

The Future of Institutional Repositories: Seeking Major Advances in Quantity and Quality

NII Institutional Repositories Program

Phase 3 Report

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National Institute of Informatics

Contents

| | |
|--|----|
| Executive Summary..... | 5 |
| I. Overview of the NII Institutional Repositories Program Phase 3 | 6 |
| 1. History of the Program..... | 6 |
| 2. Overview of Phase 3 Activities and Accomplishments | 6 |
| 2.1 Quantitative growth in institutional repositories..... | 6 |
| 2.2 Innovative projects..... | 6 |
| 2.3 Growth of communities | 7 |
| 3. Academic Policy and Institutional Repositories..... | 7 |
| 3.1 The 4th Science and Technology Basic Plan | 7 |
| 3.2 Council for Science and Technology | 8 |
| 3.3 Revision of Degree Regulations | 8 |
| 4. Issues..... | 8 |
| 4.1 Strategic project implementation | 8 |
| 4.2 Further spread and sustainability of IRs..... | 8 |
| 4.3 Collecting diverse content..... | 9 |
| 4.4 Sharing and dissemination of results..... | 9 |
| 5. Looking Ahead..... | 9 |
| II. Area 1: Content Creation for New IRs..... | 10 |
| 1. Overview | 10 |
| 1.1 Commissioned institutions: The number of IRs and institutions operating IRs doubled in Japan, with the projects supplying the stimulation | 10 |
| 1.2 System types: Drop in DSpace share, big rise in WEKO | 12 |
| 1.3 Lead time: Continues to decrease | 12 |
| 2. Program Accomplishments and Remaining Issues | 13 |
| 2.1 System operation..... | 13 |
| 2.1.1 Establishment of standard practices: Entering a stable phase | 13 |
| 2.1.2 Organization: Staff size decreasing..... | 13 |
| 2.1.3 Costs: Stable low costs?..... | 14 |
| 2.2 Content..... | 14 |
| 2.2.1 Content creation status: Steady increase but at a slower rate..... | 14 |

| | |
|---|----|
| 2.2.2 Targeted content: Continued increase in bulletin papers, moderate increase in share of academic journal papers..... | 15 |
| 3. Prospects for the Future | 16 |
| 3.1 Progress of shared repositories: Steady advances..... | 16 |
| 3.2 Significance of JAIRO Cloud: Encouraging IR establishment..... | 16 |
| III. Area 2: Research and Development Support..... | 18 |
| 1. Overview | 18 |
| 2. Project Accomplishments and Issues..... | 19 |
| 2.1 Establishment of a mathematics portal (Hokkaido University) | 19 |
| 2.2 Standardization and upgrading of institutional repository output assessment (Chiba University)..... | 20 |
| 2.3 Doctoral thesis distribution support package development (The University of Tokyo) | 20 |
| 2.4 Demonstration experiments connecting electronic publishing and repositories in a cloud computing environment (Nagoya University) | 21 |
| 2.5 Permanent identifier verification experiment to introduce an identification function in the open access environment (Kanazawa University) | 22 |
| 2.6 Repository of Archaeological Reports (Shimane University)..... | 23 |
| 2.7 Development of an automatic document collection and registration workflow system (Kyushu University) | 23 |
| 2.8 Development and dissemination of XoonIps new version and Library model (Keio University)..... | 24 |
| 3. Prospects for the Future | 24 |
| IV. Area 3: Support for Community Activities in Academic Information Distribution..... | 26 |
| 1. Overview | 26 |
| 1.1 Background: Numerical results and absence of governance..... | 26 |
| 2. Development of the Support Program | 26 |
| 2.1 2004 academic year: Institutional Repository Portal Project, visit to Japan by Stevan Harnad ... | 26 |
| 2.2 2005 to 2007 academic years: Phase 1 support program | 27 |
| 2.3 2008 to 2009 academic years: Phase 2 support program | 27 |
| 3. Project Accomplishments and Issues..... | 29 |
| 3.1 Advance of communities (DRF) | 30 |
| 3.2 Copyright management (SCPJ)..... | 30 |
| 3.3 Human resource development..... | 30 |
| 4. Prospects for the Future | 31 |
| V. NII Provision of JAIRO Cloud (A SaaS type IR cloud service)..... | 32 |
| VI. Prospects for the Future | 34 |

| | |
|--|----|
| 1. Looking Back at the Support Program | 34 |
| 2. Issues for IRs in Japan | 35 |
| 2.1 Enhancing the platform and functions | 35 |
| 2.2. Repository assessment | 35 |
| 2.3 Subject repositories | 36 |
| 2.4 Human resources and linking across organizations | 36 |
| 3. The Next Stage of Activities | 36 |

Executive Summary

1. The present report covers Phase 3 of the Institutional Repositories Program (2010 to 2012 academic years).
2. In Phase 3, commissioned projects based on public invitation were carried out in three areas, namely Area 1: Content creation for new IRs, Area 2: Research and development support, and Area 3: Support for community activities.
3. In Area 1 the NII provided assistance with IR setup and content creation for 24 institutions (8 national universities, 4 other public universities, 10 private universities, and 2 inter-university research institutes) in the 2010 academic year, 31 institutions (10 national universities, 4 other public universities, 15 private universities, and 2 inter-university research institutes) in the 2011 academic year, and 34 institutions (11 national universities, 6 other public universities, 15 private universities, and 2 inter-university research institutes) in the 2012 academic year.
4. The NII supported 8 projects in Area 2. The themes of the projects included Establishment of subject-specific repositories, Standardization and upgrading of institutional repository output assessment, Development of a doctoral thesis distribution support package, Connecting electronic publishing and repositories in a cloud environment, Permanent identifier verification experiment to introduce an identification function in the open access environment, Development of an automatic document collection and registration workflow system, and Development and dissemination of XooNIPs new version and Library module, among others.
5. Five projects were supported in Area 3. These were: Information sharing to vitalize the institutional repository community, Development of human resources to manage institutional repositories, Support for institutional repository community formation in the Kinki, Nagoya, and Tokai regions, Vitalization of institutional repository regional communities (merged with human resource development in the 2011 academic year), and a Copyright management project for open access and self-archiving.
6. An increase in the number of institutions establishing IRs in Japan and in the archived content can be seen as benefits of this program. The number of institutions was more than 350 at the end of March 2013. This effectively ranks Japan second in the world following the U.S. in number of institutions. Content, largely consisting of research bulletin papers, also continues to grow, hitting the one million mark in June 2012.
7. The program also revealed certain issues regarding IRs in Japan. The five main issues are seen to be (1) provision of a platform equipped with advanced functions incorporating the results of this program along with international interoperability, (2) strengthening of subject repositories, (3) study of principles and systems for open access, (4) study of the role of IRs in the assessment of research achievements, and (5) development of human resources to handle library work in the area of open access and carrying out collaboration and support transcending institutions.
8. With Phase 3, the NII Institutional Repositories Program has ended. Based on the accomplishments of this program, the NII will continue carrying out initiatives, in cooperation with the Committee for the Promotion of Institutional Repositories, that support the further development of institutional repositories in Japan.

I. Overview of the NII Institutional Repositories Program Phase 3

1. History of the Program

The NII Institutional Repositories Program (CSI-commissioned projects) was started in the 2005 academic year, by the National Institute of Informatics (NII) to assist with the creation of academic institutional repositories, as part of the Cyber Science Infrastructure program (CSI). The NII provided support for projects by 19 universities in the 2005 academic year, the first year of the program. Besides the creation of institutional repositories (IRs) themselves, further experience in system development and operation was gained. Starting in the 2006 academic year, an open call for applications was issued to all national, other public, and private universities in Japan, and two categories were created under which universities could seek support: Area 1, “Construction and operation of IRs,” for providing assistance in the establishment of new IRs, and Area 2, “Innovative research and development,” aimed at obtaining concrete results to drive advancement of IRs in Japan. Phase 1 of the program, from the 2005 to 2007 academic years, has been written up in the report, *New Horizons in Academic and Scholarly Communication*. Phase 2 of the program was carried out in the 2008 to 2009 academic years, carrying over the two areas of Phase 1 in order to continue promoting IRs. See *The Changing World of Academic and Scholarly Information Distribution: Advances in Institutional Repositories* for details of Phase 2. Phase 3 commissioned projects were carried out over the three-year period from the 2010 to 2012 academic years. In Phase 3, commissioned projects were conducted in three areas, namely Area 1: Content creation for new IRs, Area 2: Research and development support, and Area 3: Support for community activities. Institutions were selected based on public invitation as before, and further efforts were made to develop institutional repositories in Japan.

2. Overview of Phase 3 Activities and Accomplishments

2.1 Quantitative growth in institutional repositories

In Phase 3, as in the two earlier phases of the program, Area 1 projects provided support for the launching of institutional repositories. Over the eight years since the commissioned projects were begun, the number of institutions establishing IRs has risen sharply, exceeding 350 by the end of Phase 3. This effectively ranks Japan second in the world following the U.S. in number of institutions with an IR. The number of materials (full-text) contained in IRs, moreover, by June 2012 had reached a million, making Japan one of the leading countries of the world in the area of IRs.

Comparing different types of universities, the IR diffusion rate is by far the highest in national universities overall; but in Phase 3 the number of other public and private universities establishing repositories has risen noticeably. Among the likely causes of this rise we can point to the success of this program in vitalizing the IR community for sharing knowhow and experience in building IRs, along with the start of JAIRO Cloud (a SaaS type IR cloud service) by the NII in the 2012 academic year.

2.2 Innovative projects

In Phase 3, the program supported multiple innovative projects concerning content enhancement and IR advancement, in order to raise the level of IRs and increase their value.

Among these projects were Establishment of subject-specific repositories including a mathematics portal and repository of archaeological reports, Standardization and upgrading of institutional repository output assessment, Development of a doctoral thesis distribution support package, Connecting electronic

publishing and repositories in a cloud environment, Permanent identifier verification experiment to introduce an identification function in the open access environment, Development of an automatic document collection and registration workflow system, and Development and dissemination of XooNips new version and Library module, among others. As in Phase 1 and 2, a variety of activities were carried out toward IR advancement, each of which can be seen as having achieved a certain degree of success.

