Revisit the implementation status of research data management in Chinese academia

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Abstract

The paper examines the current literature of RDM implementation status, then follows a three-level model to revisit the implementation status of RDM in Chinese academia by reviewing the governmental documents, funding agencies' policies, and institutional efforts. The findings suggest that the macro-environment of RDM in China is interrupted at the agency level caused by the inactions of strategies and lack of policies. The results also suggest that national universities varied in RDM services and repositories, and the macro-environment of RDM in China is problematic. The paper then identifies the problems, discusses the fundamental issues, and proposes solutions from three principles.

Keywords Research Data Management, Data Policy, Data Repository, Data Curation, Data Stewardship, University Libraries

Introduction

In recent months of 2020, historical research data's controversial issues have resulted in international debates among countries. The unexpected political arguments of a non-scientific nature distressed those fighting the epidemic on frontlines and disintegrated scientific efforts towards the disease. However, the impact caused by the debates about the availability of historical research data proved the necessity of research data management (RDM). It also implies that a well-implemented RDM strategy contributes to the public good, not only validating research results. Rapid access to research data ensures scientists and epidemiologists perform duties for timely results and strategies (Yozwiak *et al*., 2015).

RDM is a broad concept being vastly discussed, and it can be generalized as a process, facilitated with tools, to manage the full lifecycle of data to ensure the preservation, access, security, discovery, and reusing (Corti et al., 2014; Allison, 2015). The paper uses the term RDM to refer collectively to data management involving services, tools, and systems. The paper aims to investigate the status quo of RDM implementation in China. The paper examines the current literature of RDM implementation status in the world and China, then outlines the macro-environment of RDM into a three-level model. The paper reviews to determine if there are any guideline documents at the government level, policies at the funding agency level, and technology and service models at the institution level. The results detect that the model is interrupted at the agency level by finding no RDM policies imposed by all national funding agencies. The results also suggest that national universities varied in RDM implementations, and

the RDM macro-environment, in general, is problematic. The paper finally discusses some fundamental issues that remain unsolved in RDM and proposes solutions to them.

Literature Review

The practice of research data management (RDM) has prevailed in academia for over two decades since research data gained recognition as one of the stand-alone research outputs (Atkins, *et al*., 2003; Akers *et al*., 2014). Research funding agencies, led by the U.S. National Institutes of Health (NIH, 2003) and the National Science Foundation (NSF, 2011), started to require data management plans in the submitted proposals. Mandated by governmental guiding documents (OSTP, 2013), the federal departments and public agencies have all implemented their RDM policies, requiring RDM plans in the application proposals (Sheehan, 2016; Holdren, 2017). RDM has become a global movement exemplified by the global society GO FAIR and its FAIR Principles (Wilkinson *et al*., 2016). Many other countries have been increasingly adopted similar strategies, which are usually regulated by governments and enforced by funding agencies (Adyinoglu *et al*., 2017; Donnelly, 2018; Redkina, 2019; Schöpfel *et al*., 2018; Searle *et al*., 2015).

A broad range of literature has discussed the importance of RDM and identified it as one of the future trends of librarianship (ACRL, 2012; ACRL, 2016). A retraction of research published by *Science* signified the necessity of RDM, as one of the cited reasons was the lack of original data that can be used to confirm the validity of the reported findings (McNutt, 2015). Recent achievements in the Higgs boson and gravitational waves present the significance of shared data collaborations (Redkina, 2019; Teperek, 2018). In recent months of 2020, during the pandemic COVID-19, controversial issues of historical research data have caused international arguments (Akpan & Jaggard, 2020; Brewster, 2020; Huang & Li, 2020) that not only distressed those fighting the epidemic on the frontlines but also escalated to some political incidents smashing the global society (Chiu, 2020; Vazquez, 2020; Winter, 2020). The impact caused by the debates about the availability of retrospective data reinforces the necessity of RDM. It also indicates that a well-implemented RDM strategy could have contributed as a core function in epidemiology to help maintain the public health and societal order during epidemics, as Yozwiak *et al*. (2015) reported in their *Nature* article, that scientists' rapid access to the open data had led to the timely identification of the causes of the spread Ebola epidemic in the initial period.

