series of scholarly assessment policy documents released from the central government level in the past decades (see Table 1). But the interviews and survey confirm the dominance of quantifiable metrics to determine where to publish.

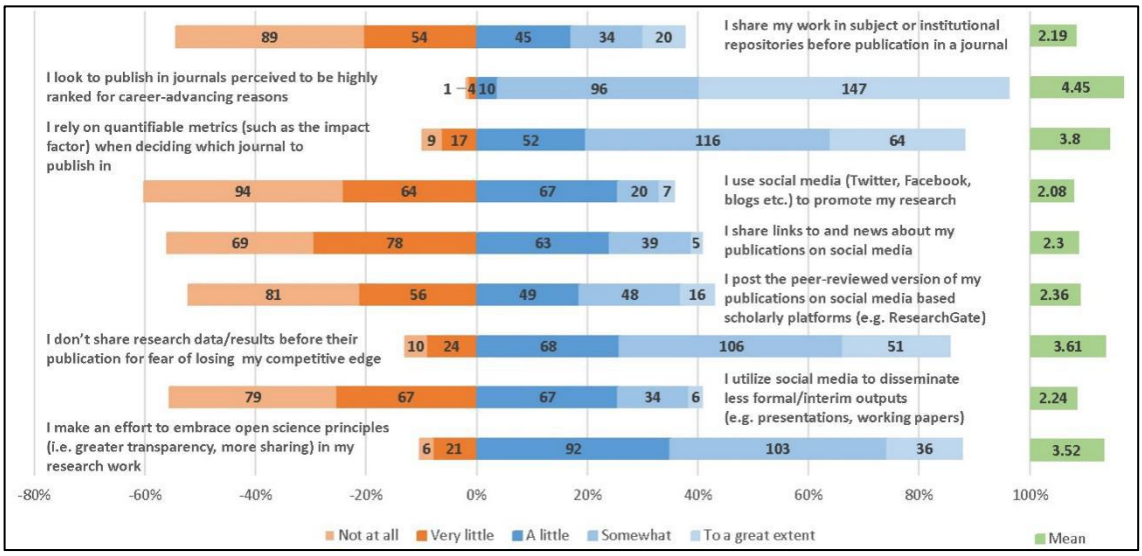

Figure 3: To What Extent Are the Following Statements True about Your Current Practices Concerning Publishing?

Authorship Contribution and Policy

The survey showed that the vast majority of Chinese ECRs have co-authored papers and contributed to their papers in a variety of ways (see Table 3). Writing papers is the most common activity for researchers to contribute to the papers (83.91%). Editing paper and analyzing data ranked the second and third for Chinese respondents (73.91%). What they tend not to be closely involved with is obtaining funds for open access publishing.

Clearly that the vast majority of ECRs' institutes have authorship policies. But are ECRs satisfied with these rules? Do they have influence on making authorship policies? If yes, what will they do? The questionnaire asked four questions regarding authorship policy because it is so decisive for ECRs' career development. Not surprisingly, most Chinese respondents' universities have made (formal or informal) authorship policies that determines authorship status, order and reward. In terms of the specifications of the authorship policy, criteria for determining the first authors is the most widespread one (79.64%), followed by determining who can be named as authors, as the corresponding author (57.01%) and the order of the authors (59.28%) (see Table 4). Criteria for determining the corresponding author is very important in China because many universities and institutions give corresponding authors the same reward as the first authors.

Table 3: What was Your Contribution to the Papers You have Co-Authored?
(Tick as many as applies)

Rank	Authorship Contribution	N = 230
1	Writing the paper	193 (83.91%)
2	Editing the paper	170 (73.91%)
3	Analysing the data	169 (73.48%)
4	Reviewing the literature	126 (54.78%)
5	Producing or gathering data	126 (54.78%)
6	Conducting the fieldwork	87 (37.83%)
7	Finding funds for the research	50 (21.74%)
8	Obtaining funds for open access publishing (APC)	24 (10.43%)
9	Other (please specify)	4 (1.74%)
10	Null	1 (0.43%)

