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Trends in Electronic Scientific, Technical, and Medical Journals —The Research Information Gathering Environment and Business Innovation—

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1 Introduction

Academic research in the area of science and technology is communicated and made available in many forms[1]. Researchers announce their results in some type of medium to make them widely known to other researchers, to have them accepted, and to build a record of their achievements. In the case of scientific, technical, and medical researchers, they most often present their results to their peers at academic conferences before writing papers for submission to journals. In the journal editing process, examination and review (peer review) by other researchers allows a certain quality standard to be maintained as articles are regularly compiled and published. Universities, academic societies, and publishers have engaged in this business since the 17th century. Even today, journals are the most important medium for the presentation of research results.

Recently, especially since about 1995, the development of full-fledged information services on the Internet has made it possible to transmit information in ways that bypass periodicals. Even the journals themselves have repeatedly experimented with new ways of utilizing these services. At first, there has been a shift to electronic formats for work and information that were formerly paper based, namely, the digitization of journal information and the conversion of review work to electronic media. Subsequently, various electronic journal services that utilize the unique characteristics of the Internet and that would have been impossible with paper-based journals have been examined, enabling the realization of functions such as citation links. Now, electronic journals are even able to offer everything from search functions to provision of final primary data as integrated services, including links to databases. The result is that many more people now have opportunities to see scientific and technical information, which formerly circulated only among a few experts.

Meanwhile, a vigorous debate from the perspective of journal publication as a business, including electronic journals, is now underway regarding the proper form for journal publication. In particular, the appearance of open-access activities has begun to have a major impact on the publishing model, which formerly focused on subscriptions by libraries.

This article, therefore, examines the classic yet new topic of trends in electronic journals and the ways in which the publishing industry is being shaken by open-access activities. It describes electronic journal services and their surrounding environment in 2007 and offers proposals for improving the management of Japanese electronic journals.

The research information gathering environment, including electronic journals, is constantly undergoing innovation. In order to clarify this report's arguments and provide a fixed point of reference in this constantly changing environment, the report describes the general process and services as of January 2007 of electronic scientific, technical, and medical journals (STM journals) from article submission to Internet publication. It adds an explanation and examination based on this description.

2 The role of electronic journals in research activities

2-1 Electronic journal services today

Many international STM journals now have article-submission functions on their websites. With the introduction of electronic submission, submissions by mail have fallen dramatically[2]. For articles submitted online, fellow researchers (editorial board members and reviewers) still carry out conventional review (peer review) and judge suitability for publication, but do so using electronic files. Articles accepted for publication proceed to publication processing. Some biology journals publish reviewed articles on the Internet as received. Until around the year 2000, the development of electronic submission and review systems itself was an issue, but today system specifications and development costs are stable, and already businesses that provide general-use systems and take advantage of economies of scale are in development. In concrete terms, these include an Editorial Manager service[3], which handles electronic review for over 1,800 journals, mainly those of Elsevier, which is the world's largest science, technology, and academic publisher, and ScholarOne[4], which provides electronic submission and review services for over 1,000 journals.

One advantage of electronic journal services is that there is no need for binding, and so individual articles can be released on the Internet as soon as they have been proofread. Many journals carry out such advanced online release. The creation of portals providing economies of scale for electronic journal release services has advanced even faster than the above-mentioned electronic submission and review systems. Led by ScienceDirect[5], Elsevier's vast electronic journal release platform, a number of publishers provide electronic journal services for up to several hundred titles.

Furthermore, a number of e-only experiments are underway[6]. These include halting publication of paper journals and issuing a number of journals only in electronic form and creating new journals only as electronic ones. Among journals considered to be the leaders in their respective fields in Europe and the United States of America, however, few have completely halted publication of the paper form.

Issuance of an electronic journal requires appropriate subscription management. For paper journals, this is carried out by sending copies after payment of subscription fees. In the case of electronic journals, however, usually only access rights are provided. Generally, library subscriptions are managed by IP addresses, and individual subscriptions are managed by IDs and passwords. Furthermore, billing on a per-article basis is possible with electronic journals, and these days, many journals have single-article sales services. This enables readers to purchase only the articles they need even if they are not subscribers. The service is an effective method particularly in cases where readers obtain their desired information from the results of a database search.

So that more researchers will quickly become aware of newly published articles, many journals have content alert services that send tables of contents to readers, who have registered their e-mail addresses. In most cases, the tables of contents include links to the articles so readers can directly view the ones that interest them.

In addition, new-arrival notification services utilizing the RSS 1.0 and 2.0[7] formats have begun spreading. Reportedly, growth in the number of people registered for content alerts has leveled off, while RSS usage is increasing[8].

Electronic journal services can use access counts to determine relatively accurately which journals and articles are read most often. In order to compare journals from different publishers, however, rules for access counting are necessary. This led to the creation of the COUNTER project by libraries and publishers in England[9]. Currently, major publishers provide access statistics services that follow the rules (Code of Practice) set by the project mainly to libraries.

