

Possibilities of Networked Electronic Theses in Japan

ETD 2013 Conference Paper

1. Introduction

In Japan, the system of granting degrees is governed by the degree regulations (the Ordinance of the Ministry of Education, Science and Culture No. 9) that were established in 1953, following the 1947 enactment of the School Education Act.

Regarding degree awarding, university libraries are concerned with the preservation and provision of doctoral theses for public consultation. The degree regulations before April, 2013 stipulated that “a person who has been conferred a doctorate shall publicize the entire thesis in the form of printing.” The printed doctoral thesis was generally preserved in the library of the university that had awarded the doctorate and could be read by users upon request. In accordance with the degree regulations, one copy of the doctoral thesis was also sent, at its request, to the National Diet Library (NDL),¹ which is a legal deposit library of Japan. The NDL preserved and provided the copy for public reading. Thus, “publicized” doctoral theses had been secured in at least two types of libraries in the “form of printing” before April, 2013.

Due to the revision of the degree regulations in April 2013, “publication in the form of printing” was revised to “publication via the Internet.” Regarding the revised degree regulations, the notification by the Director-General of the Higher Education Bureau,² the Ministry of Education, Culture, Sports, Science and Technology (MEXT) stated that the institutional repository (IR) of each degree awarding institution should mainly be used for “publication via the Internet.” Following this, the NDL was to automatically collect doctoral theses from IRs through the Internet.

After the revision of the degree regulations, the Japanese Coordinating Committee of University Libraries (JCCUL), which is an organization that regulates university library communities in Japan, drafted guidelines to be followed when performing “publication via the Internet” using IRs, and sent the guidelines to associations of national, public, and private university libraries in cooperation with the MEXT, the NDL, and the National Institute of Informatics (NII).³ With this development, each university could now play an important role in “publication via the Internet.”

In Japan, IRs have been rapidly established through the financial support of the NII’s Institutional Repositories Program (IRP),⁴ which was launched in 2005. As of July 2013, 243 repositories, including repositories shared by multiple institutions, have already been inaugurated. A nationwide IR community called the Digital Repository

Federation (DRF)⁵ has been formed to perform various information-sharing activities (Ikuko Tsuchide et al. 2013), and human support systems have been prepared. The standard for metadata called junii2⁶ has been developed, and the metadata of each institution, compliant with junii2, are harvested using the NII's Institutional Repositories Data Base (IRDB) Contents Analysis System⁷ instead of individual IR platforms. Using the NII's Japanese Institutional Repositories Online (JAIRO)⁸, a user interface of the IRDB, one-stop search service is provided. The JAIRO is partially linked with the Citation Information Service by NII (CiNii)⁹ that searches journal articles in Japanese. Thus, infrastructure for the use of open-access contents has been sufficiently developed.

“Publication via the Internet” due to the recent regulatory revision requiring open access to doctoral theses becomes feasible because of the sufficiently-mature infrastructure and university library communities, whose horizontal cooperation has been reinforced through various projects regarding IRs. The revision of the degree regulations, by which open access to doctoral theses using IRs is mandatory in principle, opens up the possibility of forming “networked electronic theses.”

Regarding the progress of government bodies and university library communities toward the formation of networked electronic theses in Japan, this paper describes (1) the present situation of IRs in Japan, (2) the present situation of degree regulations and the main points of the revision, (3) possibilities of networked electronic theses using IRs, (4) activities of university library communities, and (5) future perspectives (conclusion).

2. Present Situation of IRs in Japan

2-1. Development of IRs

According to the Directory of Open Access Repositories (OpenDOAR),¹⁰ of 138 repository platforms (only for IRs which have already been registered in the OpenDOAR), 99 were DSpace (the largest number), as of July 13, 2013. Some IRs used commercial software, but many used open source software.

The first IR in Japan was Chiba University's Repository for Access to Outcomes from Research (CURATOR),¹¹ established in 2004. CURATOR has mainly collected departmental bulletin papers or memoirs from the beginning, and this manner of collection is the foremost characteristic of IRs in Japan. In Japan, although bulletin papers have been digitized in some universities, they have been generally distributed in the form of contribution and exchange. In the case where a researcher wants to access the information of a paper inserted in a bulletin paper, if the researcher's university does not preserve the bulletin paper, the researcher asks another university, which possesses

the bulletin paper, to copy the paper. This procedure has been widely adopted. Since universities opened bulletin papers to the public through IRs in a significant way, the number of inter-library requests for photo-copying papers has decreased. Thus, IRs have been determined to be effective (Kenji Koyama et al. 2008) . At present, the number of full-text materials that are publicly available through IRs is approximately 1.2 million. Of these items, approximately 52% are departmental research bulletins (Figure 1).

