Open Access Scholarly Information Infrastructure as Socio-Technical Interaction Networks[1]

Jennifer E. Beamer[ab]

[a] California State University, San Berardino – jennifer.beamer@csusb.edu
[b] Claremont Colleges Library, Claremont, California[2]

Preprint paper (this paper has not been published elsewhere)

Abstract

The paper explores the role of the National Institute for Informatics, Tokyo, Japan, in advancing open-access cloud-based repository infrastructures. This study, funded by a JSPS Short-Term Extramural Fellowship in 2022, uses the Socio-Technical Interaction Networks-STIN framework to understand open access information infrastructures through technical systems and social practices. It found that NII has concentrated its efforts on developing an integrated suite of services across the academic life cycle, including the JAIRO Cloud repository, research data management platforms, and the CiNii Research Platform. A point that came out very strongly in the study is that social infrastructure- for example, a Japan Consortium for Open Access Repositories, JPCOAR- creates a framework for training, workshops, and collaboration spaces for the academic community. This study described how NII grew from early repository development with funding support to developing comprehensive, interoperable systems serving more than 829 universities and research institutions. The study chronicled how NII combined technical innovation and community building to build Japan's largest scholarly information infrastructure through interviews with staff, attending seminars, and site visits to major universities.

Keywords: Open access · Open science · Institutional repository · Socio-Technical Infrastructure

I.   Introduction

The Japanese Inter-University Research Institute, known as the National Institute for Informatics (NII), located in Tokyo, Japan, is a national and global leader in developing Open Access cloud-based repository infrastructure. The NII's pivotal role in expanding and enhancing state-of-the-art cyberinfrastructure for disseminating scholarly information is evident in its hosting of the scholarly outputs for more than 829 universities and research institutions, the highest number in any country worldwide, according to Open DOAR (2021).

II.   Background

Under a JSPS Short Term Extramural Fellowship in 2022, this research aimed to understand the social and technical infrastructure and systems the NII has built and designed to share open-access scholarship in Japan and to a larger global audience. I wanted to understand how the NII supports open-access information infrastructures and consists of an assemblage of technical infrastructure, social norms, and organizational practices, as there are both social and technological interactions between the people who build and use the systems, those who develop the systems, and a configuration of components that constituted the whole of the information system.

III.   Methodology:

This JSPS Short-Term Extramural Fellowship research aimed to understand the social and technical systems the NII has built and designed to share open-access scholarship in Japan. The objective was to understand how the NII supports open-access information infrastructures and consists of an assemblage of technical infrastructure, social norms, and organizational practices, as there are both social and technological interactions between the people who build and use the systems, those who develop the systems, and a configuration of components that constitute the whole of the information system. In previous research, I have successfully used a holistic approach based in the field of social informatics known as the Socio-Technical Interaction Networks strategy (STIN) to examine the relationships between the people and the system of Open Access Infrastructure.

The STIN approach is "a conceptual framework for identifying, organizing, and comparatively analyzing patterns of social interaction, system development, and the configuration of components that constitute an information system" (Scacchi, 2005, p. 2). The STIN model helped me map some critical relationships between people and people, between people and technologies, between technologies and their infrastructures, and between technologies that constitute the NII technologies in use. For example, other research (Kling et al., 2003; Kling, Sawyer, & Rosenbaum, 2000) has shown that a STIN can also include the relationships among "people (including organizations), equipment, data, diverse resources (money, skill, status), documents and messages, legal arrangements and enforcement mechanisms, and resource flows" (Kling et al., 2003; p. 48).

This framework supports the researcher in identifying these elements and exploring the relationships between them through eight steps, or heuristics (p. 57). The eight heuristics are (Kling et al., 2003; p. 57)
H1. Identify a relevant population of system interactors
H2. Identify core groups
H3. Identify incentives
H4. Identify excluded actors and undesired interactions
H5. Identify existing communication forums
H6. Identify resource flows
H7. Identify system architectural choice points
H8. Map architectural choice points to socio-technical characteristics.

Thus, the methodology used for this work was that of the Socio-Technical Interaction Networks Strategy (STIN). The STIN strategy is "a conceptual framework for identifying, organizing, and comparatively analyzing patterns of social interaction, system development, and the configuration of components that constitute an information system" (Scacchi, 2005, p. 2). Using STIN to map some of the critical relationships between people and people, between people and technologies, between technologies and their infrastructures, and between technologies that constitute the NII technologies in use (Kling et al., 2003; Kling, Sawyer, & Rosenbaum, 2000). Using the STIN framework above, I interacted with the people and the systems, collected documentation, and interviewed and spoke with those who worked at the NII.