2.3 Growth of communities

For the advancement of institutional repositories, along with initiatives for building the system and enhancing content, a network of human resources supporting these activities is essential. With this in mind, projects were commissioned since Phase 1 for supporting the formation of repository communities. In Phase 3, five projects were carried out in Area 3: Support for community activities. These were, 1) Information sharing to vitalize the institutional repository community, 2) Development of human resources to manage institutional repositories, 3) Support for institutional repository community formation in the Kinki region (2010 and 2011 academic years) and in the Nagoya and Tokai regions (2012 academic year), 4) Vitalization of institutional repository regional communities (merged with human resource development in the 2011 academic year), and 5) Copyright management project for open access and self-archiving.

These projects helped spur major growth of the IR community in Japan. For example, the number of participants in Japan's largest repository community, the Digital Repository Federation (DRF), in June 2013 reached 150 institutions. The DRF strives to disseminate and share the latest information through publication of the DRF Monthly, mailing lists, and other means, while contributing to global repository network formation by cooperating with communities outside Japan. Another example is the Society Copyright Polices in Japan (SCPJ) database. As of December 2013, more than 2,600 academic societies were registered in this database which is establishing a position as an indispensable reference source when registering content. Among the most important roles of these projects is the major contribution to developing the human resources supporting the advancement of repositories in Japan by a wide range of community activities at the national and regional level.

3. Academic Policy and Institutional Repositories

3.1 The 4th Science and Technology Basic Plan

In the 4th Science and Technology Basic Plan adopted by Cabinet decision in August 2011, Chapter IV. Enhancing Basic Research and Human Resource Development, Section 4. Formation of an international-standard research environment and foundations includes (3) Improving the research information infrastructure. As policy measures to this end, the Plan calls for promoting the establishment of institutional repositories in universities and public research institutions to advance the systematic collection and storage of papers, observations, experimental data and other educational and research results in digital form, as well as encourage open access to these resources. The Plan further calls on the government to promote networking of digital information resources, data standardization, the provision of basic information indicating the location of content, and the enhancement of information correlation functions, realizing federated searching across domains, structuring, and automation of knowledge extraction. The Plan also notes the need for building and expanding systems as "knowledge infrastructure" enabling federated search and extraction of all research information. While praising the IR-related efforts to date, the Plan drafters suggest that IRs are an important component of this knowledge infrastructure.

3.2 Council for Science and Technology

In July 2012, the Science Information Infrastructure Working Group, Research Environment Infrastructure Group, Subdivision on Science of the Council for Science and Technology issued a report on “Enhancement of infrastructure toward strengthening of global dissemination and distribution of academic information.” The report noted the growing interest worldwide in open access from the standpoint of further promoting the global dissemination and distribution of academic information, and advises active efforts on behalf of open access to research results, pointing to the benefits to be had from fostering open access journals and from making use of the institutional repositories being established by universities and other organizations.

3.3 Revision of Degree Regulations

Following deliberations in the Graduate School Division of the Central Council for Education, in March 2013 the Ministry of Education, Culture, Sports, Science and Technology in an Ordinance of the Ministry revised its Degree Regulations. As a result, the principle of publishing doctoral theses in printed form was replaced by digital publishing in the IRs of the degree-granting institution, so that IRs came to be essential information infrastructure of universities with the role of making doctoral theses available to the public.

4. Issues

4.1 Strategic project implementation

In implementing this program, the NII established the Library Liaison Working Committee under the Organization for Scientific Resources Operations and Coordination, as a committee of nationwide university librarians and experts charged with evaluating and selecting commissioned project proposals. While the Working Committee helped to achieve transparency in the process of calling for proposals and screening, it cannot be said with confidence that it has functioned adequately in the areas of indicating clear strategic directions of projects, overall coordination of the program, disseminating individual projects, and achieving synergy across projects. Learning from this, it will be necessary to consider the organizational structure for promoting IRs from now on.

4.2 Further spread and sustainability of IRs

Over the three phases of this program, the growth in the number of repositories and content archived in Japanese repositories has been remarkable. With the spread of community formation and shared repositories, the experiences of pioneering universities and knowledge have been accumulated and a mutual support structure has been established, creating an environment in which individual institutions can operate their IRs independently.

There are questions, however, as to whether these independent efforts can be sustained after the commissioned projects have ended. Given the severe financial situation of university libraries, the costs of operating a repository are likely to become a burden on them. Another question is whether libraries will be able to continue obtaining the personnel responsible for system maintenance and administration and for gathering content. Moreover, the situation of core libraries in charge of shared repositories not being able to maintain the system is starting to become a reality. At the same time, while the vast majority of universities throughout Japan are already operating IRs, there are not a few universities and research institutions that have yet to establish a repository, despite they are producing research results well worth disseminating.

Based on these issues, consideration will need to be made for the further spread and sustainability of IRs, including the use of JAIRO Cloud.

4.3 Collecting diverse content

Thanks to this program, the number of archived materials has continued to grow; but most of these are papers published in research bulletins. Raising the availability and visibility of bulletin papers, which up to now had been hard to obtain, can undoubtedly be counted as one success of this program. Papers published in academic journals, on the other hand, while increasing gradually in their share of overall IR content, are still small in absolute number. It would be hard to conclude that this program has contributed adequately to the progress of Green Open Access.

Another issue is that IRs today include almost none of the “observational and experimental data” mentioned in the 4th Science and Technology Basic Plan. As content that can support the active learning being carried out by students, the importance of learning resources and materials is also drawing attention of late; but this kind of content is still being archived only sporadically. Development into research data repositories, learning resource repositories and the like is a big issue that is starting to come into view on the horizon.

4.4 Sharing and dissemination of results

The Area 2 projects aimed at IR advancement have resulted in the development of considerable good software and tools. Examples from Phase 3 projects include a mathematics portal and other subject repositories, ROAT for output assessment, author identifiers and systems for electronic publishing and registration workflow. Various projects in Phases 1 and 2 also produced results.

These results, however, have stayed within their individual projects and have not spread widely. Besides, while everyone recognizes the usefulness of SCPJ, its maintenance and administration depend on the efforts of a specific library, due to the failure to create an organizational structure for its joint provision. Regarding the effective use of the accumulated copyright policies of academic societies, as well, tangible results are hard to see.

Drawing on the lessons learned from this experience, it will be necessary to assess anew the results of the program and to consider how the results can best be shared and spread more widely. The involvement of communities like the DRF in this process would be strongly expected.

5. Looking Ahead

With Phase 3, the NII has ended the Institutional Repositories Program. Discussions of open access, however, are more active than ever in Japan and the rest of the world; and the role of IRs in this move toward open access is likely to become even greater. This program, moreover, over its three phases lasting eight years has been a catalyst for the rapid growth of IRs in Japan, while at the same time a number of new issues are coming to light.

Given this situation, in October 2013 the Committee for the Promotion of Institutional Repositories was newly established under the Cooperation Promotion Council between the NII and the Japanese Coordinating Committee for University Libraries. Based on the project results to date and the issues that have become clear, the Committee will create an organizational framework for continued IR promotion; and it is hoped that university libraries and the NII will cooperate closely in tackling the issues, so that IRs may mature into knowledge infrastructure in the true sense.

II. Area 1: Content Creation for New IRs

1. Overview

1.1 Commissioned institutions: The number of IRs and institutions operating IRs doubled in Japan, with the projects supplying the stimulation

The number of commissioned institutions grew each year during Phase 1 (2005 to 2007 academic years) and Phase 2 (2008 and 2009 academic years) of the program, but dropped significantly in Phase 3 (2010 to 2012 academic years). The main reason for this change is that in Phase 3, in order to give priority to organizations newly establishing IRs, those receiving support since Phase 1 were excluded. It can also be seen as the result of more IRs being operated without support; in other words, the large drop in number of commissioned institutions is because organizations are now capable of sustained, independent IR operation, which was the aim of the support program in the first place.

The annual trends in number of Area 1 commissioned institutions are shown in Table II-1 below. Looking at the 2010 academic year, of the 24 commissioned institutions, 8 were national universities, 4 were other public universities, 10 were private universities, and 2 were inter-university research institutes. Compared with the 2009 academic year, the final year of Phase 2 projects, the number of national universities had dropped greatly from 54 to 8, while other public universities declined by 1 and private universities by 3. This is because in Phase 1 many of the commissioned institutions were national universities, and these were not eligible for support in Phase 3. In addition, IRs have spread in other public and private universities, so that with the increase in institutions already having established an IR, there were fewer new applications this time. Even so, in the final year of Phase 3 the number of institutions had increased by 10, reflecting the progress mainly by other public and private universities in IR establishment.

Moreover, primed by the results of this program, the significance and necessity of IRs have become widely recognized in university library circles, and the number of IRs continued strong growth in Phase 3. The spread of IRs in Japanese university libraries overall, not only among commissioned institutions, is as shown in Table II-2. The number of IRs nearly doubled in three years, from 144 at the end of the 2009 academic year to 281 by the end of the 2012 academic year. Of the 783 universities in Japan (as of the 2012 academic year), 35.9% operate IRs, doubling in three years from 18.6% in the 2009 academic year. While the rate of diffusion in national universities stands out compared to other public and private universities, the rates among the latter have grown very strongly. This can be seen as a major accomplishment of the program, whose activities have invigorated IR communities and, through the launching and operation of JAIRO Cloud (a shared IR platform), have encouraged other public and private university libraries to establish IRs.

Table II-1 Trends in commissioned institutions

| | Commissioned institutions | Types of institutions | | | |
|--------------------|---------------------------|-----------------------|--------------|---------|--------------------------------------|
| | | National | Other public | Private | Inter-university research institutes |
| 2005 academic year | 19 | 17 | - | 2 | - |
| 2006 academic year | 57 | 47 | - | 10 | - |
| 2007 academic year | 70 | 57 | - | 13 | - |
| 2008 academic year | 68 | 54 | 2 | 12 | - |
| 2009 academic year | 74 | 54 | 5 | 13 | 2 |
| 2010 academic year | 24 | 8 | 4 | 10 | 2 |
| 2011 academic year | 31 | 10 | 4 | 15 | 2 |
| 2012 academic year | 34 | 11 | 6 | 15 | 2 |

Table II-2 Spread of institutional repositories (as of end of 2012 academic year)

2009 academic year

| | Total | Types of institutions | | |
|----------------------------|-------|-----------------------|--------------|---------|
| | | National | Other public | Private |
| Institutional repositories | 144 | 73 | 14 | 57 |
| Universities | 773 | 86 | 92 | 595 |
| Institutional repositories | 18.6% | 84.9% | 15.2% | 9.6% |

(Numbers of schools are from MEXT Basic Survey of Schools report for 2009.)