Digitization back to the first issue is necessary in order to fully utilize the convenience of an electronic journal, and many leading journals have already completed the digitization. In other words, the need to visit a library in order to find

past articles is already diminishing steadily. In particular, the volume of interlibrary loans for journals in English, for which digitization is advanced, is declining[10,11].

This is the situation surrounding standard electronic journal services as of 2007.

2-2 *Comprehensive electronic journal services: collaboration among electronic journals and with databases and portal sites*

Below, this article describes services related to electronic journals as well as electronic journal services from a more comprehensive standpoint.

(1) Article identifiers for the age of electronic journals: OpenURL, DOI, and link resolvers

First, this article will discuss the article identifiers that make collaborative services utilizing electronic journals possible. Since the age of paper journals, there have been identifiers, such as ISSN, which specifically identify each publication. These are in widespread use for periodical management. However, although there were identifiers, such as PII and SICI[12], to specify individual articles, their use was not so widespread. With the shift to electronic journals, the existence of each article's URL has become important. Organizations that have extracted secondary information since the paper-journal age, such as PubMed[13] in the medical field and Chemical Abstracts (ChemPort)[14] in chemistry, have developed identifiers that follow proprietary rules. These were part of the organizations' particular services, but generalization and standardization of such identifiers have advanced. OpenURL has spread with the goal of broadly identifying articles through the use of fixed and relatively easy-to-understand URLs[15]. Meanwhile, the Publishers International Linking Association, Inc. (PILA), which is controlled by major publishers, and the CrossRef project were established[16] in order to insert links in publications that cite one another. Journals belonging to this organization receive Document Object Identifiers (DOIs). Management of the DOIs and articles' URL data (they have link resolvers) enable links to each article. In other words, URLs can be constructed and accessed for each article in journals with these identifiers, and individual links can be inserted. As will be discussed below, this has made collaboration with databases and portals more efficient.

(2) Links to various kinds of databases

Before the introduction of the kinds of electronic journal services existing today, there were so-called secondary information services, such as the above-mentioned PubMed and Chemical Abstracts. Their information was already in databases before the spread of the Internet, but digitization on a per-article basis and hyperlinking has enabled this to move from secondary information databases to articles that are primary information. This coordination between secondary and primary information has had a significant impact on researchers' information gathering. Instead of looking through thick books of abstracts and then finding individual journals, scholars are now able to use their PCs to conduct searches using keywords, allowing them to easily view relevant articles from the results they obtain. This is a radical change in the research information gathering environment. Because articles may not be found in searches of specialty-field databases, many journals actively seek to establish links with such specialized databases. On the other hand, a major change brought about by digitization and collaboration with databases is that, like the long tail phenomenon found with booksellers, such as Amazon.com, search results find journals that were not widely read in paper form alongside major journals, leading to greater readership for their articles. In particular, this has increased opportunities for Japan's English-language journals to receive exposure overseas[17]. (See Figure 1.)

The same trend has been seen with citation databases. Thomson Corporation's (formerly ISI) Web of Science (WOS)[18] was one of the earliest databases to link a cited-works database with primary information. Elsevier released its similar SCOPUS cited-works database in 2004[19]. From its inception, SCOPUS has collaborated with Elsevier's ScienceDirect and other primary information sources.

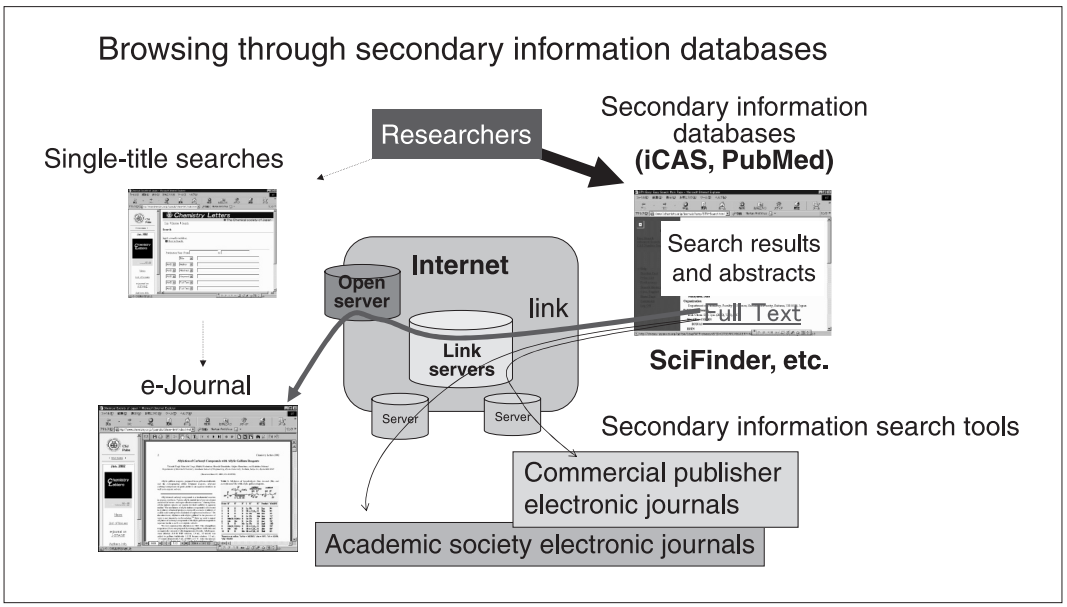

Figure 1 : The importance of searches from secondary information databases

Revised from Journal of Information Science and Technology Association, Vol. 53, No. 9, pp. 441-447 (2003)[17]