Despite the initial focus on these bulletins, IRs have also collected peer-reviewed journal articles, doctoral theses, and research reports, as shown in Figure 1. Doctoral theses and research reports are considered to belong to the category of “gray literature.” Since 2005, many IRs have been established in national, public, and private universities, inter-university research institute corporations, and independent administrative agencies through the NII’s IRP. As of March 31, 2013, the number of IRs was 243 and the number of organizations, in which IRs had been established, was 351 (Figure 2).

[FIGURE 1]

Figure 1. Temporal changes in the number of contents in IRs and the details of the contents

[http://irdb.nii.ac.jp/analysis/index_e.php] (CAPTION)

[FIGURE 2]

Figure 2. Temporal change in the number of organizations in which IRs have already been established

[http://www.nii.ac.jp/irp/en/archive/statistic/irp_2013_statistic.html] (CAPTION)

2-2. IR communities in Japan

Several IR communities exist in Japan. Three IR communities are described briefly here.

Digital Repository Federation

A typical IR community in Japan is the DRF, which was organized in 2006 with support from the IRP. The aim of the DRF is to facilitate information sharing to accumulate academic achievements in universities and research institutes, to internally and externally transmit the accumulated academic achievements, and to support information sharing.^{1 2} As of August 23, 2013, 152 organizations (including universities and research institutes) participate in the DRF.

Communities of regional repositories

Japan also has regional repositories, and regional repository-based communities have taken action (as of July 20, 2013, 11 regional repositories exist). Regional repositories have typically been established in the form of one regional repository for each prefecture. Each regional repository typically contains materials from 20 to 30 large and small national, public, and private universities.

JAIRO Cloud community

JAIRO Cloud^{1 3} is a cloud-type shared IR based on WEKO, a repository module, operated by the NII. The JAIRO Cloud community supports mutual aid among institutions using JAIRO Cloud. Due to the revision of the degree regulations in April 2013, a person who has received a degree (doctorate) is obliged to publicize the doctoral thesis through the Internet, and the recommended venue to achieve that is the appropriate IR. JAIRO Cloud is available for institutions, in which IRs have yet to be established.

2-3. IR networks in Japan: Portal services by the IRDB and the JAIRO

In May 2007, the NII launched JuNii+, which is a research service for IR contents in Japan. Since October 2008, JuNii+ has been publicized as JAIRO. The IRDB has responsibility for the harvester function of the JAIRO. Metadata collected from each IR by the IRDB are in the form of junii2, which is the standard of metadata developed based on Dublin Core, and almost all IRs in Japan support metadata in the form of junii2.

Using the collected data, the IRDB analyzes the contents of each IR and provides statistical functions. The collected metadata are also used for the JAIRO and the CiNii, which are database services provided by the NII. Using the IRDB and the JAIRO, open-access contents publicized by IRs can be comprehensively and easily searched. Thus, the JAIRO becomes the national portal of Japan. As of March 31 2013, 271 institutions (to be harvested) and 1,610,939 contents (1,198,005 full-text items)^{1 4} can be searched.

3. Present Situation of Degree Regulations in Japan

3-1. Overview of the degree regulations before the revision in April 2013

In Japan, in order to guarantee that the quality of a doctoral thesis proves the researcher's ability to perform research activities independently, the degree regulations before the revision provided that "a person who has been conferred a doctorate is

obliged to publicize the entire thesis in the form of printing,” so that universities could mutually guarantee the quality of doctoral theses conferred by each university.

Regarding publication of doctoral theses in the printed form, no actual details were provided in laws and regulations. However, the Ministry of Education, Science and Culture (MEXT) advised that doctoral theses were to be inserted in publications such as books and academic journals. At present, although digitization has advanced, a doctorate recipient shoulders the burden of printing the doctoral thesis. In some cases, the preservation and provision of a doctoral thesis for public reading in the library of the degree-awarding university and the NDL are considered as the publication of a doctoral thesis in the form of printing. Thus, the present degree regulations are inconsistent with the actual situation of doctoral theses.