2012 academic year

| | Total | Types of institutions | | |
|----------------------------|-------|-----------------------|--------------|---------|
| | | National | Other public | Private |
| Institutional repositories | 281 | 85 | 33 | 163 |
| Universities | 783 | 86 | 92 | 605 |
| Institutional repositories | 35.9% | 98.8% | 35.9% | 26.9% |

(Numbers of schools are from MEXT Basic Survey of Schools report for 2012.)

Table II-3 Software introduced by commissioned institutions in 2012

| | Software product | University users | Main universities |
|-------|------------------|------------------|--|
| 1 | DSpace | 14 | Hirosaki University, Kanagawa University, Hiroshima University of Economics, National Institute for Fusion Science, National Museum of Ethnology, etc. |
| 2 | WEKO | 8 | Shinshu University, Senshu University, Toyo University, Nagoya City University, Kyoto Notre Dame University, etc. |
| 3 | XooNips | 5 | Aomori University of Health and Welfare, Bunkyo University, Seigakuin University, Nara University, Beppu University, etc. |
| 4 | NALIS-R | 3 | Ibaraki University, Niigata University, University of the Ryukyus |
| 5 | InfoLib-DBR | 2 | Yamanashi Prefectural University, Osaka City University |
| 6 | Earmas | 1 | Kagawa University |
| 7 | iLiswave | 1 | Chubu University |
| Total | | 34 | |

Table II-4 Lead time to release

| | Days to trial release | Days to general release |
|--------------------|-----------------------|-------------------------|
| 2005 academic year | 276 | 379 |
| 2006 academic year | 255 | 410 |
| 2007 academic year | 247 | 258 |
| 2008 academic year | 174 | 227 |
| 2009 academic year | 255 | 349 |
| 2010 academic year | 269 | 340 |
| 2011 academic year | 220 | 261 |
| 2012 academic year | 105 | 189 |

1.2 System types: Drop in DSpace share, big rise in WEKO

Of the systems (software) used for IRs in Japan, DSpace has continued to maintain a dominant share ever since the program started. Looking, however, at the software in use by commissioned institutions in the 2012 academic year as shown in Table II-3, while DSpace was still the most common, being used by 14 of 34 institutions, the share has fallen somewhat since Phase 1 (47 of 71 institutions) and Phase 2 (47 of 75 institutions). Meanwhile, WEKO on which JAIRO Cloud is based, developed and provided by the NII, has seen major growth. The increase in home-grown and easy-to-implement options like WEKO when building a new IR can be seen as one factor behind the growth in number of IRs noted in the previous section.

1.3 Lead time: Continues to decrease

As shown in Table II-4, the time required from commissioning of the project to test release was 269 days in the 2010 academic year, 220 days in 2011, and only 105 days in the 2012 academic year, becoming shorter with each year. The time to general release likewise has continued to decrease year by year, from 340 days in the 2010 academic year to 261 days in 2011 and 189 days in the 2012 academic year. This

can be attributed to the establishment of a support structure for universities newly establishing an IR, as knowledge has accumulated from the experiences of pioneering universities and IR communities have been formed.

Note that the data in Table II-4 does not include institutions that had already made a test release or general release at the time of commissioning, and the number of institutions covered is small, so that it would not be appropriate to infer nationwide trends from this data alone. Nonetheless, comparing these results with the data at the start of the project in the 2005 and 2006 academic years, lead time to release has clearly been shortened, which may be considered a major accomplishment of the program.

2. Program Accomplishments and Remaining Issues

2.1 System operation

To assess the way system operation has changed between Phase 2 and Phase 3, the data on organization (2.1.2) and costs (2.1.3) for the 2009 and 2012 academic years are here compared.

Table II-5 Personnel involvement in IRs

| | 2009 academic year (final year of Phase 2) | | | | |
|--------------------|--|--------|-----------|-------|-------|
| | Content | System | Promotion | Other | Total |
| Average | 2.26 | 2.23 | 3.23 | 0.46 | 5.47 |
| Median | 1.00 | 1.00 | 2.00 | 0.48 | 4.00 |
| Max. | 5.00 | 5.00 | 6.00 | 0.50 | 12.40 |
| Min. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Standard deviation | 0.93 | 0.97 | 1.70 | 0.35 | 3.39 |

| | 2012 academic year (final year of Phase 3) | | | | |
|--------------------|--|--------|-----------|-------|-------|
| | Content | System | Promotion | Other | Total |
| Average | 1.97 | 1.45 | 1.41 | 0.13 | 2.19 |
| Median | 0.50 | 0.20 | 0.20 | 0.10 | 0.80 |
| Max. | 3.57 | 2.00 | 2.00 | 0.25 | 6.00 |
| Min. | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Standard deviation | 0.81 | 0.38 | 0.36 | 0.07 | 1.31 |

2.1.1 Establishment of standard practices: Entering a stable phase

For effective operation of an IR, after the system is built various standard practices need to be drawn up, including policies and rules concerning organizational approvals within the institution (university) and administration. The Phase 2 report stated that, “Overall, the know-how for establishing standard practices for IR operation seems to have become well established.” Looking at the situation in each commissioned institution in Phase 3, it would appear that the process of establishing standard practices in institutions newly building an IR is progressing well. In Phase 1 this was very much a learning process; in Phase 2 the necessary know-how was established; and in Phase 3 it can be seen as entering a stable phase.

2.1.2 Organization: Staff size decreasing

A variety of organizational approaches are taken to IR operation, something that has been true in all three phases of this program. The necessary IR operational functions can be divided into content creation, system administration, and promotional activities. Table II-5 shows the number of personnel involved in each of these in Phase 2 and Phase 3. The table simply shows a comparison of the numbers of personnel,

but in practice, organizational approaches vary widely by each institution, for instance, some universities make a single organizational unit responsible for all these functions concurrently; in others the tasks are divided across the entire library organization; while others have established a cross-sectoral working group to undertake IR operation.

The changes from Phase 2 can be seen by comparing the personnel involvement in the 2009 and 2012 academic years on an FTE (full-time equivalent) base. This shows a large drop from 3.39 persons in 2009 to 1.31 persons in the 2012 academic year. The same trend is seen in each of the operational functions. The Phase 2 report commented that the large rise in personnel in the 2008 academic year “can be seen as reflecting the rise in importance of institutional repositories in the services of university libraries,” but in Phase 3 the reverse trend is to be seen. While there is room for various interpretations, rather than seeing a decline in the role of IRs, it is more likely that the methods for performing operations have become established and can be carried out efficiently, with fewer personnel needed. It is also quite possible that the sharp drop in number of personnel involved in system administration is that participation in JAIRO Cloud reduces the number of personnel needed by institutions for system administration.

Table II-6 Breakdown of costs

| | Content production costs (CSI portion only; 1,000s of yen) | | Other personnel costs (1,000s of yen) | |
|--------------------|---|-----------------------|--|-----------------------|
| | 2009 academic year | 2012 academic year | 2009 academic year | 2012 academic year |
| Average | 1,409 | 833 | 468 | 50 |
| Median | 1,072 | 720 | 318 | 0 |
| Max. | 5,400 | 1,800 | 2,000 | 513 |
| Min. | 0 | 0 | 0 | 0 |
| Standard deviation | 1,189.34 | 585.79 | 479.48 | 133.49 |

2.1.3 Costs: Stable low costs?

According to Table II-6, the average overall cost of producing IR content in the 2012 academic year was 833,000 yen, a drop from 1,409,000 yen in the 2009 academic year, while other personnel costs dropped in the same period from 468,000 yen to 50,000 yen. In each case the average values showed major declines.

These results are no doubt heavily influenced by the large drop in number of institutions covered in the analysis for the 2012 academic year, less than half the number in 2009, and the smaller number of big universities supported in Phase 3. Nonetheless, the significant drop in both content production costs and other personnel costs would seem to indicate that it has become possible to build and operate an IR this cheaply.

2.2 Content

To see the trends in content production not only for commissioned institutions but for IRs in Japan as a whole, reference is made to data from the IRDB content analysis system.

2.2.1 Content creation status: Steady increase but at a slower rate

As shown in Table II-7, the accumulated number of IR materials increased by 217,272 items in the 2010 academic year, surpassing the one million mark, and has continued to grow thereafter, with 205,551 items added in 2011 and 229,568 items added in the 2012 academic year. While the growth rate has slowed

compared to Phase 2, the number of materials can be seen as growing stably along with the increase in number of IRs.

Table II-7 Content creation status

| | Increase | Cumulative |
|--------------------|----------|------------|
| 2007 academic year | -- | 278,511 |
| 2008 academic year | 327,390 | 605,901 |
| 2009 academic year | 268,686 | 874,587 |
| 2010 academic year | 217,272 | 1,091,859 |
| 2011 academic year | 205,551 | 1,297,410 |
| 2012 academic year | 229,568 | 1,526,978 |

That content growth has slowed despite the huge increase in number of IRs noted in 1.1 can be explained as in the Phase 2 report, namely, “the large amount of content registration that takes place when repositories are newly launched tends to taper off and give way to everyday, routine content registration, inevitably leading to a decline in the number of new materials.” Another likely factor is that most larger universities completed the building of IRs in Phase 1 and 2, while in Phase 3 they are mainly being established by smaller institutions.

2.2.2 Targeted content: Continued increase in bulletin papers, moderate increase in share of academic journal papers

Looking at the status of content production by resource type in Table II-8, research bulletin papers continued to increase in Phase 3, reaching 584,352 items of the total of 1,136,508 full-text materials, or more than half. While only 185,397 of archived items were academic journal papers, their share of the total grew from 14.0% in Phase 2 to 16.3% in Phase 3.

Table II-8 Materials by resource type

(as of March 31, 2013)

| | Full text | Metadata |
|-------------------------------------|-----------|-----------|
| Academic journal articles | 185,397 | 333,536 |
| Dissertations | 48,371 | 82,018 |
| University research bulletin papers | 584,352 | 658,469 |
| Conference papers | 18,384 | 90,342 |
| Conference presentation materials | 4,774 | 18,095 |
| Books | 12,394 | 23,821 |
| Technical reports | 8,220 | 16,825 |
| Research reports | 25,979 | 28,751 |
| Articles in general periodicals | 41,203 | 51,274 |
| Preprints | 336 | 371 |
| Learning materials | 3,160 | 8,446 |
| Data/databases | 52,412 | 52,665 |
| Software | 26 | 32 |
| Other | 151,500 | 162,333 |
| Total | 1,136,508 | 1,526,978 |

The number of dissertations, meanwhile, at 48,371 dropped in share from 5.2% to 4.3%. With revisions to the Degree Regulations in fiscal 2013 enabling electronic publication of dissertations and adopting a policy encouraging open access, the digital archiving of dissertations in IRs can be expected to advance.