Six Chinese respondents ticked "other" option and five of them said the authorship policy also determines affiliating university and its order. Chinese ECRs had mixed feeling about their universities' authorship policy. When asked "Would you do things differently if you were in charge of arrangements?", a total of 83 respondents said "don't know", counted for 37.56 percent of all 221 participants. For the rest, 62 ECRs said "yes" and 76 said "no", counted for 28.05 percent and 34.39 percent of all respondents (n = 221). For those who said they will do things differently, some said it will hinder collaborations among different universities if only rewards the first author's affiliating universities, and more people complained about the existing authorship policies that rely too much on the order of the author rather than their "substantial contribution".

Table 4: If Yes, What are the Main Specifications of the Policy?
(Tick as many as applies)

Rank	Authorship Policy	N = 221
1	Criteria for determining first author	176 (79.64%)
2	Criteria for determining the order in which authors are named	131 (59.28%)
3	Criteria for determining the corresponding author	126 (57.01%)
4	Criteria for determining who can be named as authors of a paper	123 (55.66%)
5	Other (please list):	6 (2.71%)
6	Null	1 (0.45%)

Peer Review

Over 80 percent ECRs have the experience of responding to reviewer's comments on papers. Most Chinese respondents found the experience was good (126, 58.33%, n = 216). They thought it was a good learning experience which could improve their skills and knowledge, moreover, through responding to the reviewers, they understand better how academic publishing works. Among those who reported they had mixed or bad experience, most of them complained that the reviewing process took too long (see Table 5). As authors' works are being reviewed, Chinese ECRs seemed more positive, they were more likely to see the benefit.

Table 5: What did You Feel about Responding to Reviewers' Comments?

	Feel about responding to reviewers' comments	**Total N**
Rank	**Benefits**	**N = 126**
1	Was a good learning experience	106 (84.13%)
2	Improved my writing/presentational skills	100 (79.37%)
3	Helped to plug holes in my knowledge	77 (61.11%)
4	Helped understand the academic publishing process	72 (57.14%)
5	Academic recognition afforded was beneficial for career progression	52 (41.27%)
6	Others (please specify):	1 (0.79%)
7	Null	2 (1.59%)
Rank	**Mixed or bad**	**N = 90**
1	Reviewing process took too long	67 (74.44%)
2	Reviewers' comments were superficial	39 (43.33%)
3	Reviewers badly chosen	23 (25.56%)
4	Reviewers were not receptive to new ideas	22 (24.44%)
5	ECRs are treated as novices	15 (16.67%)
6	No opportunities to respond to the reviewer after receiving the review	9(10%)
7	Others (please specify)	8(8.89%)
8	Reviewers' comments were not informed	5(5.56%)
9	Null	1(1.11%)

The questionnaire asked if ECRs had reviewed papers. Over half of the respondents said that they have been a reviewer (Yes = 136, 51.71%; No = 127, 48.29%; n = 263) and being invited by the journals and supervisors were the main ways how they got recruited (see Table 6). When asked "what did you learn from acting as a reviewer?", most Chinese ECRs said that they watched what others doing (110, 80.88%, n = 136). They wanted to help others to improve their works (84, 61.76%, n = 136) rather than seeing other people's errors and learning from them (67, 49.26%, n = 136).

A further question about peer review preference was asked. A list of six frequently used peer review were provided for respondent to choose. Some are very traditional ways and some others are more open and transparent, ECRs were invited to choose only one type of proposed peer review they prefer best as a reviewer. Double blind was the preferred choice by Chinese ECRs (128, 48.67%, n = 263). Although it is not perfect, the double bind peer review system is strongly preferred by Chinese ECRS because they thought that anonymity is crucial for an honest and unbiased review and can overcome reviewer bias, misconduct or abuse. About one fifth of Chinese respondents even voted for triple blind, namely not only are authors and reviewers blind to each other's identities but editors are also blind to the identity of both (Table 7). Chinese respondents seemed more like anonymity as triple blind was the next most popular form. It showed that new and open peer review forms are not very popular among Chinese ECRs because they believed that anonymity is crucial for unbiased review.

