Implications of Scientific Data Management Policies for Scientific Data Management in Archival Departments: A Quantitative Text Analysis Based on Policy Instruments (Postprint)

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Abstract

[Purpose/Significance] Scientific data constitutes an important component of research archives. Determining the policy orientation of local governments regarding scientific data management holds strong practical guiding value for archival departments in formulating scientific data management and policies. [Method/Process] This study selects 13 implementation guidelines for scientific data management issued by local governments in China, conducts a quantitative analysis using policy instruments, examines the current status of scientific data management policies in China, and from the perspective of archival management, proposes insights conducive to the development of scientific data management policies for archival departments. [Results/Conclusion] As an important institution safeguarding information resources, archival departments should leverage their advantages and characteristics in scientific data management, actively promote the development and improvement of the scientific data management policy system, facilitate the formulation of scientific data archiving policies, and strengthen the coordinated development of scientific data management policies.

Full Text

Preamble

Scientific Data Management Policy and Its Implications for Archives Departments: A Textual Quantitative Analysis Based on Policy Tools

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Abstract: [Purpose/Significance] Scientific data constitutes an important component of scientific research archives. Assessing the policy orientation of local governments regarding scientific data management holds strong practical guiding value for archives departments in formulating scientific data management policies. [Method/Process] This study selected 13 implementation rules for scientific data management issued by local governments in China, conducted quantitative research using policy tools, analyzed the current status of scientific data management policies in China, and proposed insights beneficial to the development of scientific data management policies for archives departments from an archival management perspective. [Result/Conclusion] As a vital institution safeguarding information resources, archives departments should leverage their unique advantages and characteristics in scientific data management, actively promote the development and improvement of the scientific data management policy system, facilitate the formulation of scientific data archiving policies, and strengthen the coordinated development of scientific data management policies.

Keywords: Scientific data management; Archives departments; Policy tools; Quantitative research
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1 Introduction

1.1 Research Question

Scientific data, also referred to as research data or scientific research data, primarily refers to data generated through basic research, applied research, and experimental development in natural sciences, engineering technology sciences, and other fields, as well as raw data and derived data obtained through observation, monitoring, investigation, inspection, and testing for use in scientific research activities [1]. In 2018, the General Office of the State Council issued the "Measures for the Management of Scientific Data," followed by the release of numerous provincial-level implementation rules. As a crucial strategic resource supporting national scientific and technological innovation, scientific data management has attracted increasing attention and importance.

The archives community has also been actively exploring scientific data management work to promote orderly, standardized, and controllable scientific data management. Archives departments in China have a long history of participating in scientific research activities. In 1961, the Central Committee of the Communist Party of China approved the trial implementation of the "Fourteen Opinions on Current Work in Natural Science Research Institutions (Draft)," which proposed adhering to and improving the technical archives system (scientific

and technological archives were also called technical archives in the early days) to maintain the stability of scientific research [2]. In 1980, the State Council promulgated the "Regulations on Scientific and Technological Archives Work," which put forward requirements for the management of scientific and technological archives (including scientific research archives) [3]. In 1992, the industry standard "Management Standards for Scientific Research Project Archives" issued by the State Archives Administration came into effect, with its archiving scope including "important original records, collation records, and reports from experiments, tests, and inspections," as well as "observation, detection, and investigation records and collation records and comprehensive analysis reports" [4]. To adapt to the reform of the scientific and technological system and promote better archival services for scientific and technological innovation, the State Archives Administration and the Ministry of Science and Technology released the newly revised "Regulations on the Management of Scientific Research Archives" on September 11, 2020 [5], which incorporated scientific data into the archiving scope of scientific research archives, further clarifying China's requirements for scientific data archiving management.

With the widespread application of science and technology in various fields, massive amounts of scientific data are continuously generated, and multiple disciplines such as space science and life sciences have entered the era of big data [6-7]. How to achieve comprehensive collection of scientific data, ensure its quality, enable long-term preservation, and make it usable has become a practical problem that scientific data management institutions need to solve. Due to the unique advantages of archival management work in value appraisal, long-term preservation, security and confidentiality, and continuous availability, archives departments play an irreplaceable role in scientific data management. However, from the perspective of China's current archival management policy system, the vast majority of policy content lacks elaboration on specific scientific data management measures. At the same time, China's current scientific data management policies lack guidance on scientific data archiving and cannot effectively support the scientific data management work of archives departments. In summary, China urgently needs to strengthen the formulation of relevant policies applicable to archives management departments' participation in scientific data management.