IV.   Preliminary Findings:

The NII Cyber Science Infrastructure Development Department has built services for scholars throughout the academic lifecycle. This is reflected in the "NII Research Data Cloud," as shown in Figure 1 below. The lifecycle has many interoperable systems that connect to other large systems, including RCOS (for Open Sciences), RDM (research data management Platform, the CiNii Research Platform, and the JAIRO Cloud Repository by WEKO3 (for scholarly outputs). All these Platforms have multiple social features for access to research articles and adhere to global standards, for example, metadata and archival hosting of data and data management, assigning of Digital Object Identifiers, Researcher IDs, and integrations for funding agencies. Moreover, the NII also provides social environments for the technical systems for scholars to learn about Open Access practices and share scholarly work. This includes building a community of practice for the universities named JPCOAR (the Japan Consortium for Open Access Repositories) and providing training courses, workshops, and collaboration spaces. In the following sections are some highlights from the various interactors.
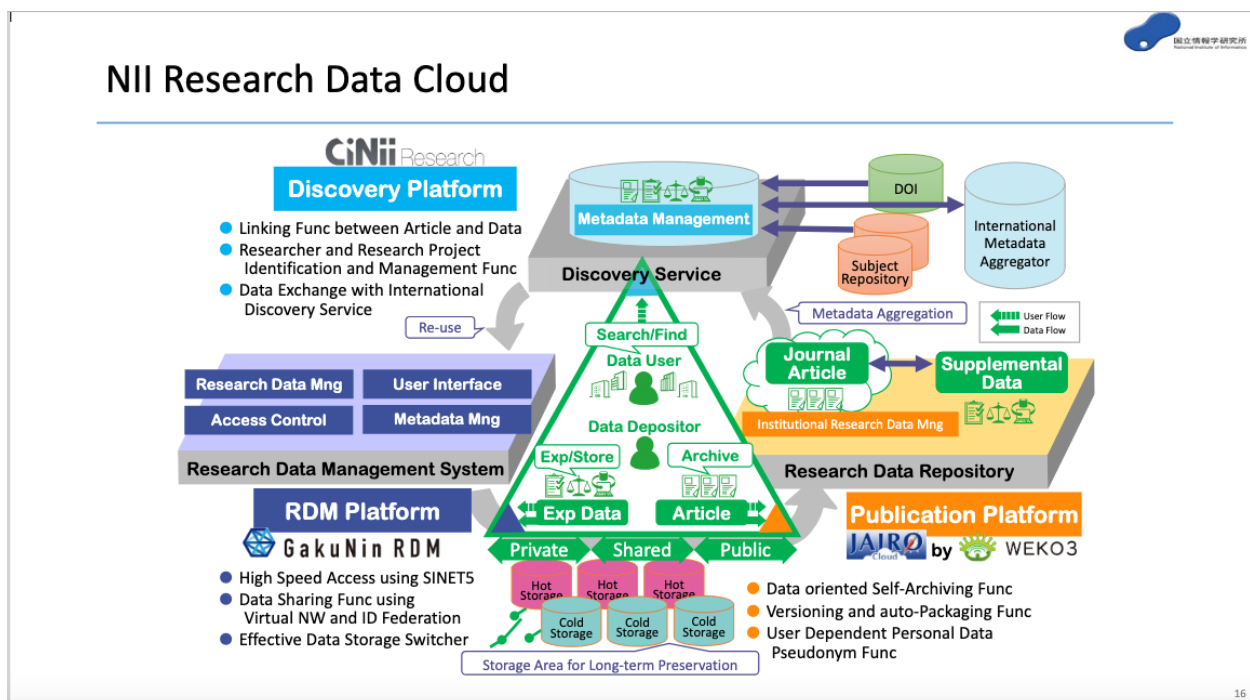

Figure 1: Services for Scholars: NII Research Data Cloud and interoperable services. (Presumably from NII Website https://rcos.nii.ac.jp/en/service/rdm/. Source and permission to use obtained from: Miho Funamori, presentation at FSCI 2022, entitled Open Research Infrastructures for Scholarly Communication in Japan: E03 – Open Access, Bibliodiversity and Research Assessment Reform Across Borders. (p. 16) available here: https://researchmap.jp/funamori/presentations/39380775).