Table 6: Experience of Being a Reviewer

Rank	Think of the last time you were recruited for a review, how were you recruited?	N = 136
1	An invitation from journal because of my previous publications in the same journal	53 (38.97%)
2	An invitation from my supervisor/ mentor or the head of your group	36 (26.47%)
3	An invitation from journal because of my previous relevant publications in other journals	33 (24.26%)
4	An invitation from journal because I have contacts in the editorial board	11 (8.09%)
5	Because I am a member of the editorial board	2 (1.47%)
6	Null	1 (0.74%)
Rank	**What did you learn from acting as a reviewer?**	**N = 136**
1	What other researchers are doing	110 (80.88%)
2	How to be positive and contribute to the improvement of other people's work	84 (61.76%)
3	Seeing other people's errors is a good learning experience	67 (49.26%)
4	Reviewing is time consuming	47 (34.56%)
5	How uncomfortable it is to criticise/reject the papers of one's peers/colleagues	37 (27.21%)
6	Reviewers not given enough time to do a proper job	25 (18.38)
7	How poor writing standards are	19 (13.97)
8	Others (Please specify):	2 (1.47%)
9	Null	1 (0.74%)

Table 7: Preference of Peer Review and the Reasons?

Rank	What type of peer review do you prefer best as a reviewer? (choose one)	N = 263
1	Double blind (The reviewers don't know the identity of authors, and vice versa)	128 (48.67%)
2	Triple blind (Not only are authors and reviewers *blind* to each other's identities but editors are also *blind* to the identity of both).	50 (19.01%)
3	Single blind (The author does not know who the reviewers are)	22 (8.37%)
4	No preference / Don't know	20 (7.6%)
5	Open identities- where reviewer's name is published	14 (5.32%)
6	Null	13 (4.94%)
7	Open reports – where only the content of the review is made public	9 (3.42%)
8	Post-publication – where papers are reviewed after publication	7 (2.66%)
Rank	**What is the main reason for your choice? (pick one main reason)**	**N = 263**
1	Anonymity is crucial for an honest and unbiased review	168 (63.88%)
2	Transparency encourages reviewer accountability and thoroughness	39 (14.83%)
3	Anonymity can overcome reviewer bias, misconduct or abuse	28 (10.65%)
4	Null	13 (4.94%)
5	Transparency inhibits voicing negative views/criticisms	8 (3.04%)
6	Others (specify, please):	7 (2.66%)

Although ECRs were in favour of traditional double-blind peer review, they strongly agreed that it can be improved for ECRs (see Figure 4). Chinese respondents look forward to more constructive comments to improve articles (*M* = 4.02, *SD* = 0.83) and thought that reviewers should be more open to innovate ideas (*M* = 3.89, *SD* = 0.82). More rigorous assessment was ranked number three by Chinese ECRs (*M* = 3.83, *SD* = 0.86). Publishers were thought to be the best organizer to run peer review by most Chinese ECRs (203,

77.19%; n = 263). For those who thought publishers should not continue to organize peer review, learned or scientific societies were most frequently nominated as replacement (45, 47.87%; n = 94).