3-2. Main points of the revision of the degree regulations^{1 5}

To facilitate the digitization of and open access to universities’ educational and research achievements, to reduce the burden of printing a doctoral thesis, and to effectively attain the purpose of the degree regulations, the degree regulations were revised so that after April 1 2013, doctoral theses would be publicized through the Internet.^{1 6} The present degree regulations provide that doctoral theses must be open to the public for a long period of time instead of temporary availability.

The degree regulations were revised as follows: (1) a degree-awarding university shall publicize the abstract of a doctoral thesis and the abstract of the results of thesis review through the Internet within three months after conferring the doctorate, and (2) a doctorate recipient shall publicize the full text of the doctoral thesis through the Internet within one year after receiving the doctorate.

The publication of a doctoral thesis through the Internet should not be performed by each doctorate recipient using his/her own preferences, but the university that has awarded the doctorate should shoulder the responsibility of managing and transmitting the doctoral thesis. Therefore, the present degree regulations provide that a doctorate recipient shall publicize the doctoral thesis in cooperation with the university that has awarded the doctorate. Regarding the actual method of the publication, the MEXT advised that, in principle, the IR of a degree-awarding university should publicize the doctoral thesis. A university without an IR should consider establishing one as an important device to accumulate, transmit the scholarly information and make it openly accessible on the Internet. Until an IR is established, the university should publicize doctoral theses on its website. Alternatively, such a university can submit a doctoral thesis to the NDL and the NDL provides the doctoral thesis through the Internet instead

of the publication of the doctoral thesis using an IR.

The NII supports the establishment of an IR, and the NDL collects and preserves full texts of doctoral theses just as before.^{1 7} For the NDL to collect and preserve doctoral theses and for the NII to construct an environment for exhaustively searching doctoral theses, a system was developed, in which copies of degree awarding reports are shared. A degree-awarding university is obliged to submit a copy of a degree awarding report to the Minister of MEXT.

Under the present degree regulations, doctorate recipients are obliged to publicize full texts of doctoral theses. When a degree-awarding university allows a doctorate recipient not to publicize the full text of the doctoral thesis due to an objectively unavoidable reason, the doctorate recipient can publicize the summary of the doctoral thesis instead of the full text. In this case, the degree-awarding university must provide the full text of the doctoral thesis, in print or in digital format, for public reading by request and the university must send the full text to the NDL. Once the unavoidable reason no longer exists, the doctorate recipient must publicize the full text of the doctoral thesis.

3-3. First political commitment of the Japanese Government toward open access

According to the School Basic Survey^{1 8} conducted by the MEXT in 2012, 783 universities exist in Japan. Of these universities, the number of national universities was 86 (with doctoral programs in 77), the number of public universities was 92 (with doctoral programs in 56), and the number of private universities was 605 (with doctoral programs in 303). In Japan, approximately 15,000 doctoral theses have been produced every year in these 436 doctoral universities. Due to the recent revision of the degree regulations, all doctoral theses after April 1 2013 have been publicized through the Internet using IRs and the NDL, although some are publicized in the form of full text and some are in the form of summary. This is due to the first mandatory open access policy of Japan, which puts the fourth Science and Technology Basic Plan^{1 9} into concrete form. The fourth Science and Technology Basic Plan facilitates IR construction and open access. The mandatory open access policy occupies an internationally important position in terms of scale and significance.

4. Possibilities of Networked Electronic Theses using IRs

*4-1. Revision of *junii2*, the Japanese standard for metadata*

Drawing on the discussions in Sections 2 and 3, this section describes how to create an electronic thesis network.

The degree regulations before the revision stipulated the printing of a doctoral thesis as the means by which the scholarly community could verify an appropriate level of quality. The recent revision of the degree regulations changed the publication device from printing to the Internet. By this, the purpose of the degree regulations could be effectively attained, which in turn required that publicized doctoral theses must be able to be found efficiently and easily. Even if doctoral theses are publicized through the IR of each degree grantor, the individual existence of an IR is ineffective for this purpose.

As mentioned in Section 2, junii2, which was developed by the NII, is the standard format for metadata in Japan. When each repository inputs metadata in accordance with junii2, the IRDB can harvest the metadata. Section 2-5 showed us that the IRDB harvests metadata from 271 institutions,²⁰ analyzes the contents, and performs JAIRO services. After launching JAIRO services, doctoral theses can be comprehensively searched and found quickly.

