

Knowledge Organization System for Group Knowledge Environment Based on Research Process: Postprint

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Abstract

[Purpose/Significance] Targeting research groups and centered on the scientific research process, the construction of a group knowledge environment that integrates information resources, information services, and information exchange—achieving comprehensive integration of library information resources, user personalized knowledge resources, virtual research environments, and information services—represents an effective pathway for libraries to strengthen communication and feedback with frontline researchers, embed information services into users' research processes, achieve service innovation, and support scientific and technological innovation. [Method/Process] Based on an analysis of knowledge and information requirements throughout the research process in conjunction with research workflows, this study investigates and analyzes the knowledge organization characteristics of advanced group knowledge environments both domestically and internationally. [Results/Conclusion] Drawing upon experience from the construction of the Group Knowledge Environment Platform at the Chinese Academy of Sciences, this paper proposes reference recommendations for knowledge organization methods in group knowledge environments.

Full Text

Preamble

Academic Exploration: Knowledge Organization System of Knowledge Environments for Research Groups Based on the Research Process

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Abstract

[Purpose/Significance] For research groups, constructing an integrated knowledge environment that combines information resources, information services,

and information exchange around the scientific research process represents an effective approach for libraries to strengthen communication and feedback with frontline researchers, embed information services into users' research workflows, achieve service innovation, and support scientific and technological innovation. [Method/Process] This paper analyzes the knowledge and information required throughout the research process and investigates the knowledge organization characteristics of advanced group knowledge environments both domestically and internationally. [Result/Conclusion] Drawing from the experience of constructing the Chinese Academy of Sciences (CAS) Group Knowledge Environment Platform, this paper offers recommendations for knowledge organization methods in group knowledge environments.

Keywords: research process; research groups; knowledge environment; knowledge organization

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1 Research Background and Significance

In the knowledge economy era, knowledge innovation and application have become the most critical components of scientific and technological innovation. All knowledge innovation relies on the support of information resources. Against the backdrop of e-research and open access, scientific research exhibits characteristics such as resource digitization, knowledge sharing, networked communication, and collaborative workflows. Microsoft, in *The Fourth Paradigm: Data-Intensive Scientific Discovery*, noted that human research activities are transitioning from traditional research paradigms to a fourth paradigm based on data-driven scientific discovery [1]. Simultaneously, as scientific research becomes increasingly sophisticated, collaboration across multiple disciplines and institutions is often required, making cross-regional, cross-disciplinary, and cross-institutional research collaboration an inevitable trend. These developments have transformed researchers' information needs.

Researchers' dependence on traditional information environments is gradually decreasing, while obtaining information through open networks has become a common research practice. The growing importance of scientific data in research has also generated strong demand among researchers for preserving and sharing both research outcome data and process data. Additionally, researchers hope to conveniently access the latest developments in their fields, disseminate their own findings as quickly as possible, and urgently require convenient methods for knowledge sharing and academic exchange.

Therefore, building an integrated scientific research knowledge environment for research groups—including individual scientists, innovation teams, key laborato-

ries, and research groups—that provides knowledge resources, knowledge management, knowledge sharing, knowledge exchange, and knowledge collaboration services around the research process, and that achieves comprehensive integration of virtual research environments, scientific and technological information resources, users’ personalized knowledge resources, and knowledge services, represents an effective pathway for libraries to embed themselves in users’ research processes and provide knowledge-based services.

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2 Knowledge Environment Requirements Analysis Based on Research Process

The UK Joint Information Systems Committee (JISC) proposes a research lifecycle consisting of “scientific question formulation—research team organization—research topic determination—scientific exploration implementation—final scientific and technological achievements output” [2]. Based on this research lifecycle, this section analyzes researchers’ various information needs throughout the research process and the objects involved in each requirement.

- (1) **Understanding Disciplinary Overview:** Researchers need to understand the basic situation of their field, including prominent experts, major research institutions, authoritative professional journals and websites, and commonly used tools.
Involved Objects: People, institutions, professional journals, professional websites, professional tools.
- (2) **Grasping Disciplinary Development Trends:** Researchers hope to track the frontiers and latest developments in their field to understand disciplinary trends, adjust their research objectives, and guide their research practice.
Involved Objects: Frontier and progress information.
- (3) **Seeking Project Opportunities:** Researchers hope to obtain the latest information on project applications, guidelines, and funding, while also understanding peers’ projects in the field to seek collaboration opportunities.
Involved Objects: Projects, people, application guidelines.
- (4) **Locating Research Resources:** According to project research needs, researchers must constantly query required literature, experimental data,

images, and various other research resources.

Involved Objects: Literature, experimental data, images.

- (5) **Research Collaboration:** Researchers hope to conduct literature sharing, thematic discussions, and other collaborative activities within their groups, while also facilitating convenient feedback and discussions with external researchers.

