Influencing Factors, Key Issues, and Implications for Open Science Policy Formulation in Research Institutions (Postprint)

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Date: 2025-01-02T00:00:00+00:00

Abstract

[Purpose/Significance] To investigate the influencing factors in the formulation of open science policies for research institutions, identify key issues, and provide references for Chinese research institutions in developing such policies.

[Method/Process] First, qualitative research methods are employed to construct a theoretical model of the influencing factors for open science policies in research institutions. Then, based on this model, a questionnaire survey is conducted, drawing on the expertise of Chinese researchers to identify key issues in policy formulation and provide specific recommendations.

[Results/Conclusion] The formulation of open science policies for research institutions needs to align with national policy orientation, clarify guiding principles, enhance decision-making capabilities, balance and coordinate multi-party interests, and ensure material resource investment, thereby fully leveraging the principal role of research institutions in the open science process.

Full Text

Influencing Factors, Key Issues and Implications of Open Science Policy Formulation in Research Institutions*

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Abstract: [Purpose/Significance] This study investigates the factors influencing open science policy formulation in research institutions, identifies key issues, and provides references for Chinese research institutions in developing open science policies. [Method/Process] First, a qualitative research method was employed to construct a theoretical model of the influencing factors. Based on this model, a questionnaire survey was conducted to identify key issues in policy formulation through the insights of Chinese researchers, offering specific recommendations. [Result/Conclusion] Formulating open science policies in research institutions requires alignment with national policy orientation, clarification of guiding principles, enhancement of decision-making capabilities, balanced coordination of multi-stakeholder interests, and guaranteed material resource investment to fully leverage the principal role of research institutions in advancing open science.

Keywords: open science; open science policy; research institutions; influencing factors

*This work is supported by the National Social Science Fund of China project titled "A Practical Study on the Construction of Library Transformation Context and Transformation Path Under the Open Access Environment" (Grant No. 19BTQ016).

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Received: 2024-03-25
Revised: 2024-06-18
Pages: 59-70

1 Introduction

Open science represents a transformation toward a new research paradigm [1] and plays a vital role in safeguarding scientific human rights, enhancing innovation capacity, bridging information gaps, and maximizing public benefits. Open science policy constitutes a key factor influencing open science development [2]. As one of the core stakeholders in open science, research institutions abroad have successively formulated open science policies to coordinate institutional actions, such as the *Open Science Roadmap of the French National Centre for Scientific Research* (2019) [3], *Open Science Policy of the Norwegian University of Science and Technology* (2020) [4], *Open Science Policy of the University of Zurich* (2021) [5], *Open Science Policy of the Helmholtz Association* (2022) [6], and *Open Science Policy of the University of Split* (2023) [7]. These policies cover multiple aspects including open access, open data, open science infrastructure, evaluation and incentives, education and training, open code and software, citizen science, and international cooperation [8].

Existing research on open science policies primarily focuses on policy content, formulation, implementation, and evaluation. Policy content studies can be divided into specific policy research targeting particular open science practices and holistic policy research on overall practices and policy systems. For instance, Chen Chuanfu et al. proposed the concept of "open access deficit" and recommended constructing an open access public policy aligned with national strategic needs for comprehensive innovation [9]. S. Moradi et al. reviewed open science policies in seven European countries, conducting thematic analysis across three dimensions: open input, open process, and open output [10]. Sheng Xiaoping et al. conducted grounded theory analysis of China's national-level open science policy system, summarizing policy characteristics and proposing improvement recommendations [11]. Policy formulation research includes studies on the significance and necessity of formulation as well as the formulation process. D. G. Aristegui et al. noted that as liberal economic policies impact scientific research, open science initiatives have become crucial measures to defend the freedom and independence of scientific research and oppose its commodification [12]. R. Inkpen et al. identified sensitive issues requiring attention in open data policy formulation, such as the value definition of data as a public resource and potential ethical issues in data usage [13]. Implementation research includes studies on the roles of different actors and problem-solution analyses during execution. Long Yixuan et al. analyzed the varying choices of national funding agencies in facing open science—firm implementation, active support, or wait-and-see—and pointed out that different countries need differentiated countermeasures to address challenges [14]. L. Erika noted that due to the lack of incentive mechanisms, researchers' willingness to comply with open science policies is low, recommending that policy formulation should change this phenomenon [15]. Policy evaluation research primarily focuses on policy effectiveness and improvement schemes, such as N. Robinson et al., who proposed a set of open access evaluation indicators at the institutional level to monitor policy implementation and impact, combining empirical evidence to propose solutions for promoting open access policy execution [16].