1.2 Research Status

Although scientific data research in China started relatively late, it has yielded rich research results, while foreign research on policies is relatively scarce. Regarding scientific data management policies, research in this area has not yet formed a unified system. Currently, China's scientific data management policies are still in the development stage, with scholars mostly selecting representative foreign policies as research objects to analyze international organizations and developed countries' scientific data management policies. Research results can be mainly divided into two categories:

(1) Research on policy-making entities. The stakeholders of scientific data are important components of scientific data management. With the continuous generation and rapid growth of scientific data, various stakeholders have created numerous knowledge activities, stimulating the internal driving force for scientific data management and accelerating the formulation of scientific data management policies. He Qingfang believes that the United Kingdom, the United States, and Australia have established relatively complete scientific data management and sharing policies, and proposes that scientific data policy formulation mainly concentrates on government, funding agencies, publishing institutions, and universities [9]. Some scholars also believe that a complete scientific data management and sharing policy and regulation system should include macro-level policy systems such as data sharing principles issued by international organizations and laws and regulations formulated by national government agencies, meso-level scientific data policies formulated by scientific research funding agencies, and micro-level scientific data policies formulated by universities and publishing institutions [10-11].

(2) Research on policy content. Policy content research is mainly divided into three categories: Analysis of scientific data lifecycle management policies: For example, Xing Wenming et al. found that British university research data policies focus on data management plans as the core throughout the entire research data lifecycle [12]; Jiang Xin studied scientific data policies issued by foreign funding agencies and concluded that policy content includes data creation, storage, publication, access, reuse, and archiving in the data lifecycle stages [13]. Research on scientific data open sharing policies: International organizations not only emphasize the value of scientific data open sharing but also attach importance to high-quality scientific data, interoperability, and data evaluation, while stressing intellectual property protection and the responsibility of stakeholders [14]; A. Zuidewijk et al. proposed five new principles for improving public organization open scientific data policies [15]; Xie Qiuyan and Qian Peng, after investigating foreign institutions and organizations' scientific data open sharing policies, suggested that policy norms should be issued from four areas: data generation and collection, data custody and use, data sharing evaluation and supervision, and data sharing guarantee [16]. Interpretation of scientific data management measures and implementation rules: Xing Wenming et al. believe that the "Measures for the Management of Scientific Data" has formed a scientific data management system with the data lifecycle as the warp and stakeholders as the weft [17]. Gao Yuwei et al. used content comparative analysis to analyze 11 scientific data management implementation rules issued by local governments and institutions from multiple levels [18].

From an archival management perspective, although archival management policies involve little content on scientific data management and scientific data management is relatively absent, domestic and foreign scholars have still con-

ducted certain research. Yan Peng proposed strategic suggestions for archives departments' participation in scientific data management by constructing an interactive relationship model between archives departments and stakeholder institutions [19]; Chen Tian et al. designed a full-process management model for scientific data based on data preservation thinking, filling the gap of archives departments' absence in scientific data management activities [20]. T. P. Lauriault et al. pointed out that archivists have advantages in data quality control and metadata capture [21]. D. Noonan et al. believe that archivists should play the roles of participants and consultants, improve archival appraisal skills, and make full use of professional knowledge to collect research data [22]. A. H. Poole believes that archivists should participate early in the data lifecycle and proposes that relevant theories in the archival field such as the principle of provenance, appraisal, metadata, and risk management are applicable to scientific data management [23].

