Transformation and Development of Digital Resource Construction in Research Libraries: A Case Study of the Chinese Academy of Sciences Documentation and Information System (Postprint)

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Abstract

Purpose/Significance: This study aims to summarize the transformation and development of digital resource construction in research libraries, particularly the second transformation triggered by open resources, to explore future development directions for digital resource construction in research libraries.

Method/Process: Taking the Chinese Academy of Sciences Documentation and Information System as an example, this paper reviews its digital resource construction practices and effectiveness, and forecasts future development—taking integrated scientific resources and open resource construction as the foundation for transformation, and fine-grained knowledge association and presentation as the development goal.

Results/Conclusion: Research libraries encounter numerous issues during the transformation of digital resource construction. The following recommendations are proposed: 1) formulate clear digital resource construction plans; 2) rationally invest funds, human resources, and technology; 3) clarify usage rights for open resources and actively promote open access; 4) strengthen inter-library cooperation and sharing in open resource construction; 5) strengthen cross-boundary cooperation in knowledge resource organization.

Full Text

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Transition and Development of Digital Resource Construction in Research Libraries: A Case Study of the Chinese Academy of Sciences

Library and Information System

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Abstract:
[**Purpose/Significance**] This paper aims to summarize the transition and development of digital resource construction in research libraries, particularly the second transformation triggered by open resources, and to explore future development directions for digital resource construction in research libraries. [**Method/Process**] Taking the Chinese Academy of Sciences Library and Information System as an example, this paper examines its digital resource construction practices and effectiveness, and anticipates future development based on the construction of comprehensive science and technology resources and open resources as the foundation for transformation, with fine-grained knowledge association and presentation as the development goal. [**Result/Conclusion**] Research libraries encounter numerous problems during the transition of digital resource construction. This paper proposes the following recommendations: Develop clear digital resource construction plans; Allocate funds, personnel, and technology rationally; Clarify usage rights of open resources and actively promote open access; Strengthen inter-library cooperation and sharing in open resource construction; Enhance cross-border collaboration in knowledge resource organization.

Keywords: research library; digital resource construction; open access; transition and development; ISLI

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Since the 21st century, with changes in information technology and academic communication and publishing formats, digital literature resources have increased rapidly. As a crucial service institution in the academic environment, research libraries have begun the first resource construction transition from print to digital media. Currently, most print journals have been replaced by electronic journal full-text databases, and some foreign original books and conference proceedings from major publishers (such as Elsevier, Springer Nature, Wiley, RSC, SPIE, IEEE, AIAA, etc.) have begun to be replaced by electronic book or conference full-text databases. The digitization of literature resources

has dramatically changed user behavior and significantly impacted research libraries' resource construction and service models. Although the first transition from print to digital resources is not yet complete, it has become an irreversible trend.

Simultaneously, alongside the gradual digitization of traditional commercial publishing, open access (OA) has flourished. Open access academic resources, represented by scholarly journals and papers, have become indispensable resources for academic research and are gradually approaching a turning point of "becoming mainstream academic resources" [1]. Moreover, with the development of E-learning, E-science concepts, and digital research environments, web publishing, personal homepages, academic social networks, and other platforms have emerged, generating large amounts of free, high-value open academic resources on the internet—user-generated content (UGC) such as science blogs, science forums, academic communities, and scholars' personal homepages—that serve as important supplements to commercial academic resources. Given the enormous academic value of open resources and the important mission of research libraries to support teaching and research, along with funding and personnel constraints, research libraries need to make internal adjustments to their resource construction work, shifting the focus of digital resource construction to open resources while procuring database resources and undertaking library digitization.

Under the combined influence of data-intensive scientific research (the fourth paradigm) [2], personalized user demands, and emerging technologies (big data technology, data integration, machine learning, data mining, natural language processing), research libraries' digital resource construction has entered a second transition period. The subject of resource construction has shifted from commercial literature resources to comprehensive science and technology resources, especially various types of open knowledge resources. The construction model has transformed from subscription and procurement to integration and collection.