3. Prospects for the Future

3.1 Progress of shared repositories: Steady advances

The shared repositories launched in Phase 2 have continued to be operated successfully, while the number of such repositories as well as the participating institutions have grown significantly. In Phase 2 there were eight repository groups used by a total of 60 institutions. In Phase 3 this grew to 13 groups and 152 institutions. In each region where shared repositories are operated, the people involved in their operation have formed communities, not only sharing information concerning repository operation in each region and carrying out joint operations, but also leading to more exchanges among regional library personnel and mutual sharpening of skills.

Taking advantage of these shared repositories, participation has grown beyond national, other public, and private universities to include two-year colleges, specialized vocational schools, and also public libraries and archives, with many examples being seen of their success in stimulating regional library activities. The work of library personnel relating to IRs is not limited to system administration and content production (digital archiving). Also of note is their contribution to formation of library communities transcending the type of institution. It is to be hoped that such activities will continue in the future and will develop further.

3.2 Significance of JAIRO Cloud: Encouraging IR establishment

The commissioning of projects for IR establishment and operation started out with the NII Institutional Repository Portal Project in the 2004 academic year. In the following year support was provided to 19 institutions in the form of commissioned projects, and since the 2006 academic year projects have been carried out in Area 1 for seven years aimed at starting up IRs and creating content for them. With Phase 3, the commissioning of Area 1 projects has come to an end. From now on IR establishment and content creation will be left up to the independent efforts of each institution. The accomplishments of Area 2 and 3 projects in innovative R&D and community building have made IR building a much easier endeavor compared to the early years. Even so, there is no question that trying to start up an IR from scratch today still involves a certain amount of difficulty.

Given this situation, there are high expectations for JAIRO Cloud, started in the 2012 academic year. This service provides a SaaS type IR cloud service platform based on WEKO, developed by the NII reflecting the experience and wishes of institutions involved in IR operation. User communities have already sprung up, providing highly useful guidance to institutions wanting to establish a new IR. In fact, by the end of the 2012 academic year, one year after the service started up, already 75 institutions were using the service to offer IRs, and some 87 institutions were taking part in JAIRO Cloud including those applying for the service. The numbers have continued to grow rapidly since then, reaching 79 institutions offering IRs through the service and 149 applying as of July 25, 2013.

As already noted, Area 1 of this program ended with the 2012 academic year, after making great accomplishments. Given the large role JAIRO Cloud plays in promoting new IR establishment and operation, it can be seen as a project that carries on the spirit and significance of Area 1. While more than a third of Japanese universities already operate IRs, there are still many universities and research institutions that have yet to establish a repository, despite they are producing research results well worth being published to the world. IRs being “institutional” repositories, they can best fulfill their natural role

when they are in fact established in each institution. The advance of JAIRO Cloud is being looked to with high hopes for the further spread and development of IRs in Japan.

III. Area 2: Research and Development Support

1. Overview

In Phase 3, Area 2 supported innovative projects that, as stated in the call for proposals, will “contribute to the creation of and cooperation among academic IRs, to their advancement, and to increasing their value.” Proposals were solicited for each of the themes set in advance, and projects were commissioned from the following institutions.

A. Projects for enhancing content

A-1. Doctoral thesis distribution (The University of Tokyo)

A-2. Innovative project for disseminating research results funded by Grants-in-Aid for Scientific Research (KAKENHI)

A-3. Academic journal articles (Kyushu University)

A-4. Other

B. Projects for advancing institutional repositories

B-1. IR creation software (Keio University)

B-2. Development and provision of eScience infrastructure

B-3. Establishment of subject repositories (Shimane University)

B-4. Permanent identifiers (Kanazawa University)

B-5. Institutional repository output assessment (Chiba University)

B-6. Connecting electronic publishing, in-house academic circles, university publishing and repositories in a cloud environment (Nagoya University)

B-7. Practice and assessment toward use of repositories to reconfigure library operations and services

B-8. Other (Hokkaido University)

Whereas Area 1 was focused on IR establishment in specific institutions, Area 2 consisted of innovative projects including many projects involving system development.

In this section, we will examine the project results from the standpoint of their users. Although the first users that come to mind are the researchers who provide and use the content of IRs, there were also projects whose intended users were institutions (mainly libraries), such as projects aimed at supporting IR operators. Specifically speaking, projects for establishing subject repositories can be considered as projects intended for researchers as the main users. IR assessment, on the other hand, is a typical example of a project whose results are intended for institutions as users.

In Area 2 projects, the most important result is not development of a system for a specific institution but rather the ripple effects. In that sense, the projects by Hokkaido University and Shimane University for building subject repositories can be expected to have certain ripple effects that will be welcome to users in each of the fields covered. Ripple effects for institution users can also be expected, as consideration has

been made for drawing up and using metadata specific to the collection models and subject fields of the repository, so that the results are quite applicable to other fields where similar undertakings are to be carried out. Chiba University's ROAT can likewise be considered a kind of subject repository aimed at institutions generally. That is, it is not intended for use by a specific institution but can be expected to have wide ripple effects for data sharing and broad sharing of repository assessment platforms. A feature of all these initiatives is that the user community is clearly identified and they are carried out in collaboration with the community. By contrast, projects that do not have their user community in clear view, even if intended for a broad user base, in reality are struggling to catch on.

It should be useful for those contemplating similar undertakings to note that the projects that succeeded in attracting users with relative ease were those that did not require installation in each institution and presented the lowest barriers to use. The above-mentioned ROAT and (although an Area 3 project) SCPJ are examples of use-oriented systems that do not require installation. If, on the other hand, a system is of the type that requires separate installation in each institution, education and training of the institution users need to be carried out. For the projects that struggled to catch on, as noted above, this appears to be one of the reasons. Even though it was the type requiring individual installation, however, the Keio University project showed that it is possible to gain wide use of the development results by working in collaboration with the user community.

Of the themes not receiving applications, the enthusiasm gap between Japan and other countries was felt most strongly with regard to research data management (B-2). In Japan, which does not have the pressure of mandatory open access to research results, there are few fields where it is desired to make research data public, and even these are likely to build their own independent database. In other words, the necessity to build a data repository supported by institutions (libraries) is not strongly felt, which can be seen as a situation like that noted above, of institutions (libraries) not having their user community clearly in view. In the case of the Shimane University Repository of Archaeological Reports, however, or the ROAT log repository, these are different from the conventional type of repository and their users are also different from those of conventional repositories of academic papers. These can be seen as a type of data repository, and it would seem appropriate to consider them a model to be aimed for. If, in other words, there is incentive to create a (non-document) repository and there is a user community, this can be called a data repository; and if it is pursued by the "*hita-hita*" approach, (meaning to be tenacious and to work step-by-step in Japanese), useful knowledge for building a full-fledged data repository should also be obtainable.

2. Project Accomplishments and Issues

2.1 Establishment of a mathematics portal (Hokkaido University)

In this project, a Japanese subject repository was created using metadata for Japanese journals and research bulletins in the field of mathematics archived in IRs and other digital repositories.

A feature differentiating this repository from existing subject repositories such as arXiv and PubMed Central is that this is an overlay repository using digital repositories as information sources. That is, rather than being an overlay journal for one academic journal, it archives large numbers of titles from the same field. Making this possible were the unique culture of the mathematics community and the CSI program initiatives leading up to this project. The mathematics community has a tradition of sending papers to a specific review journal (Mathematical Reviews) when they are written, which assigns an identifier to them. This makes it possible to extract just the mathematics-related papers from the diverse content in subject repositories. In addition, research bulletins are important media for the Japanese mathematics community; and digitalization of bulletins (Area 1) made it possible to archive many journals (around 70

titles) in a short time. Among the archived papers are some going back more than half a century, which should contribute to the mathematics field.

Using EPrints as the system and, for data exchange, such standard protocols in the academic information distribution field as OAI-PMH and OAI-ORE, this project is also important for presenting one approach to reuse of repository content.

2.2 Standardization and upgrading of institutional repository output assessment (Chiba University)

This project made further advances in ROAT, which was created in Phases 1 and 2. The approach to data extraction from access logs is based on COUNTER, a standard for electronic journal and database access statistics. Adopting COUNTER means that access to IRs can be compared and assessed in relation to access counts to electronic journals and other electronic information resources provided by libraries. With ROAT, statistics are processed based on IP address. This project tested the possibility of more precise processing making use of cookies. Since ROAT uses the COUNTER Code of Practice as the standard for handling duplicate entries, the project also looked at whether this is an appropriate standard.

In order to verify the validity of the statistics handling, the study used the usage statistics for CURATOR, the Chiba University's repository for Access to Outcomes from Research.

An "International Seminar on Standardization of IR Usage Statistics: How we count the access to institutional repositories" was held in January 2011 as a forum for announcing the results. Through this Seminar, the project's results were positioned in the worldwide developments in IR assessment including those of Germany and France. At the same time, the possibility of sharing robot lists and the like was deliberated. Being widely publicized at seminars in Japan, ROAT has high recognition as a means of access assessment. ROAT service is currently stopped, but it would be desirable to have a similar service deployed in a form that can be used by many IRs.

Besides output assessment at the IR level, the project results should be useful for assessing IR content and providing feedback to people registering content.

2.3 Doctoral thesis distribution support package development (The University of Tokyo)

In its efforts to promote the archiving of dissertations in IRs, the University of Tokyo has continued efforts to encourage each department to actively register dissertations in the IR. As a result, an increasing number of schools and departments are archiving all the dissertations submitted to the school/department. This project analyzed such activities and then designed a system that provides one-stop service for dissertation archiving. Individual elements are assigned as metadata for the items specific to dissertations.

Degree name: dc.description.degree

Degree level: dc.description.degreelevel

Report number: dc.description.thesisno

Degree number: dc.description.degree

School/department: dc.description.degreegraduate

Date issued: dc.date.issued

Granting institution: dc.description.degreegrantor

Discipline: dc.description.degree.discipline

In actual registering of dissertations, entry is made using a dissertation registration interface independent from the IR, to enter dissertation-specific metadata in addition to other data required for IR registry, and the results can be machine registered in DSpace in SWORD format. The DSpace version must be selected properly to enable this machine registration in SWORD format.

