

How University Libraries Should Be in the Age of Open Science
(Summary of Deliberations)

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Subcommittee on How University Libraries Should Be in the Age of
Open Science, Committee on Information Science and Technology,
Council for Science and Technology (CST)

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1. Introduction

The Council for Science and Technology has been discussing and compiling reports on the form university libraries in Japan should take. The themes discussed have varied from time to time, but include the development of academic knowledge distribution infrastructure, centred on research, as follows: the concept of the science information system that paved the way towards the introduction of the catalogue information service (NACSIS-CAT/ILL) in the 1980s; the realisation of e-library functions in the 1990s; and the enhancement of the academic knowledge transmission functions of universities in the 2000s. The themes discussed also include the enhancement of information literacy education since the 1990s and the expansion of support for education and learning with the introduction of the learning commons concept from the 2010s onwards.

These have been the most important issues for university libraries in each era and, based on the reports received, university libraries in Japan have expanded their functions and have been oriented towards innovation in terms of the functions, means of utilisation, and services they are expected to provide. On the other hand, consistent in these discussions was the essential recognition that university libraries, as repositories of information, data, and knowledge, exist to maintain a system in which knowledge is continuously reproduced by increasing the discoverability of such information, data, and knowledge in the context of university education and research, by guaranteeing access to them, and by enabling their use.

Recently, the importance of new research support including data as a new form of content has been touted. In the establishment of a new research system (promotion of open science and data-driven research, etc.) in the Sixth Science, Technology, and Innovation Basic Plan approved by the Cabinet in March 2021, the management and utilisation of research data based on open and closed strategies are called for, and the direction of efforts such as the digital transformation of libraries and strengthening of support functions through such transformation are specified. Naturally, staff engaged in university library work are now required to respond to these new functions, and to even have the required knowledge to understand the differences in the handling and characteristics of data by field, in addition to their knowledge of database management and digitisation.

Furthermore, since December 2019, amid the significant restrictions on activities during the COVID-19 pandemic, the restriction of physical access to university libraries has had a significant impact on education and research activities. Under the circumstances, there is now a strong recognition of the urgent need to consider the nature of university libraries that

are not restricted by their physical location. In “Measures to promote future academic research and information science and technology towards the post-COVID era (opinion)” (30 September 2020, Information Committee, Council for Science and Technology), it was stated that: “The digitisation of university libraries and the digitisation of academic knowledge are closely related issues” and that “Consideration should be given and efforts should be made so that university libraries in Japan become interconnected digital libraries through the sharing of diverse academic information resources, etc.”

Based on previous reports, etc., the Council for Science and Technology established the “ Subcommittee on How University Libraries Should Be in the Age of Open Science” (hereinafter referred to as the “ Subcommittee”) under the Information Committee. The Subcommittee has discussed the roles and functions that will be required of university libraries in the future, and has compiled the following report.

2. How University Libraries Should Be in the Age of Open Science

The digital transformation (hereinafter referred to as “DX”) that is taking place in the field of education and research is having an impact on the state of university libraries. In terms of research, the establishment of a new system of science (promotion of open science and data-driven research) is required, and in addition to conventional books, theses, etc., research data will also be subject to management, publication, etc. Therefore, university library staff are expected to understand the life cycle of research and to establish relationships with researchers in order to promote research together. In terms of education, there is a need to realise learner-oriented education, and university libraries are required to be able to provide teaching and learning resources in the most appropriate form in consideration of the user environment, etc. As the DX in education and research requires collaboration among various departments within a university, it is necessary for university libraries to consider their functions while being aware of their position and role within their university’s overall education and research promotion system.

The development of DX in education and research requires university libraries to support various university activities as a “digital library” in a form suitable for future use in education and research. The “digital library” referred to here is a further development of the “electronic library” concept that was actively discussed in the 1990s. It also refers to the idea of a university library that promotes its own DX in a way that embraces changes in management, services, staff knowledge, and skills that are perceived to occur as a result of the digitisation of contents. In this summary of the deliberations, this new “digital library” is positioned as the ideal form—one that embodies the essence of today’s university libraries—to be

realised by FY 2030, when the next Science, Technology, and Innovation Basic Plan is due to be completed. The following examines concrete measures to achieve this from four aspects: contents and related services, the service environment, securing and development of human resources, and the cooperation among university libraries and other academic knowledge providers that is indispensable for realising the first three.