A. Japan's Early Repositories

In the early days of Japanese institutional repositories, the NII focused on supporting the development of universities' institutional repositories by providing funding through the "NII Cyber Science Infrastructure Projects (NII最先端学術情報基盤（CSI）委託事業). This support led to the creation of metadata schemas and an environment featuring a search system called Institutional Repositories Database Contents Analysis: IRDB.

Then, in 2004, the NII launched a Joint Project for the Verification of Software Installation for Building Institutional Repositories (機関リポジトリ構築ソフトウェア導入実証実験共同プロジェクト). Initially, six

participating universities provided support for constructing repositories at their universities. The initiative then started along with the subsequent "NII Institutional Repositories Program: 学術機関リポジトリ構築連携支援事業".

B. Developing a Search System for Japan's Institutional Repositories

The NII collaborated with the Japan Consortium for Open Access Repositories (JPCOAR), fostering a cooperative scholarly environment for developing search systems. This collaboration aimed to promote institutional repository activities in partnership with university libraries and to develop metadata schemas for repositories in Japan. This ultimately led to the creation of JAIRO Cloud[3], a cloud-based nationwide repository.

Based on the metadata schema Junii2, several search systems were released: 1) JAIRO: Japanese Institutional Repositories Online (学術機関リポジトリポータル), and 2) NII Institutional Repositories Database Contents Analysis: IRDB (コンテンツ分析システム). These systems were initially launched on a trial basis in 2008 and then officially debuted in April 2009 as services to collect and search metadata of institutional repositories in Japan. JAIRO operated until the end of March 2019.

In April 2019, the JAIRO cloud and the NII Institutional Repositories Database Contents Analysis: IRDB (コンテンツ分析システム) were integrated to form IRDB, to a database for institutional repositories that supported a new metadata schema, the JPCOAR schema.

C. Implementing JAIRO Cloud: A Shared Repository Service:

In April 2012, the National Institute of Informatics (NII) developed WEKO, a general-purpose software for institutional repositories, and distributed it to universities and other institutions as open source. The official operation of JAIRO Cloud, a Shared Repository Service (共用リポジトリサービス), utilized WEKO as a cloud-based system (commonly referred to as SaaS) to promote the development of institutional repositories in Japan and to support institutions that struggle to build and operate their repositories independently.

In August 2013, the Institutional Repositories Promotion Committee (IRPC) was established under the Council for the Promotion of Cooperation Between University Libraries and the National Institute of Informatics. Subsequently, in July 2016, the Japan Consortium for Open Access Repositories (JPCOAR) was formed as a coalition of the IRPC and the Digital Repository Federation (DRF), and the JAIRO Cloud was launched in participating libraries by the NII.[4] With the establishment of JPCOAR, the management of JAIRO Cloud was transferred to a joint operation between the NII and JPCOAR.

At that time, the primary goal of JAIRO Cloud was to support the development of institutional repositories that share the educational and research accomplishments of universities and other institutions, thereby fostering collaboration among them and enhancing open access to these resources. (Yamaji et al., 2015). During FY2005, the NII assisted 19 universities with grants to establish repositories at these institutions. This project continued until March 2013, during which we created the "Digital Repository Federation: DRF (デジタルリポジトリ連合)" and gained experience in building and managing repository systems.

The Japan Consortium for Open Access Repositories (JPCOAR) was established in July 2016 by the Institutional Repository Promotion Committee (2013). JPCOAR focused on hosting initiatives that promote open access, identifying issues related to open access, and continuing the advocacy efforts of the Institutional Repository Promotion Committee, which included "enhancing the involvement of librarians and researchers to encourage the distribution of scholarly information and academic resources." The JPCOAR board describes itself as a nationwide community in Japan whose mission is to:

---

[3] As understood from Japanese: Overview of the Open Access Repository Promotion Association. Retrieved March 2019 from https://jpcoar.repo.nii.ac.jp/

[4] Akira Niitsuma, personal communication, May 23, 2019

1. Accelerate Open Science and Scholarly Communication
2. Co-operate with JAIRO Cloud (nationwide institutional repository platform)
3. Increase and Enrich IR content (e.g., journal articles, research data…)
4. Plan and Conduct Training Courses, and
5. Collaborate with International Efforts with 586 member institutions (as of March 2019). [5]

During fieldwork and data collection for this research, it was discovered that JPCOAR consists of multiple working groups and task forces. These groups and task forces change over time as the importance of activities shifts and as various groups complete their assigned tasks. A running list of past and present working groups and task forces can be found on the JPCOAR website under 作業部会・タスクフォースの活動 [6] (Note: The JPCOAR website is only available in Japanese.)