The entry procedure using the registration interface is designed to enable self-archiving by the submitter of a dissertation. Revisions to the Degree Regulations in FY2013 are expected to lead to a huge increase in doctoral thesis registrations. An issue for the future will be to upgrade the system so as to handle this increase.

In order to perform retroactive registration of dissertations, the author list was extracted from the dissertation database of the University of Tokyo, containing bibliographic information and abstracts of dissertations, and the work was started. Since printed editions of doctoral theses are stored in the General Library of the university, these are being registered first. To the extent the currently affiliated institution could be confirmed from author contacts and email addresses, it was possible to discern trends in affiliation corresponding to the discipline in which a degree was earned. When it comes to post-doctoral studies, it becomes more difficult to determine the next affiliation once the initial posting has ended.

With the partial revision to Degree Regulations after the final year of the project ended, there is no denying the major impact of these changes on the publicity efforts and system design aspects of the project, on which much time and labor were spent. At the same time, innovative technologies were adopted such as the use of SWORD for content sharing between the registration interface and DSpace. While this experience was specific to the University of Tokyo, the results of this project should contribute to future handling of dissertations in IRs.

2.4 Demonstration experiments connecting electronic publishing and repositories in a cloud computing environment (Nagoya University)

This project sought to promote digitalization of academic information leading to the enhancement of IR content. The specific approach was to support peer review and other workflow of academic journals by means of Open Journal Systems (OJS), and enable accepted papers to be registered directly in the IR. It also prepared and distributed a starter kit consisting of the typical customization necessary for use in Japan along with operation assistance scripts and documents.

While there is a similar project by Waseda University on Developing an Electronic Publishing (editing and peer review) System, that system was developed with paper publishing in mind, whereas the Nagoya University project adopts a universal design using SWORD and provides an API for ease of reuse.

The results are being used in actual publishing of the *Journal of College and University Libraries*, so that improvements can be made based on feedback. A problem has come to light in that the university running the *Journal of College and University Libraries* changes regularly, preventing the server from being installed in one institution. Even apart from the change in operating university, the barriers are high for small-scale academic journals to introduce OJS and the like on their own. Rather than a system that needs to be installed at individual institutions, it is therefore preferable to introduce a cloud system, for example one for each discipline, and to share the system among multiple journals in that discipline. In fact, there are already systems like the one assisting workflow for international conferences in the information field that are widely shared, and that can be used readily by both conference organizers and submitters.

2.5 Permanent identifier verification experiment to introduce an identification function in the open access environment (Kanazawa University)

Assignment of author identifiers is a global trend, with ORCID being one example; but the introduction of author identifiers to IRs has just begun and is not yet common practice in Japan. To help rectify this situation, a project was carried out for introducing author identifiers in DSpace, widely used as an IR platform. For each IR some kind of unique number is assumed as the author ID. In this experiment, the Kanazawa University Repository for Academic Resources (KURA) was upgraded to DSpace Version 6.1, and a metadata field was set corresponding to author ID. The KAKENHI researcher number was adopted as author ID and registered for all current university faculty members. At the same time JAIRO was made to support author ID.

The following universities are participating in this project along with Kanazawa University. Hokkaido University, Nagasaki University, Nara Women's University, and Kwansai Gakuin University systems all use DSpace. Osaka City University is participating in the experiment with its non-DSpace system, using university funds. Of the more than 110,000 records of the participating universities, author identifiers have been registered for more than 35,000, or 31%. Those behind the project are not content with this result. It may not be practical, however, to make all DSpace-based IRs in Japan compliant with this scheme, since it requires certain amount of cost to outsource the upgrading of DSpace to Version 1.5 or above so as to support the author ID.

From a global standpoint, it will be necessary to correlate the author IDs assigned by ORCID or the like to the KAKENHI number or other ID assigned to authors registering papers in a Japanese IR.

The following was learned from the results of a survey conducted by Kanazawa University. Those responding showed good understanding of the author ID concept and recognized the advantages of registering such an ID. When it came to actual registration, however, the results were less encouraging. Among national and other public universities, around 40% have started or plan to start registration, while for private universities this is only around 20%. Of those who have begun registration, most institutions adopt as the author ID either the researcher name resolver ID, the researcher number assigned in the institution, or the KAKENHI researcher number. Advantages cited include distinguishing authors with the same name, and database linking. Among reasons given for not registering were the problem of customizing DSpace, etc., and lack of information. Summing up, while the need for assigning author identifiers is recognized, it would seem that mainly cost and lack of information are preventing universities from going forward.

To advance the assigning of author identifiers in this situation, it will be important to create various application examples. A case like the following can be thought of as one application of author ID. Suppose someone's first step toward becoming a researcher is to submit a doctoral thesis to one institution. When that young researcher does postdoctoral work at institution A, and then goes on to become an associate professor at institution B, his or her accomplishments can be output using the author ID based on JAIRO. If a universal data exchange format is supported on the JAIRO end, it will be possible for the researcher's list of accomplishments to appear in a natural form on his or her website. A function like this can be seen as highly significant to a young researcher's career. This project is meaningful also as a way of encouraging such applications.

A major issue going forward will be upgrading from older versions of DSpace.

2.6 Repository of Archaeological Reports (Shimane University)

This project developed a subject repository archiving reports on archaeological surveys issued following site excavations. Numerous titles of archaeological reports are being published, but individual titles are issued in small numbers and have very limited distribution. Moreover, archaeological reports differ from the kinds of documents conventionally archived in an IR in that, in many cases, they are not the output of members of institutions operating IRs, in other words, universities (In Japan, most archaeological reports are issued by the municipality where the archaeological site is located). Therefore, there is no framework for content collection, and it was necessary to create a document collection model itself.

This project began by designing a model for collecting the reports through the library operating an IR, but the limits to the conventional model became clear. That is, it is difficult to motivate a university library to actively go out and collect output that was not produced by its members, and difficult to cover the wide scope of these reports. A collection model was therefore devised based on self-archiving by the content holder, namely, the municipality issuing the reports.

This project built a subject repository targeting a specific community, but deserves strong praise for adding metadata concerning archaeological sites, different from that for ordinary documents, and for engaging content holders that were not covered by conventional IRs. These features will provide important reference for collection models in research data management, expected to become necessary in the future. Research data differs from general academic papers in that while the necessary metadata naturally differs for each discipline, it would be difficult from a cost standpoint to create a separate research data repository for each discipline. This project suggests an approach whereby university libraries provide support to the content holder community (researchers in the case of research data) in developing the metadata and creating a cloud-based system, and the community members register the data by self-archiving.

2.7 Development of an automatic document collection and registration workflow system (Kyushu University)

An automatic document collection and registration workflow system was developed to encourage archiving of papers in IRs. The system is made up of two subsystems, one with the automatic document collection function and the other with the registration workflow management function. The latter includes a copyright handling status management system, for smooth confirmation of whether public release is allowed, a process that can be time-consuming.

These systems are meant to assist with management of the steps for registering documents in an IR. In order to bring about an increase in the number of documents archived in a repository, it is necessary not only to increase the number of voluntary applications by authors to register their papers but to make the registration process more efficient. Registering a paper in an IR requires confirming mainly two kinds of copyright policies, the copyright held by the author and that assigned to the publisher. The faculty inquiry system can be seen as a means for confirming the author's copyright policy.

On the other hand, the system developed in this project automates the process for confirming the publishers' copyright policies by linking to outside database services such as SHERPA/RoMEO or SCPJ. During the trial period from April 2011 to October 2012, the number of academic papers registered averaged around 20 per month. In the four months from the start of system operation, the number of consents to register averaged more than 100. Because actual publishing in a repository occurs after copyright and other processing, there are differences between the number of consents to register and

number of registrations; but continuing with system operation can be expected to result in a large increase in registrations.

Ever since the experimental system went into operation in November 2012, the number of papers registered has increased. The staff whose work time was measured in this project also registered bulletin papers and other documents that did not need copyright processing. Even if this was taken into account, there was not a notable drop in registration efficiency despite the number of registration requests for documents requiring copyright handling, such as academic journal papers, increased by fivefold. This project was of considerable interest as an attempt to improve the efficiency of document collection and registration work, particularly the portion requiring administrative manpower. The linking to SCPJ or other database in handling copyrights is an aspect of the project that deserves to become more widespread. If this system is able to spread beyond the participating institutions, it will be a result that can be utilized effectively.

2.8 Development and dissemination of XooNIps new version and Library model (Keio University)

This project incorporated an already developed XooNIps module (Library module) in a new version of XooNIps whose development was being considered, facilitating customization and other aspects. The project was also actively publicized and a user community was formed.

While Area 2 features many system development projects, the resulting systems tend not to be for general use since they are specific to the circumstances of the developing institution. A feature of this project, on the other hand, is that it engaged in activities bringing together the general repository system developer community and user community, not simply to assist with the development but to help enable the output to be used effectively. At the same time the developers were helped by feedback of user wishes to the developer community.

While the installed base of XooNIps is not as large as systems such as DSpace, this project by facilitating communication between the developer community and user community showed the true potential of an Area 2 project involving system development.

3. Prospects for the Future

The Area 2 projects up to Phase 3 of the CSI program were in many cases carried out with the objective of raising the level of individual functions. It is to be hoped that, after reviewing the results of these projects, universities will embrace and realize concepts for raising the benefits of IRs as a whole.

Here, let us look into the interrelationship among the projects conducted in Area 2 of Phase 3. In developing a registration workflow system and promoting automation of content formation, copyright management was automated by linking to SCPJ. This kind of approach is effective also in the case of journal papers serving as a model for doctoral theses, whose registration in an IR has become mandatory, so that it would seem useful to study use of this approach in assisting with distribution of doctoral theses. Moreover, if a new XooNIps Library module is going to be developed, as a platform it should have a similar automation function. Attempts to connect electronic publishing and IRs, especially those seeking development into overlay journals, have continued since the early days of IRs. It is to be hoped that such development will continue.

As for ROAT, which was further advanced for use in IR output assessment, consideration should be given to incorporating it into different platforms so that it can come into wider use. If it can be shown what form

it will take with XoonNips, platforms like DSpace and EPrints, or if use cases can be clarified for shared repositories in each region, or JAIRO Cloud, this should contribute to the advancement of IRs in Japan.