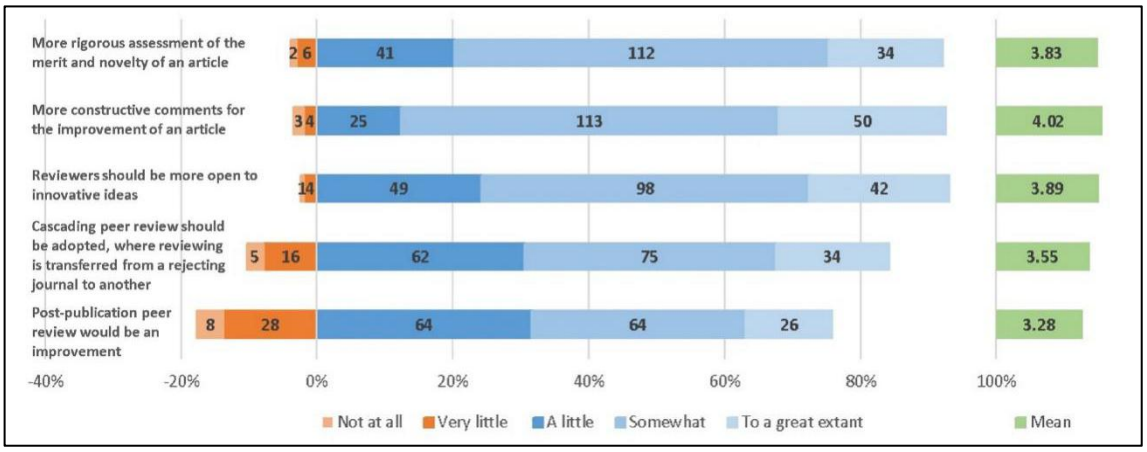

Figure 4: To What Extent Do You Think Each of These Actions will Improve Peer Review for ECRs?

Open Access

Open access has begun to reshape the landscape of scholarly publishing (Morrison 2017; Zhao 2014) and is often predicted to be the future of scholarly communication (Joseph 2013; Lewis 2012; Schonfeld 2015). Many researches confirmed that open access makes it easier to promote an academic work (Abrizah et al. 2016; Tenopir et al. 2014).

A recent survey on Chinese researchers' usage of open access journals (Xu et al. 2020) showed that half of the respondents had published papers with open access journals, the percentage has increased compared to most of existing surveys on Chinese researchers conducted a few years ago (Ren 2015; Xu et al. 2016).

The followed questions focused on ECRs perceiving about open access. Researchers were presented with two groups of statements which refers to advantages and disadvantages of open access respectively and asked the extent to which they agreed with them (see Figure 5 and 6). Chinese researchers had identical views on the topic of open access. They agreed that publishing open access has many benefits including increasing visibility, impact and networking potential. Meanwhile, they were still concerned that open access publishing cost might be high (M = 3.03, SD = 1.197) and there are many predatory journals (M = 3.13, SD = 1.067).

Open Data

Data is the most valuable research asset for researchers. Most of Chinese ECRs have produced data during their works (220, 83.65%, n = 263). Among those who have produced data, most (124, 56.36%, n = 220) of them have made their data available. This is different from a previous semi-structure interview conducted by CIBER (CIBER Research Ltd 2018). Chinese ECRs became more likely to open their data rather than generally welcoming the idea of data sharing. In terms of how did they make data open, Chinese ECRs confirmed that publishing it as supplementary material is the main way (see Figure 7). There may be a clash between the wish to use their evidence first (in papers in high ranking journals as supplementary material) and the obligation to openness. Publishing in data journals has taken on, a total of 22 Chinese respondents said they did so. Respondents were asked the

reasons for making or not making data open. Their answers showed that Chinese ECRs are generally welcoming of data sharing, which is thought good for reproducibility and verification purposes and, hence, good for science (see Table 8). Nevertheless, the requirement of journals is vital too. In regard to why not sharing data openly, most Chinese respondents said that mainly because no policies that mandate data sharing. Lack of incentives and no requirement from journals, "who will do such things (sharing date openly)", as one of the respondents said.