The Japan Consortium for Open Access Repositories is a Japan-wide community that aims to achieve open access and open science by disseminating knowledge via digital repositories. JPCOAR was formed in July 2016 and has 678 members, including universities, research institutions, and libraries throughout Japan.[7] One of its key contributions is elaborating the JPCOAR metadata schema, which should be applied to Japanese institutional repositories to improve the discoverability of research data. Finally, JPCOAR collaborates with international organizations, such as the Confederation of Open Access Repositories (COAR), to align its efforts with global open-access initiatives.

V.   Conclusion

Throughout my short stay at the NII, I was introduced to the many relationships among "people, equipment, data, diverse resources (money, skill, status), documents and messages, legal arrangements and enforcement mechanisms, and resource flows" (Kling et al., 2003; p. 48). Professor Funamori introduced me to and provided opportunities for me to speak with the main groups and teams who work on cyberinfrastructure, including RCOS, JPCOAR, and JAIRO cloud, most of whom work within the NII.

Additionally, I attended many NII-related seminars, including NISTEP Transformative Agreements and JUSTICE on Japanese Transformative Agreements. I also spoke with NII librarians and staff, who gave me insights into repositories, education, and processes around Open Access support. I had a full one-day meeting with several staff members at NII to discuss open educational resources. I also met with faculty and staff at two top-tier Japanese Universities, Kyoto University and Hokkaido University.

Finally, I learned a great deal about JPCOAR, JAIRO Cloud, repository features, and assessment from D. Dr. Kawai and Dr. Hayashi, both of whom I will continue to collaborate with as I leave Japan and work to continue to understand Open access in Japan into the future. The relationships I have built these past two months will last as we all work to understand and learn from each other in future collaborative endeavors. The impact of this research and publication will be felt in the next few years. In summary, I learned a great deal and have come to understand the work of many different people and teams as they work to build and educate on open access and institutional research infrastructure.

---

[5] As understood from Japanese: Overview of the Open Access Repository Promotion Association. Retrieved March 2022 from https://jpcoar.repo.nii.ac.jp/

[6] Publication SPARC Japan Annual Reports 2013 – 2018. Retrieved December 2022 https://www.nii.ac.jp/sparc/en/publications/#2

[7] As understood from Japanese: Overview of the Open Access Repository Promotion Association. Retrieved March 2022 from https://jpcoar.repo.nii.ac.jp/

References

Funamori, M. Presentation at FSCI 2022, titled "Open Research Infrastructures for Scholarly Communication in Japan: E03 – Open Access, Bibliodiversity, and Research Assessment Reform Across Borders" (p. 16), is available here: https://researchmap.jp/funamori/presentations/39380775.

Overview of the Open Access Repository Promotion Association (JPCOAR). Retrieved March 2019 from https://jpcoar.repo.nii.ac.jp/

Kling, R., McKim, G., & King, A. (2003). A Bit More to IT: Scholarly Communication Forums as Socio-Technical Interaction Networks. Journal of the American Society for Information Science and Technology, 54(1), 46–67.

Kling, R., Rosenbaum, H., & Sawyer, S. (2005). Understanding and communicating social informatics: A framework for studying and teaching the human contexts of information and communication technologies: Information Today, Inc.

Open DOAR Directory of Open Access Repositories. Retrieved 09/20/2021 http://v2.sherpa.ac.uk/view/repository_visualisations/1.html

Scacchi, W. (2005). Socio-Technical Interaction Networks in Free/Open-Source Software Development Processes.

SPARC Japan Annual Reports 2013 – 2018. Retrieved December 2022 https://www.nii.ac.jp/sparc/en/publications/#2

Yamaji, K., Aoyama, T., Furukawa, M., and Yamada, T. (2015, August). Development and Deployment of the Open Access Repository and Its Application to the Open Educational Recourses. In International Conference on Genetic and Evolutionary Computing (pp. 395-403). Springer, Cham.