2. Transition of Digital Resource Construction in Research Libraries

2.1 Overview of Digital Resource Construction Transition

In 2015, the Pew Research Center found through public opinion surveys in the United States that libraries, especially public libraries, are indispensable community infrastructure but are at a "crossroads" of transformation [3]. Funding support is the basic prerequisite for libraries to undertake role positioning and service transformation in the new era. The 2016 IFLA Trends Report noted that "as libraries transform and develop their services to meet the rising expectations of funders, they also need more financial support" [4]. In summary, the global environment, internet popularization, and emergence of new technologies have created opportunities for libraries to pursue new transformations.

"Library transformation does not refer to a specific state but rather the reform and adjustment libraries make to their traditional working conditions in response to changes in the digital environment to meet user information needs and consolidate their social status. This may involve improvements to specific businesses, changes in organizational structure, or adjustments to macro development strategies" [5].

In related research, scholars such as Zhang Xiaolin [6], Wu Jianzhong [7], Chu Jingli [8], Chen Chuanfu [5], and Zhu Qiang [9] have reflected on the current situation and problems of library transformation from different perspectives, providing important theoretical guidance and direction for library transition and development.

In terms of digital resource construction transformation practices, there are Peking University Library's subject-based acquisition plan [10], the special topic database constructed by the Provincial Party School Library [11-12], local university libraries transforming their original collection resources according to applied technology disciplines and practical needs when transitioning to application-oriented universities [13], Qingdao Binhai University Library's establishment of subject service blogs and encouragement of subject librarians to participate in literature resource ordering [14], and the promotional effect of crowdfunding concepts on library transformation [15], as well as crowdfunding to establish a one-stop service platform for OA journal resources [16]. All these represent different transformation approaches for various types of libraries in digital resource construction.

2.2 Specific Transformation Practices of the Chinese Academy of Sciences Library and Information System

As a typical representative of research libraries, the Chinese Academy of Sciences Library and Information System, after basically completing the first transformation of resource construction, launched the construction of an integrated registration system for comprehensive science and technology resources in 2009 to register, index, and systematically preserve comprehensive science and technology resources on the internet. Subsequently, it launched systematic collection projects for various types of open resources that are freely available on the internet, including academic conference papers, educational resources, journal articles, socio-economic data, and books, beginning the second transformation of digital resource construction channels from procurement to procurement and collection, and resource types from literature resources to comprehensive science and technology resources. Although this transformation has just begun, its impact on future research library resource construction is already emerging.

2.2.1 Construction of the Integrated Science and Technology Resource Registration System The meaning of comprehensive science and technology resources is quite broad. In addition to traditional literature resources (including various carrier forms such as print and network), it also includes various

non-literature resources such as research projects, scientific data, software tools, research equipment, and institutions. To centrally reveal and manage comprehensive science and technology resource systems, the Lanzhou Library and Information Center of the Chinese Academy of Sciences launched the construction of the Integrated Registration System for Science and Technology Resources (IRSR) in 2009. The goal was to build a centralized resource collection metadata registration system, providing a reliable platform and technical support for semantic annotation and management of comprehensive science and technology resources, and laying the foundation for automatic discovery and association expansion of various resources based on semantic technologies [18]. As of May 2018, the IRSR system had registered and published nearly 100,000 resource and institution data entries.

2.2.2 Construction of Open Knowledge Resource Systems The integrated science and technology resource registration system is equivalent to a traditional bibliographic database, while open resources emphasize full-text openness. Around the same time as constructing the integrated registration system, the Chinese Academy of Sciences Library and Information System launched open knowledge resource service systems for open conference papers, open educational resources, open journal articles, open socio-economic resources, and open books, as well as the Chinese Academy of Sciences Institutional Repository and ChinaXiv preprint system.

(1) Construction and Integration of Open Knowledge Resources. Compared with various commercial resources, open resources still have certain gaps in quantity and importance. To increase the visibility of open resources, the Chinese Academy of Sciences Library and Information System launched the construction of an open knowledge resource center system in 2016, integrating scattered open books, journal articles, conference papers, educational resources, policies, regulations, and other types of open knowledge resources into the OAinONE platform [19] to achieve scale effects and influence for open resources.

The OAinONE platform's data comes from three sources: various open resources collected and processed by the four libraries and information centers of the Chinese Academy of Sciences; open resources in professional fields selected and processed by relevant institutes of the Chinese Academy of Sciences; and third-party open resources collected through open interfaces.