(3) Traffic from search portals

In addition, general search portal sites began adding scientific, technical, and scholarly information to their search services a few years ago. Google Scholar has already launched a scientific, technical, and scholarly information portal site, using its own search engine to provide citation information services[20]. Microsoft's Windows Live Academic has been established to compete with Google[21]. Purchase of PPV services and other concrete uses of Google Scholar search results are beginning to be reported[8]. The direction of these search portal trends, including status of utilization, bears watching. Of particular interest is how researchers in the pharmaceutical and chemistry fields, which have secondary information databases characterized by a high degree of specialty and reliability, will handle these more generalized portal sites.

(4) Links to works cited and citing works

As mentioned in 2-2 (1), through the CrossRef project that creates mutual links among cited works, major publishers have become able to shift efficiently from cited works to articles in other journals. In addition, not only have links to cited works been achieved, but links to citing articles can be inserted in cited works. Once an article is released, links can be added to the article if other works cite it (forward linking). Because the number of such forward links is generally held to be equivalent to the number of articles citing, if all journals have this function, in theory it would allow the level of usage to be ascertained without reliance on citation databases.

(5) The appearance of digital resource management tools

Finally, the libraries of various institutions are using integrated management systems (digital resource management tools) to manage electronic journals, databases, and electronic books (eBooks, which this article does not discuss). Active steps are being taken to realize efficient navigation functions that will facilitate the finding of desired materials, allow cross-material searches to be carried out, and provide other efficient end-user services[22].

(6) Diverse access methods brought about by the shift to electronic journals

In the above forms, local services for electronic journals, from primary information creation to article release, are becoming quite fixed while adhering to the old peer review system. The next stage will be an examination of how journals and individual articles can be linked to databases and portal sites and managed.

Furthermore, as depicted in Figure 2, the information search environment for researchers can be divided into four routes. These are: A)

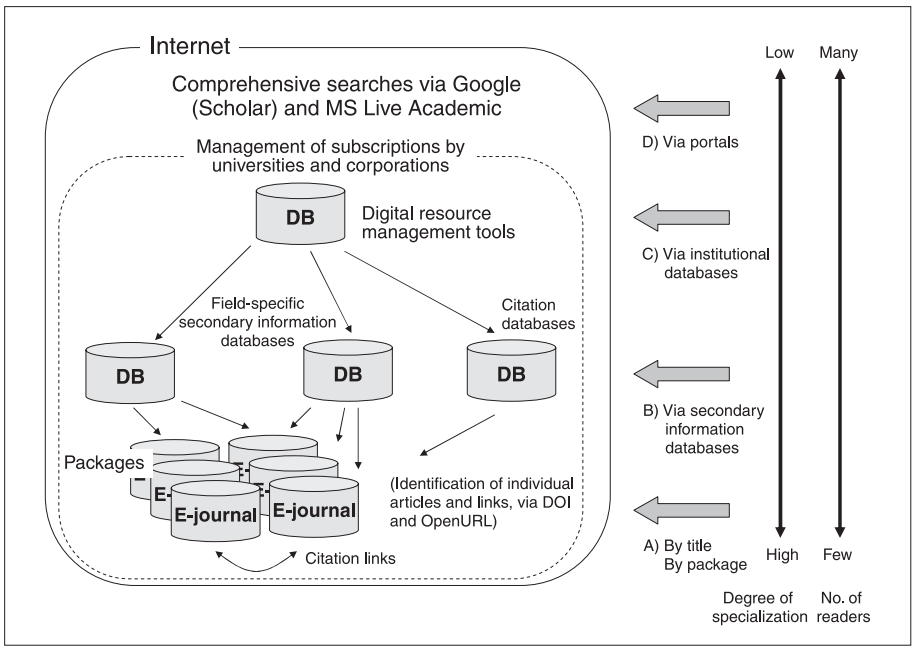

Figure 2 : Conceptual diagram of access routes to electronic journals

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directly accessing electronic journals by title or package; B) database searches of highly specialized secondary information and citation information managed primarily by libraries; C) integrated searches of the databases of digital asset management tools, which are also primarily library-managed; and D) searches via free portal sites. This provision of access through multiple routes and to a broad range of users including the general public through Google and so on is impossible with paper journals. With the digitization of archives now almost complete, the age when paper copies are available at libraries is now ending. At the same time, the publishing bodies of each journal cannot ignore the existence of these routes and must ensure that the contents of their publications are constantly available through multiple routes.