Overall, existing research mainly consists of investigative analyses and promotional studies of open science policies domestically and internationally, lacking in-depth analysis focused on specific stakeholders at the policy formulation level, and the integration with the core policy audience—the researcher community—needs further enhancement. This study adopts the perspective of research institutions as the main subject, closely integrates with China's researcher community, explores the influencing factors in open science policy formulation for Chinese research institutions, clarifies key issues, and proposes solutions, aiming to provide reference and recommendations for relevant policy formulation.

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2 Analysis of Factors Influencing Policy Formulation

2.1 Research Methods

Open science policies in research institutions are closely related to researchers, research management departments, and institutional libraries. This study employs qualitative research methods to understand practitioners' practical perceptions and explore the influencing factors and mechanisms in open science policy formulation for Chinese research institutions.

Qualitative research emphasizes the quality rather than quantity of research subjects, typically employing purposive sampling methods that select subjects based on the researcher's judgment of maximum information provision for the research topic [17]. According to the research topic and qualitative research principles, this study invited science and technology management personnel, researchers, and librarians from multiple domestic research institutions as interview subjects. The basic information is shown in . All respondents were actively promoting open science. Given that research libraries are currently advocates and drivers of open science and open access movements in China, the interview subjects included multiple librarians with experience in open science policy formulation and implementation.

During interviews, the researcher adjusted or expanded questions based on respondents' answers, discussing relevant details around core issues. Each respondent participated in a 30-minute in-depth interview, yielding 11 first-hand interview records (conducted between October and November 2022). The interview outline is shown in . The qualitative research software NVivo 12 was used to code the interview data: first, statements related to open science policies in research institutions were initially conceptually coded to extract influencing factors; then, characteristics of each factor were compared, relationships between concepts were 梳理 ed, and initial codes were categorized and merged while paying attention to discovering new concepts and adding new codes; finally, relationships between codes were 梳理 ed to summarize the influencing factors of open science policy formulation in Chinese research institutions, as shown in .

2.3 Theoretical Model and Mechanism of Influencing Factors

Based on qualitative analysis, this study constructed a theoretical model of factors influencing open science policy formulation in research institutions, as shown in [Figure 1: see original paper].

2.3.1 Policy Framework Dimension The policy framework is a key factor affecting policy formulation, with the scientific rationality of the policy itself directly influencing policy development. The main influence pathways of policy framework factors include: **Policy philosophy** should embody people-centeredness and reciprocity, building consensus from researchers' common needs to ensure mutual benefit and achieve the essence and optimal state

of open sharing. **Policy positioning** must first align with institutional development strategies, clarify key issues to be addressed, and ensure consistency between institutional policies and the values of policy community stakeholders, accurately positioning within the macro policy system and clarifying the basis for policy implementation. **Policy objectives** should balance the interests and demands of different stakeholders to ensure mutual benefit as much as possible, while weighing public welfare against profitability, respecting and protecting the market value of knowledge achievements, encouraging phased or voluntary open sharing, supplemented by certain binding, guiding, or even mandatory policies to avoid excessive protection of individual profits that delays collective progress. **Policy characteristics** should reflect both uniqueness—explaining the policy's impact on traditional research communication models and its value to stakeholders—and comprehensiveness, discussing open science from institutional and even global perspectives by integrating past, present, and future contexts to clarify the necessity of policy formulation. **Policy content** includes: first, the scope of sharing, such as sharing subjects, methods, duration, extent, and objects (whether intra-institutional, national, or international); second, the content to be opened, such as different types of outputs and versions of publications; third, reasonable open sharing mechanisms to ensure countries and institutions at different technological development levels can benefit from open science; and fourth, intellectual property protection, providing legislative or policy support for rights management of scientific data while enabling open sharing and use. **Policy implementation** should determine policy types and implementation methods, combining mandatory and encouraging approaches, clarifying policy effectiveness, adopting graded and categorized promotion based on characteristics of different elements and their development stages in China's open science practice, and using grassroots research institutions' practical results to gain attention from higher-level units for coordinated policy implementation.