In summary, scholars have analyzed scientific data management policies from different perspectives, focusing on overall descriptions of policy content and providing corresponding suggestions for China's scientific data policy formulation. This also reflects that, compared with foreign countries, China's scientific data management policies are not yet perfect, with limited policy content and a lack of quantitative research on policies. Moreover, current research is mostly limited to the perspective of scientific data management, with insufficient archival management research perspectives, which is not conducive to a comprehensive understanding and further improvement of policies. Therefore, it is necessary to strengthen quantitative analysis of specific policy texts in China, summarize policy characteristics and limitations, and provide ideas and useful inspiration for policy formulation by archives departments.

2 Research Methods

2.1 Research Texts

This study selected implementation rules for scientific data management publicly issued by some local governments in China as research objects. Using "scientific data management measures" and "scientific data management implementation rules" as keywords, we searched on provincial people's government websites and the Internet, with a release deadline of December 31, 2020. After screening, 13 policy texts were finally obtained, as shown in Table 1 .

2.2 Research Tools

This study selected policy tools for textual quantitative research because "policy tools" are one of the means to achieve policy goals and an important way to achieve effective national governance. By utilizing policy tools, the essence and connotation of policies can be analyzed from different perspectives. There are various classification methods for policy tools, with the most typical being the classification method of R. Rothwell and W. Zegveld (1985). This method

was first applied to science and technology policy analysis. It strengthens the government's environmental role, weakens the mandatory role, and divides policy tools into three categories: environmental, supply, and demand [24]. Liu Binfang et al. used Rothwell and Zegveld's innovative policy tool classification method to analyze government data governance policies in the big data era [25]; Li Yajing used policy tools to analyze China's scientific data open policies [26].

The research object of this paper is the implementation rules for scientific data management issued by local governments in China. The policy content is macroscopic and social, and the government's mandatory role has been weakened, which is similar to the concept of Rothwell and Zegveld's innovative policy tool classification. Therefore, this paper chooses to use Rothwell and Zegveld's policy tool classification method to analyze the policy texts.

2.3 Policy Tool Types

Based on the theoretical foundation of policy tools and Rothwell and Zegveld's policy tools, drawing on existing research results, the basic policy tools of the "implementation rules" are divided into three categories: environmental, supply, and demand (see Table 2), and coding rules are formulated.

Environmental policy tools have an indirect impact on scientific data management, supply policy tools promote scientific data management activities, and demand policy tools play a pulling role in scientific data management through government outsourcing, exchange and cooperation, and organizational coordination.

2.4 Coding Method

Coding text content is the core of content analysis, and the rationality of coding directly affects the final quantitative results. This paper takes specific chapters and clauses in the selected policy texts from Table 1 as content analysis units, codes them in the form of "policy number-specific chapter and clause," and finally forms 585 content analysis unit codes (see Table 3).

3 Statistics and Analysis

3.1 Statistical Results

Based on the above policy content analysis coding, frequency statistics were conducted on the 13 texts totaling 585 policy content units under the dimension of policy tools (see Table 4) to more intuitively reveal the content characteristics of the policies.

From the perspective of policy tool statistics, the 13 "implementation rules" utilized three types of policy tools: environmental, supply, and demand, but the proportions of the three are significantly different. Among them, environmental policy tools accounted for the highest proportion at 68.9%, supply policy

tools accounted for 21.9%, and demand policy tools accounted for 9.2%. The proportions of supply and demand policy tools are too low, the three are uncoordinated, and the deficiencies in supply and demand policy tools should be addressed in policy formulation.

3.2 Analysis Results

Further analysis of the specific usage of policy tools in each dimension of the 13 "implementation rules" yields the following conclusions:

3.2.1 Environmental Policy Tools Environmental policy tools account for 68.9%, indicating that local governments attach great importance to creating an environment for scientific data management. Among environmental policy tools, "regulation and control" has the highest proportion at 40.4%. The various "implementation rules" hope to establish corresponding systems in terms of regulations, standards, evaluation and assessment, and audit supervision to ensure the standardization of scientific data management activities. "Data collection" accounts for 11.9%, with all 13 "implementation rules" stipulating that data collection methods should be used to ensure the timeliness, quality, and completeness of scientific data collection. "Data security" and "data sharing services" account for 18.1% and 19.6% respectively. Scientific data involving state secrets, national security, social public interests, commercial secrets, and personal privacy should be protected. The ultimate destination of scientific data is sharing and utilization, so the "implementation rules" propose promoting scientific data sharing while carrying out data value-added services. "Intellectual property" accounts for 3.2%. Protecting intellectual property can effectively safeguard the vital interests and research achievements of scientific researchers and promote their enthusiasm for sharing. However, from the perspective of regulation and control policy tools, there is a lack of content on "archiving system," "long-term preservation," and "appraisal and destruction." Regular inspection and evaluation of the format, content, and quality of scientific data, and timely archiving of valuable data, are important ways to achieve standardized control, integrated management, and long-term preservation of scientific data.