Involved Objects: People, sharing and discussions.

- (6) **Knowledge Management:** Researchers hope to effectively organize and manage their information materials.

Involved Objects: Information materials.

- (7) **Experimental Practice:** Most scientific research must rely on relevant instruments, equipment, and computer software/hardware to be completed.

Involved Objects: Instruments, equipment, computer software/hardware.

- (8) **Outcome Dissemination:** Researchers disseminate their scientific research outcomes through academic paper publication, patent applications, awards, and products to promote orderly research progress and transformation of scientific and technological achievements.

Involved Objects: Academic papers, patents, awards, products.

Based on the above analysis, to embed the group knowledge environment throughout the entire research process and truly meet researchers' information needs, various types of knowledge and information must be effectively organized and presented.

3 Case Analysis of Important Group Knowledge Environment Systems

The knowledge organization system of a group knowledge environment constitutes the methods and means for achieving knowledge organization and represents the key factor affecting the implementation and effectiveness of knowledge services in group knowledge environments. The construction system for group knowledge environments primarily includes layers such as knowledge sources, knowledge organization, and knowledge services, as shown in Figure 1 [Figure 1: see original paper].

Many countries and institutions have conducted system construction and project research for group knowledge environments based on this architecture, accumulating rich experience. Below, this paper analyzes the knowledge organization systems of several important international group knowledge environment platforms.

3.1 VIVO

VIVO is a Facebook-style professional social networking system built by Cornell University and six other institutions using \$12.2 million in federal funding from the U.S. National Institutes of Health to connect biomedical researchers across the United States. Traditional research journals cannot reveal what scientists are working on or their research interests. Through this network, researchers can see what others in the network are studying. It aggregates academic trends, research experts, academic activities, research tools, instruments, equipment, academic institutions, and other information. In VIVO's system research ontology framework, important classes include research agents, equipment, events, information resources, and research projects, along with auxiliary classes such as academic degrees, addresses, and positions. The VIVO ontology can systematically organize knowledge resources with research agents as the main thread [3].

3.2 Mendeley

Mendeley is a free research management tool and academic social network with desktop and web versions. On the platform, users can connect with peers in their discipline and discuss research trends. The desktop version helps users organize research papers and citations, automatically inserting references from documents and bibliographies, and can automatically extract bibliographic data, keywords, and citations from RDF files to create a searchable full-text database. It supports import/export of BibTeX, RIS, and EndNote XML formats and can interface with other reference management tools like Zotero and CiteULike. The web version allows users to access their research paper database from anywhere, share documents in closed groups, collaborate on research projects online, and connects users like a distributed academic institution for easy statistics on the latest research trends [4].

In addition to organizing resources around basic research agents, Mendeley's most distinctive feature is its convenient personal literature management functionality, which facilitates knowledge management in the research process.

3.3 Academia

Academia is a group knowledge environment platform with over 1.6 million users, providing a platform for researchers with similar interests to connect, organized by institution, department, and research field. Researchers can create a webpage for their work, share documents, find colleagues and acquaintances through Facebook, LinkedIn, and Gmail, and dynamically track others' work through Twitter-style updates. Users can also access full texts, professional mailing lists, job postings, and customize news alerts related to their fields and journals (over 10,000) [5].

Academia's features include: (1) users fill in relevant research topics during registration; (2) provides NewsFeed service based on user research interest tags;

(3) offers intelligent processing of research institution names, displaying relevant institutional information for user selection during registration to ensure standardization and consistency.

4 CAS Group Knowledge Environment Construction

4.1 Overview of CAS Group Knowledge Environment Construction

Based on the actual research needs of various research groups at the Chinese Academy of Sciences, CAS has built a series of group knowledge environment platforms for research groups or laboratories (see Figure 2 [Figure 2: see original paper]), supporting disciplinary groups in integrating resources, services, knowledge organization, and exchange according to their research needs. In practice, the most critical aspect is the organization and management of existing group resources and related knowledge. Different research groups have different disciplinary fields and organizational structures, so knowledge organization methods share commonalities while also having unique characteristics tailored to specific needs.

4.2 Knowledge Organization System of CAS Group Knowledge Environment

Based on the analysis of researchers' needs at each stage of research activities and combined with experience from CAS group knowledge environment platform construction, the core concepts/elements of the CAS group knowledge environment primarily consist of research agents, research conditions, research activities, research outputs, and other concepts.

- (1) **Research Agents:** The primary service objects of group knowledge environments, including researchers, research teams, and institutions.
- (2) **Research Conditions:** The basic conditions required for researchers to conduct scientific research, including professional journals, scientific literature databases, scientific databases (datasets), instruments and equipment, project funding, professional websites, and commonly used tools.
- (3) **Research Activities:** The main manifestations of research conducted by research agents, and the relevant activities undertaken by research users to meet their research needs (research practice, knowledge management, research collaboration, locating research resources, seeking project opportunities, understanding disciplinary overviews, grasping disciplinary development trends, outcome dissemination), including research projects, academic conferences, scientific experiments, surveys, training, and lectures.