(1) The educational and research support functions and new services required of university libraries in the future.

[Points]

- University libraries will proceed with the digitisation of existing contents in a form suitable for use in future education and research, and promote open access of contents to be produced in the future as a result of academic research, etc. In addition, the various services that support the utilisation of digitised contents and current operations will be restructured with a user-oriented focus. Furthermore, university libraries will promote the accumulation, digitisation, and distribution of academic knowledge in Japan through collaboration among university libraries and other academic knowledge providers.
- In digitising Japanese-language collections of books, the digitisation of the collections of the National Diet Library (NDL) will form the core of the project, with steps taken to avoid duplication in the digitisation of the collections of individual university libraries. By optimising the environment to access such collections, a nationwide digital archive infrastructure will be built.
- Each university library will continue to actively promote open access of academic papers through institutional repositories, etc., and take appropriate measures to ensure that such papers are permanently available to the public.
- Each university library, in cooperation and collaboration with relevant departments, will consider and implement measures to increase the discoverability of publicly available research data. In addition, each university library will clarify its role as a university library and implement user-oriented initiatives while working within a university-wide research promotion system that considers the entire process from the start of research to the publication of research results (research life cycle) and addressing the trend towards the digitisation of education.

- University libraries have proceeded with digitising their book collections. The large-scale digitisation of Japanese-language collections is underway at the National Diet Library (NDL) and the National Institute of Japanese Literature (NIJL). These digitisation efforts have become extremely important for building Japan's academic knowledge infrastructure. Going forward, university libraries will need to systematically develop an

environment for the effective utilisation of this infrastructure for university education and research, taking account of the steady progress made by the government in building of such large-scale infrastructure. In doing so, university libraries should play a mutually complementary role by digitising their own collections that are not included in the government infrastructure. Efforts should be made to ensure that these digitised contents will eventually function as a nationwide digital archive that is visible to users as an integrated system.

- University libraries have promoted open access to academic papers, etc. published as the result of new academic research activities through institutional repositories, etc. Open access is an important component of open science, and further progress in open access is desirable in the future. There are currently various methods of open access, but whichever method is used, perpetual access needs to be guaranteed. DX is in progress not only in STM (science, technology, medicine) research but also in the humanities and social sciences, as exemplified by digital humanities. Promoting open access and digitisation of texts are also desired for not only journal articles, but also books and various reports. Particularly for fields where the digitisation of specialised books is lagging, it is also necessary to consider the role to be taken on by university libraries in digitising and making available books that are not candidates for commercial distribution.
- In recent years, in view of the promotion of open science and data-driven research, there is a need to reconstruct knowledge starting from research data. However, unlike theses, etc., research data is not standardised in terms of format across disciplines, and its volume varies widely from one discipline to another. According to “A Survey on Open Research Data and Open Access” (2020) by the National Institute of Science and Technology Policy (NISTEP), there are high expectations for support work for which specialised knowledge and data expertise would be considered a requirement, and needs related to data literacy and guidance are also high. On the other hand, although just under 60% of Japanese universities and research institutions actually provide or are considering providing research data management services, many have yet to formulate a research data policy and only a few provide literacy support and data curation support. Although many researchers would like to know more about data maintenance and publication, less than 10% of institutions have actually organised or are planning relevant training sessions or symposia. In view of this divergence between research itself and research support, there is a need to establish a researcher-oriented research data management environment and support system that fully respond to the characteristics of a given field and the reconstruction of knowledge starting from research data.