Technological infrastructure, personnel supports, and service models of RDM have all been established and practiced (Akers *et al*., 2014; Pralle, *et al*., 2013; Hudson-Vitale, *et al*., 2017). However, a recent study by Mons (2018) revealed that only a small fraction, about 12 percent, of research data is shared and stored in reliable repositories. Reasons for the reluctance to data sharing varied, but as researchers suggested, it is more a people problem than a technical one (Schöpfel *et al*., 2018; Stuart *et al*., 2018; Ward *et*

al., 2011). For the regions where RDM still lags in academia, for example, Turkey, Russia, and China, the lack of policy guidance of funding agencies or governments, as well as researchers' general perceptions of RDM, have become the major hindrance to the implementation of it (Aydinoglu *et al*., 2017; Redkina, 2019; Si *et al*., 2015). Data scientists noticed that the lack of policy, strategy, knowledge, and skills in the research environment undermines the implementation of RDM in Turkey (Aydinoglu *et al.*, 2017). Redkina (2019) revealed a similar survey result and showed that Russia's respondents expressed the need for advice, practical assistance, and necessary skills in Russia. Scholars called for immediate policy mandates issued by the funding agencies and an RDM education for effective habit adaption for graduate students and early career scholars (Aydinoglu *et al*., 2014; Powell, 2016; Tenopir *et al*., 2011).

In China, a few scholars started to discuss data curation in 2001, but not until 2011, the first research paper about RDM was published (Ou and Zhou, 2016). The recognition of RDM is the foundation where facility and capability can be built upon, which requires a consensus of a conceptual shift in academia (Chen and Xu, 2017). Si *et al*. (2015) outlined the significant barriers to the implementation of RDM in China, including the lack of policies from the funding agencies, inadequate time and energy devoted by researchers, and the scientists' unwillingness to share. Ou and Zhou (2016) noticed similar challenges and summarized actions on a complete RDM ecosystem, which incorporates mechanism, platform, regulation, framework, and education; they continued to introduce four nationwide Chinese data repository systems in their case study. Liu and Ding (2016) described a shared repository among 13 universities in Wuhan and claimed it a successful pilot RDM project launched by the academic library. In a Chinese journal article, Liu and Zeng (2017) performed a comparative study on ten data repositories and the associated data services, and they called for official regulations, system optimization, and professional education.

Research Design

Just like what scholars specify, "RDM is not just a technical problem but a people problem" (Schöpfel *et al*., p.259). A complete deployment of RDM relies not only on technologies; instead, it is also more essential for academia to unanimously reach a macro-recognition of RDM before technological and service implementation can be achieved. Moreover, the development of policy introduces tools and procedures to the research and fundamentally improves the research practice from the very beginning of the research cycle, which, in turn, nurtures a conceptual shift of RDM in the research environment. Hence, the development of policy, as well as the execution of it, are both decisive in RDM implementation.

According to the current literature, Chinese scholars have been calling to establish of policies and regulations to mandate RDM activities and guide RDM services (Chen and Xu, 2017; Liu and Zeng, 2017; Ou and Zhou, 2016; Si *et al*., 2015). Based on their

appeals, the study hopes to revisit the macro-environment of RDM in China to seek answers to the three questions.

RQ1: What kinds of RDM documents the upper government has issued in terms of any policies, memorandums, or guidelines?

RQ2: What kinds of actions the national funding agencies take in terms of required RDM plans or assessments?

RQ3: What kinds of activities the national universities take in terms of technological infrastructure and service model?

As illustrated in Figure 1, the study follows the structured flow-chart to address the three research questions. In RQ1, the study examines how the upper administration's attitudes towards RDM activities include joining globally open data initiatives, publishing any guideline or policy documents, or setting up any budgetary items to promote RDM. Through RQ2, the study can better understand how the public funding agencies are encouraging or governing RDM activities for their funded programs and if the central government has published memorandums or executive orders, for example, how these national funding agencies are executing RDM policies. RQ3 focuses on the institutional level to investigate whether and how the technologies and service models get developed at national universities, which form the group of primary funding beneficiaries.

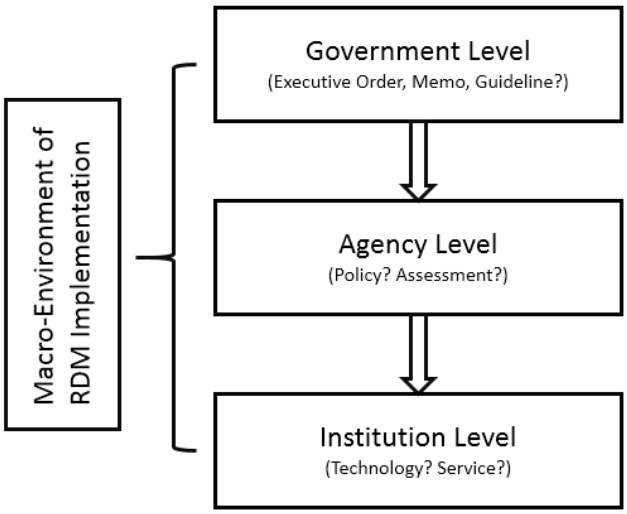

Figure 1. Structured Flow-chart of RDM Implementation

The authors used scholarly databases, digital portals of international societies, and other open resources on the Internet to discover joint initiatives and global efforts towards RDM. The authors find that following the bibliographies in found literature enhances this part of the work's efficiency and ensures the reliability of information sources. The authors visit all Chinese national funding agencies' websites for the agency

level and scrutinize their published guidelines of all funding programs, especially the most recent ones released in 2020. The authors focus on two particular aspects in the agencies' documents: 1) if the agencies require RDM plans in the submitted proposals, and 2) if the agencies announce plans to assess the implementation of RDM plans for funded projects.