The OAinONE platform plays several roles: OA resource registration and integration: integrating heterogeneous OA resources through automatic collection and manual organization to form a domestic OA resource center. OA resource services: providing universal resource access services for different user groups, as well as topic analysis, mining, and statistical services for specific disciplines.
OA resource evaluation: establishing evaluation indicators for different types of OA resources, evaluating resources, recommending excellent resources, and increasing influence, such as OA journal evaluation and submission recommendation services.

The OAinONE platform's resource organizational structure is closely related to its service model. The platform first provides undifferentiated universal services based on various open resources, and on this basis, derives personalized service projects of different topics and types from numerous resources, such as "Science Policy Collection," "Science Lecture Hall," and "Multi-disciplinary Professional Field OA Resource Service Platform," as shown in Figure 1 [Figure 1: see original paper].

(2) Construction of the Chinese Academy of Sciences Institutional Repository (CAS IR Grid). The Chinese Academy of Sciences launched pilot construction of the Institute of Mechanics IMEC IR and the Library and Information Center LAS IR during 2007-2008, and based on these pilots, initiated the first phase of large-scale promotion in 2009 [20], launching the construction of the Chinese Academy of Sciences Institutional Repository (CAS IR Grid), integrating institutional repositories of 112 research units across the academy, making it one of the world's largest institutional repositories. As of May 2018, the total number of entries exceeded 800,000, with a full-text rate approaching 75% and cumulative downloads exceeding 18 million [21], becoming an important component of open knowledge resources in the Chinese Academy of Sciences Library and Information System and playing a significant role in effectively collecting and preserving the intellectual assets of the Chinese Academy of Sciences and promoting their global dissemination and exchange. Figure 2 [Figure 2: see original paper] shows a screenshot of the CAS IR Grid homepage.

(3) Construction of the ChinaXiv Preprint System. To meet the need to protect authors' priority rights and promote the preservation and service of China's excellent scientific research achievements to the Chinese scientific community [22], the Chinese Academy of Sciences Library and Information System completed the construction of the ChinaXiv preprint system in 2016, providing one-stop upload, search, and full-text download services. As of May 2018, the number of preprint papers published in the system had exceeded 10,000 [23], becoming an important platform for researchers to pre-publish research results and conduct peer exchanges.

Additionally, the Chinese Academy of Sciences Library and Information System has created IOP and BMC open publishing funding projects and participated in the SCOAP3 project on behalf of the National Science and Technology Library (NSTL), converting literature purchase funds into APCs to fund Chinese Academy of Sciences researchers to publish OA papers.

3. Development of Digital Resource Construction in Research Libraries

While achieving the second transformation of digital resource construction, research libraries actively promote the development of digital resource construction in both breadth and depth. Breadth mainly involves achieving full integration of open and commercial resources on the basis of large-scale procurement of

commercial resources and collection of open resources, facilitating comprehensive knowledge resource mastery for researchers in specific fields. Depth involves fully mining the knowledge connotation of digital resources, achieving extraction, annotation, association, organization, and presentation of knowledge units from different types of knowledge resources, facilitating in-depth understanding of knowledge content and interrelationships from various sources.

3.1 Integration of Open and Commercial Resources

Through the digital commercial resource integration, discovery, retrieval, and service system, the Chinese Academy of Sciences Library and Information System has achieved IP address-sensitive access permission identification, integrated retrieval, full-text delivery of journal/conference papers, and chapter-based electronic book full-text delivery across the academy. In recent years, various types and forms of OA resources have continued to grow. By the end of 2015, the proportion of research papers in the Web of Science Core Collection that were openly accessible had reached 26.54% [24]. To make fuller use of OA resources, reduce over-reliance on commercial databases, and slow down the annual price increase of commercial databases to a certain extent, it is necessary to achieve full integration and integration of open and commercial resources, guiding users to use various open resources as much as possible to fully realize the value of open resources.