- With regard to open research data, various types of professional support are required at each stage of the research life cycle, which is where university libraries become involved. Various departments within a university (e.g. information systems, research promotion, etc.) are therefore required to work together in close cooperation and collaboration and with a clear definition of roles to establish an effective support system to be used by researchers. It is also important to consider how to cooperate or share roles with commercial publishers, etc., which are currently involved in the research process from initiation to evaluation.
- Under these circumstances, the first role university libraries should play with regard to open research data is to increase the discoverability of publicly available research data. In order to achieve this, it is necessary to create and accumulate field-specific metadata that describe the contents of the data in detail. This needs to be done— on the premise that international identifiers are assigned to researchers who are the creators of data or authors of theses as well as to the data and theses that are produced as a result of using this data—in parallel with building a system that links such data and theses and makes them mutually searchable. A nationwide system is essential for the creation and maintenance of such a system, but its specific features need to be discussed in the future.
- Meanwhile, regarding the DX in education, the Compensation System for Public Transmission for Educational Purposes was established in 2020 to ensure the ready use of various copyrighted works as teaching materials in order to maintain the quality of education in distance learning, etc. using information and communication technology, and to respond to new teaching methods such as the flipped classroom. To enable teachers and students to use copyrighted works in the classroom without fear of overstepping legal boundaries, university libraries, which handle copyrighted works on a regular basis and are knowledgeable about the Copyright Act, could in the DX era be in charge of providing copyright education as part of information literacy education as well as offering advice on individual cases.
- In addition to this, attention should also be paid to the long-term preservation of digitised materials, the handling of paper materials as a backup, and the relationship with licensing agreements when handling digitised materials. In addition, regarding the response to copyright following changes in the functions and services that university libraries are required to provide, such libraries are required to take into account related rights, etc., and, if necessary, make recommendations on the nature of various systems.

(2) The effective utilisation of information science and technology, as well as university libraries as “spaces,” to achieve the abovementioned support functions and services.

[Points]

➤ The realisation of a “digital library” requires a redefinition of university library functions in a way that is not constrained by physical “spaces.” To achieve this, it is necessary to clarify the “library schema,” organise and re-examine what users want, and build an optimal environment designed to reflect these.

➤ In doing so, the entire university will consider that part of the existing work related to the development of the learning environment that has mainly been carried out by the university library, including reconsidering whether the university library will continue to carry out this work, based on an evaluation of library activities carried out to date.

- The digitisation of books held in library collections and other books, etc. that circulate in society will bring about an environment in which machines, rather than people, are tasked with reading and processing large amounts of text. Based on this, digitised contents will be accessible irrespective of their physical location by making it institutionally possible to transmit such contents directly to users and publish them on the internet. This has the potential to eliminate disparities in access to information that clearly existed in the days when people relied on paper documents.
- With the development of DX in education and research, future university libraries are required to redefine university library functions and realise services accordingly, without being constrained by physical “spaces.” For example, the transformation of teaching and learning styles in education into a model of “anytime, anywhere, with anyone” is envisaged. In this context, it is necessary to reconsider what kind of information usage space teachers and students respectively need in terms of access to information and organise accordingly. The prerequisite for this is the need to clarify the “library schema” as the basic logical structure that defines its own existence, which is necessary for designing library services suitable for various users. What the “library schema” actually looks like will vary according to the research or teaching context, discipline, and position (e.g., teacher or student). Particular attention should therefore be paid to this point when realising university library functions in virtual spaces in the future. In the future, it is envisaged that different virtual spaces (metaverse) will be set up according to different

user positions and connected to the “library schema.”

- Since progress in the DX of education will significantly change the teaching and learning environment, university libraries will have to make new efforts to establish systems to support the use of copyrighted works in the creation of teaching materials. In doing so, activities to improve the learning environment in which university libraries have played a leading role, such as the provision of a learning commons, for example, should also be reviewed after evaluating the results of such activities. While university libraries should place the utilisation of digitised contents at the core of their functions, the learning environment should be restructured for the university as a whole.
- However, the realisation of “digital library” does not make physical spaces unnecessary. A university library as a physical space is expected to develop as a space where physical and virtual spaces merge, or as a space with added value, such as a sophisticated interface with virtual spaces, thereby enabling people to connect with people or people to connect with contents across time and space.

(3) The human resources required to realise the abovementioned functions and services

[Points]

- The knowledge and skills required of university library staff in realising a “digital library” will be systematised and reviewed. Correspondingly, the establishment of a new accreditation system for obtaining a professional qualification and the utilisation of existing study programmes will be promoted for university library staff. In this way, organisational structures and systems will be established to resolve structural issues, such as the promotion of professional skills development and the creation of new career paths.
- Among the knowledge and skills required of university library staff, since they will be involved in the management of research data in addition to their existing duties, it is essential that they understand the nature of academia and the life cycle of research in the university. In order to provide support appropriately, they need to be aware of the function of their support and their position within the research life cycle.
- By clarifying the role of future university libraries and taking into account the concept of restructuring operations based on such clarification, each university, while reviewing its overall human resource allocation and establishing education and research promotion systems, will review its organisational structure in light of human resource allocation so that specialised human resources can be allocated to university libraries.