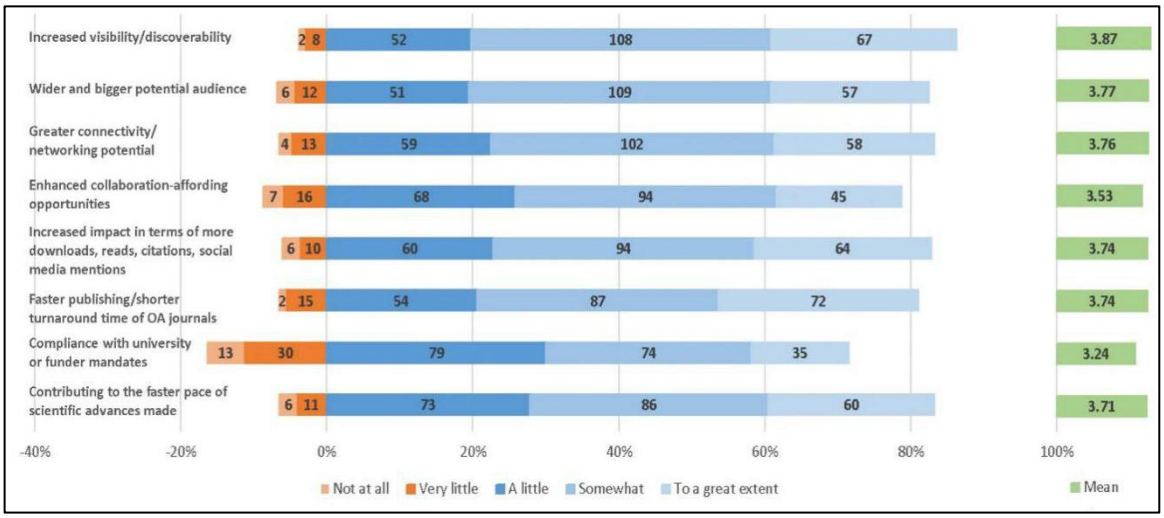

Figure 5: To What Extent Do You See Each of the Following as Advantage of Publishing Papers as Open Access?

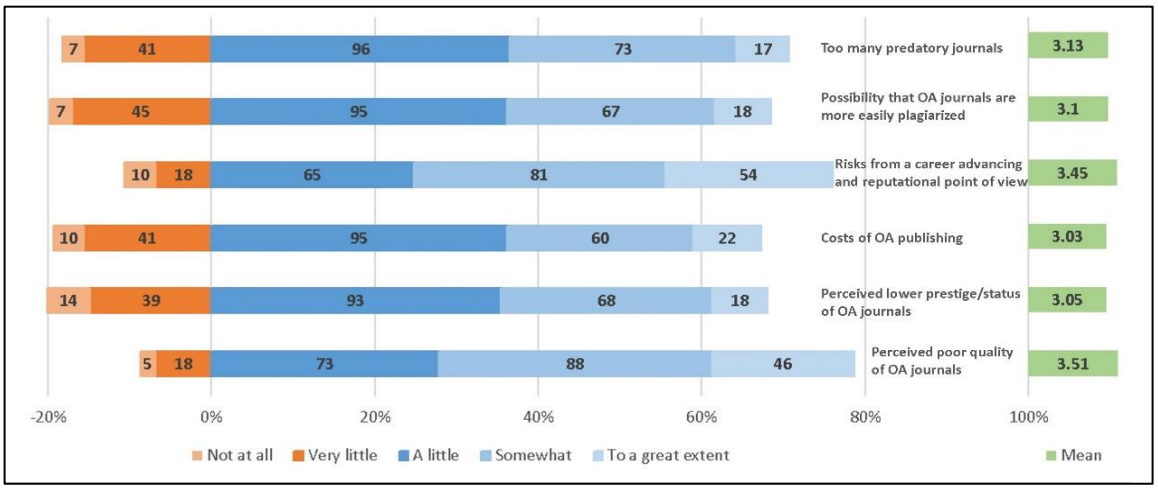

Figure 6: To What Extent Do You See Each of the Following as Disadvantages of Publishing Papers as Open Access?

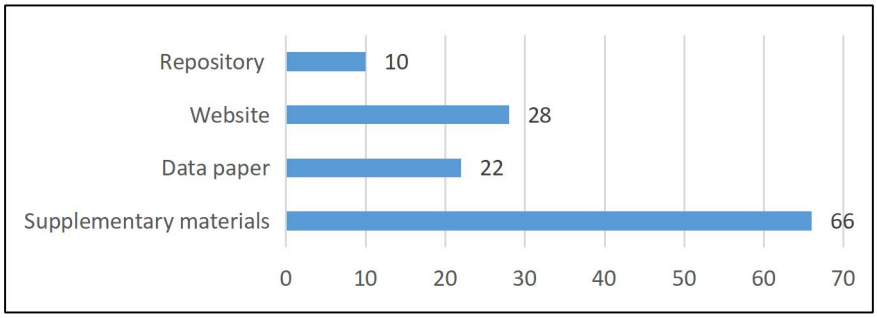

Figure 7: How Was Your Data Made Available?