Two of the projects concerned subject repositories. Regardless of the size of a university, it is likely to have its own special features somewhere in its research and education. Assuming that an institutional repository plays the role of showcasing the research and education institution, then if a university takes the lead in building a subject repository in a research and education field that shows its individuality, this should help bring out the distinctive flavor of that university further.

Regarding the project that experimented with assigning author identifiers, we are now in an age when altmetrics cannot be ignored, which means that archiving of research accomplishments cannot be separated from the issue of guaranteeing the identity of the archived content. The assignment of author identifiers is something that, in addition to broad support in IRs, should be implemented also for metadata schema supporting metadata harvesting.

Are we succeeding in creating the organizations and developing the personnel that, with a broad overview of the individual cases seen not just in Area 2 but in Areas 1 and 3 as well, can reflect these in each IR? Also, is there wide recognition of how to make use of IRs? Are there signs of new kinds of uses coming into being?

While this is something that always arises as an issue regarding such questions, in the case of ROAT, for example, if its functions can be implemented in a universal manner, it will be possible to share and analyze logs on a regular basis, with the results being returned both to users and to those registering content. System development personnel, besides being small in number, often become separated from IR duties due to reassignment. Considering the technology people accumulate, it would seem like a good idea to think seriously about tie-ups not only with librarians but with research and development labs as well.

Outside Japan, new developments are being seen especially in the area of data repositories, centering on DSpace, EPrints, and Fedora user groups. The DRF was central in information exchange and human exchange activities with overseas IR communities, but these efforts may have been weak in the case of aspects corresponding to Area 2. Looked at individually, important activities are being carried out at the international level, and it is to be hoped that exchanges with the global community will continue.

Finally, the role to be played by IRs in research and education institutions has expanded greatly over the course of the CSI program from Phase 1 to 3, and is likely to continue expanding quantitatively in the future. The process of obtaining a broad overview of the CSI program results, and once more reviewing and sharing the role to be played by IRs within and outside of each institution, will be an important foundation for further advancement.

IV. Area 3: Support for Community Activities in Academic Information Distribution

1. Overview

1.1 Background: Numerical results and absence of governance

This support program, which began in the 2005 academic year following upon the NII Institutional Repository Portal Project conducted in the 2004 academic year, yielded many results up to its conclusion in the 2012 academic year, the final year of Phase 3. Worth noting first of all is that the original issue was system provision, and in this area the number of institutions establishing IRs exceeded 350 by the end of Phase 3. The next issue was content, and here the number of materials archived reached the one million mark in June 2012. These statistics show that Japan has become one of the world's leaders in promoting IRs.

With the addition of Area 2 projects in the 2006 academic year, the second year of Phase 1, and of Area 3 projects in Phase 3 starting in the 2010 academic year, the program has grown to encompass a variety of related themes, making it somewhat difficult to get an overview of the results as a whole. The commissioned institutions put strong efforts into tackling each of these themes, and one can easily imagine that the above mentioned system provision and content creation must have provided important foundation for making advances in individual themes. Even so, in terms of whether the results obtained by the commissioned institutions spread to other institutions, and whether there were synergies among each of the results, it would be hard to conclude that the good practice permeated the overall IR community and produced comprehensive benefits. This points to the possibility of a lack of governance.

2. Development of the Support Program

Phase 3 of the support program adopted as the Area 3 theme, "Support for Community Activities in Academic Information Distribution." In summing up Phase 3 it would be good first of all to look at the history to date.

2.1 2004 academic year: Institutional Repository Portal Project, visit to Japan by Stevan Harnad

In the 2004 academic year, the NII conducted a pioneering project with a small number of partner universities, the Institutional Repository Portal Project. (Details are given [in Japanese] in the report of March 2005 at <http://www.nii.ac.jp/irp/archive/basic/pdf/NII-IRPreport.pdf>.) A notable event that year was a series of sessions featuring Stevan Harnad, a leading advocate of self-archiving, who was invited to Japan for the occasion. An informal meeting with Mr. Harnad was held on November 24, 2004, followed by a forum session on the 25th as part of the annual Library Fair & Forum event. Mr. Harnad stressed the importance of free access to peer-reviewed research, long one of his favorite themes, suggesting that the content to be made open be limited to peer-reviewed papers. He further suggested collaboration between the two BOAI strategies (BOAI-1: Open Access Self-Archiving, BOAI-2: Open Access Publishing) in the cost area. That is, university libraries in pursuing the Green Road should reduce subscriptions and transfer a third of costs to (what is now called) the APC (Article Processing Charge) of the Gold Road, eventually achieving 100 percent open access. He further noted that the journals supporting Gold Open Access (at the time) were only around 5 percent of the total, and advocated that priority should be given to the Green Road.

The remarks that day of Mr. Harnad, one of the leading lights behind the Open Access (OA) movement, made a deep impression on the young people in charge of running IRs, and had a major impact on community activities thereafter.

2.2 2005 to 2007 academic years: Phase 1 support program

The support program started out in the 2005 academic year, commissioning projects to 19 institutions and holding administrative personnel workshops. The issues at the time were system provision, linking with other internal and external systems, formulating publicity strategy and creating an organizational structure in the university, and obtaining content. The pioneering universities endeavored to share outstanding examples in these areas.

Starting in the 2006 academic year, support was divided into two areas, Area 1, “Construction and operation of IRs”, and Area 2, “Innovative research and development.” 22 projects were selected for Area 2. Of these, six projects were carried out on the themes of “value-added services and collaboration.” These were: Access path to Institutional Resources via link resolvers [AIRway] (Hokkaido University), Development of a XooNIPS Library module (Keio University), Federated Search for Institutional Academic Resources (Kyushu University), IR Evaluation (Chiba University, Mie University), Community [DRF] (Hokkaido University), and Copyright Management [SCPJ] (University of Tsukuba). Of these, DRF and SCPJ are projects equivalent to those carried out in Area 3 of Phase 3, indicating that projects to support community activities had already started at this time.

Through this process, the IR community not only pursued the Green Road favored in the West but carried out a range of support activities to meet the circumstances of each university. While IR in Japan tend to be seen as successors to ordinary digital libraries, it should be noted that the success of the Japanese IR community lies in emphasizing that IRs are more than simply the digitalization of materials housed in libraries, and that it is necessary to provide access to not only metadata but full-text papers. The serials crisis emerged in the West in the 70s and 80s, and was followed by the age of widely available Internet environments. Open Access (OA) is a best-of-both-worlds idea that combines the merits of traditional peer-reviewed journals with the copy-and-distribute functions of digital media on the basis of the Internet environment. Mr. Harnad explained that the purpose of OA is not to punish, undermine or replace existing journals. Making it clear that OA has no intention to punish existing journals may help motivate researchers promote open access. In Japan, however, awareness of the serials crisis and of the arrival of digital environments came at the same time, which may have sown confusion. Educational materials put out by the community sometimes suggested a simple dualistic situation in which commercial publishers were evil. This was also at odds with the utilitarian stance behind electronic journal consortium contracts, in which large numbers of universities participated and which was a major issue in the industry at the time.

Fourteen projects were adopted in Area 2 for the 2007 academic year. Of these, five projects were carried out on the theme of “problem resolution and information sharing aimed at further advances.” These were: A regional shared repository [HARP] (Hiroshima University), Data sharing for achievement database (Kanazawa University), Log analysis (Chiba University, Mie University), Community [DRF] (Hokkaido University) and Copyright management [SCPJ] (University of Tsukuba). Regional shared IR projects had begun in this phase.

2.3 2008 to 2009 academic years: Phase 2 support program

In the 2008 and 2009 academic years, projects were organized into Area 1: “Further expanding IRs and creating content,” and Area 2: “Building new services through collaboration among IRs to activate research

and education activities, and investigation, research and development to contribute to improving the convenience of IRs.” In Area 2, 21 projects were selected. Of these, nine were conducted under the theme of “Research on ensuring the sustainability of IRs and enhancement of their value.” These projects were aimed at: creating user communities (Chiba University), providing workshops (Kyushu University), log analysis [ROAT] (Chiba University), research visibility analysis (Shinshu University), inter-library loans [IRcuresILL] (Otaru University of Commerce), promotion of self-archiving and content utilization by researchers (Kyushu University), analysis on the selection between electronic journals and IRs [ZS] (Hokkaido University), respectively, in addition to DRF and SCPJ projects. There were also four shared repository projects under the theme of “Collaboration among IRs,” carrying over efforts for building shared repositories that started from the 2007 academic year. Three of these were aimed at developing subject repositories in the medical (Sapporo Medical University), archaeological (Shimane University), and education (Tokyo Gakugei University) fields, and one project aiming at the development of an operation model for shared repositories, led by (Hiroshima University).

With Phase 2 the support program entered a period of expansion. It was also a time when incorporation of national and other public universities led to the denial of the convoy system which used to make universities so reliant on government protection and guidance, as well as raised awareness of competition for outside funds. Regarding the individual solicited proposals, the funders failed to ensure sufficient communication necessary for sharing the overall outlook and coordinating across projects in the processes from the call for project proposals to screening, adoption, and drawing up plans. While this is inevitable to a certain extent given the constraints of the commissioned project approach, it was entirely left up to the individual universities to come up with improvements and propose revisions for addressing problems arising in the course of the project, and the program lacked a procedure for broad exchange of views on the project’s direction or feedback to the whole. The only official opportunity for sharing project contents was the CSI Conference at the start of the academic year. As a result, the initiatives were splintered in different directions; and while the significance of individual projects deserves praise, their output was not suited to the circumstances of other institutions besides the one commissioned for a project, making it difficult in many cases to expect ripple effects or synergy across project results.

In assessing the proposals for content creation in Area 1, the emphasis was on dissertations, reports of research funded by Grants-in-Aid for Scientific Research, and research bulletins. The reasons for promoting these kinds of documents are that, whereas electronic journals and other major publications produced outside the university at least come to be used through subscriptions, documents edited, produced, and issued by the university itself will not make it to the stage of a content base unless the university digitalizes and publishes them. The program led directly to an increase in content volume, but diverged greatly from the Green Road as OA strategy. These materials have as their background an environment specific to Japan, for example weak awareness of the principle of making dissertations public, the dissertation-based doctoral degree system, the approach to returning to the public the results of public funding, and distribution and peer review by exchange of donations. Accordingly, these are materials for which we cannot rely on overseas precedent for solutions to problems. In the Area 2 project on IR community, a slow and steady method was recommended for gaining acceptance of OA, in which library personnel approach researchers individually and come to understand the practical aspects of their research activities. This was then translated as the “*hita-hita*” approach and introduced outside Japan, where it drew interest. This method, however, was not conceived in awareness of the above content specific to Japan, but had in mind the Green Road premised on the environment outside Japan.