- In the past, university library staff were able to perform their role with the knowledge and skills they had accumulated with experience. Since 2000, however, more advanced and extensive knowledge and skills have been required in light of the diversification of various digital services and information resources, such as search systems, etc.
- There is currently a need to establish university-wide research promotion systems, which requires new knowledge, including an understanding of the research life cycle, not only among researchers but also among those who support them. It is important to develop support personnel who can consider not merely the technical aspects of system construction, etc., but also the nature and characteristics of information itself and the context in which academic contents and research data are placed. It is essential that university library staff who provide research support understand the research life cycle

and are aware of the functions that such support serves within the context of the cycle.

- Appropriate support at each stage is essential to ensure that research data is appropriately managed according to the life cycle of research in universities. The knowledge and skills required to manage and support research data include knowledge of academic content distribution, an understanding of the research life cycle and data life cycle, and basic knowledge on information management and metadata to be assigned to research data. However, as the situation surrounding university libraries is likely to change in the future, the required knowledge and skills will need to be continually reviewed.
- Despite the fact that many of the tasks related to research data management in which university libraries are involved increasingly require advanced knowledge and skills, there is a shortage of specialised human resources and no pathway for the development of expertise. To develop a specialised workforce, it is important to secure appropriate personnel and provide ongoing training. At present, however, the lack of an established career path makes it difficult to attract suitable personnel. The government needs to put in place mechanisms for resolving structural issues, such as establishing career paths and positions for such specialised human resources. The establishment of a career path will allow specialised personnel to undertake a wider range of tasks and engage in management-level work while relying on a high degree of expertise.
- When a high level of specialisation is required, a large university library with a large staff can assign specialists to each site, as is the case in the U.S. In the case of Japan, however, where libraries are small, there are limits to what can be done at an individual level. In such cases, for example, as discussed below in section (4), this could be addressed by a number of universities cooperating with each other, such as by forming a consortium among their libraries.
- As the DX of research, including the management and utilisation of research data, involves various departments, such as those related to information management and research promotion, it is important that they share clear objectives and avoid sectionalism. For example, it is essential to cooperate with the research promotion-related department in the formulation of research data management plans when applying for research grants, and with the information management-related department with regard to repository construction, authentication, etc. Particularly with regard to authentication, since it is extremely important for the management and utilisation of research data within the

university, stronger cooperation is necessary, for example, by establishing a joint response team as needed. At the same time, it is important that various relevant departments form agile teams able to deal with and solve new challenges as they arise. In addition, to ensure smooth collaboration between teaching staff and support personnel, it is essential to have shared objectives as to the purpose of the DX of research and to build mutual trust.

- In response to the clarification of the role of university libraries in the future, the restructuring and coordination of the work performed by them, and the development of specialised human resources in accordance with these, each university needs to review its organisational structure and allocation of human resources so that specialised personnel can be appropriately assigned to university libraries. It is expected that this will be done in conjunction with the review of the allocation of human resources throughout the university and the establishment of education and research promotion systems.
- At the same time, it is important to provide systematic SD (Staff Development) and FD (Faculty Development) education for teaching staff in order to promote changes in attitudes as the DX of education and research progresses. Recurrent education is also effective for coping with future changes. Universities are required to create an environment in which relevant staff are given opportunities to undertake such education and to support them in doing so. Furthermore, it is necessary to incentivise career advancement through personnel evaluation, etc., and to enhance motivation for recurrent education at the individual level. In addition, as for the recurrent education in research data management that will be required in the future, the government must give full consideration to specific measures for this, as the types of personnel expected to undertake it will be diverse, including not only university library staff but also those working with information systems.