Table 8: Reason for Making / Not Making Data Openly Available

	Option	N	Percentage
Open	Enables reproducibility	31	32.29
	Enables reuse	21	21.88
	Ensures preservation and future accessibility	23	23.96
	Encouraged/ mandated by open science policies	18	18.75
	Compliance with journal publication policy	36	37.5
	Confers a citation advantage	12	12.5
	Signals credibility	43	44.79
	Facilitates collaboration	13	13.54
	Belief in Open Science policies	14	14.58
	No answer/Others	7	7.29
Not open	Competitive worries	37	29.84
	Risk to career advancement as data sharing not generally rewarded by current reward systems	31	25
	No policies that mandate data sharing	77	62.1
	Too much trouble to clean up	20	16.13
	Size of datasets prohibited sharing	21	16.94
	The nature of data (i.e. confidential, national security related) prohibited sharing	26	20.97
	No answer/Others	7	5.64

Social Media

Social media has been frequently used for scholarly purpose by ECRs worldwide (Nicholas et al. 2017) and it is now becoming mainstream for researchers to use scholarly social media to share, network and showcase - and this applies to Chinese ECRs too. For some Chinese ECRs, using social media is an everyday, mainstream activity: "I use WeChat for scholarly communication almost every day". This survey showed that more than 70 percent respondents used social media in scholarly communications, mainly for keeping up-to-date (M = 4.04, SD = 0.85), searching for scholarly information(M = 3.67, SD = 1.06) and networking with peers and colleagues (M = 3.47, SD = 1.04).

Among all social media, WeChat was mentioned mostly, and then the ResearchGate, followed by Emuch (an online community of postgraduates and young researchers in China) and A Scholar (a China based academic social media website like ResearchGate). Besides, Github, Mendeley and Figshare were mentioned too.

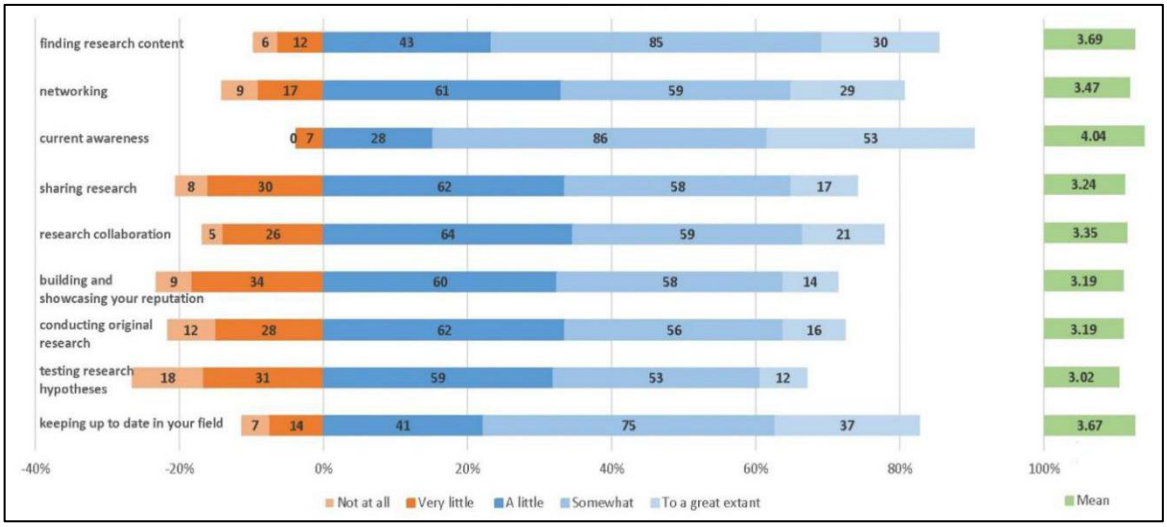

Figure 8: To What Extent Do You Use Social Media for Each of the Following Purposes?