2.3.2 Subject Capability Dimension The capabilities of policy subjects and multi-subject collaboration capabilities guide policy formulation: **Research institution capability** involves the integration of open science concepts with institutional missions. Whether institutional decision-makers can clearly recognize the positive significance and importance of open science for transforming the academic communication system is crucial for placing open science policy formulation on the institutional agenda. The decision-makers' cognitive attitudes, judgment capabilities, and leadership directly relate to institutional policy formulation. Only with full support and recognition from leadership can research institutions leverage their principal capabilities and effectively use policy as a "commanding stick." Additionally, some research institutions' pioneering experiments and innovations can demonstrate and drive more actors. **Library capability** involves libraries as support units that have long undertaken literature resource procurement, reference services, and institutional research output analysis. Integrating open science has become an indispensable

part of library business responsibilities, with many institutional open science policies currently led by libraries. Therefore, librarians' competence and overall library capabilities directly affect policy formulation and implementation.

Multi-subject collaboration capability recognizes that adapting to open science is not unilateral library action but a challenge for the entire academic community. Establishing implementation responsibility systems and coordination mechanisms among subjects, balancing stakeholders' interest demands, and uniting open science stakeholders to form a "corps-style" driving force are essential.

2.3.3 Political Environment Dimension National policies, higher-level institutions, and government systems collectively constitute the political environment facing institutional policies, dominating their direction: **National policies** require a reasonable mechanism to guide open sharing willingness, necessitating national-level strategic adjustments and overall deployment to make top-level plans and designs for the academic communication system, creating a macro policy environment supportive of open science development. **Government systems** involve government support as one of the most critical influencing factors, including consensus among different governments internationally, coordination and consensus within domestic systems (e.g., within the Ministry of Education) and between different systems (e.g., Ministry of Education and Ministry of Science and Technology). **Higher-level institutions** exercise direct leadership over research institutions, with their attitudes directly affecting policy formulation. Research institutions need to communicate fully with higher-level institutions to form open dialogue and consensus on promotion, leveraging policy support and resource allocation from above.

2.3.4 Resource Guarantee Dimension Resource guarantee is the material foundation for policy formulation. Research institutions must provide necessary and appropriate resources for policy formulation, including: **Product guarantee** ensures that scientific knowledge as a public product itself has high quality and open value. **Organization guarantee** requires reasonable work frameworks and specialized organizations, such as institutional libraries or dedicated organizations leading the initiative, driving participation from publishers, researchers, and other actors to promote policy formulation through organized action. **Funding guarantee** involves policy formulation as a multi-party game process requiring financial support and investment, which is also a direct factor in mobilizing participants' enthusiasm and enhancing institutional initiative, while continuously optimizing input-output benefits. **Human resource guarantee** requires strengthening research investment to clarify policy elements, key points, breakthrough points, and integration with business practices, as well as understanding international development trends and experiences, leveraging staff research capabilities for policy layout and planning, while also requiring human resource investment during policy negotiation to ensure stable operation of all formulation stages. **Technology guarantee** involves

technological advances in software, hardware, and networks that can effectively achieve integration and platform construction of open science resources, with open science policies requiring support from open science infrastructure.