(4) Effective collaboration among university libraries

[Points]

- The various challenges faced in realising a “digital library” will be addressed from the perspective of interoperability, for example, by forming a “consortium” of several university libraries. That is, the “one university, one library” model will not be a binding premise.
- A forum will be established within the government to discuss common issues that may newly arise in the future and consider new support measures, etc. in the process of realising the “digital library” concept.

- The Standards for Establishment of Universities (Order of the Ministry of Education, Culture, Sports, Science and Technology), which is revised and enforced in October 2022, lists libraries as among the facilities needed by universities. It goes without saying that each university is responsible for establishing its own university library, allocating appropriate resources, including specialised human resources, and operating it in such a way as to serve its own education and research needs. However, it is anticipated that it will not be easy to provide the new functions and services required of university libraries in the future, nor perform the accompanying allocation and development of relevant human resources, whether through collaboration among the relevant departments within a university or by a single university library acting alone.
- With regard to the “digital library,” there is no need to be bound by the traditional premise that developing a single library system is sufficient for a single university. For example, there are a number of issues that need to be addressed in collaboration among universities to realise a “digital library,” such as sharing platforms for handling digital contents, interlinking different platforms, integrating content use agreements, and jointly operating library systems. In doing so, it is important to conceive of collaboration from a data-centric perspective. In addition, as mentioned in section (3) above, the allocation of specialised human resources that is beyond the capacity of a single university could, for example, be implemented by forming a “consortium” of several university libraries.
- If the academic knowledge resources that have been accumulated so far become available digitally, and if it becomes a fundamental practice that future research results are produced digitally, a “digital library” in which many university libraries collaborate by

interconnecting digital contents in their various forms, regardless of whether commercial or non-commercial, could be constructed. The government will set up a forum to examine common issues that may arise in the process of realising the “digital library” concept, and will consider solutions and new support measures through the cooperation of universities and university library-related organisations.

- While promoting cooperation among university libraries will provide university library staff with a more active professional network as well as incentives to come up with new initiatives and ideas, it may also result in changes to longstanding workflows. Therefore, it is important for each university to consider the path it will take to develop the kind of human resources it will need for the future, and to make the best use of the advantages produced by cooperation and collaboration among university libraries as well as the advantages of working according to its own unique demands.

3. Conclusion

University libraries are an important component of the academic knowledge infrastructure that supports student learning at universities as well as the higher education and academic research activities conducted by universities. They have been performing the roles and functions of systematically collecting, accumulating, and publishing academic texts and supporting university-based education and research, while responding to the progress of digitisation in society as a whole and changes in the distribution of academic knowledge. In addition, university libraries are now required to manage new contents and provide services, including access to research data, amid the promotion of DX in education and research activities, the recent COVID-19 pandemic, and the global acceleration of the open science trend.

Under these circumstances, the future “digital library,” representing the digitisation of university library functions, is expected to promote the further enrichment and distribution of academic knowledge and to stimulate education and research at universities as a whole. In addition, contents that become a new point of focus in the DX of education and research, such as research data and teaching materials, should be managed using a whole-of-university approach that includes relevant departments, as they are not the domain of university libraries alone. Thus, the issues addressed in this summary of deliberations should be shared not only with those associated with university libraries, but also with university administrations, and should be addressed as a part of a university-wide initiative. In doing so, university libraries are, however, expected to take the lead in planning and trialling initiatives and sharing their knowledge and views.

In order to realise the “digital library” of the future, as mentioned earlier, the university library functions required in the open science era will be examined and verified from the perspective of the four items listed in (1) to (4) above by 2030, when the next Science, Technology, and Innovation Basic Plan is completed, and issues with priority will be addressed in line with the mission of each university.

It should be noted that there are many new issues to be tackled by university libraries in achieving these goals, and there are limits to what individual universities and university libraries can do on their own. For this reason, it is important to define initiatives that will serve as model cases for cooperation and collaboration among several university libraries and to establish a mechanism for sharing the results of such initiatives, and support from the government is essential to make this happen.

This summary of deliberations sets out a basic idea of the future function of the university library in Japan, and shows the direction to aim for in order to promote efforts to realise this function within the scope of each university's mission. Through the sharing of the issues and discussion points listed here among universities and university libraries, and continued consideration of these issues and points, it is strongly hoped that university libraries, with an understanding of their essential nature, will transform themselves in line with changes in the technological and social environment for the development of education and research in Japan.