3 Electronic journals as a business: conditions outside Japan

3-1 The unchanging commercialization and oligopoly of academic publishing

Even before the shift to electronic journals began, the academic publishing business was based on a subscriber-fee model. In other words, the business developed with subscription fees, paid mainly by libraries, as its primary income source. Some journals also collect publication and reprint fees from authors, but subscriptions are the primary source of income for all journals.

Commercialization and oligopolization have been advancing in academic publishing since the era of paper journals. Steep price increase meant that since libraries had to paid higher subscription fees, they were able to subscribe to fewer titles, leading to the "serial crisis"[23]. The economies of scale characteristic of the shift to electronic journals are accelerating this process of oligopolization. For example, Elsevier's ScienceDirect covers more than 1,700 titles, and journals are sold not by the title but as an entire electronic journal platform or package (the "Big Deal")[24].

However, library budgets in most countries are falling. Even where budgets are increasing, they are insufficient for libraries to maintain the number of titles or to subscribe to new ones[25], so libraries have formed consortia to resist this kind of Big Deal, negotiating the lowest prices they can on package purchases and working to keep as many titles as possible available for viewing in their institutions. A recent report claims that due to the Big Deal, the number of titles per library has increased, as has usage[26]. Utility is being debated in the closed world of the Big Deal and consortia.

Meanwhile, small and medium-sized publishers

unable to participate in such schemes are finding that their businesses are faced with a serious handicap. Relatively large academic societies in Europe and the USA have created packages with several top journals in their fields, developing their businesses in the same way commercial publishers do with their journals. Furthermore, some small and medium-sized publishers are attempting to join forces to package their electronic journals[27]. There are, however, currently no other ways for publishers with only a few titles or a single title to develop their electronic journal businesses.

3-2 Is barrier-free access possible? The open access movement

Under the above-described conditions, concern is rising regarding excessive commercialization in the distribution of scientific, technical, and scholarly information, which should be broadly disseminated on a not-for-profit basis. Numerous initiatives opposing commercial journals have been introduced. These initiatives are led mainly by libraries. The Association of Research Libraries (ARL) began developing the SPARC movement[28] even before the shift to electronic journals began.

Furthermore, there has been an upsurge in "open access" activities[29]. There are various definitions of open-access activities, but here, they are defined as activities designed to provide access to article data (including full texts) to anyone, free of charge. The basic idea behind these activities is that because the majority of research is tax-supported, the results should be widely and generally available. In the medical field in particular, there are barriers (the need for paid subscriptions) to taxpayer access to the latest medical information. Open-access activities have developed out of an awareness of this problem.

Furthermore, characteristics peculiar to electronic journals are driving these activities. If the information is placed on an Internet server without authentication, anyone can access article data. A major advantage of electronic journals over paper is the simplicity and economy of their distribution, and it is driving these activities.

Currently, there are many methods that facilitate open access, and innovation is unceasing. Below are some examples.

(1) Preprint servers and self-archiving by field: from the researchers' perspective

First, even prior to the advent of the open access movement, physics and a few other fields have had a culture of placing manuscripts on preprint servers before submitting them for publication. This came about in response to the desire of researchers to expose their work to colleagues as early as possible. arXive is a typical example[30].

Furthermore, Stevan Harnad and others have long been an advocate of the self-archive movement, by which authors make manuscripts available free of charge on their own servers[31]. However, since self-archiving provides little benefit to the authors themselves, this practice has not become widespread.

(2) Recommendations by foundations: the activities of research funding organizations

Research funding organizations have also reacted to the open access movement. In 2003, the USA's National Institutes of Health (NIH), the UK's Wellcome Trust, and leading members of the above-mentioned SPARC joined to issue the Bethesda Statement to promote open-access activities. In response, in 2004, NIH began requesting that authors of papers related to NIH-supported research place them on PubMed Central, where they can be accessed without charge[32]. This request was made more strongly in 2005. The UK's Wellcome Trust makes a similar recommendation and provides mirror servers for PubMed Central.

NIH's series of actions related to this recommendation has had a significant impact on academic societies, commercial publishers, and libraries. Although it has engendered debate on a number of issues, it has also been a driving force behind open-access activities undertaken from various perspectives, as will be discussed below.