3.2.2 Supply Policy Tools Supply policy tools account for 21.9%, indicating that at this stage, the support of local governments for scientific data management is not obvious. Among supply policy tools, "scientific and technological information support" and "financial investment" have the highest proportions at 38.3% and 23.4% respectively. Scientific and technological information support includes establishing scientific data open sharing platforms and data centers to provide good data circulation channels. At the same time, providing financial support for research units and scientific researchers can ensure the healthy and sustainable development of scientific data. "Human support" accounts for 18.8%. As an essential key force in scientific data management activities, strengthening talent training and team building can effectively promote

scientific data management. “Infrastructure construction” and “technical support” account for relatively low proportions at 12.5% and 3.8% respectively. Infrastructure is the material foundation for scientific data openness. Ensuring that equipment and facilities are in place is a basic requirement for guaranteeing scientific data storage management and utilization. The lack of technical support will reduce the efficiency of scientific data management and sharing services, but the “implementation rules” do not pay enough attention to technology. Therefore, to further improve scientific data management and services, attention should also be paid to introducing and enhancing technical support.

3.2.3 Demand Policy Tools Demand policy tools only account for 9.2%, and currently it is difficult for them to undertake the task of driving scientific data management activities. Among them, “organizational coordination” accounts for 50%. All “implementation rules” attach great importance to the overall management and organizational coordination of scientific data work. From science and technology administrative departments, competent departments, and legal person units to scientific data centers, all emphasize collaboration between departments and institutions, but lack communication and cooperation with other information management institutions. “Government outsourcing” and “exchange and cooperation” account for 25.9% and 24.1% respectively. The “implementation rules” propose that competent departments should entrust qualified legal person units to establish scientific data centers, indicating that legal person units that organize and excavate scientific data resources are strong competitors for scientific data center construction. Exchange and cooperation is not only an important window for promoting scientific data sharing and utilization but also an important way to participate in the formulation of domestic and international rules and standards, but the proportion is relatively low.

3.3 Research Conclusions

Based on the quantitative analysis of policy tools and the specific content involved in the policies, this study found that the policy content of the 13 provincial “implementation rules” in China covers scientific data collection, collection and delivery, preservation, sharing and utilization, and security and confidentiality. However, there are still problems at the policy formulation level, including an imperfect policy system, overuse and imperfection of environmental policy tools, and missing application of supply and demand policy tools.

3.3.1 The Scientific Data Management Policy System Needs Improvement The “implementation rules” have inherited and developed the “Measures for the Management of Scientific Data,” but the management system and norms are not sound, the texts are relatively single, and the policy system is imperfect. Archives departments, as important institutions safeguarding information resources, have an unshirkable responsibility and mission to protect important and core scientific data as important historical assets of the Party and the state and permanently preserved archives. To achieve standardized and

controllable management of scientific data, archives departments should give full play to their advantages in information resource management and utilization, and actively promote the formulation and development of scientific data management policies based on the clear provision that scientific data is included in the archiving scope of scientific research archives.

Archives departments have already formed a complete and systematic management system and norms, with unique advantages in both collection and preservation and utilization of archives. However, archives departments lack experience in scientific data management and were relatively absent in the early stages, failing to participate in scientific data management activities in a timely manner. Archival management policies and scientific data management policies are independent of each other, with little cross-fusion of content, but they are also complementary to a certain extent. For example, scientific data management policies cover data collection, collection and delivery, preservation, sharing and utilization, and security and confidentiality, but lack supervision and value appraisal of data in the collection stage, and scientific data archiving has not yet been reflected in policies. Archives departments are responsible for archiving management, but due to insufficient experience in the full-process management of scientific data, there are no relatively specific and clear target norms for the archival management process and system of scientific data. Therefore, on the basis of investigating the current situation of scientific data policies of other management entities, archives departments should summarize advantages and disadvantages, strengthen the archival management of scientific data in combination with business work and archival management functions and tasks, and make up for the practical problems existing in scientific data management.