Glossary

<C>

Catalogue Information Service (NACSIS-CAT/ILL) (P1)

A system operated by the National Institute of Informatics (NII), consisting of NACSIS-CAT for creating a comprehensive catalogue database of materials held in university libraries in Japan and NACSIS-ILL for supporting inter-library lending and borrowing of materials using the comprehensive catalogue database.

Compensation System for Public Transmission for Educational Purposes (P6)

The system was established by the May 2018 amendment to the Copyright Act. In order to facilitate the use of copyrighted works in ICT-based education, the system now allows public transmission to be carried out without having to individually obtain the permission of copyright holders, etc. by paying compensation from the educational establishments using the system.

<D>

Data Curation (P5)

Producing, operating, and maintaining research datasets so that they are accessible and usable by researchers looking for research data. Specifically, data curation means collecting and structuring research data with user-friendliness in mind.

Data-Driven Research (P1)

A new methodology in science that has emerged as a result of improvements in computing performance, where research results are derived by analysing big data collected online, etc. without setting a hypothesis in advance. As the existence of large amounts of freely available data is essential for this type of research, Open Research Data is strongly required to promote its conduct.

Data Literacy (P5)

The ability to read, understand, interpret, and analyse a variety of data. However, particularly with regard to research data, because the format and other aspects can differ greatly from one area to another, and knowledge of the area to which the data pertains is essential for understanding the data, knowledge of the research area in a form that is linked to the research data is also a necessary element.

Digital Humanities (P5)

A fusion of informatics and the humanities that aims to gain new knowledge and perspectives by using informatics methods to solve issues in the humanities, and to open up new fields of informatics using issues in the humanities as an impetus.

Digital Transformation (DX) (P2)

The term means “transformation of people’s lives for the better by the penetration of information technology.” In the context of this summary of deliberations, universities pursuing DX not only improve the efficiency of their business processes through the use of big data

and various digital technologies, but also transform education and research itself. DX also refreshes the organisational climate and creates new value, thereby strengthening the research and educational capabilities of universities.

<F>

FD (Faculty Development) Education (P11)

A generic term for organised efforts by teachers to improve and enhance the content and methods of their teaching. The Standards for Establishment of Universities require universities to implement FD in this sense, but it is not simply limited to training for the improvement of class contents and methods and may also refer to a wide range of activities for the improvement of education, research activities, social contribution, and the overall professional development of faculty members involved in administrative management.

<I>

Institutional Repository (P4)

An internet-based archiving system for the preservation and dissemination of electronic intellectual products produced at universities and other institutions. It plays a major role in transforming the distribution of academic knowledge by enabling researchers to publish their own papers themselves, while at the same time guaranteeing accountability to society for their educational and research activities through the dissemination of educational and research results by universities and other institutions. In the Sixth Science, Technology, and Innovation Basic Plan, it is positioned as one of the core elements for the realisation of open science.

<L>

Learning Commons (P1)

A physical space provided by a university or other institution that supports students' independent study. This space enables a style of discussion in which several students come together and use information obtained from a variety of information resources, both electronic and printed. In addition, students can receive not only material support, such as computer equipment and printed materials, but also advice and assistance from library staff.

Library Schema (P7)

The basic logical structure required to design library services. It defines: (1) the hard aspects, such as the design of the physical space, (2) the soft aspects, such as the provision of various contents and services by librarians, and (3) the relationship between the two, which is embodied in the actual libraries and the services provided in them. A unique library schema will be defined for each library, but it should be noted that it will look different depending on the attributes of users (e.g. field, position, etc.).

Life Cycle of Research (P2)

A series of processes starting with the formulation of a research plan, the preparation of proposals for obtaining research funding, the execution of actual research and experiments, etc., the publication of results, and the obtaining of an evaluation of the research by the academic community or society. It is often expressed as a circular diagram, in order to emphasise the continuity of one project to the next.

<M>

Metadata (P6)

A term meaning “structured data about data.” It is a stylised description of the attributes of a piece of information that is used to organise that information. It is an important element for improving the availability and promoting the use of various types of information. Specific examples of metadata for research data include the date and time of creation of the data, the creator, the format, the title, and annotations.