National universities operating under the Ministry of Education of China are major research institutions that lead nationwide contributions in teaching and research activities and many supportive infrastructure developments. They are also the primary beneficiaries of research funding granted by all levels of public grant agencies, which are financially supported by governments of different levels from national, provincial, to prefecture-level. The comparative analysis and case studies of data repositories in the current literature facilitate the procedure of research. In the study reviewing all national universities and associate libraries, Liu and Zeng (2017) identified ten active data repositories developed and sustained by nine national universities. Based on their findings, the authors started to investigate these ten data repositories and the associated libraries. After that, the authors visit all 33 national university libraries' virtual sites to search for any provided RDM services and search for additional data repositories.

Results

The study finds that as early as 2004, the Ministry of Science and Technology (MOST) of China had joined several other countries, along with the members of the Organisation for Economic Co-operation and Development (OECD), to adopt a declaration about ensuring open access to research data that are supported by public funding (OECD, 2004). The OECD is an intergovernmental economic organization with 37 member countries committed to seeking answers to common problems and coordinating domestic and international policies. In order to recognize the importance of open access to research data, the OECD followed up in 2007 to publish principles and guidelines that intend to set out standards and objectives for the agreed governments to follow (OECD, 2007).

In 2005, the MOST of China officially released a development plan about data sharing to push forward establishing a sharing network for research data (MOST, 2005). However, not until March 17, 2018, the General Office of State Council (GOSC) of China eventually issued the first RDM official order document, mandating public funding agencies of all levels to develop and implement RDM policies (GOSC, 2018). The executive order cited scientific necessity, public accessibility, and data security and then charged the public funding agencies to develop regulations and assessment toolkits for RDM activities.

As for RQ1, the finding demonstrates that China's central government had been committed to the global initiative to ensure the public accessibility of research data generated by publicly funded research. After that, the central administration has also put effort into advancing and regulating domestic progress. The efforts are evidenced by the

official policies published by the ministry office (MOST, 2005) and the state council (GOSC, 2018).

For RQ2, however, granted the GOSC policy had been published in 2018, the authors found that none of the national funding agencies in China require RDM plans for their 2020 programs; neither do they require an assessment of RDM activities for funded projects. One of the reasons can be the GOSC policy did not specify a deadline for implementation of RDM. As a result, funding agencies were not compelled or motivated for actions. The finding includes all 115 funding programs of 26 national departments and bureaus (see Appendix I). Without compulsory policies and assessment guidelines, activities of RDM can rely only on the autonomous research habits of the funded grantees. Preservation, discovery, and access to research data cannot be sustained without a systematic structure. The finding reveals the inaction of national funding agencies about RDM policies.

For RQ3, after visiting the virtual library sites of all 33 national universities, the authors found that three of them, Peking University (PKU) Libraries, Fudan University (FDU) Libraries, and Wuhan University (WHU) Libraries, provide RDM services to campus researchers. The RDM services they provide include consultation of RDM, assistance in developing RDM plans, and hosting repository systems for research data. The rest of the 30 institutions do not list any RDM services information (see Appendix II). The result contradicts the ten data repositories' findings in Liu and Zeng's article (2017). The study found only four repository systems currently hosted by three university libraries (PKU, FDU, & WHU). In contrast, the other six repositories and six libraries mentioned in Liu and Zeng's article do not provide any RDM information or repository links on their library websites.

The authors then attempted to discover the ten data repositories listed in Liu and Zeng's article (2017), in which the article only lists the names of ten repositories without providing links to them. The findings (see Appendix III) show that only PKU and FDU University are still hosting functioning repositories for public access. Both universities use open source technology Dataverse and consistently update the systems. Both repositories contain datasets. Peking University Open Research Data contains 305 datasets, and Fudan University Social Science Data Repository contains 777 datasets as of July 7, 2020. Although WHU claims that they provide RDM services on their website, their system showed no updates since 2012 with a malfunctioned search box. Worse, there is no data content found in the repository.