Selected in Area 1 were 66 institutions, including some large-scale universities that had already completed system provision, and some of these chose to keep their distance from the community.

3. Project Accomplishments and Issues

Starting in the 2010 academic year, projects were divided into three areas, namely Area 1: “Content creation for new IRs,” Area 2: “Research and development,” and Area 3: “Support for community activities”. Area 1 was limited to new applicants, with institutions adopted in earlier calls for proposals being excluded this time around. In Area 3, newly added to cover community-related topics, five projects were adopted. These were carried out on an annual basis as follows.

a) Information sharing to vitalize institutional repository community

2010 academic year / Lead: Hokkaido University; Participating: Kanazawa University, Osaka University; Contributing: Hiroshima University, Otaru University of Commerce, Chiba University

2011 academic year / Lead: Hokkaido University; Participating: Kanazawa University; Contributing: Osaka University, Hiroshima University, Otaru University of Commerce, Chiba University

2012 academic year / Lead: Hokkaido University; Contributing: Osaka University, Hiroshima University, Otaru University of Commerce, Chiba University

b) Training human resources in IR administration

2010 academic year / Lead: Osaka University; Participating: Chiba University; Contributing: Hiroshima University, Shimane University, Hamamatsu University School of Medicine, Nara University

2011 academic year / Lead: Hiroshima University; Contributing: Osaka University, Chiba University

2012 academic year / Lead: Hiroshima University; Contributing: Osaka University, Chiba University

c) Support for IR community formation in the Kinki region (2010-2011 academic years), Support for IR community formation in Nagoya and the Tokai region (2012 academic year)

2010 academic year / Lead: Osaka University; Participating: Nara Women’s University; Contributing: Ryukoku University, Osaka City University, Kobe City University of Foreign Studies

2011 academic year / Lead: Osaka University; Contributing: Nara Women’s University, Ryukoku University, Osaka City University, Kobe City University of Foreign Studies

2012 academic year / Lead: Nagoya University; Contributing: Osaka University

d) Vitalizing local institutional repository communities (2010 academic year) (Carried over from the Phase 2 support program “Shared Repositories Project: Model development and dissemination.” Merged with “Human resources development” from the 2011 academic year.)

2010 academic year / Lead: Hiroshima University; Contributing: Yamagata University, Bunkyo University, Shinshu University, Fukui University, Hiroshima Institute of Technology, Yamaguchi University, Nagasaki International University, University of the Ryukyus

e) Copyright management project on open access and self-archiving

2010 academic year / Lead: University of Tsukuba; Contributing: Chiba University, Tokyo Institute of Technology, Kobe University

2011 academic year / Lead: University of Tsukuba; Contributing: Chiba University, Tokyo Institute of Technology, Kobe University

2012 academic year / Lead: University of Tsukuba; Contributing: Chiba University, Tokyo Institute of Technology, Kobe University

3.1 Advance of communities (DRF)

The lack of overall coordination and association among the initiatives carried out in the Phase 2 support program on each theme has been pointed out above; but initially this tendency was to be seen in part also in Area 3 of Phase 3. Over the three years of Phase 3, however, coordination was improved; and from the 2011 academic year IR communities throughout Japan began holding training sessions for IR staff. There were also attempts to set up organized collaboration between regional communities and the national community (DRF). After the DRF was reorganized in February 2010 and started on the way to becoming an autonomous organization, the number of support projects of various kinds among IR staff across institutions began to increase from previous levels. Moreover, through mutual human exchanges internationally, the presence of the community came to be seen in the global OA movement; and the DRF endeavored to issue and share the latest information about such efforts through ongoing publication of a new monthly public relations magazine, a mailing list and other means. The number of institutions participating in this community also began to increase, mainly those building new systems, reaching 152 institutions in July 2013.

Internally, the organization of the DRF advanced steadily, as steps were taken to turn its administration over to the next generation. When it comes to cooperation with existing industry organizations, however, sufficient efforts have not been made to set up the necessary contacts. Under such circumstances, part of the Degree Regulations were suddenly revised from fall of 2012. It was with opportune timing that moves were made to carry out close contact and cooperation between the MEXT administrative divisions and DRF, and to share the latest information on information aggregation sites on the DRF website.

3.2 Copyright management (SCPJ)

As with the DRF, the SCPJ project is a continuation of a support project that began in the 2006 academic year. While there is no denying the significance of this project, it shares the same weakness with many other support projects of being limited to the single organization carrying it out and not being expanded beyond the organization in charge of running it each year (such as by splitting up the processing duties or widening the participating organizations in the joint project). The SCPJ project made efforts to conduct surveys and the like over the years it was carried out, but Phase 3 ended without making sufficient strides to build consensus on copyright policies through coordination among the publishing sector, libraries, universities and research institutions.

The project did make contributions to community support, the theme of Area 3, but cannot be seen as having achieved creation of a new community or continuity of the community.

3.3 Human resource development

A new issue that arose as IRs came to be established in each university is human resource development. In the “Advancement” period of Phase 2, there was wide demand for rollout training of staff in institutions newly creating IRs; and staff from early-adopter institutions, who form the core of the IR community, were active in providing nationwide support. In Phase 3, human resource development took on a new dimension. Against the background of the practice common in national universities of reassigning personnel every three years or so, demand grew for training of new appointees to take over duties in institutions with IRs already up and running. Another factor was that as the Japanese IR community pursued ties with the overseas community, they came into contact with more advanced training systems, based on specialized experiences accumulated in countries like the U.K. with personnel

practices different from those in Japan (e.g., IR staff are hired as specialists and are not subject to the personnel transfer that is part of generalist education in Japan), leading to an awareness of the need for upper-level training for the sake of further advances in Japan's IRs.

While the IRs through Phase 2 retained a largely experimental and trial color, by Phase 3, against the background of steady progress in disseminating research results in service of the institution's accountability to society, their place became increasingly established in the everyday duties of an institution. Human resource development, likewise, through Phase 2 was a volunteer effort by the community, whereas from Phase 3 it was carried out on a more organized basis in the new framework of IR successor training and IR specialist training conducted by institutions in conjunction with the NII.

In developing human resources through IRs, the aimed-for skills go beyond operational knowledge concerning system operation. They include also the ability to draw up proposals, build a consensus, and obtain the budget for startup of new projects, as well as the skills for creating an organizational collaboration structure in the institution across departments, keeping track of the actual activities of each researcher, and carrying out duties based on a broad understanding of pioneering initiatives in Japan and other countries, of the basic concepts and policies governing the institution's research efforts and information infrastructure, and of government policies. While these skills are essential for personnel in an educational and research institution, they are skills seldom encountered as long as one remains within the framework of traditional library work. There was a time when the key issues for university libraries were computerization of library duties and dealing with electronic journals. When the focus came to be on IRs, one feature of the time was the emergence of management personnel from the ranks of IR personnel.

4. Prospects for the Future

The NII and the Private and Public University Libraries Consortium concluded a collaboration agreement in October 2010, with the second area of cooperation being to create a system for disseminating university knowledge by means of IRs. In the 2013 academic year, the specific organization for deciding matters to be carried out under the agreement was at last becoming finalized. It is hoped that this will be the occasion for solving the lack of governance seen as the biggest issue in Area 3.

In the 4th Science and Technology Basic Plan (adopted by cabinet resolution of August 19, 2011), heading the list of promotion measures is open access, with the role of IRs indicated clearly. In talking about the need for information dissemination, the Basic Plan starts out by mentioning the Fukushima Daiichi Nuclear Power Station accident, and notes that the need for communicating information in and outside Japan is now more urgent than ever. Making research results known is demanded also each time an issue comes up with China and South Korea regarding different views of history. People in universities need to be aware that these crisis situations and urgent demands form the background.

What can be done in such a situation? In open access, the direction of information flow is turned around. Traditionally, the main roles of libraries were to obtain resources from outside the university and provide them for use inside the university. Today, universities are strongly demanded to communicate to the outside world the research results produced inside the university. The IR community has endeavored to develop human resources with a view to changing awareness, so as to make this 180 degree shift in the research information infrastructure. It would be best for the power accumulated by the community to be utilized hereafter for the sake of the whole.

V. NII Provision of JAIRO Cloud, A SaaS type IR cloud service

The history of JAIRO Cloud began at the same time as the start of Phase 3 of this program (the 2010 academic year). After the system and service were designed, repeated trials were carried out in pioneering universities. Table V-1 summarizes the history to the start of operation, including the development of the system, regulations, and manuals as well as the establishment of the early community.

As of December 2013, the system was operating stably for service provision to organizations newly setting up an IR. From the 2014 academic year it is planned to expand the scope of organizations participating in JAIRO Cloud, actively accepting migration of institutions already operating their own repositories. The already existing IRs are operated based on functions each institution has worked to perfect over the years, including the results of Area 2 of this program. The challenge for JAIRO Cloud is to determine which leading-edge initiatives could be incorporated in the service as common functions, and how the service level and value of IRs throughout Japan could be raised while considering cost-effectiveness.

The content registered in JAIRO Cloud and the repositories of each institution is provided in junii2 metadata format, is harvested by means of OAI-PMH, and is stored in the Institutional Repository Database (IRDB). The growth of Japan's IRs is to be seen in the IRDB content analysis system. In the IR Portal (JAIRO), cross-searching of Japanese IRs can be performed using metadata stored in the IRDB. Sharing the information in the IRDB with CiNii as well helps increase accesses to IRs. The existence of junii2 and the IRDB, moreover, enables flexible support for new initiatives, such as collection of dissertations and support for JaLC. By closely linking NII services and the IRs of university libraries, an ecosystem has been established for encouraging distribution of academic information. The idea of collecting information in Japan's IRs so that the information can be used more actively may seem only natural. The fact is, however, that there are hardly any examples to be found in the world of comprehensive initiatives whereby standards are drawn up and all the libraries throughout the nation are combined in this way.

Much still remains to be done, however, from the standpoint of sharing and distributing information more strategically. The first candidate is to enhance OA content by making use of CiNii and ILL logs. Thanks to the development of JAIRO Cloud, it is now possible to proceed from the idea stage to implementation and testing in a short time. In order to raise further the significance and value of IRs, further initiatives are needed that make the information aggregated in the NII a source of power for university libraries.