Metaverse (P7)

An online virtual space. It is represented as a three-dimensional space expressed by computer graphics, where people enter via alter egos called avatars and carry out various activities such as education, research, creation, entertainment, buying and selling of goods, etc. As a second “reality,” it is also considered an arena for professional life and life itself.

<O>

Open Access (P4)

Making academic texts, such as theses, etc. available free of charge via the internet and accessible to everyone without restriction. There are various means of realising open access, which can be broadly classified into two categories: those realised by researchers themselves or by academic libraries acting on their behalf providing theses, etc. to an institutional repository or discipline-specific archives, and those realised by journal publishers establishing a business model that does not rely on subscription fees.

Open and Closed Strategies (P1)

The strategic segregation of products, services, etc. (“research data” in the context of this summary of deliberations) into those that should be shared with others and promoted for use (open) and those that should be kept secret and protected for various reasons (closed).

Open Science (P1)

A new way of doing science that aims to open up new avenues for the creation of knowledge and innovation by making the results of research funded mainly by public money widely and easily accessible and usable not only by academia but also by industry and society in general. At the core is Open Access and open research data.

<P>

Platform (P12)

The underlying equipment, software, and net services required to operate a certain device or software, or the operating environment in which they are combined. In the context of this summary of deliberations, it refers to systems for the provision and dissemination of academic knowledge that are built and provided by university libraries, such as institutional repositories.

<R>

Recurrent Education (P11)

Education provided to working people, mainly professionals, after they have completed

their schooling and entered the workforce. This includes not only full-time retraining away from the workplace, but also part-time education provided while working in a profession.

Research Data Policy (P5)

A basic policy set by a university or other institution on the handling of research data generated by its members, such as researchers. Sometimes also referred to as “research data management and publication policy.” It will include a definition of research data, responsibilities for data management and publication, and the responsibility of those involved in research to help promote the use of research data. The effectiveness of the policy can be enhanced by separately detailing the various points at issue raised in the formulation of the policy as a “commentary/supplement” and publishing it together with the policy.

<S>

SD (Staff Development) Education (P11)

Initiatives such as the creation of training opportunities to allow faculty members involved in university administrative management, education, and research to acquire necessary knowledge and skills and further improve their abilities and qualifications.

1. Introduction

- The Council for Science and Technology has been discussing the form university libraries in Japan should take and the most important issues for university libraries in earlier eras. According to their own reports, university libraries in Japan have expanded their functions and have been oriented towards innovation in terms of the functions, means of utilisation, and services that they are expected to provide.
- These discussions were based on the recognition that university libraries exist to maintain a system in which knowledge is continuously reproduced by, in the context of university-based education and research, increasing its discoverability, guaranteeing access to it, and enabling its use.
- Recently, since the direction of efforts such as the digital transformation of libraries and strengthening of support functions have been required to be specified, staff engaged in university library work are now required to understand the differences in the handling and characteristics of data by field. Furthermore, due to the COVID-19 pandemic, there is a strong recognition of the urgent need to consider the nature of university libraries that are not restricted by their physical location.

2. How University Libraries Should Be in the Age of Open Science

- Since university libraries are required to be able to provide teaching and learning resources in the most appropriate form, taking into account the user environment, etc., based on DX in the field of education and research, it is necessary for university libraries to consider their functions while being aware of their position and role in the overall education and research promotion system.
- It is also necessary to further develop the “electronic library” concept that has been discussed to date and to support the various activities a university library may undertake as a “digital library” that promotes its own DX in a way that embraces changes in management, services, staff knowledge, and skills that are perceived to occur as a result of the digitisation of content.
- In this summary of deliberations, the new “digital library” is examined with regard to four aspects as the ideal form—one that embodies the essence of the university library—with the aim of realising this ideal form by FY2030, when the next Science, Technology, and Innovation Basic Plan is due to be completed.