The findings (see Appendix III) also found that Tsinghua China Data Center is not a data repository used for preserving and publishing research data. Instead, it is co-developed with the National Bureau of Statistics and is housing national statistical data for research purposes. The virtual access to the data is restricted by authorized authentication. Moreover, the findings show that one repository is not found after all attempts. One repository is not accessible because of server expiration, and the rest of the three "data repositories" are designed only for news release purposes without any

collected data or normal repository functions. All systems are out of date according to the published information on them.

Discussion

The government administrations of countries worldwide share the same RDM policy principle, which is committed to ensuring research results and data of public-funded scientific research to be made available and accessible to the public. The principle is based on the understanding that the availability of research results drives productivity and catalyzes economic growth and that the accessibility to research data reinforces accountability, facilitates understanding, maximizes research impact, and accelerates innovation.

However, inactions of RDM were evidenced among the national research funding agencies in China (see Appendix I), though they were charged to implement detailed policies and guidelines by the GOSC (2018). As illustrated in Figure 2, if the national funding agencies take no action to develop policies for managing research data management, the implementation flows of RDM are interrupted in the middle, regardless of how supportive the upper administration is or how well the downstream institutions prepare. Based on this, the authors call for immediate actions of funding agencies to impel RDM in China.

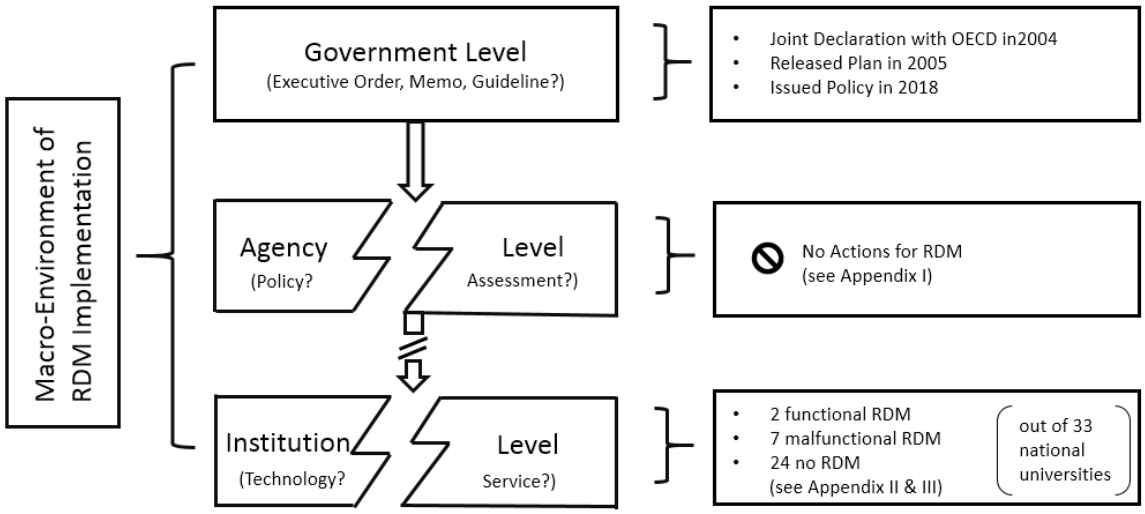

Figure 2. Summarized Results of RDM Revisit in China

The results also reveal that most national universities, which are monopolizing supports of policies, funds, and resources from the country, do not perform well in what they are supposed to. Only two institutions (PKU and FDU) sustain an active RDM service and repositories made publicly accessible to the taxpayers. It is deplorable to find that one of the leading national institutions is making use of public-funded results for profiting purposes and that one is not making the data accessible to the public (see

Appendix III). However, the rest of the 29 national universities and libraries are found to have either abandoned incomplete systems or appeared to ignore the RDM demands in academia as no such information or services being found.

In hopes of pushing forward the development of RDM in China, which is also for the academic good and the public good in terms of scholarly communication and open access, the authors propose three principles that need to be discussed, considered, and resolved before a healthy macro-environment can be fostered. The three principles are executability, facility, and capability.

The executability is defined here as the implementation efficiency, which should be substantially influenced by the funding agencies' recognition of RDM. Scientists and researchers possibly do not think about RDM (Aydinoglu *et al*., 2017; Chen and Wu, 2017; Read *et al*., 2019), but it would be discouraging to see policymakers in the lead funding agencies think the same way (Mervis, 2010; Schöpfel et al., 2018). Making the RDM an essential element of the proposal would force the grant applicants to plan for it; requiring RDM to be assessed would ensure its implementation during the lifecycle of the funded projects. Hence, the sooner the grantors set up the direction sign, the better for grantees to find their ways to reach the destination. The GOSC of China could have also taken follow-up actions to ensure the 2018 work order being executed and to disclose updates with both academia and the public, as its counterpart in the U.S. has done (OSTP, 2017).