The integration of open and commercial resources can be mainly achieved through commercial resource discovery systems and research libraries' self-developed resource integration or discovery systems. Currently, major commercial resource discovery systems in the market include EBSCO Discovery Service (EDS), Ex Libris Primo Central (Primo), Serials Solution Summon (Summon), and OCLC WorldCat Local (WCL). These systems can provide one-stop integrated retrieval and full-text linking services for various types of commercial digital resources, important open resources, and library self-built resources according to users' digital resource subscription situations, and can provide customized services such as subject topics according to user needs.

Commercial resource discovery systems have powerful functions but may not fully meet the needs of research libraries in terms of professionalism. For research libraries to develop their own digital resource integration/discovery systems, they first need to obtain large amounts of metadata, which is difficult for ordinary research libraries to accomplish. Therefore, the Chinese Academy of Sciences Library and Information System adopts the approach of customizing commercial resource discovery system APIs to obtain rich metadata, and then integrates these metadata with self-built characteristic digital resources and OA resources to compensate for the deficiencies of commercial resource discovery systems.

3.2 Extraction and Association of Knowledge Elements

Resource integration can to some extent bring together the same or similar knowledge resources from different sources and of multiple types, but it cannot accurately reveal the internal and interrelationships among various knowledge resources. To achieve such associations, the Chinese Academy of Sciences Library and Information System has explored the use of linked data technology to associate multi-form knowledge resources, initially achieving associations between literature and patents, and literature and scientific data. However, these associations remain at the journal (book) title and article title level, and the revelation and processing of finer-grained knowledge elements are not yet systematic or at scale.

To deeply reveal and organize knowledge elements in OA journal articles and patent documents, it is possible to develop knowledge element coding and extraction specifications based on the International Standard Link Identifier (ISLI) [25] and establish association field coding specifications and application specifications. The ISLI standard, the first international standard drafted and managed by China's press and publication industry, urgently needs to build and expand specific application services [26]. Currently, ISLI only defines coding specifications for entity associations at the publication level for service types, while the association coding for fine-grained knowledge elements (such as authors, institutions, terms, etc.) is still under research. The project will refer to the ISLI standard to participate in developing a set of fine-grained knowledge element coding systems and application specifications suitable for library knowledge service systems, including but not limited to knowledge element type definitions, association types, association rules, and coding specifications for association fields, as well as the applicable objects, resolution methods, and presentation forms of the coding system.

(1) Development and Application of Fine-Grained Knowledge Element Coding Systems Based on the ISLI Standard. The project will develop a fine-grained knowledge element coding system and application specifications suitable for library knowledge service systems, including knowledge element type definitions, association types, association rules, and coding specifications for association fields.

(2) Efficient Extraction, Rich Association, and Coding of Knowledge Elements from Massive Textual Information. Determine the types of knowledge elements to be extracted from OA journal articles and patent documents, establish knowledge element extraction, standardization, coding, and updating specifications, as well as quality control systems and verification mechanisms, and develop a fine-grained knowledge element annotation management system. Establish rich association relationships according to the types, levels, logical relationships, and practical application scenarios of knowledge elements, form knowledge units, and improve corresponding updating mechanisms.

(3) Dynamic Generation and Collaborative Editing of Knowledge

Graphs Based on Knowledge Units. A knowledge graph is a collection of various types of knowledge units and their relationships in a specific knowledge domain. Dynamic generation of knowledge graphs requires accurate description and standardized coding of various types of knowledge units, as well as the formulation of dynamic aggregation rules for knowledge units to achieve crowdsourced collaborative editing of knowledge units and knowledge graphs, as shown in Figure 3 [Figure 3: see original paper].

4. Problems and Countermeasures in the Transition and Development of Digital Resource Construction in Research Libraries

4.1 Problems and Challenges

The challenges facing library resource construction come from multiple aspects, including economic, environmental, technical, and knowledge-level issues, as well as ideological and conceptual issues; personnel team issues, as well as management, institutional, and policy issues; issues related to new organizational and publishing methods, as well as issues related to readers' reading preferences, resource acquisition channels, methods, and approaches [27]. These issues have important impacts on the second transformation of research library resource construction, affecting the development of research library resource construction and whether research libraries can effectively support educational and scientific research endeavors.