2.3.5 Cultural Atmosphere Dimension The cultural atmosphere of open sharing has a driving influence on open science policy formulation in research institutions: **Open science stakeholder attitudes** include whether consensus on open science is formed among upstream and downstream stakeholders, whether cooperation and coordination occur throughout the research lifecycle, and whether researchers can achieve further self-motivation and spontaneous sharing, extending the sharing atmosphere from some disciplinary communities to the entire academic community. **Impact of open science** involves changes in researchers' research models and processes brought by open science, the rising demand for knowledge open sharing, and the continuous enrichment of academic resource types, all of which need consideration in policy formulation. Additionally, security issues (e.g., information security) and ethical issues (e.g., priority rights recognition) brought by open science cannot be ignored. **Academic environment** varies across different disciplines, with varying degrees of openness appropriate—for instance, basic disciplines can be more open while those involving key technologies may require barriers. Moreover, influenced by different national political systems and social environments, whether the academic environment has a culture of mutual assistance and sharing also affects policy formulation difficulty. **Evaluation mechanisms** involve scientific and technological evaluation systems shaping research culture. Strengthening attention to the openness characteristics of research outcomes in evaluation policies, recognizing researchers' open practices, and highlighting actual research contributions can effectively improve open science policy effectiveness.

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3 Identification of Key Issues in Policy Formulation

3.1 Research Methods

Researchers are the main practitioners of open science. To understand Chinese researchers' views on open science policies in research institutions, this study designed a questionnaire based on the influencing factors theoretical model, leveraging researcher group wisdom to further assess the impact degree of each factor and identify key issues in policy formulation.

The questionnaire used a five-point Likert scale. It first surveyed respondents' cognition of open science policies in research institutions, then asked them to assign "influence" scores to each policy formulation influencing factor, with "1-5" representing "no influence," "minor influence," "moderate influence," "major influence," and "very major influence," respectively.

Related research indicates that a pre-survey sample size of 25-75 is sufficient to test differences between items [18]. Therefore, to ensure scientific validity,

this study invited 25 respondents for a small-scale pre-survey before formal distribution, optimizing question wording and logic based on pre-survey results.

Given the questionnaire's specialized nature, the formal survey primarily targeted Chinese researcher groups with some open science knowledge. Distribution occurred from December 29, 2022, to January 4, 2023. Through targeted invitations, distribution in open science-related communication groups, and posting questionnaire links on relevant public accounts, 359 electronic questionnaires were collected, with 297 valid questionnaires (82.73% valid response rate).

This study used Cronbach's α coefficient to test reliability. The α coefficients for all five dimensions of influencing factors exceeded 0.7, indicating good reliability. To verify structural validity, a rotated factor loading matrix was used to observe correspondence between factors (dimensions) and items. The matrix showed that each item loaded higher on its own dimension than on others, indicating good structural validity. These results demonstrate strong reliability for use in subsequent analysis.

3.2 Results

3.2.1 Sample Characteristics Sample characteristics are shown in . The sample was widely distributed across variables, providing a representative sample of the researcher community involved in this study with good statistical significance.

3.2.2 Current Cognition of Open Science Policies in Research Institutions As shown in [Figure 2: see original paper] through [Figure 4: see original paper], regarding the impact of open science on research institutions, nearly four-fifths of respondents (74.07%) believed open science has significantly impacted research institutions, four-fifths (78.45%) believed research institutions play a significant role in promoting open science, and all respondents (100%) believed research institutions need to formulate general open science policies to better coordinate institutional actions. These results indicate that the vast majority of researchers recognize open science's comprehensive and profound impact, consider research institutions as crucial stakeholders, and view policy formulation as necessary.

3.3 Summary of Key Issues in Policy Formulation

Based on questionnaire results, this study visualized the influence degree of each factor by establishing a coordinate system. As shown in [Figure 5: see original paper], the x-axis represents five dimensions of influencing factors (sorted left to right by score from high to low), and the y-axis represents the average score of each factor's influence degree (averaged from Likert scale values, showing data centrality—higher scores indicate more positive overall attitudes). Factors scoring $ $4.35 were classified as key factors influencing open science policy formulation in research institutions, summarizing critical issues as follows:

1. **Policy philosophy alignment with open science** (52.53% "very major influence," 40.07% "major influence")—the strongest factor in the "policy framework" dimension. Clear policy philosophy is the foundation for policy planning and the guiding principle throughout formulation, implementation, and evaluation. Research institution policies should reflect open science connotations while aligning with international trends, national development, and institutional needs.

2. **National-level top-level design and planning** (58.25% "very major influence," 33.67% "major influence")—the strongest factor in the "political environment" dimension. As official decision-makers with legitimate authority for public policy, national governments play a crucial role. Many foreign research institution policies have emerged in response to national-level open science policies.