(3) Institutional repositories: new library activities

In order to resist the above-described commercialization of journal publishing

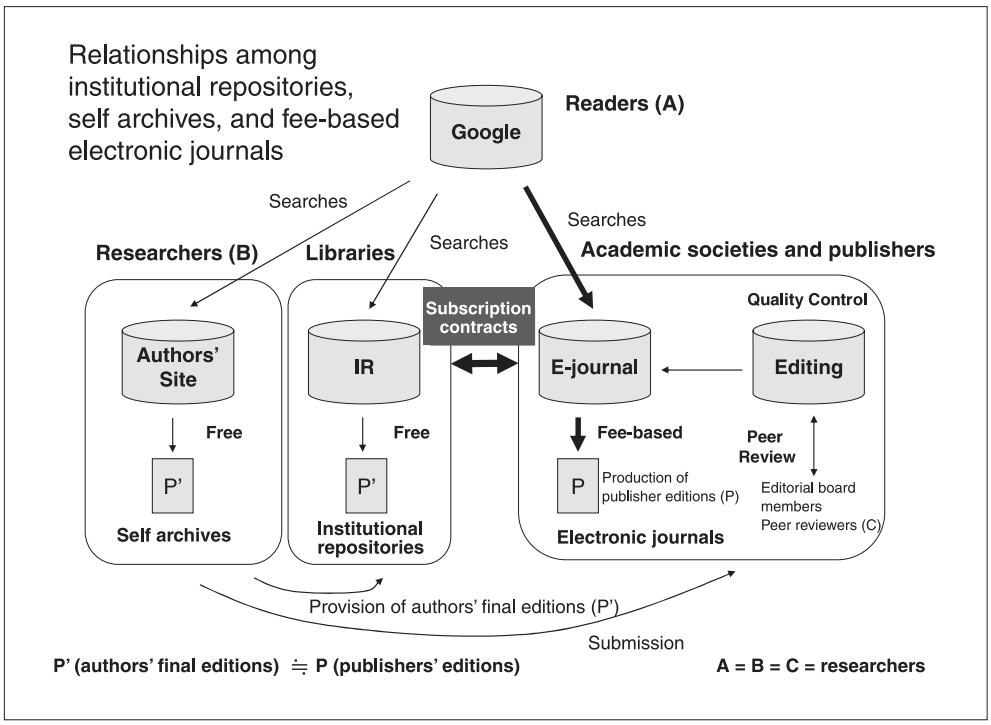

Figure 3 : Correlation diagram of those involved in the open access movement

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and sharp price rises, libraries are actively recommending self-archiving to researchers. Furthermore, they are preparing open information servers (institutional repositories[33]) at the institutions to which they belong. Along with bulletins, doctoral dissertations, and other information belonging to universities, they insert articles by affiliated authors in place of the authors. Depending on approval conditions (including insertion in institutional repositories) granted by publishers, the inserted manuscripts are either the authors' final editions after review has been completed or the final publishers' editions prepared for release. These files are usually in PDF format.

Although such institutional repositories, which can be seen as an extension of self-archiving, do not yet have extensive collections of article data, most of them are searchable with Google. This means that once all research institutions have these repositories, the majority of scientific, technical, and scholarly articles will be searchable and viewable free of charge. When this free distribution channel is fully realized, it will have a significant impact on the distribution of scientific, technical, and scholarly information. Libraries are also working towards this end. For publishers, however, this is a matter of life and death, so it is a subject of great debate[34]. (See Figiure 3.)

(4) Open access journals: publishers' response

Publishers have no objection to the concept of open access itself. Publishing, however, costs money[35], and so, the response of commercial publishers and others who endeavor to make profits from publishing has been negative. Furthermore, some not-for-profit academic societies in Europe and the USA also earn money from publishing and apply it to their educational and other activities[36]; so, while they are not vehemently opposed to a quick shift to open access, most are adopting a cautious attitude.

Partly as a response to the activities of libraries and government institutions, however, some are seeking alternatives to the conventional subscription-fee model. Initiatives underway as of January 2007 are fully open access through author-pays models, optional author fees, and partially open access through adjustment of release periods.

Examples of early adopters of the author-pays model are BioMed Central[37] in life sciences and the New Journal of Physics[38], a joint production of the UK's Institute of Physics Publishing and German Physical Society (Deutsche Physikalische Gesellschaft). The most representative current

examples actively applying this model are the scientific journals of the Public Library of Science (PLoS)[39]. For example, PLoS Biology requires a publication fee of US$2,500 from authors to pay for operations, whereas access to the electronic journal is completely free. However, the initial publication fee, when the journal started in 2003, was US$1,500, and this rise in only its third year of operation raises the question of whether the author-pays model is viable.

With optional author fees, payment of an optional fee on a per-article basis makes articles immediately available to readers free of charge. For example, with Springer's Open Choice[40], an author payment of US $3,000 enables free access to that article. Springer is actively urging research funding organizations to use the option. In this way, the idea of research funding organizations paying the fees in place of authors has begun to gain some traction. With this mode, if all authors choose to pay and if there is an option that reduces subscription fees to zero, a shift to the fully open access journals discussed above is theoretically possible. Existing journals have begun to act with alacrity to make this option available and are presently observing the results.

Finally, open access through adjustment of release periods is the provision of free access after a specified period has elapsed, and some publishers began doing this prior to the start of the open access movement. This mode is characterized by the fact that the subscriber-fee model can be maintained, and on a per-article basis, some will require payment, and some will be free, depending on the timing. The preceding two methods are therefore usually at the center of discussions on the introduction of open access.