Due to various reasons, the second transformation of research library resource construction is much more difficult than the first transformation. The main reasons include:

(1) Transformation of Scientific Research Paradigms. The academic environment is shifting toward data-intensive fourth paradigm research, which places higher demands on libraries. The existing resource structure and service capabilities of research libraries cannot well adapt to the new developments in scientific research [28]. The contradiction between the current state of resource construction and changes in reader usage demands and the academic publishing environment causes research libraries to become alienated from users' actual needs, making it difficult to fulfill their roles and values.

(2) Limitations of Existing Resource Construction Models and Systems. The current resource construction models of research libraries are not adapted to open resource construction. As mentioned earlier, the procurement model only applies to traditional literature information resources and database resources, with single and limited construction channels and models. Open resources cannot be directly purchased and can only be collected and processed independently or through cooperation for sharing and integration, all of which require significant funding and personnel investment.

Influenced by traditional resource construction models, most of research li-

braries' funds are allocated to commercial digital resources, with relatively little investment in open resource construction. Moreover, existing research library literature funds cannot be directly invested in the collection and processing of open resources and can only be invested in the form of project funds, lacking long-term construction personnel and funding guarantees, resulting in low scale, effectiveness, and influence of open resource construction.

(3) Copyright Issues in Open Resource Construction. Research libraries face rather thorny copyright issues in open resource construction. Publishers and database providers' appropriation of academic copyrights has impacted the development of the open access cause and the free acquisition of OA resources, limiting the development of self-archiving, institutional repositories, and disciplinary repositories. Among non-OA open resources, many information resources have unclear copyrights, and collecting them may pose infringement risks.

(4) Limitations of Management Systems and Professional Personnel. Adjustments to research library organizational structures and departmental reorganization bring uncertainty to personnel allocation for digital resource construction. At the same time, research libraries need fresh forces and professional talent injection to integrate interdisciplinary business thinking during the resource construction transformation period, enrich traditional business processes, and lay the foundation for building new management systems.

(5) Limitations of Existing Services and Technologies. The resource services provided by research libraries are relatively single and cannot adapt to users' new needs in the information environment, nor can they meet the new needs of research library resource transformation. Moreover, technological innovation leads library development, and the degree to which research libraries utilize new technologies and integrate them with traditional services is closely related to transformation effectiveness.

4.2 Measures and Recommendations

(1) Develop and Improve Digital Resource Construction Plans and Programs. Research libraries should formulate digital resource construction plans, improve construction programs, and under the guidance of these programs, strive to achieve transformational development. They should adhere to the dual approach of procurement and collection, integrating and organizing literature resources and comprehensive science and technology resources, commercial resources and open resources, to fully meet both universal and personalized needs of research users.

(2) Increase Funding, Personnel, and Technology Investment, and Allocate Resources Rationally. Both commercial and open resources are important components of research libraries' digital resource systems. Research libraries should allocate their funds and human resources rationally to the construction of these two major resource components. As the proportion of com-

prehensive science and technology resources and open resources in research libraries' digital resource systems continues to increase, funding and personnel investment in open resource construction should also increase accordingly.

(3) Clarify Usage Rights of Open Resources and Actively Participate in and Promote Open Access. Open resources have diverse types, and corresponding copyright agreements are also complex and varied. To avoid violations and infringement in the reuse of open resources, libraries should master the copyright protection requirements of various open resources, clarify usage rights, and carry out utilization and dissemination of open resources within the scope of copyright protection. At the same time, in various self-built open resource systems, reasonable copyright protection measures should be adopted to maximize the dissemination of open resources while protecting authors' rights.

(4) Strengthen Inter-Library Cooperation and Sharing in Open Resource Construction to Improve Organizational Utilization Capacity. The number of open resources is growing rapidly, but research libraries' human resources and funding investment are very limited. Therefore, relying solely on some research libraries cannot complete open resource construction well, making it necessary to strengthen inter-library cooperation to achieve joint construction and sharing of open resources. The National Science and Technology Library launched the construction of an open resource service system in 2015, with member institutions participating in the construction of journals, conference proceedings, courseware, and other types of open resources, becoming a model for cooperative open resource construction.