3.3.2 Environmental Policy Tools Are Overused and Imperfect The statistical results show that the use of environmental policy tools is characterized by: The "regulation and control" tool (40.4%) is used too frequently, possibly because local scientific data management work is still in its initial stage, the policy system is not yet sound, and management norms and processes are not specific enough, so they are constantly emphasized in policies, forming an overuse phenomenon. Based on the analysis of specific policy content, it is found that the "implementation rules" ensure standardized management of scientific data by establishing various management systems and mechanisms, showing a characteristic of "emphasizing regulation and control." Emphasis is placed on scientific data sharing services (19.6%) and data security (18.1%). The ultimate purpose of scientific data management activities is sharing and utilization. Data security is an important issue existing in the management and utilization process. In addition to strictly restricting the open sharing of scientific data involving state secrets and security, social public interests, commercial secrets, and personal privacy, as well as in external exchange and cooperation, the "implementation rules" also implement a graded and classified protection system for scientific data. Despite the overuse of environmental policy tools, there are still problems with imperfect policy tools. For example, value appraisal

of scientific data and determination of archiving scope have not yet been addressed. While emphasizing the security of scientific data involving secrets and physical storage security, there is a lack of corresponding policy systems and standard norms to guarantee long-term preservation, appraisal and destruction, and statistical work of scientific data. The collection and preservation of scientific data are emphasized, but the storage difficulties and problems brought by massive data are ignored. The issue of long-term effective utilization of scientific data has not been explained, and how to establish a continuous utilization mechanism for data so that data will not be lost due to project interruption or lack of management agency functions is a problem that requires long-term consideration.

3.3.3 Missing Application of Supply and Demand Policy Tools There are missing applications of supply and demand policy tools, specifically reflected in: Supply policy tools emphasize scientific and technological information support (38.3%), attaching importance to the construction of scientific data centers at all levels and types, but neglecting the supporting role of human resources, funds, infrastructure, and technology. The "implementation rules" have missing applications of demand policy tools, overemphasizing the role and impact of environmental regulation, indicating that the "implementation rules" do not pay enough attention to the pulling effect of social demand. Strengthening collaboration among subjects can not only reduce management costs but also improve management capabilities. However, the "implementation rules" emphasize provincial-level coordination in demand policy tools, focusing more on macro-management issues, and apply fewer policy tools for collaboration among subjects. There is a lack of policy coordination among important scientific data management entities such as scientific data centers, library and information institutions, and archives management departments.

4 Policy Recommendations

Based on the above analysis results of the "implementation rules" text, which basically present the formulation of provincial scientific data management policies in China, this study takes improving the scientific data management system and strengthening scientific data archival management as entry points to propose corresponding suggestions for the formulation of scientific data management policies for archives departments.

4.1 Promote the Improvement and Development of the Scientific Data Management Policy System

Actively promoting the improvement of scientific data management systems and norms not only strengthens the main responsibility of archives departments but also continuously optimizes the entire scientific data management policy system. The "implementation rules" inherit and develop the "Measures for the Management of Scientific Data," but the management system and norms are

not sound, the texts are relatively single, and the policy system is imperfect. Archives departments, as important institutions safeguarding information resources, have an unshirkable responsibility and mission to protect important and core scientific data as important historical assets of the Party and the state and permanently preserved archives. To achieve standardized and controllable management of scientific data, archives departments should give full play to their advantages in information resource management and utilization, and actively promote the formulation and development of scientific data management policies based on the clear provision that scientific data is included in the archiving scope of scientific research archives.

A complete scientific data management policy system should not only include the management policies for science and technology administrative departments, competent departments, legal person units, and scientific data centers involved in the "implementation rules" but should also incorporate information management institutions, clarify the interest relationships among various stakeholders, strengthen subject coordination among various departments, improve the scientific data management policy system from multiple aspects, and strengthen policy effectiveness.