3-3 What open-access activities have brought about: the appropriate way of distributing scientific, technical, and scholarly information in the age of electronic journals

This article has described some initiatives aimed at bringing about open access. The question that constantly dominates this discussion is, "Who should pay for the cost of distributing scientific, technical, and scholarly information?" Consequently, research funding organizations, libraries, and publishers, including academic societies, are now involved in numerous experiments aimed at finding a practical resolution to this question from their own perspectives. Noteworthy trends among these experiments are libraries beginning to take on information-transmission functions and research funding organizations beginning to contribute to policies on research publication and distribution. In other words, rather than simply addressing cost issues, they have begun to deal with the question "Who is responsible for the distribution of scientific, technical, and scholarly information?" The possibility that those involved may have to change has arisen[41,42].

Furthermore, under these circumstances, attention is being given to what researchers, who have the greatest essential interest in the matter, think of open access and how they will act. With the exception of the UK's Royal Society[43], however, researchers in general show little interest. This is because the desire of researchers is to have their research well regarded by their peers and to receive the career benefits that accompany this. Their first priority is publication in so-called high impact journals, and they have little interest in whether those journals are not-for-profit or open access. With so much research funding coming from taxes, however, they may not be able to remain indifferent given the increasing societal demand for accountability in the use of tax monies.

Thus, although there is now a general consensus on the basic services to be provided by electronic journals, from a business perspective the situation is chaotic. In particular, since the move to electronic journals raises the possibility that not only will business forms change but that responsibility for information distribution activities will shift, it is necessary to carefully observe this reorganization.

4 The impact of electronic journals on Japanese academic societies

4-1 *The status of Japan's shift to electronic journals*

(1) The environment supporting electronic journals in Japan

Figure 4 depicts those involved in Japan's distribution of scientific, technical, and scholarly information. Within the framework of the Ministry of Education, Culture, Sports, Science and Technology, the Japan Science and Technology Agency (JST) and the Japan Society for the Promotion of Science (JSPS) provide research funding. Both support Japanese academic publishing through J-STAGE and Grants in Aid for Scientific Research for Publication of Scientific Research Results. There are researchers affiliated with both the academic societies that publish journals and the libraries that subscribe to them. Furthermore, the National Institute of Informatics (NII) supports academic societies through SPARC/JAPAN[44], which provides steady support for library activities. In addition, the National Diet Library is involved with the permanent storage of scientific, technical, and scholarly information. Surrounding this are the academic and commercial publishers of Europe and the USA with their strong brand power, and many Japanese researchers submit articles to overseas journals. Against this background, this article will discuss several Japanese initiatives (by category) in the electronic journal business and its support systems.

(2) Completely independent type: a case in physics

The Institute of Pure and Applied Physics (IPAP) is an organization formed by the publishing arms of the Physical Society of Japan and the Japan Society of Applied Physics. Its major journals are the Journal of the Physical Society of Japan and the Japanese Journal of Applied Physics. The organization developed an electronic submission and review system and an electronic journal publishing platform on its own. It offers paid subscriptions to its electronic journals and includes various types of links, such as CrossRef and Google.

(3) Domestic collaborative type: cases of independent administrative agencies

Currently, Japan's approximately 130 English-language journals use the Japan Science and Technology Agency's (JST) J-STAGE[45] to open their electronic journals. Some academic

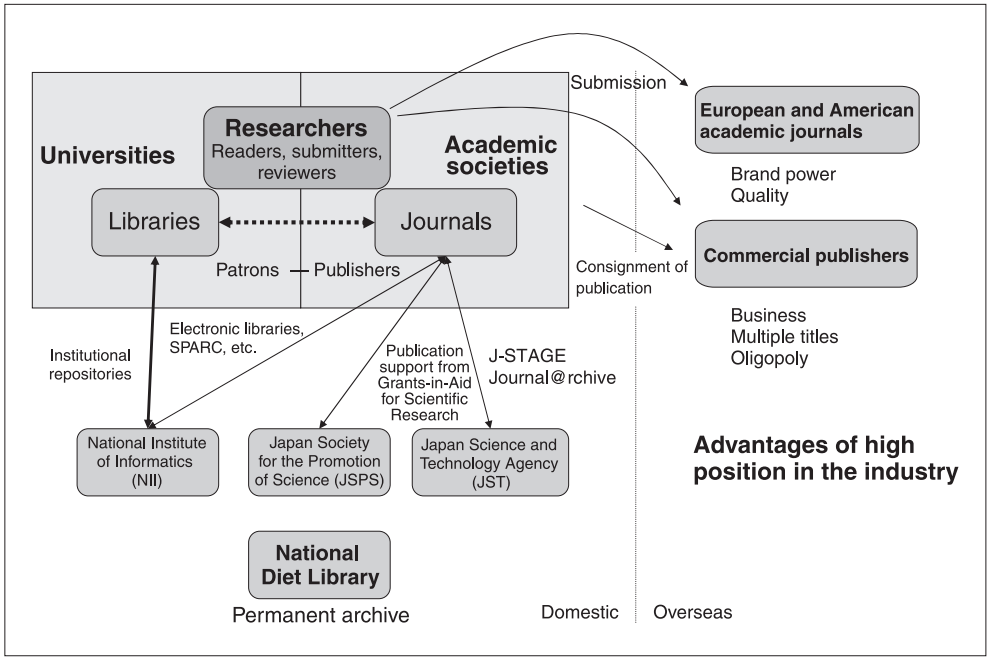

Figure 4 : Correlation diagram of those involved in distribution of scientific, technical, and scholarly information