(5) Strengthen Cross-Border Cooperation in Knowledge Resource Organization to Achieve Knowledge-Based Organization of Knowledge Resources. The ISLI standard has been promulgated for many years. In addition to the mature ISLI/MPR application solutions, other typical application solutions are currently lacking. However, under the strong promotion of national press and publication authorities, multiple application solutions and application systems are under research and development. The application of ISLI in the library community has been much quieter. Research libraries should seize this opportunity to carry out cross-border cooperation with publishing institutions and other types of knowledge service organizations, research and develop application solutions based on the ISLI standard suitable for research library open resource management and services, achieve knowledge-based organization of open resources, and accelerate the transition and development of digital resource construction in research libraries.

Library transformation is not only a necessary process for the library industry to achieve its overall progress but also an inevitable choice to respond to environmental changes, understand user needs, and improve its own structure [29]. In the new academic information environment, resource construction centered on open academic resources is not only an important supplement to traditional commercial academic resources but also the main trend and development focus for future research library resource transformation. The Chinese Academy of

Sciences Library and Information System has achieved certain practical results in both the development and construction of comprehensive science and technology resources and the integrated construction of open knowledge resources. In terms of fine-grained knowledge presentation, it will conduct in-depth research and construction on content mining of knowledge resources and association of knowledge elements. However, during the transition period of digital resource construction, the Chinese Academy of Sciences Library and Information System has also encountered many problems, such as some limitations of the library itself like existing resource organization and construction models, management systems, and resource services, as well as external issues like the transformation of scientific research paradigms and copyright of open resources that urgently need to be resolved. These are also common problems in the resource construction transformation of research libraries. Therefore, in the new period of resource construction transformation, research libraries, on the basis of effective guarantee and rational utilization of funds, personnel, and technology, first need to develop specific construction plans that focus on both universal and personalized needs of research users; second, clarify the usage rights of open resources and make full use of open resources within reasonable scope; and simultaneously strengthen inter-library cooperation and cross-border cooperation to achieve joint construction and sharing of open resources and knowledge-based organization of knowledge resources.

References:

[1] Zhang Xiaolin, Li Lin, Liu Xiwen, et al. Open access academic information resources: Approaching the “mainstreaming” turning point[J]. Library and Information Service, 2012, 56(9): 42-47.

[2] HEY T. The fourth paradigm: Data-intensive scientific discovery[M]. Washington: Springer, 2012.

[3] HORRIGAN J. Libraries at the crossroads: Pew Research Center[R/OL]. [2018-05-07]. http://assets.pewresearch.org/wp-content/uploads/sites/14/2015/09/2015-09-15_{{{libraries}}}_{{FINAL}}}.

[4] IFLA. IFLA trend report 2016 update[R/OL]. [2018-05-08]. https://trends.ifla.org/files/trends/assets/trend-report-2016-update.pdf.

[5] Chen Chuanfu, Chen Yi. Library transformation and its prospective risks[J]. Journal of Library Science in China, 2017, 43(4): 32-50.

[6] Zhang Xiaolin. Research libraries 2020: Embedded collaborative knowledge laboratories?[J]. Journal of Library Science in China, 2012, 38(1): 11-20.

[7] Wu Jianzhong. What will libraries look like in 2025?[J]. Reference for Party and Government Cadres, 2016(5): 54-55.

[8] Chu Jingli, Xu Ping, Zhong Yongheng, et al. Seeking library innovation and transformation in a changing environment: Investigation report on seven

major library and information institutions in the United States[J]. Library and Information Service, 2011, 55(1): 10-16.

[9] Zhu Qiang, Zhang Hongyang, Liu Suqing, et al. Experiencing transformation and exploring the future: Investigation report on three famous university libraries in the United States[J]. Journal of Academic Libraries, 2012, 30(2): 5-12.

[10] Zhu Qiang. Transformation of library resource construction: Taking Peking University Library as an example[J]. Shanghai University Library and Information Studies, 2017(3): 5-12.

[11] Yang Fan. Thoughts and practices on the transformation and development of party school libraries: Taking the Library of Anhui Provincial Party School as an example[J]. Inner Mongolia Science Technology and Economy, 2017(19): 106-108.

[12] Jin Wanyan. Research on the transformation and development of provincial party school libraries: Taking the Library of Qinghai Provincial Party School as an example[J]. Climbing (Philosophy and Social Sciences Edition), 2017(5): 156-160.