4.2 Actively Promote the Formulation of Scientific Data Archiving Policies

The "implementation rules" show unbalanced use of environmental, supply, and demand policy tools, particularly lacking the important policy tool of scientific data archiving. To incorporate scientific data into the archiving scope, archives departments should focus on promoting policy support for scientific data archiving.

In terms of theoretical research, archives departments should actively cooperate with scholars and experts in the archival field and scientific data management field to discuss the theoretical support and practical needs of scientific data archiving policies, propose the importance and feasibility of improving scientific data archiving policies from a theoretical level, and strengthen the archiving of important scientific data to ensure the integrity and security of important national strategic assets. In terms of policy layout, archives departments should give full play to the principles of unified leadership and graded management of archival work, first promote the formulation of scientific data archiving policies for key industries and disciplinary fields, gradually form a comprehensive construction pattern of scientific data archiving policies, and drive the overall development. In terms of practice, archives institutions with scientific data resources should pay more attention to research on scientific data archiving, be brave in exploration, and based on existing resource volumes and characteristics combined with management practice, establish corresponding systems and norms to form good scientific data archiving demonstrations and provide practical cases for scientific data archiving policy formulation.

For example, in the scientific data collection and delivery stage, value appraisal of scientific data should be clarified. Archives departments cannot archive all scientific data. Therefore, it is necessary to clarify the archiving scope of scientific data, emphasizing that archived scientific data must be important data with long-term preservation significance after value appraisal. Archives departments should start from the data collection and delivery plan, collaborate with scientific data management institutions to formulate scientific data archiving policies from the "source" of data generation, and strengthen the acceptance system for scientific data archiving by archives departments in the project acceptance stage. At the same time, in the archiving process, attention should be paid to the long-term preservation of scientific data, and a long-term preservation mechanism should be established. Archives management departments are a national systematic organization with continuity in archival resource preservation and utilization. Although archives classification and management have time limits for open utilization, archives departments will not disappear, the preservation and utilization of archival resources will not be interrupted, and archives will not be lost. The long-term maintenance and access utilization of scientific data will be permanent and continuous.

4.3 Create a New Situation of Coordinated Development of Scientific Data Management Policies

Currently, China's scientific data management work is highly similar to and overlaps with scientific research archives management work in terms of management objects, processes, methods, and objectives [27]. From the perspective of the development of scientific data itself, archiving management will become an inevitable trend. At the same time, due to the supplementary role of archives departments' management policies and methods to other scientific data management entities, all management entities need to seek coordinated development in policies. According to the collection, organization, preservation, utilization, and other processes in the full lifecycle management of scientific data, as well as the different main responsibilities and duty assignments, policy coordination at multiple levels and degrees among policy-making entities should be achieved to avoid policy content conflicts and policy inadaptability, ensuring that scientific data is collected completely, managed well, and used effectively.

On the one hand, archives departments should establish cooperation mechanisms with scientific data management institutions in policy and standard formulation. Scientific data has differences and characteristics in different disciplinary fields. Archives departments gather and manage various resources and data, undertaking a "communication" hub function to a certain extent. They should actively coordinate, establish multi-subject coordination mechanisms, and strengthen cooperation with different disciplinary fields: Focus on scientific data archiving scope, metadata, format, appraisal principles, and long-term preservation to promote the construction of a data standard system for collaborative governance of scientific data and scientific research archives. Take scientific data security