Prepared by the STFC

societies also utilize electronic article submission and review. In addition to collaborating with PubMed, ChemPort, and CrossRef, J-STAGE also provides access statistics services equivalent to COUNTER standards. The Chemical Society of Japan's Chemistry Letters effectively utilizes J-STAGE for prompt and efficient continuous realization of standard electronic journal services. The average time it takes from receipt of an article to publication on the Internet is among the shortest in the world for general chemistry journals[42].

Furthermore, the National Institute of Informatics' (NII) NII-ELS publishes scanned files of paper journals as well as book and periodical data and makes them available for free or for a fee, depending on the policy of the publishing academic societies[46].

(4) Overseas collaborative type: a case in electronic information and communications

After review, using its own electronic submission and review system, of articles for a target audience outside Japan, the Institute of Electronics, Information and Communication Engineers (IEICE) goes through the Oxford University Press to use the Highwire[47] electronic journal platform to publish an electronic journal. Articles with a target audience within Japan are published on the IEICE's own servers. For overseas readers, the IEICE utilizes a foreign, large-scale, not-for-profit platform to provide standard services and carries out public relations in other countries.

(5) SPARC/JAPAN and other activities

Through the above-described SPARC/JAPAN project, the National Institute of Informatics (NII) has begun a Japanese information distribution infrastructure improvement project. It is now in the fourth year of its second stage. One of the packages the project has selected is UniBio Press, which bundles seven life sciences academic society journals into a package of electronic journals. Beginning in 2007, the package has been available on the BioOne platform. Furthermore, in addition to support for individual academic societies and journals, the project encourages training activities and works to develop human resources that can take charge of journals.

The Japan Society of Mechanical Engineers (JSME) halted publication of its English-language journals and has progressively set about creating new electronic journals by specialty. These journals are electronic only. JSME sees its mission as publication of electronic journals, supporting this endeavor through member fees and submission (publication) fees.

4-2 The harsh Japanese electronic journal business

As described above, the shift of Japan's scientific, technical, and medical journals to electronic form is already well advanced. Although some positive results have been obtained, as a business, electronic journals are in a vulnerable position. The reasons are examined below.

(1) The impact of Grants in Aid for Scientific Research

Including preceding programs, funding for publication of paper journals through Grants in Aid for Scientific Research for Publication of Scientific Research Results has been carried out since 1955. It is important support for Japanese publishing in this field[48] as well as for English-language journals facing basic structural handicaps, such as publishing in English in a Japanese-speaking country. On the other hand, because funding is given annually and the system does not allow profits since it only covers deficits, there is concern that this approach acts as a disincentive to improving quality. Moreover, although some improvements are being made, because funding standards have required publication in a paper journal, it is difficult to obtain funds to publish in an electronic journal.

(2) The problem of integrating academic societies

There are many academic societies in Japan, and the need for integration and reform has been widely discussed[49,50], however, the number of Japanese academic societies has not decreased. For example, looking at the register of academic societies published by the Japan

Science Support Foundation, in 2001-2003 there were 1,620 societies, while in 2004-2006 the number actually increased to 1,730. This crowd of academic societies lowers the efficiency of their work, including electronic journals, widening the gap with Europe and the USA.

(3) Journal quality control problems and publisher functions

The proliferation of academic societies means that publishing organizations remain small and scattered, without the oversight of the publishing professionals found in Europe and the USA. In most cases, personnel in charge also have other work, making it extremely difficult to improve the quality of electronic journal services or the information published. In addition, public relations activities are essential for raising the profile of journals and getting authors to submit high-quality manuscripts[51], and electronic journals require legal work related to licensing, copyrights, and so on. Very few personnel in academic societies have any expertise in such areas. This is an enormous problem.

5 Proposals for the improvement of Japanese electronic journals and information distribution

As described above, Japanese electronic journal activities face the same problems as Japan's academic societies themselves. Poor in terms of both financial and human resources, only scant improvements can be brought about by the efforts of individual societies. Based on conditions overseas and in Japan, and in consideration of the reports of working groups under the Council for Science and Technology[52,53], this article will examine proposals for improvements to strengthen Japanese electronic journals.