3. **Research institution decision-making and judgment capability** (50.51% "very major influence," 42.42% "major influence")—the strongest factor in the "subject capability" dimension. Effective governance requires strong coordination, balancing interests, and interacting with policy objects and environments. Decision-makers must strengthen research investment and establish reliable mechanisms.

4. **Consensus among open science stakeholders** (50.51% "very major influence," 42.42% "major influence")—the strongest factor in the "cultural atmosphere" dimension. Government agencies, research institutions, funding agencies, publishers, and libraries must each play their roles in driving researchers to practice open science. Whether stakeholders can balance interests and reach consensus is a key issue.

5. **Adequate and stable funding investment** (47.47% "very major influence," 41.75% "major influence")—the strongest factor in the "resource guarantee" dimension. Funding is the basic material resource for policy implementation. Research institutions must secure support, develop budget plans, consider human and material costs, and establish supervision mechanisms to optimize input-output ratios.

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4 Implications for Open Science Policy Formulation in Research Institutions in China

4.1 Align with National Policy Orientation and Call for Top-Level Design

National open science policies emphasize specific national interests and practical needs, providing significant impetus and guidance for institutional policy formulation. Survey results show that national top-level design is the most critical influencing factor for institutional policy formulation. In recent years, Finland

[19], the Netherlands [20], France [21-22], Canada [23], Austria [24], and Spain [25] have successively released national open science plans or roadmaps, with main contents shown in .

Institutional-level policies respond to and implement national policies. For example, *Utrecht University's Open Science Programme 2018-2021* [26] closely relates to the Netherlands' national plan, covering open access publications, FAIR and open research data, and reward measures. *Paul Valéry University Montpellier's Open Science Charter* [27] references France's *Digital Republic Act* and national open science plan, responding to the national advocacy of "as open as possible, as closed as necessary." *The University of Zurich's Open Science Policy* implements Switzerland's national open access strategy requirement that "national research funding agencies ensure public access to research results."

China has not yet issued a dedicated open science master policy, but the 2021 revised *Law on the Progress of Science and Technology* proposes "promoting the development of open science." Open science should become a key topic in China's science and technology policy, requiring specific goals and top-level design to provide direction for institutional policy formulation.

4.2 Clarify Policy Guiding Principles

Both expert interviews and surveys emphasized that policy philosophy should reflect open science connotations. This study considers open science as a scientific culture with "openness" as its core concept throughout the entire research lifecycle, dedicated to accelerating knowledge discovery and dissemination, promoting broad cooperation, improving research efficiency, enhancing transparency, reproducibility, and usability, establishing an equal, inclusive, cooperative, and sharing academic atmosphere, and maximizing public interest.

This study examined guiding principles in existing institutional policies, compiled in [Figure 6: see original paper]. The most frequently mentioned principles were inclusion, sustainability, collaboration, diversity, public good, and transparency, followed by knowledge commons, accessibility, efficiency, equality, innovation, openness, participation, quality, reproducibility, and scrutiny. Therefore, this study summarizes guiding principles for research institution open science policies as: **Inclusion and diversity**: Accommodating diversity in language, disciplines, research topics, outputs, and workflows to support research needs and knowledge exchange from both within and outside academia. **Sustainability**: Adopting non-profit operation models to provide stable, secure, and reliable open science services and infrastructure, ensuring permanent unrestricted access for all. **Collaboration and participation**: Promoting normalized cooperation inside and outside institutions, encouraging interdisciplinary, cross-regional, and cross-stakeholder collaboration, enabling all stakeholders to participate in and benefit from open science. **Transparency and openness**: Encouraging transparent sharing of data, methods, and results at all research stages to make openness the default paradigm, improving research

reproducibility and quality. **Public interest**: Clarifying that research outputs from publicly funded research belong to public assets and should be openly shared for societal benefit.