[13] Zhao Jing. Comparison and enlightenment of application technology university library construction: Taking three local university library transformations as examples[J]. Journal of Suihua University, 2017, 37(8): 128-131.

[14] Wei Xiangyan, Li Jipeng, Lü Peng. Discussion on literature resource construction models under the background of library transformation: Taking Qingdao Binhai University Library as an example[J]. Journal of Zunyi Normal College, 2018(1): 168-170.

[15] Liang Rongxian, Tang Zhi. Research on the application of crowdfunding concepts in university library transformation[J]. Library Work and Study, 2018(5): 15-20.

[16] Xu Chenchen, Sun Danxia, Zhong Si. Research on crowdfunding mechanisms for OA academic journal resources in university libraries[J]. Journal of Library Science, 2016(10): 20-23.

[17] Integrated Registration System for Science and Technology Resources[EB/OL]. [2018-05-10]. http://irsr.llas.ac.cn/.

[18] Wang Sili, Ma Jianxia, Zhu Zhongming, et al. Research on association strategies for comprehensive science and technology resources under the semantic Web model[J]. New Technology of Library and Information Service, 2011, 27(6): 32-37.

[19] Open Access Resource Integration Service Platform[EB/OL]. [2018-05-10]. http://oa.las.ac.cn/.

[20] Zhang Dongrong, Zhu Zhongming, Li Lin, et al. Construction, promotion, and service of Chinese Academy of Sciences institutional repositories[J]. Library

and Information Service, 2013, 57(1): 20-25.

[21] Chinese Academy of Sciences Institutional Repository Grid[EB/OL]. [2018-05-10]. http://www.irgrid.ac.cn/.

[22] Wang Ying, Zhang Zhixiong, Qian Li, et al. Construction of ChinaXiv preprint service platform[J]. Digital Library Forum, 2017(10): 20-25.

[23] Chinese Academy of Sciences Scientific Paper Preprint Platform[EB/OL]. [2018-05-11]. http://chinaxiv.org/.

[24] Zhu Jiang, Ren Xiaoya. Analysis and research on OA papers in high-quality academic journals: Taking Web of Science Core Collection as an example[J/OL]. Knowledge Management Forum, 2018, 3(2): 95-105.

[25] ISO 17316:2015[EB/OL]. [2018-05-20]. https://www.iso.org/standard/59560.html.

[26] Zhao Haitao, Zhou Changling, Li Wenyan. Research on ISLI application in knowledge services[J]. Publishing Reference, 2017(4): 14-17.

[27] Chen Yijun. Internet thinking and the transformation of library literature resource construction[J]. Library Research and Work, 2017(1): 46-51.

[28] Liu Ming, Li Na. Big data trends and special libraries[J]. Chinese Journal of Medical Library and Information Science, 2013, 22(2): 1-6.

[29] Liu Aihua. Practical logic of research library transformation and development[J]. Journal of the National Library of China, 2016, 25(4): 11-21.

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Zhu Jiang: Overall research design, writing and revision of the main body of the paper (Sections 1, 2, 3, 4).
Ren Xiaoya: Literature research and analysis, writing and revision of partial sections (Sections 2, 4, 5).
Jiang Enbo: Paper supplementation and revision.
Huang Jinxia: Paper supplementation and revision.
Chen Yunwei: Paper revision.

Transition and Development of Digital Resources Construction in Research Libraries ———Taking the Libraries of Chinese Academy of Sciences as an Example

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Abstract: [Purpose/significance] This paper aims to summarize the transition and development of digital resources construction in research libraries, especially the second transition triggered by open resources, and to explore the future development direction of digital resources construction in research libraries. [Method/process] Taking the Libraries of Chinese Academy of Sciences as an example, this paper examines the practice and effectiveness of digital resources construction, and anticipates the future development based on the construction of comprehensive science and technology resources and open resources as the transformation foundation, with fine-grained knowledge association and presentation as the development goal. [Result/conclusion] Research libraries are faced with many problems in the transition of digital resources construction. This paper proposes the following suggestions: Develop clear digital resources construction schemes; Allocate funds, manpower and technology rationally; Clarify the usage rights of open resources and actively promote open access; Strengthen inter-library cooperation and sharing in open resources construction; Enhance cross-border cooperation in knowledge resources organization.

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