The facility is considered an essential infrastructure that can sustain the lifecycle of RDM for research institutions and individuals. Unless funding agencies are all like NIH (2003) or NSF (2011), which had taken actions before any administrative orders, infrastructure can only be established after RDM's being widely accepted. The term infrastructure here does not only indicate technological equipment; it instead means more about a series of virtual applications, like an umbrella, which assists in RDM overall. A few societies and movements, such as DMT Clearinghouse, FORCR11, or OpenAIRE, provide examples that help policymakers build upon. To be specific, facilities include data management planning tools, data repositories, security standards, metadata and discovery protocols, and more. The lack of such facilities impedes the progress of RDM. However, the development of such facilities is built on the essential recognition of RDM itself. The recognition of it can be made possible on the consensus of a conceptual shift in academia.

RDM professionals' capability is imperative for, first, developing necessary facilities, and second, executing plans. As an interdisciplinary specialty, RDM survives on a domain of mixed knowledge and skills that is suitable for and claimed by academic librarianship in the U.S. (ACRL, 2016; Pralle *et al*., 2013; Hudson-Vitale *et al*., 2017). On the one hand, preparing future-professionals for RDM requires library schools or iSchools in the country to develop relevant curriculums and to undertake down-to-earth education duties, such as practical skills and professional training; one the other hand,

employing proper professionals for RDM positions requires systematic reform of both institutional status and recruitment mechanism.

Conclusion

Sturdy cognitions are not easy to be altered, and rigid regulations are hard to be reformed. However, progress can still be expected should exotic catalysts, e.g., best practices, technologies, talents, and regulations in other countries, be introduced to the solidified paradigm. Though RDM literature has been found in the Chinese databases, the discussion stops where it is and does not lead to concrete actions. The study reveals that the macro-environment of RDM implementation in China needs a refreshing stimulation, which can cause an upgrade of the RDM paradigm in academia. Efforts will be needed, and the right-now can be the time.

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Appendix I: Implementation Status of RDM by the National Research Funding Agencies in China

The authors reviewed all 115 funding programs of 26 national departments and bureaus of China. The authors found that none of the funding agencies required any RDM plans for the applications or any assessment guidelines for funded projects. The reviewed funding programs are all newly launched 2020 programs. The review was completed as of July 6, 2020. Below is a list of all programs and links to information pages.

Ministry of Industry and Information Technology

- http://www.miit.gov.cn/n1146290/n1146402/c7850050/content.html

National Publication Foundation

- https://www.npf.org.cn/web/detail.html?id=1994&categoryId=27

National Archives Administration of China

- http://www.saac.gov.cn/daj/tzgg/202004/fb94c764b208438cb9a19a0e0a76ea38.shtml
- http://www.saac.gov.cn/daj/tzgg/202001/a9b6ccb1d0dd4bd5a5debff2535e0c1d.shtml

State Administration for Science, Technology and Industry for National Defense

- http://jmjh.miit.gov.cn/tzgg/HZ808081713a4ccb0171f759cf4e2749.shtml
- https://kyc.wit.edu.cn/info/1019/2411.htm
- http://www.caea.gov.cn/n6759295/n6759296/c6809489/content.html

Chinese Academy of Governance

- http://www.cqdx.gov.cn/bmwz/kycd/zxtz/content_6574

State Ethnic Affairs Commission

- https://www.neac.gov.cn/seac/xxgk/202003/1139653.shtml

National Energy Administration

- http://www.nea.gov.cn/2020-04/30/c_139021171.htm
- http://www.nea.gov.cn/2020-04/29/c_139018202.htm
- http://www.nea.gov.cn/2020-04/09/c_138961016.htm
- http://www.nea.gov.cn/2020-02/26/c_138820326.htm
- http://www.nea.gov.cn/2020-02/25/c_138817367.htm
- http://www.nea.gov.cn/2020-04/29/c_139018202.htm
- http://www.nea.gov.cn/2019-05/15/c_138060218.htm
- http://www.nea.gov.cn/2020-01/03/c_138676236.htm

General Administration of Sport of China

- http://www.sport.gov.cn/n316/n336/c942096/content.html

National Bureau of Statistics

- http://www.stats.gov.cn/tjgz/tzgb/202004/t20200409_1737789.html
- http://www.stats.gov.cn/tjgz/tzgb/202001/t20200110_1722456.html
- http://www.stats.gov.cn/tjgz/tzgb/202005/t20200519_1746437.html