4.3 Enhance Institutional Decision-Making and Judgment Capabilities

Institutional decision-making and judgment capability is key to ensuring policy quality, as policy subjects' quality, organizational structure, and implementation capacity affect policy quality [28]. First, strengthen research investment by thoroughly studying existing open science policies, grasping international trends, summarizing main contents and implementation models of current institutional policies for reference, and aligning with institutional development plans. Establish decision-making mechanisms that achieve full democratization and leverage advisory experts, defining policy issues and agendas through extensive research and discussion with policy objects, negotiating policies with detailed strategies and effective tools to reach consensus and conduct pilot trials.

Second, conduct effective internal structural adjustments. Among institutions that have issued open science policies, over half have adjusted departmental structures or established dedicated project teams for implementation, clearly defining organizational structures and division of responsibilities. For example, University College London established the Open Science Office to provide resources and support for key action areas in its policy [29]; Tampere University plans to establish a permanent open science coordination group to guide and supervise implementation [30]; Delft University of Technology's open science policy is coordinated by the Open Science Committee with dedicated team management [31]. Given open science's numerous components and stakeholders, structural adjustments or establishing specialized open science project teams help coordinate practices and avoid fragmented, inconsistent internal actions.

Finally, establish reliable supervision and evaluation mechanisms to ensure policy execution. Current open science practice has shifted focus to local institutions and grassroots activities [32]. Research institutions should adopt combined qualitative and quantitative methods for continuous dynamic monitoring and evaluation. For instance, the *CNRS Open Science Roadmap* implementation is led by CNRS's Department of Scientific and Technical Information, with three units responsible for information and data analysis, joint services, and digital dissemination to implement specific actions and undergo regular reviews. International organizational policies also provide good references: LERU established a "University Agenda Checklist" in its policy [33], enabling institutions to assess their progress across open science agendas, identify priorities, and measure policy effectiveness—crucial for supervising progress and achieving policy goals.

4.4 Coordinate Stakeholder Interests and Foster Open Science Consensus

Open science involves numerous stakeholders with complex policy formulation processes. Based on investigations [34-35], this study summarizes major demands of each stakeholder from motivation and hindrance perspectives, as shown in .

The premise of policy formulation is fully understanding stakeholder interests and demands to design policies effectively. First, policies should start from research activity subjects' interests, highlighting common goals such as improving research efficiency and quality, enhancing academic and social impact, shaping core competitiveness in an open science environment, bridging information gaps, promoting public participation, and increasing social benefits from public investment. Second, define "openness" scenarios, degrees, and scopes—whether knowledge and data openness is national or international, coordinate public and private aspects of open content, and implement graded, categorized, and scenario-based openness (e.g., higher openness for basic research at international frontiers while protecting key technologies and national security). Finally, coordinate interest conflicts among stakeholders regarding rights and responsibilities, such as copyright conflicts in knowledge openness, conflicts between personal privacy rights and public right to know, public welfare versus profitability conflicts, and conflicts between open sharing practices and imperfect incentive mechanisms, balancing rights and obligations to protect core stakeholder interests.

4.5 Provide Stable Human, Financial, and Material Resources

Achieving open science cultural transformation requires long-term, sustained investment. Research institution open science policies are typically 3-5 year strategic plans requiring extensive cooperation between secondary colleges/departments and service departments (human resources, finance, libraries, technology), creating high demands for human, financial, and material resources. Whether a comprehensive funding guarantee system exists is key to successful policy implementation.

Current foreign institutions emphasize budget planning for open science policy implementation. For example, Utrecht University's 3-year *Open Science Programme 2018-2021* [27] clarified governance structure and budget allocation based on preliminary planning, estimating overall expected costs and investment, allocating funds to specific projects like open access, FAIR data, and open code/software, with varying annual amounts that will be refined during implementation. *Delft University of Technology's Open Science Strategy 2020-2024: Research and Education in the Era of Openness* [32] budgeted annual project and management costs from 2020-2023, with a total 4-year budget of €3 million, subject to regular evaluation and annual budget adjustments with the steering committee.

When drafting open science policies and launching projects, institutions should clearly define implementation organizational structures, clarify member responsibilities, comprehensively consider implementation and management costs, refine budget plans to each annual specific project, and conduct subsequent fund usage reviews and effectiveness evaluations to continuously optimize input-output ratios [36], such as developing more detailed budgets for priority items. Through stable, flexible funding investment and close cooperation among staff and business departments, various open science policies and actions can be effectively implemented.