Following the recent regulatory revision, the NII revised junii2 so that the following metadata elements were added as descriptive elements of doctoral theses:²¹

- (1) granted (degree number)
- (2) dateofgranted (date of degree awarded)
- (3) degreename (degree name)
- (4) grantor (degree grantor)

When a person who has been awarded a doctorate after April 1, 2013 registers the doctoral thesis in an IR, all the above elements are required. By these elements, “when,” “from which organization,” and “for what field” the person was conferred a doctorate can be specified. When these metadata elements are harvested by the IRDB, a doctoral thesis can be found with a very high probability, making it easier for the quality of each doctoral thesis to be determined.

The schema of “textversion (publisher),” an existing element, was also updated. The textversion describes the version of a registered content. In addition to the existing three elements of “author/publisher/none,” “ETD” (including the main body of a doctoral thesis) was added as an option. By this addition, where the full-text file of a doctoral thesis is included it can be specified, and the full text of a doctoral thesis can be harvested by the NDL, as described below.

4-2. Modification of crosswalks for IRs in degree-awarding universities

Degree-awarding universities that operate IRs use various types of software ((DSpace, XooNIps, etc.). For metadata to be harvested by the NII's IRDB, crosswalks must be modified.

When metadata are harvested by a service provider such as the NII, crosswalks determine which metadata item of the original party is output to which metadata item of the receiving party in the form of XML. For example, Tsukuba Repository, the IR of University of Tsukuba (DSpace is used as the platform), uses the element <contributor.author> as the input field for the author's name. In junii2, the element <creator> is used as the input field of author's name. For a doctoral thesis to be correctly harvested by the IRDB, Tsukuba Repository sets crosswalks in such a way that data with <contributor.author> are delivered to the IRDB as data with <creator>. Each university must add the aforementioned elements to its software registration screen and establish appropriate crosswalks.

4-3. *NDL's automatic collection of full texts from IRs*

Before the revision of the degree regulations, the NDL had collected, preserved, and provided doctoral theses which had been sent from universities in book form. After the revision, the NDL is to collect, preserve, and exhibit doctoral theses that have been publicized through the Internet.^{2 2}

Following the publication of a thesis in the form of electronic data, the NDL is to collect doctoral theses using one of methods: (1) automatic collection or (2) direct transmission from universities using the NDL's data transmission system. Automatic collection is available on the assumption that the repository of each organization should correspond to the revised junii2, and metadata can be harvested by the NII's IRDB. Moreover, when the date of degree awarded (dateofgranted) of metadata is after April 1, 2013 and the publisher (textversion) is "ETD," full-text data can be automatically collected. With this method, each organization is not necessary to send doctoral theses in book form to the NII. Figure 3 shows a schema of the publication of a doctoral thesis through the Internet after the revision of the degree regulations.

[FIGURE 3]

Figure 3. Schema of the publication of a doctoral thesis using an IR (the arrow indicates the flow of data) (CAPTION)

(1) First, a degree applicant submits his/her digitized doctoral thesis to the section in charge of degree awarding through an electronic medium. (2) After the

doctoral thesis is accepted, the doctoral thesis is publicized from an IR established by the degree-awarding university through the Internet. (3) Metadata in accordance with JII2, the Japanese standard for metadata, are harvested by the NII's IRDB. (4) The NDL collects metadata from the IRDB. (5) The NDL automatically collects full texts of doctoral theses by visiting IRs using the URLs of full texts in metadata. The NDL provides doctoral theses for in-library public reading and permanently preserves their electronic files, which is a critical mission of the NDL.

4-4. Support from the NII and the NDL to universities without IRs

When the IR of a university does not mesh with the automatic collection by the NDL or when a university has not established an IR and the publication of a full text is performed on its website, doctoral theses are directly transmitted to the NDL using the NDL's data transmission system. That is to say, these universities transmit metadata and full-text data to the NDL using the NDL's data transmission system (Figure 3 (6)). The NDL has been developing a data transmission system to be in use by early 2014.

Some universities without IRs began to consider the establishment of an IR following the revision of the degree regulations. The NII is urging these universities to participate in JAIRO Cloud, which is a shared IR as noted in Section 2. At present, more than 100 institutions (including those still in the application phase) are taking part in JAIRO Cloud and establishing IRs. As shown in Figure 2, the number of institutions in which IRs have already been established grew significantly during the year between March 2012 and March 2013, and the increase is mainly due to new participants in JAIRO Cloud. Due to the recent revision of the degree regulations, the 436 national, public, and private universities with doctoral programs are required to publicize doctoral theses via the Internet. Almost all national universities have already established IRs, and some public and private universities will establish IRs and participate in JAIRO Cloud. Thus, systems of distributing doctoral theses will be improved even further.