as the starting point to promote the construction of a scientific data security standard system. Data security is the prerequisite to ensure that scientific data is in an effective protection state and can be legally utilized. The "Data Security Law of the People's Republic of China" proposes supporting different subjects and institutions to cooperate in data security risk assessment, prevention, and disposal, formulating important data catalogs, strengthening the protection of important data, and establishing a data security emergency response mechanism [28]. Establish a complete supervision mechanism at the policy level for the purpose of standardized collection and custody of scientific data. Scientific research archives work is subject to effective supervision and guidance by archival authorities together with national and local science and technology authorities. However, in the "implementation rules" issued by various provinces, some rules require competent departments to evaluate and assess their affiliated legal person units and data centers but lack scientific and effective supervision mechanisms. Collaborate with scientific data management institutions and scientific researchers to formulate appraisal and opening policies for scientific data after archiving. An important activity of scientific data management is to actively promote sharing and utilization. Although the newly revised "Archives Law" has shortened the closure period of archives from 30 years to 25 years for opening to the public and is continuously promoting the opening and utilization of archives [29], the current utilization degree of archives cannot yet meet the needs of achieving scientific data sharing and utilization goals. Therefore, all parties need to strengthen coordination to formulate opening policies for scientific data after archiving, so that scientific data can be shared and utilized to the greatest extent after archiving.

On the other hand, not only should the coordination between scientific data policy-making entities and policy standard systems be promoted, but archives departments should also have overall internal planning. Currently, archives departments' relevant policies for scientific data management are not yet institutionalized and systematic. Therefore, from the formulation of national macro-policies to the establishment of rules and regulations in various industries and departments, the archival field should ensure policy interoperability and consistency, strengthen the concept of coordination, and form a top-down institutional norm for scientific data archival management.

China's local governments are in the development stage of scientific data management, and scientific data management policies have room for further optimization. Archives departments are in the exploration stage of scientific data management. On the one hand, they should attach importance to introducing effective experience and concepts from archival management practice and research into scientific data management activities, optimizing scientific data archiving work, and promoting the construction of scientific data management policies in the archival field. On the other hand, they need to strengthen policy coordination with other scientific data management entities, form a complementary policy network, focus on the full process of scientific data management, and achieve policy interaction, balance, and integrated development among various

entities.

References

[1] Notice of the General Office of the State Council on Issuing the Measures for the Management of Scientific Data [EB/OL]. [2021-03-02]. http://www.gov.cn/zhengce/content/2018-04/02/content_{5279272}.htm.

[2] Zhou Xiuxian. Scientific and technological archives and scientific research management [J]. Science Research Management, 1981(3): 23-37.

[3] Regulations on Scientific and Technological Archives Work [EB/OL]. [2021-06-25]. https://www.saac.gov.cn/daj/xzfg/198012/5739ff2b6b8a64233a63bfbd6508ed2a9.shtml.

[4] Management Standards for Scientific Research Project Archives [EB/OL]. [2021-06-25]. https://www.saac.gov.cn/daj/hybz/201806/699bc21a3d30480bb3ccd037deebf95c/files/46ce8e0e4

[5] Regulations on the Management of Scientific Research Archives [N]. China Archives News, 2020-10-29 (3).

[6] Zou Ziming, Hu Xiaoyan, Xiong Senlin. Opportunities and challenges of big data in space science [J]. Bulletin of Chinese Academy of Sciences, 2018, 33(8): 877-883.

[7] Chen Fengzhen, You Lijin, Yang Fan, et al. CNGBdb: China National GeneBank DataBase [J]. Hereditas, 2020, 42(8): 799-809.

[8] Zhang Lili, Wen Liangming, Shi Lei, et al. Latest developments in scientific data management and open sharing at home and abroad [J]. Bulletin of Chinese Academy of Sciences, 2018, 33(8): 774-782.

[9] He Qingfang. Investigation and analysis of foreign scientific data management policies [J]. Shanghai University Library and Information Work Research, 2016, 26(2): 9-13.

[10] Zhou Yuqin, Xing Wenming. Research on the policy system of scientific research data management and sharing in China [J]. Chinese Journal of Medical Library and Information Science, 2018, 27(8): 1-7.

[11] Zhao Hua, Wang Jian. Scientific data sharing policy and its enlightenment to China agricultural scientific data sharing [J]. Agricultural Outlook, 2015, 11(11): 70-74.

[12] Xing Wenming, Song Jian. Content analysis of research data policies in UK universities [J]. Digital Library Forum, 2019(1): 21-29.

[13] Jiang Xin. Research on open sharing policies of scientific data of foreign funding agencies: Based on policy text analysis of NVivo 12 [J]. Journal of Modern Information, 2020, 40(8): 144-155.