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5 Summary

This study explored influencing factors and key issues in open science policy formulation for Chinese research institutions through qualitative research and questionnaire surveys. Results show that influencing factors mainly comprise five dimensions: policy framework, subject capability, political environment, resource guarantee, and cultural atmosphere. Among these, whether policy philosophy aligns with open science, institutional decision-making capability, national top-level design, adequate funding, and stakeholder consensus are key factors. Based on these findings, this study proposes recommendations including aligning with national policy orientation, clarifying guiding principles, enhancing institutional decision-making capabilities, balancing multi-stakeholder interests, and guaranteeing material resource investment, providing valuable references for Chinese research institutions to formulate and optimize open science policies.

This study has limitations. First, the sample coverage of the researcher community was relatively limited, and results heavily depend on respondents' subjective preferences. Although respondent differences were controlled during research, varying cognitive levels and limited numbers inevitably constrain conclusions. Second, this study focused on the policy formulation stage at the theoretical research level, while policy formulation aims to serve practice, with feedback requiring implementation and evaluation to manifest. Therefore, this study cannot assess policy implementation effectiveness. Future research will expand sample scope, increase multi-dimensional data collection, strengthen empirical research, and further promote scientific and rational open science policy formulation for Chinese research institutions through extensive policy data.

References

[1] IFLA. Open science commons: a holistic and ecological view of science[EB/OL]. [2024-07-15]. https://www.ifla.org/events/open-science-commons-a-holistic-and-ecological-view-of-science-2/.

[2] Open Science Monitor. Updated methodological note[EB/OL]. [2024-07-15]. https://research-and-innovation.ec.europa.eu/document/download/ef40c673-6cfc-4625-a3a8-dd83ea35b7d7_{en}?filename=open_{{{science}}}{{monitor}}}{{{methodological}}}{{note}}}

[3] CNRS. Science ouverte[EB/OL]. [2024-07-15]. https://www.science-ouverte.cnrs.fr/.

[4] NTNU. Policy for open science at NTNU[EB/OL]. [2024-07-15]. https://www.ntnu.edu/policy-for-open-science.

[5] University of Zurich. Open science policy[EB/OL]. [2024-07-15]. https://www.openscience.uzh.ch/en/definition/policy.html.

[6] Helmholtz Open Science Office. Helmholtz anchors open science[EB/OL]. [2024-07-15]. https://os.helmholtz.de/en/newsroom/news/article/helmholtz-anchors-open-science/.

[7] OpenAIRE. The University of Split has adopted an open science policy[EB/OL]. [2024-07-15]. https://www.openaire.eu/blogs/the-university-of-split-has-adopted-an-open-science-policy.

[8] WANG Y H. Open science policy of research institutions abroad and its implications[J]. Digital library forum, 2024, 20(5): 1-12.

[9] CHEN C F, HUANG Y C. Research on the open access deficit and the construction of open access public policy[J]. China soft science, 2024(3): 66-75.

[10] MORADI S, ABDI S. Open science-related policies in Europe[J]. Science and public policy, 2023, 50(3): 521-530.

[11] SHENG X P, ZHANG Y. Advancing with times: analysis of open science policies at national level in China[J/OL]. Library tribune: 1-10[2024-07-19].

[12] ARISTEGUI D G, RENDUELES C. Open, free … and public. the political challenges of open science[J]. Argumentos de razon tecnica, 2014(17): 45-64.

[13] INKPEN R, GAUCI R, GIBSON A. The values of open data[J]. Area, 2021, 53(2): 240-246.

[14] LONG Y X, ZHAO K H, WANG S L, et al. From open access to open science: choices and challenges of research funding institutions[J]. Journal of information resources management, 2021, 11(4): 70-79.

[15] ERIKA L. Threat of policy alienation: exploring the implementation of open science policy in research practice[J]. Science and public policy, 2020, 47(6): 803-817.

[16] ROBINSON-GARCIA N, COSTAS R, LEEUWEN T. Open access uptake by universities worldwide[J]. PeerJ, 2020, 8(2): e9410.