- (4) **Research Outputs:** The main outcomes of scientific research, covering both formal publications and grey literature, including journal articles, dissertations, conference papers, books, research reports, scientific data, and scientific and technological achievements.
- (5) **Other Concepts:** Primarily refer to unified concepts or classifications such as disciplinary fields and geographical locations.

The above are the core classes of the group knowledge environment research ontology, which can be further divided into subclasses. Through class definitions and the determination of object properties, relationships between classes are established. Figure 3 [Figure 3: see original paper] presents the defined classes and properties, where ellipses represent classes and lines represent properties.

By establishing a knowledge organization system, each group knowledge environment builds a basic resource system and information system, while also establishing basic platform modules, thereby effectively achieving knowledge organization for the group knowledge environment platform.

4.3.1 Managing Research Outputs Using Institutional Repositories

The CAS group knowledge environment utilizes institutional repositories to organize and manage research outputs, facilitating timely updates of output data and the establishment of output hierarchical relationships. As shown in Figure 4 [Figure 4: see original paper], the CAS institutional repository module is embedded within the group platform, directly using the institutional repository for knowledge organization to better connect research agents with research outputs. Its main functions include: revealing relationships between research agents and outputs, classifying research outputs, conducting statistical analysis of research agents and outputs, and enabling retrieval and updating of results, making research agents and outputs a distinctive component of the group knowledge environment platform's information content organization.

4.3.2 Embedding Resource and Service Systems to Organize More Resources

The CAS group knowledge environment can embed library service systems, RSS news aggregation components, and other tools into the knowledge environment system to achieve deeper resource organization. During the organization of information resources on the group knowledge environment platform, research activity information requires continuous processing. The embedding of library service systems and RSS news aggregation components can solve the problem of high labor costs and enable more convenient and efficient knowledge organization and updating.

5 Recommendations for Knowledge Organization in Group Knowledge Environment Construction

Based on experience from CAS group knowledge environment platform construction, this paper proposes the following recommendations for knowledge organization methods in group knowledge environments:

5.1 Strengthen Research Process Knowledge Management Functions

Knowledge management plays an important role in the research process and serves a critical function in group knowledge environments. Currently, most group knowledge environments can effectively organize and manage final knowledge outputs from institutions and individuals, yet lack effective organization of knowledge generated during the research process. Mendeley effectively combines research communication with research literature management, organizing process documents effectively. Organizing and sharing process literature and process knowledge in this manner represents an important direction for the development of group knowledge environments.

5.2 Enhance Organization of Open Resources, Open Data, and Open Tools

Against the backdrop of open innovation in knowledge society, open resources, open data, and open tools have developed rapidly, with increasing knowledge available for open sharing online. Researchers can not only select needed research information from a wider range but also participate in the dissemination and optimization of research information. This knowledge constitutes an important component of group knowledge environments, and strengthening the organization and processing of such open information is a crucial method for enriching group knowledge environments.

5.3 Strengthen Organization of Value-Added Information

Group knowledge environments can use visualization tools to graphically reveal interactions between people and between information, integrate research evaluation and recommendation functions to assess and intelligently recommend research literature, and conduct dynamic assessments of research trends in specific fields based on a series of research activities.

5.4 Develop Social and Mobile Functions

The web version of Mendeley provides document organization and management, research collaboration functions, and supports location-based search and discovery of relevant researchers and research groups. Meanwhile, users can access their literature databases anytime and anywhere through mobile devices such as iPhones and iPads to support mobility and synchronized utilization. Mendeley's evolution reflects social and mobile characteristics, representing the future

development direction of group knowledge environments.

References

- [1] TONY H, STEWART T, KRISTIN T. The Fourth Paradigm: Data-Intensive Scientific Discovery [M]. Translated by PAN Jiaofeng, ZHANG Xiaolin, et al. Beijing: Science Press, 2012.
- [2] How JISC is helping researchers [EB/OL]. [2015-04-21]. <http://www.jisc.ac.uk/whatwedo/campaigns/res3/j>
- [3] MEDHA D, JON CR, BRIAN C, et al. VIVO: connecting people, creating a virtual life sciences community [J]. D-lib magazine, 2007, 13(7/8) [2015-04-21]. <http://www.dlib.org/dlib/july07/devare/07devare.html>.
- [4] Your research, anywhere [EB/OL]. [2015-04-21]. <http://www.mendeley.com/>.
- [5] Academia.edu - Share research [EB/OL]. [2015-04-21]. <http://www.academia.edu>.

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