National Pblic Complaints and Proposals Administation

- http://www.gjxfj.gov.cn/gjxfj/xxgk/ggb/webinfo/2020/02/1583224189796548.htm

State Language Commission

- http://www.moe.gov.cn/s78/A18/A18_gggs/A18_sjhj/202005/t20200512_453364.html

National Intellectual Property Administration, PRC

- http://www.sipo.gov.cn/gztz/1148462.htm
- http://www.sipo.gov.cn/gztz/1147174.htm

National Natural Science Foundation of China

- http://www.nsfc.gov.cn/publish/portal0/tab434/info77811.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77808.htm
- http://www.nsfc.gov.cn/publish/portal0/tab434/info77794.htm
- http://www.nsfc.gov.cn/publish/portal0/tab434/info77778.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77766.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77764.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77762.htm
- http://www.nsfc.gov.cn/publish/portal0/tab442/info77633.htm
- http://www.nsfc.gov.cn/publish/portal0/xx/info77631.htm
- http://www.nsfc.gov.cn/publish/portal0/tab434/info77621.htm
- http://www.nsfc.gov.cn/publish/portal0/tab434/info77554.htm
- http://www.nsfc.gov.cn/publish/portal0/tab442/info77553.htm
- http://www.nsfc.gov.cn/publish/portal0/tab442/info77552.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77538.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77534.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77526.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77511.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77505.htm
- http://nsfc.gov.cn/publish/portal0/tab568/info77503.htm
- http://nsfc.gov.cn/publish/portal0/tab568/info77501.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77499.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77507.htm
- http://www.nsfc.gov.cn/publish/portal0/tab434/info77448.htm?from=singlemessage
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77431.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77408.htm
- http://nsfc.gov.cn/publish/portal0/tab442/info77398.htm
- http://www.nsfc.gov.cn/publish/portal0/tab626/info77364.htm
- http://www.nsfc.gov.cn/publish/portal0/tab442/info77303.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77959.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77917.htm
- http://www.nsfc.gov.cn/publish/portal0/tab434/info77885.htm
- http://nsfc.gov.cn/publish/portal0/tab434/info77843.htm
- http://www.nsfc.gov.cn/publish/portal0/tab434/info77836.htm
- http://www.nsfc.gov.cn/publish/portal0/tab434/info77791.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77788.htm
- http://www.nsfc.gov.cn/publish/portal0/tab434/info77749.htm
- http://www.nsfc.gov.cn/publish/portal0/tab568/info77579.htm
- http://nsfc.gov.cn/publish/portal0/tab442/info77397.htm
- http://bic.nsfc.gov.cn/Show.aspx?AI=1250
- http://xxgk.mot.gov.cn/jigou/kjs/202003/t20200331_3354355.html

- http://www.moe.gov.cn/s78/A16/s8213/A16_gggs/202004/t20200415_443525.html
- http://www.moe.gov.cn/srcsite/A08/s7056/202003/t20200313_430668.html
- http://m.moe.gov.cn/srcsite/A08/moe_740/s3863/202002/t20200210_419697.html
- http://www.moe.gov.cn/s78/A16/s8213/A16_gggs/202002/t20200201_417263.html
- http://www.moe.gov.cn/srcsite/A01/s7048/202002/t20200210_419659.html
- http://www.moe.gov.cn/s78/A16/s8213/A16_sjhj/202001/t20200119_416099.html
- http://www.cutech.edu.cn/cms/cms/infopub/infopre.jsp?pubtype=d&pubpath=cn&infoid=1577958728345571&templetid=1179125889049788&channelcode=a0136
- http://dsi.cumt.edu.cn/info/1066/4043.htm
- https://service.most.gov.cn/kjjh_tztg_all/20200428/3334.html
- http://www.most.gov.cn/tztg/202004/t20200401_152699.htm
- https://service.most.gov.cn/kjjh_tztg_all/20200331/3296.html
- http://www.most.gov.cn/mostinfo/xinxifenlei/fgzc/gfxwj/gfxwj2019/201904/t20190423_146201.htm
- https://service.most.gov.cn/kjjh_tztg_all/20200330/3279.html
- https://service.most.gov.cn/kjjh_tztg_all/20200327/3275.html
- https://service.most.gov.cn/kjjh_tztg_all/20200327/3274.html
- https://service.most.gov.cn/kjjh_tztg_all/20200327/3273.html
- https://service.most.gov.cn/kjjh_tztg_all/20200208/3225.html
- http://www.most.gov.cn/tztg/202001/t20200117_151150.htm
- http://www.most.gov.cn/tztg/202001/t20200116_151106.htm
- https://cie.nwsuaf.edu.cn/dtytz/7bad492c67d64370bca755a97ddaef22.htm
- https://service.most.gov.cn/kjjh_tztg_all/20200513/3338.html
- https://service.most.gov.cn/kjjh_tztg_all/20200512/3336.html
- https://service.most.gov.cn/kjjh_tztg_all/20200423/3332.html
- https://service.most.gov.cn/kjjh_tztg_all/20200323/3246.html