[17] LI N, WU J. Influencing factors and constructing strategies of international discourse power of Chinese English science and technology journals[J]. Science-technology & publication, 2024(5): 68-75.

[18] LOIS O, CHARLES C, GRAHAM K. New strategies for pretesting survey questions[J]. Journal of official statistics, 1991, 7(3): 349-365.

[19] Opetus-Ja Kulttuuriministeriö. Tutkimuksen avoimuudella yllättäviä löytöjä ja luovaa oivaltamista: avoimen tieteen ja tutkimuksen tiekartta 2014–2017[EB/OL]. [2024-07-15]. http://urn.fi/URN:ISBN:978-952-263-317-0.

[20] Dutch Ministry of Education, Culture and Science. National plan open science[EB/OL]. [2024-03-15]. https://repository.tudelft.nl/islandora/object/uuid:9e9fa82e-06c1-4d0d-9e20-5620259a6c65?collection=research.

[21] Ministere de L'enseignement Superieur, De La Recherche et de L'innovation. The national plan for open science[EB/OL]. [2024-07-15]. https://www.ouvrirlascience.fr/the-national-plan-for-open-science/.

[22] Ministere de L'enseignement Superieur, De La Recherche et de L'innovation. Second French plan for open science[EB/OL]. [2024-07-15]. https://www.ouvrirlascience.fr/second-national-plan-for-open-science/.

[23] Office of the Chief Science Advisor. Roadmap for open science[EB/OL]. [2024-07-15]. https://science.gc.ca/eic/site/063.nsf/eng/h_{97992}.html.

[24] Bundesministerium. Open science policy Austria[EB/OL]. [2024-07-15]. https://www.bmbwf.gv.at/Themen/HS-Uni/Hochschulgovernance/Leitthemen/Digitalisierung/Open-Science/Open-Science-Policy-Austria.html.

[25] Ministerio de Ciencia, Innovación y Universidades. National open science strategy (ENCA) 2023-2027[EB/OL]. [2024-07-15]. https://www.ciencia.gob.es/en/Estrategias-y-Planes/Estrategias/ENCA.html.

[26] Utrecht University. Open science[EB/OL]. [2024-07-15]. https://www.uu.nl/en/research/open-science.

[27] Université Paul-Valéry Montpellier III. Charte sciences ouvertes[EB/OL]. [2024-07-15]. https://www.univ-montp3.fr/fr/unit%C3%A9s-de-recherche/charte-sciences-ouvertes.

[28] CHEN S S. What is a "good policy"?—A literature review of public policy quality[J]. Journal of public administration, 2020, 13(3): 172-192, 200.

[29] Library Services. UCL office for open science and scholarship[EB/OL]. [2024-07-15]. https://www.ucl.ac.uk/library/open-science-research-support/ucl-office-open-science-and-scholarship.

[30] Tampere Universities. Open science and research[EB/OL]. [2024-07-15]. https://www.tuni.fi/en/research/responsible-research/open-science#expander-trigger–65f39225-8b9e-4265-a05f-26c479856ef1.

[31] Technische Universiteit Delft. About the-programme[EB/OL]. [2024-07-15]. https://www.tudelft.nl/en/open-science/about-the-programme.

[32] LERU. Implementing open science[EB/OL]. [2024-07-15]. https://www.leru.org/publications/implementing-open-science.

[33] LERU. Open science and its role in universities: a roadmap for cultural change[EB/OL]. [2024-07-15]. https://www.leru.org/files/LERU-AP24-Open-Science-executive-summary.pdf.

[34] KU L P. Data management services in the transition of research model: an approach of implementing open access, open data and open science[J]. Journal of library science in China, 2018, 44(6): 43-58.

[35] ZHOU Y, ZHANG Y. Study on the development strategies of open science in China—from the perspective of scientific researchers[J]. Library tribune, 2023, 43(12): 161-168.

[36] WANG Y H, CHU J L. Quantitative analysis and enlightenment on open science policy texts in scientific research institutions from the perspective of policy tools[J]. Journal of library and information science in agriculture, 2022, 34(7): 39-52.

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