5. Activities of University Library Communities

As indicated in Section 3, 783 universities (86 national, 92 public, and 605 private universities) exist in Japan. Each university has established a library in accordance with the Standards for Establishment of Universities. National, public, and private university libraries compose the Japan Association of National University Libraries, the Japan Association of Public University Libraries, and the Japan Association of Private University Libraries, respectively. In order to handle issues

common to all university library communities, an organization consisting of representatives of the above associations to regulate university library communities, called JCCUL (Japanese Coordinating Committee for University Libraries), was established.

Together with the NDL, the JCCUL has established a “liaison committee between the NDL and university libraries” to coordinate between the NDL and university library communities. As a liaison project, the committee has established a “working group regarding various issues on digitization of dissertations” (the WG) and examined a variety of problems with the digitization of doctoral theses in the last several years. In 2008, the liaison committee issued a report.^{2 3}

In order to accord with the revision of the degree regulations discussed in Section 3, the WG in cooperation with the MEXT, the NDL, and the NII created “points of attention to the revision of the degree regulation” (the points of attention)^{2 4} and distributed them to degree-awarding universities. The reason for its creation was that large differences were understood to exist in “literacy” about techniques required for the publication of doctoral theses using IRs, copyrights, and open access among universities. Almost all national universities have already established IRs. However, the number of public and private universities with IRs is lower than that without them, especially among the private universities.

The points of attention for publicizing doctoral theses through the Internet were divided into two groups and briefings were attached. One group was for degree awarding institutions and another group was for libraries. In almost all universities, libraries are in charge of IRs. The points of attention for libraries are as follows:

- (1) Publication of doctoral theses using IRs
- (2) Delivery of doctoral theses to the NDL (through the Internet)
- (3) Recommended file formats for digitized doctoral theses
- (4) Accordance with the standard for metadata (junii2) to correspond to the above points (1) and (2)

Regarding the publication of doctoral theses through the Internet, customs peculiar to Japan and various challenges with copyrights and other intellectual property rights exist. In the future, each degree-awarding university is expected to amend its degree regulations to accord with the degree regulation revision, to examine a suitable method to publicize doctoral theses using its IR, and to accumulate various examples. When university library communities are charged with a part of the above matters, the

JCCUL is expected to be in charge. Moreover, the DRF, an IR community, also exists. Thus, systems of accumulating and sharing information to facilitate open access to doctoral theses will be sufficiently prepared.

6. Future Perspectives (Conclusion)

As mentioned in Section 4, four metadata elements were added in order to describe doctoral theses. These elements correspond very nearly to elements used for describing doctoral theses in ETD-MS (version 1.1),^{2 5} as shown in Figure 4.

[TABLE14]

Table 4. Comparison between junii2 version 3 and ETD-MS version 1.1(CAPTION)

Customization of crosswalks enables information on doctoral theses to be harvested in principle. It permits IRs in Japan can be harvested by the Networked Digital Library of Theses and Dissertations (NDLTD) in the future. There is an option that the NDLTD collectively harvests IRs in Japan from the NII's IRDB, and each organization and IR community can participate in the NDLTD if it wishes. The approximately 15,000 doctoral theses accepted annually in Japan will be internationally recognized, and Japan's contribution to open access will be confirmed. The increase in the number of universities using JAIRO Cloud will facilitate the formation of a new community and will raise all library staff's awareness of open access.

The Japanese Government's intention of digitizing and providing open access to doctoral theses covers the entire educational and research achievements of each university. The success of networked electronic theses is expected to facilitate open access, supported by repositories and the Japanese Government, to other types of academic materials.

The current open access initiative on doctoral theses by the Japanese Government covers all universities possessing doctoral programs and certainly gives good effects on the open access movement in Japan. Activities of repository communities and policies of the Japanese Government are expected to be advanced further.

Note

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- ¹² See reference No. 5
- ¹³ JAIRO Cloud <https://community.repo.nii.ac.jp/> (accessed 30 August 2013)
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- ¹⁷ National Diet Library: Collection of Doctoral Theses in Japan (only in Japanese)
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