Ministry of Civil Affairs of the People’s Republic of China

- http://www.mca.gov.cn/article/xw/tzgg/202002/20200200024479.shtml

Ministry of Agriculture and Rural Affairs of the People’s Republic of China

- http://www.moa.gov.cn/xw/bmdt/202004/t20200423_6342125.htm

National Office for Artistic Sciences Planning

- http://www.nopss.gov.cn/n1/2020/0114/c219469-31548120.html
- http://www.nopss.gov.cn/n1/2020/0114/c219469-31548126.html

National Office for Philosophy and Social Sciences

- http://www.nopss.gov.cn/n1/2020/0313/c219469-31630966.html
- http://www.nopss.gov.cn/n1/2020/0109/c219469-31541437.html
- http://www.nopss.gov.cn/n1/2020/0601/c219469-31731529.html
- http://www.nopss.gov.cn/n1/2020/0428/c219469-31691453.html

National Audit Office of the People's Republic of China

- http://www.audit.gov.cn/n8/n28/c137573/content.html

Ministry of Culture and Tourism of the People's Republic of China

- https://skc.lyu.edu.cn/2020/0526/c3075a159481/page.htm
- https://www.mct.gov.cn/whzx/zxgz/wlbzhgz/202004/t20200428_852834.htm
- https://www.mct.gov.cn/whzx/bnsj/whkjs/202004/t20200424_852722.htm

National Development and Reform Commission

- https://www.ndrc.gov.cn/xwdt/tzgg/202002/t20200225_1221200.html
- https://www.ndrc.gov.cn/xwdt/tzgg/202002/t20200227_1221501.html
- https://www.ndrc.gov.cn/xwdt/tzgg/202003/t20200330_1224459.html
- https://www.ndrc.gov.cn/xwdt/tzgg/202004/t20200421_1226236.html
- https://www.ndrc.gov.cn/xwdt/tzgg/202004/t20200413_1225616.html
- https://www.ndrc.gov.cn/xwdt/tzgg/202006/t20200601_1229655.html

Ministry of Justice of the People's Republic of China

- http://www.moj.gov.cn/government_public/content/2019-05/23/gggs_235614.html

National Center for Educational Technology

- https://www.ncet.edu.cn/zhuzhan/tztgao10/20200521/5324.html

Ministry of National Defense of the People's Republic of China

- http://jmjh.miit.gov.cn/newsInfoWebMessage.action?newsId=12886884&moduleId=1066

Ministry of Housing and Urban-Rural Development of the People's Republic of China

- http://www.mohurd.gov.cn/wjfb/202004/t20200423_245165.html
- http://www.cstcmoc.org.cn/plus/view.php?aid=5167

The Supreme People's Court of the People's Republic of China

- http://www.court.gov.cn/zixun-xiangqing-228901.html
- http://www.court.gov.cn/zixun-xiangqing-226301.html

The Supreme People's Procuratorate of the People's Republic of China

- http://www.spp.gov.cn/spp/tzgg1/202001/t20200116_452943.shtml

Appendix II: Availability of RDM Services by National Universities in China

The authors visited the virtual sites of libraries of 33 national universities, which are operating directly under the Ministry of Education of China. According to the officially released information on the websites, three of them provide RDM services to researchers, while the rest of the 30 do not contain information about RDM services. The review was completed as of July 6, 2020. Below is a list of libraries of national universities and links to the library webpages.

University Libraries (3) Providing RDM Services

Peking University (PKU)

- https://www.lib.pku.edu.cn/portal/cn/fw/sjfw/keyanshuju

Wuhan University (WHU)

- http://www.lib.whu.edu.cn/web/index.asp?menu=v&obj_id=509&r=41242

Fudan University (FDU)