(1) The educational and research support functions and new services required of university libraries in the future

- University libraries will proceed with the digitisation of existing contents, and promote open access of contents to be produced in the future as a result of academic research, etc. In addition, the various services and current operations that support the utilisation of digitised contents will be restructured from a user-oriented standpoint. Furthermore, university libraries will promote the accumulation, digitisation, and distribution of academic knowledge in Japan through collaboration with other university libraries and other academic knowledge providers.
- In digitising Japanese-language collections of books, the digitisation of the collections of the National Diet Library will form the core of the project, with steps taken to avoid duplication in the digitisation of the collections of individual university libraries. By optimising the environment to access such collections, a nationwide digital archive infrastructure will be built.
- Each university library will continue to actively promote open access of academic papers through institutional repositories.
- Each university library will consider and implement measures to increase the discoverability of publicly available research data. While working within a university-wide research promotion system that considers the entire process from the start of research to the publication of research results (research life cycle), and addressing the trend towards the digitisation of education, each university will clarify the role of the university library in this new system.

(2) The effective utilisation of information science and technology, as well as university libraries as “spaces,” to achieve the abovementioned support functions and services

- The realisation of a “digital library” requires a redefinition of university library functions in a way that is not constrained by physical “spaces.” To achieve this, it is necessary to clarify the “library schema,” organise and re-examine what users want, and build an optimal environment designed to reflect these, taking into account the context of the DX of education and research.
- In doing so, the entire university will consider that part of the existing work related to the development of the learning environment that has mainly been carried out by the university library, including reconsidering whether the university will continue to carry out this work, based on an evaluation of the activities carried out to date.

(3) The human resources required to realise the abovementioned functions and services

- The knowledge and skills required of university library staff in realising a “digital library” will be systematised and reviewed. Correspondingly, the establishment of a new accreditation system for obtaining a professional qualification and the utilisation of existing study programmes will be promoted for university library staff. In this way, organisational structures and systems will be established to resolve structural issues, such as the promotion of professional skill development and the creation of new career paths.
- Among the knowledge and skills required of university library staff, since they will be involved in the management of research data in addition to their existing duties, it is essential that they understand the nature of academia and the life cycle of research in the university. In order to provide support appropriately, they need to be aware of the function of their support and their position within the research life cycle.
- By clarifying the role of future university libraries and taking into account the concept of restructuring operations based on such clarification, each university, while reviewing its overall human resource allocation and establishing education and research promotion systems, will review its organisational structure in light of human resource allocation so that specialised human resources can be allocated to university libraries.

(4) Effective collaboration among university libraries

- The various challenges faced in realising a “digital library” will be addressed from the perspective of interoperability, for example, by forming a “consortium” of several university libraries. The “one university, one library model” will not be a binding premise.
- A forum will be established within the government to discuss common issues that may newly arise in the future and consider new support measures, etc. in the process of realising the “digital library” concept.

3. Conclusion

- University libraries are an important component of the academic knowledge infrastructure that supports student learning at universities as well as the higher education and academic research activities conducted by universities. They have been playing the roles and functions of supporting education and research at universities and are now required to manage new contents and provide new services.
- Under these circumstances, the future “digital library” is expected to promote the further enrichment and distribution of academic knowledge and to stimulate education and research at universities as a whole. In addition, contents that become a new point of focus in the DX of education and research should be managed using a whole-of-university approach that includes relevant departments. That is, such contents are not the domain of university libraries alone and university administrations should share in their management. University libraries are expected to take the lead in planning and trialling initiatives and sharing their knowledge and views.
- In order to realise the “digital library” of the future, each university library will examine and verify the functions expected of it in the open science era from the perspective of the four items listed in (1) to (4) above by 2030, when the next Science, Technology and Innovation Basic Plan is completed, and issues with priority will be addressed in line with the mission of each university.
- There are many new issues to be tackled by university libraries in achieving these goals, and there are limits to what individual universities and university libraries can do on their own. For this reason, it is important to define initiatives that will serve as model cases for cooperation and collaboration among several university libraries and to establish a mechanism for sharing the results of such initiatives. Government support is essential for this.
- This summary of deliberations sets out a basic idea of the future function of the university library in Japan, and shows the direction to aim for in order to promote efforts to realise the university library function within the scope of each university’s mission. Through the sharing of these issues and discussion points among universities and university libraries, and continued consideration of them, it is hoped that university libraries, with an understanding of their essential nature, will transform themselves in line with changes in the technological and social environment for the development of education and research in Japan.