Table V-1 Timeline to the start of JAIRO Cloud operation

| | |
|-----------|---|
| Apr. 2010 | Start of WEKO development and verification on NII private cloud |
| Oct. 2010 | Start of coordination with trial users concerning service type templates including system configuration, served institutions, and target (200 institutions) |
| Feb. 2011 | First user seminar at Shinshu University |
| Apr. 2011 | Drawing up of requirements for and start of verification testing |
| Aug. 2011 | Addition of participating organizations and continuation of verification testing using Shinshu shared repository |
| Sep. 2011 | Holding of explanatory meetings on a shared IR platform in six locations in Japan |
| Dec. 2011 | Adoption of JAIRO Cloud as service name |
| Jan. 2012 | Hands-on JAIRO Cloud seminars in three locations in Japan |
| Apr. 2012 | Launch of official operation of JAIRO Cloud Start of release by Kobe Shoin Women's University as first user |

VI. Prospects for the Future

1. Looking Back at the Support Program

The NII in cooperation with university libraries has endeavored for the past decade to promote IRs in Japan. These efforts began with the Institutional Repository Portal Project conducted in the 2004 academic year. A joint project with six university libraries, it made trial use of DSpace and EPrints, representative open source software for IRs, to archive the various knowledge and experience of each library and share these with the library community.

Based on this trial, in the 2005 academic year the NII Institutional Repositories Program was begun, aimed at promoting the establishment and linking of IRs, in the broader context of the CSI program.

The biggest fruits of these efforts were their success in accelerating the establishment of IRs in Japan, resulting in a large increase in the number of institutions with repositories, and their contribution to increasing awareness of IRs. At the time the program started only a few institutions in Japan had repositories, but by December 2013 the number had grown to 399, far more than had been expected. The steady rise in number of institutions over the course of the program can be attributed to the diligent educational efforts by university libraries. With the release of JAIRO Cloud in 2012 and the revision to the Degree Regulations by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), the number of smaller institutions setting up an IR began to rise at a stepped-up pace.

At the start of this program, the definition of IR and the significance of IR establishment by university libraries were discussed. It was also a time of considerable discussion as to the kind of content university libraries should make available and in what form. The answers to those questions began to come into view in retrospect after IRs had become more commonplace, but even today a definitive consensus has yet to be reached.

The program began by adopting a broad definition of an IR as “an archive for storing and making available various scholarly content produced in the university,” without setting any particular scope of the content to be archived, but leaving IRs as voluntary initiatives of each institution and without clarifying the role to be played by libraries in the repository.

Today, IRs in Japan have come to show their presence as (1) archives providing texts mainly of research bulletins, along with some peer-reviewed journal papers, and (2) digital archives providing full texts of dissertations.

What must not be overlooked, however, is that behind the birth of institutional repositories was the emergence and development of the open access (OA) movement. In a sense, OA is a destructive movement for existing academic journals. Taking a broad view of OA, it can be seen as one undercurrent in the revolutionary flow of digitalized information on networks that started in the 1980s. The institutional repository can then be seen as one way of promoting OA, born in the limited domain of academic information. Against this backdrop, it would also seem that university libraries, responsible for securing academic information, had no choice but to get actively involved in IRs.

As prices of academic journals continued to rise, symbolized by the serials crisis, moves started up in search of new ways of distributing academic information. It is important to see the position of the IR in this growth process. Initially when the program started, due to the political aspects of OA, clearly tying IRs to OA was deliberately avoided, resulting undeniably in some ambiguity in the positioning of OA in

the program as a whole. Moreover, even if the program had clearly been branded as an attempt to impose OA on academic papers through self-archiving, it is doubtful whether university libraries would have been able to align their courses so that all moved in the same direction. Judging from deliberations in the British Parliament in recent years regarding the Finch Report, which has given rise to much controversy, it would be hard to conclude that the significance and usefulness of self-archiving are settled matters at this point in time. In Japan, too, while the importance of promoting OA through IR establishment has been taken up in the 4th Science and Technology Basic Plan, OA has still not advanced far conceptually and discussions are at an early stage. Compared to the West, there is inevitable concern that Japan lags behind in OA in discussions on the conceptual front and in activities toward institutionalization.

One more important feature of this program is that it looked to the libraries participating in the program for their voluntary activities and leadership. Adopting the approach of public calls for proposals, it set application areas allowing also for R&D conducted on a trial basis. It was hoped that the IR community would become stronger as a result and that a structure would be established for taking on new issues. A major goal of this program was that through these activities a place would be created for developing personnel to take over in the next generation. In the increasingly difficult environment for universities, not only financially but overall, more time will be needed before deciding whether this goal has been achieved.

2. Issues for IRs in Japan

For university libraries, operating an IR has come to be taken for granted. Various issues remaining at this point in time have been discussed in each section of this report, but the points considered to be the most important will be reviewed here.

2.1 Enhancing the platform and functions

Over the course of the program, development and operation support has been provided for R&D on a variety of IR platforms such as DSpace and XooNIPs, as well as for developing the support systems needed for repository operation such as SCPJ and ROAT.

From 2012 the NII set out a policy of providing JAIRO Cloud and promoting repository creation by means of WEKO. Behind this policy is the realization that the further spread and advancement of IRs will require platform standardization and concentration of resources for system development. At the same time the NII has the responsibility to ensure that repositories in Japan do not become technologically incompatible with the rest of the world, and to continue providing and maintaining an advanced support environment. To this end, the need is seen for a different kind of repository community than that up to now. Especially when it comes to advancing an innovative repository development environment, an important issue is how to go about incorporating and utilizing the results developed over the course of this program.

2.2. Repository assessment

As a result of this program, the number of IRs grew and they came to hold a respectable volume of content. In order, however, to obtain stable financial support from universities and realize a virtuous cycle enabling human resources to be deployed, it is necessary to create a situation in which various sectors in and outside the university recognize the value of IRs.

Expected to be key movements going forward are research results database enhancement and ensuring of open access for the results of publicly funded research. What are the roles to be played by IRs and university libraries in these movements? This is a question worth considering. From the start of this

program there have been universities looking to connect their IR to the university research results database; but even as the trend to strengthening assessment of research results gains further momentum, university libraries in Japan still lack a clear vision.

Likewise, they have only the slightest awareness concerning the mandating of OA in university faculties, a movement that is steadily growing in the West.

As universities attempt to clarify the significance of its repository within the university organization and to obtain further support for library activities in a new direction, the need is likely to arise for redefining the concept of OA in each university.

2.3 Subject repositories

A number of subject repositories were supported through this program. As the total of academic information continues to grow exponentially, a variety of subject-specific services may well become necessary. In such cases, the repositories built by each institution will function as archives of the materials for building subject repositories. For example, member research results papers provided by university IRs will function as the text linked to from the subject repositories put together by research institutions for individual disciplines.

In the future, the types of content included in repositories are expected to become more diverse along with progress in the archiving of databases, images and other types of material, further raising the importance of subject repositories, which offer cross-sections of the content in each IR and increase their added value. IRs will likely come to function as the foundational systems underlying such subject repositories.

2.4 Human resources and linking across organizations

In the course of this program, specific policy measures for strengthening community formation came to be discussed. This was because, while initially it was expected that libraries would be forthcoming with ideas, as the participating institutions increased in number, there was a growing need to provide organized assistance at various levels. When helping smaller institutions establish a repository, fine-tuned support is important. Meanwhile, moves to standardize and share systems and carry out international cooperation were expected to raise various skills of the personnel taking part.

Against this background the NII came up with the idea of developing and deploying JAIRO Cloud. Cloud introduction is seen as having major benefits, one of them being that it eases the system administration burden on repository staff, providing an environment in which they can concentrate on enhancing content. Provision of a common platform for repository establishment and concentrating resources should also result in overall efficiency. At the same time, the most hoped-for benefit is that in the community formed around JAIRO Cloud, the ease of passing along and sharing the skills of repository staff will not only raise the technical level, but will encourage the further development of human resources who can open up new horizons in OA-oriented library activities growing out of IRs.

3. The Next Stage of Activities

The R&D results of this program are currently not ready to be used as widely shared resources, and will need to be raised to a higher level of maturity for common use. The key points in so doing can be seen as (1) international collaboration, (2) improved accessibility, and (3) standardization and advancement of metadata. The individual results obtained from this program will next need to be studied carefully and reflected in cloud functions. It is to be hoped that in this process, human resources will be developed through support for fruitful collaboration transcending institutions.

Activities like the above must be kept in mind in international collaboration as well. While the community has long been engaged in gathering information about activities outside Japan, insufficient effort has been devoted to making use of global movements for deciding the community's own direction or to collaborating on projects and realizing common systems.

Such international collaboration cannot be carried out absent bold efforts to put the results into practice in Japan. Moves in this direction are to be seen in such areas as use of ORCID for researcher identification, but greater efforts must be put into strengthening global cooperation based on the practices of individual universities.

The intrinsic difficulty with IRs is that their benefits cannot be realized adequately through the efforts of one institution alone. To users desiring a proper discovery service for academic information, the important thing is content coverage. In cases, however, where the institutions providing the target data are few and the archived data volume is small, adequate coverage and desired level of usefulness for the user cannot be achieved.

One result of this program is that the number of institutions having repositories has gone well beyond critical mass. The next issue will be to demonstrate their usefulness by means of content coverage. In addition, an important measure for assessing future efforts will be the degree to which accessibility to the diverse content needed in education and research is improved, by linking to the Grants-in-Aid for Scientific Research database (KAKEN) and other such services.

A key feature of IRs is metadata standardization. For a repository in the narrow sense, it is natural for it to hold primary information such as the texts of academic papers, or for future repositories, data itself including research data; but if it adopts its own proprietary metadata that repository will be cut off from the rest of the world. Essential to realizing a usable discovery service is to standardize the metadata provided by each institution and also to achieve interoperability across each institution.

There is an implicit understanding regarding the metadata format used by repositories today that it applies to academic papers and to content that can be supported by extensions thereof. When research data, learning materials and other such content come to be archived, the most important issue will be to develop metadata that are useful from the standpoint of users, and for each institution to assign the same standard metadata.

The NII intends to continue supporting the innovative efforts of practical implementers with a desire to help develop the academic information infrastructure. To this end we will go on planning projects, while aligning our course with the newly established Committee for the Promotion of Institutional Repositories.