- http://www.library.fudan.edu.cn/main.htm

University Libraries (30) Do Not List RDM Service Information

Tsinghua University

- http://www.lib.tsinghua.edu.cn/service/service.html

Renmin University of China

- http://www.lib.ruc.edu.cn/

Beijing Normal University

- http://www.lib.bnu.edu.cn/

China Agricultural University

- http://www.lib.cau.edu.cn/index.php

Shanghai Jiao Tong University

- http://www.lib.sjtu.edu.cn/f/main/index.shtml

Tongji University

- https://www.lib.tongji.edu.cn/index.php?classid=11965

East China Normal University

- http://www.lib.ecnu.edu.cn/

Nankai University

- http://www.lib.nankai.edu.cn/main.htm

Tianjin University

- http://www.lib.tju.edu.cn/

Chongqing University

- http://lib.cqu.edu.cn/

Zhejiang University

- https://libweb.zju.edu.cn/main.htm

Nanjing University

- http://lib.nju.edu.cn/index.htm

Southeast University

- http://lib.seu.edu.cn/

Northeastern University

- Under search

Dalian University of Technology

- http://www.lib.dlut.edu.cn/

Central South University

- http://lib.csu.edu.cn/

Hunan University

- http://lib.hnu.edu.cn/index.htm

Sichuan University

- http://lib.scu.edu.cn/

University of Electronic Science and Technology of China

- https://www.lib.uestc.edu.cn/

Jilin University

- http://lib.jlu.edu.cn/portal/index.aspx

Xiamen University

- https://library.xmu.edu.cn/

Shandong University

- http://www.lib.sdu.edu.cn/index.html

Ocean University of China

- http://library.ouc.edu.cn/

Huazhong University of Science and Technology

- http://www.lib.hust.edu.cn/

Xi'an Jiaotong University

- http://www.lib.xjtu.edu.cn/index.htm

Northwest A & F University

- https://oldlib.nwsuaf.edu.cn/

Sun Yat-sen University

- http://library.sysu.edu.cn/

South China University of Technology

- http://www.lib.scut.edu.cn/

Lanzhou University

- http://lib.lzu.edu.cn/

Yunnan University

- http://www.lib.ynu.edu.cn/

Appendix III: Status and Testing Results of the Ten Data Repositories in China

The authors visited and tested the ten data repositories hosted by nine national universities in China, which are recorded in Liu and Zeng's 2017 article (see Reference). The authors started with the three university libraries (PKU, WHU, FDU) that provide RDM services. After that, the authors visited the rest of seven repositories. The review was completed as of February 24, 2021. Below are a list and the result summary.

The Three University Libraries Providing RDM Services (listed in Appendix II) with Four Associated Data Repositories Listed in Liu & Zeng's 2017 Article.

1. Peking University – Peking University Open Research Data

- https://opendata.pku.edu.cn/dataverse/pku

2. Peking University – China Survey Data Archive

- https://opendata.pku.edu.cn/dataverse/CSDA

Summary: These two listed repositories are the same platform. It is developed based on the open-source technology Dataverse. The second one China Survey Data Archive is a sub-collection in the first one. It contains 305 datasets and 2,036 files. The search function and browse function are working normally. The system is up to date.

3. Wuhan University – 高校科学数据共享平台 (University Scientific Data Sharing Platform) (Note: No English title provided. It is translated by the authors.)

- http://www.lib.whu.edu.cn/kxsj/

Summary: The system is in Chinese only. The system showed no updates since 2012. The search function does not work. All sub-collections are not accessible. There is no data content found in the repository.

4. Fudan University – Social Science Data Repository

- https://dvn.fudan.edu.cn/dataverse/root

Summary: The system is developed based on the open-source technology Dataverse. It contains 777 datasets and 3,391 files. The search function and browse function are working normally. The system is up to date.

The Seven University Libraries and Seven Data Repositories Listed in Liu & Zeng's Article

5. Tsinghua University – Tsinghua China Data Center

- http://www.tcdc.sem.tsinghua.edu.cn/login.shtml

Summary: The system is co-developed with the National Bureau of Statistics and is housing national statistical data for research purpose. Virtual access is protected by database authentication.

6. Shanghai Jiao Tong University – OMNILab

- URL cannot be found.

Summary: The URL cannot be found.

7. Renmin University of China – National Survey Research Center

- http://nsrc.ruc.edu.cn/en

Summary: The system showed no updates since 2009. The system is designed only for news releasing purposes. There is no search function or browse function. There is no data content found in the repository.

8. Huazhong University of Science and Technology – Chinese University Social Sciences Data Center

- https://cmis.csdc.info/toIndex.action?request_locale=en_US

Summary: The system is designed only for news releasing purposes. There is no search function or browse function. There is no data content found in the repository.

9. Sun Yat-Sen University – Center for Social Survey

- http://css.sysu.edu.cn/

Summary: The system is not accessible.

10. Hunan University – 经济数据研究中心 (Economics Data Research Center) (Note: No English title provided. It is translated by the authors.)

- http://edrc.hnu.edu.cn/index.htm

Summary: The system is designed only for news releasing purposes. The web search function does not work. There is no search function or browse function for data. There is no data content found in the repository.