Metrics

No metrics are perfect in evaluating researchers' performance but there is still a measurement required to practice. Traditional journal-based impact factor (such as JIF and WoS journal ranking) is still playing a central role in China's scientific evaluation system. It is obviously not the only metric nowadays when policy makers started to realize that JIF and SCI have shortcomings such as they are not objective when being used for evaluating papers or persons. Chinese ECRs seemed to like the usage-based metric as mentioned by one of the respondents:" Citation-based indicators are enough for me; I've never thought about other indicators."

With the widely use of social media in mainstream scholarly communication, altmetrics such as downloads and tweets were used by more and more Chinese ECRs. Some universities even consider altmetrics as a measurement when hiring and promoting researchers in China. This survey showed the that Chinese ECRs mostly used metrics (both citation-based and altmetrics) to identify important papers which they must read. Besides, they like to use metrics for monitoring their publications' impact. But some of them showed their concerns on the trustworthy of these new metrics: "It is easy to temper the records (of reads and tweets), it's like a game rather than a trustable evaluation tool", a respondent remarked.

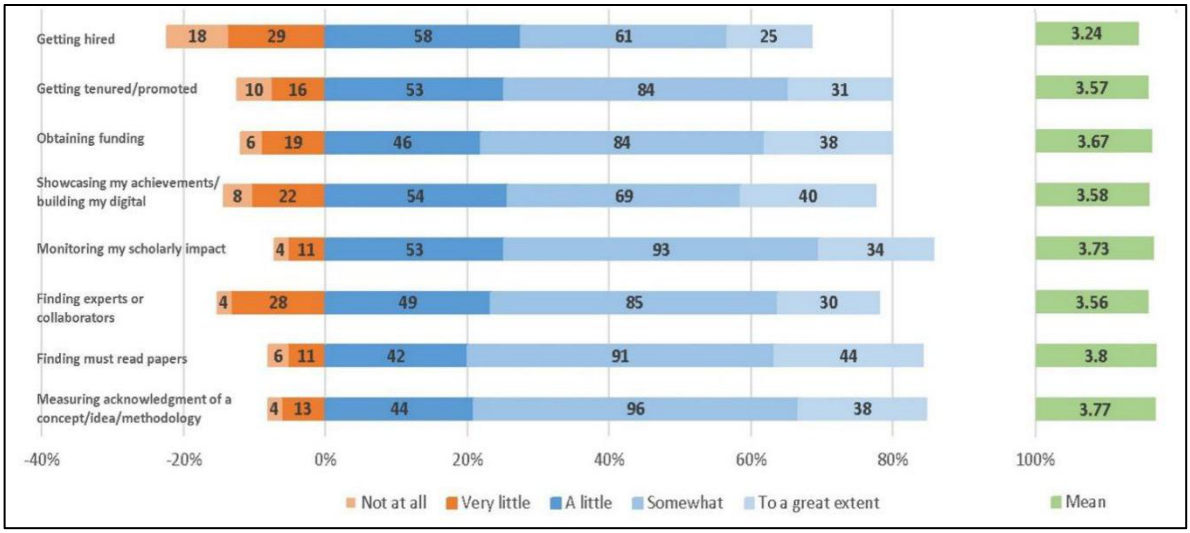

Figure 9: To What Extent Do You Use Citation Indicators for Each of the Following Purposes?