[14] You Xiaguang, Sheng Xiaoping. Comparison and characteristic analysis of

scientific data open sharing policies of 8 international organizations [J]. Information Studies: Theory & Application, 2017, 40(12): 40-45.

[15] Zuidewijk A, Janssen M, Choenni S, et al. Design principles for improving the process of publishing open data [J]. Transforming government: people, process and policy, 2014, 8(2): 185-204.

[16] Xie Qiuyan, Qian Peng. Development research on foreign scientific data sharing policies [J]. New Century Library, 2014(1): 67-71.

[17] Xing Wenming, Hong Fanglin, Li Xiaoyan. Two-dimensional perspective of scientific data management system: Interpretation of the Measures for the Management of Scientific Data [J]. Library and Information Service, 2019, 63(23): 30-37.

[18] Gao Yuwei, Shi Lei, Zhu Yanhua, et al. Comparative study on implementation rules of the Measures for the Management of Scientific Data: Taking 11 officially released implementation rules as examples [J]. China Science & Technology Resources Review, 2019, 51(3): 1-10, 17.

[19] Yan Peng. Analysis of archives departments' participation in scientific data management from the perspective of stakeholders [J]. Archives World, 2019(3): 47-49.

[20] Chen Tian, Yu Yarong, Zhang Zhaoyu, et al. Research on full-process management of scientific data based on data preservation thinking [J]. Archives and Construction, 2020(12): 4-9.

[21] Lauriault TP, Craig BL, Fraser Taylor DR, et al. Today's data are part of tomorrow's research: archival issues in the sciences [J]. Archivaria, 2007, 64(2): 123-179.

[22] Noonan D, Chute T. Data curation and the university archives [J]. The American archivist, 2014, 77(1): 201-240.

[23] Poole AH. How has your science data grown? digital curation and the human factor: a critical literature review [J]. Archival science, 2015, 15(2): 101-139.

[24] Rothwell R, Zegveld W. Reindusdali zation and technology [M]. London: Logman Group Limited, 1985: 83-104.

[25] Liu Binfang, Wei Wei, An Xiaomi. Policy analysis of government data governance in the big data era [J]. Journal of Intelligence, 2019, 39(1): 142-147, 141.

[26] Li Yajing. Research on scientific data open policy based on text analysis [D]. Harbin: Heilongjiang University, 2018.

[27] Cai Yingfang. Research on the integrated management of data management business and archives [J]. Archives Science Study, 2021(3): 40-46.

[28] Data Security Law of the People's Republic of China (adopted at the 29th meeting of the Standing Committee of the Thirteenth National People's Congress on June 10, 2021) [N]. People's Daily, 2021-06-19 (7).

[29] Policy and Regulation Research Department of the State Archives Administration. Interpretation of the newly revised Archives Law of the People's Republic of China [J]. China Archives, 2020(7): 24-25.

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Huo Qian: Determined the topic, analyzed and processed data, and wrote the paper;
Liang Xiaomeng: Drafted the outline and revised the paper;
Pan Yanan: Proposed the research idea and reviewed and finalized the paper.

English Title and Abstract

The Enlightenment of Scientific Data Management Policy to Scientific Data Management in Archives Departments: Textual Quantitative Analysis Based on Policy Tools

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Abstract: [Purpose/significance] Scientific data is an important part of scientific research archives. Judging the policy orientation of local governments on scientific data management has strongly theoretical and practical guiding value for scientific data management and policy formulation in archives departments. [Method/process] This study selected 13 implementation rules for scientific data management issued by local governments in China, used policy tools to conduct quantitative research, analyzed the current status of scientific data management policies in China, and proposed enlightenment that can benefit the development of scientific data management policies for archives departments from the perspective of archives management. [Result/conclusion] As an important organization guarding information resources, archives departments should give full play to their advantages and characteristics in scientific data management, actively promote the development and improvement of the scientific data management policy system, promote the formulation of scientific data archiving policies, and strengthen the coordinated development of scientific data management policies.

Keywords: scientific data management; archives departments; policy tools; quantitative research

Note: Figure translations are in progress. See original paper for figures.