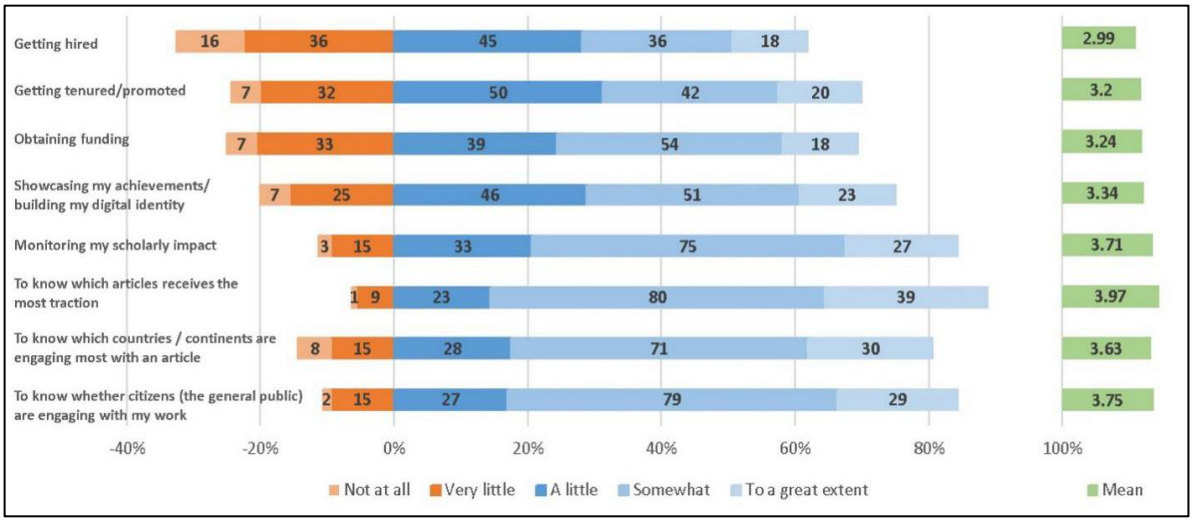

Figure 10: To What Extent Do You Use Altmetrics Indicators for Each of the Following Purposes?

CONCLUSIONS

The academic assessment policy is the driven force which determines researchers' scholarly communication behaviors from various aspects. As described earlier in this article, in the past decade, the central government of China put a lot of effort to switch the academic evaluation policy toward not-only-focused on metrics and to promote a radical reform of research evaluation which is more balanced between qualitative and quantitative criterion. Through combing the respondents' answer to the current survey and portraying Chinese ECRs scholarly communication and information behaviors, we have already seen some influence of the past policies.

First and foremost, ECRs' reading and publishing practices seemed more rely on the quality and reputation of a journal, although the quantifiable metrics were still important when

deciding which journal to publish in. Most of Chinese ECRs strongly agreed that "the journal's prestige influences their decision to read it" (*M* = 4.25, *SD* = 0.91). In terms of publishing, although highly ranked journal was mostly preferred for career-advancing reasons (*M* = 4.45, *SD* = 0.79), some Chinese ECRs have tried to embrace open science (*M* = 3.52, *SD* = 0.96).

Second, the survey result indicated that Chinese ECRs broadly support open access and are in big favor of social media. As a new wave of researchers, they saw many advantages of open access and use social media frequently for scholarly purpose. These attitudes and behaviors have been influenced by the assessment policy change too. The new policies try to introduce performance indicators towards a more balanced combination of qualitative and quantitative research evaluation; and for both sciences and social sciences, the true value of societal impact should be gauged. For implementation of the policy, some universities have started to use citation-based and social media metrics when evaluating researchers, and this could be an incentive for Chinese ECRs to embrace open access and social media.

Third, from their responses to the questions on peer review, data sharing and authorship policy, we could see that Chinese ECRs were largely agreeable that pursuing the reputation is their main purpose of scholarly communication although they still live in a rankings-besotted world. There are reasons to believe that the policy change in the past decade has disseminated the idea, especially the calling of against "Four Onlys" (the talent evaluation system relying on papers only, professional titles only, education qualifications only or reward records only) (Ministry of Science & Technology 2019a) which has greatly discussed by researchers. After that, more detailed implementation steps were put into practice by many universities and institutes.

However, the survey results also showed that the journal ranking and JIFs are still playing a decisive role in Chinese ECR's scholarly communication behavior especially in publishing decision making. This is probably because most of the national level policies are merely guidelines, which are lacking of mandatory measures. The implementation of the policy lies in universities, associations, and institutes, leading to different organizations having different solutions and responses to the policy.

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