5-1 Confirmation of the necessity of transmitting information from Japan

(1) The risk of leaving evaluation up to foreign countries

First, a reaffirmation of the necessity of transmitting information originating from Japan is required. Science is borderless, but scientists have countries. This is not merely a concept. Although by nature this does not appear in statistical data, delayed review and unfair handling of articles submitted to overseas journals have been pointed out[54]. Furthermore, even with so-called international journals, a high percentage of editorial board members are university professors who are from the country of publication. In other words, it is necessary once again to confirm the high risk that the latest knowledge and data generated by researchers will be sent to overseas evaluating bodies before they are released to the world. This is not, however, solely a Japanese problem.

(2) Lost business opportunities through reliance on foreign countries to transmit information

Publishing English-language journals internationally inevitably means that the publishing industry will acquire foreign currency. In fact, European and American academic societies and commercial publishers receive high earnings from around the world. In addition, commercial publishers also pass on those profits to their shareholders. The world market for the distribution of scientific, technical, and scholarly information is said to be worth about ¥5 trillion[54]. It is necessary to recognize that Japan's information transmission industry can become a part of international economic activity.

(3) The viewpoint of fostering the information distribution industry

Compared with journals in fields such as literature and economics, the world of electronic scientific, technical, and medical journals is one of rapid permeation. As a result, it is at the forefront of scientific communication on the Internet. In other words, activities to seize the initiative in that world are desirable for the information distribution industry as a whole.

(4) Reaffirmation of the significance of the business of transmitting primary information

In the end, the comprehensive electronic journal services expounded upon in 2-2 above are guides to achieving articles that are of primary information. They are all founded upon

the existence of primary information[42]. Japan must reaffirm the significance of producing and transmitting high-quality primary information.

5-2 Reexamination of methods of research evaluation

Above all, researchers are interested in being published in the leading journals in their fields and receiving the respect of the scientific community. The reality, however, is that the leading journals in almost all fields are published in Europe and the USA.

This ambition of researchers must be accepted. It is unrealistic to expect to change their mindset in order to hold back the relative flow of research results to foreign countries. With this in mind, some measures against the problem are still necessary. For example, limiting the discussion to researchers at universities and other not-for-profit institutions, the results of their research are important assets to them personally, but at the same time, they can be seen as benefits generated by activities paid for by taxes. Based on the idea of recovering these benefits through taxation, it may be good policy to transmit a portion of Japan's research results and connect that portion and amount to appropriate evaluation and research funding allocation. For example—and this is only an example—anything left over after taxes could be used in any way the researcher wished. It would be possible for researchers to build names for themselves through publication in leading overseas journals. Those researchers, whose papers end up generating a high tax take, that is, those who submit many influential articles successfully to overseas journals, could be given commensurate ability to transmit. Although the sudden implementation of this kind of extreme policy might draw vehement opposition from some researchers, the significance of transmitting Japanese scientific, technical, and scholarly information must somehow be reaffirmed by researchers themselves. Effective measures to address the issues discussed in this article cannot be realized unless they are predicated upon renewed awareness by researchers.

5-3 Policies of research funding organizations and publishing support organizations

As discussed above, research funding organizations, such as the NIH and the Wellcome Trust, have a significant influence on the distribution of scientific, technical, and scholarly information. In the same way, the policies of Japanese research funding organizations, such as the Japan Society for the Promotion of Science and the Japan Science and Technology Agency, relating to the distribution of the research information they target for support, have a major impact on the form of Japanese information distribution and related business activities. Future debate will turn in the direction of those policies.

5-4 Reexamination of the proper form of funding for publishing

Even giving the most positive evaluation possible to the significance and results of Grants in Aid for Scientific Research funding for publishing, swift reform or reorganization of the framework for support is necessary, with an eye towards electronic journals in particular. The discussion at the special symposium of the Science Council of Japan has been instructive[55].

In China, the National Natural Science Foundation of China (NSFC) is providing two years of support for 30 Chinese journals, forming editorial boards of people invited from China and abroad, selecting targets for support, and performing post-activity reviews. This kind of example is also instructive[56].

5-5 Improving review quality (improving the quality of academic societies)

In order to promote Japanese information transmission, the quality of the content appearing in journals must be maintained. Improving the quality of reviews is essential in order to do this. Academic societies play the important role of maintaining this review (peer review). The efforts of academic societies to form editorial organizations that meet international standards and always retain a pool of international reviewers are indispensable.

5-6 Human resources development for publishing and the internationalization of publishing organizations

In order to build top-rank journals, academic societies and publishers in Europe and the USA make both economic and human resource investments. Furthermore, trade associations of publishers, such as the Association for Learned and Professional Society Publishers (ALPSP) and STM[57,58], provide venues for various types of training and information exchange, foster publishing personnel, and develop leadership within the industry. In Japan too, academic societies and publishers need to train quickly personnel as professionals in science, technology, and academic publishing and create systems so that those professionals can have international influence.

6 Seeking the integration of electronic journal publishing organizations and a Japanese model of not-for-profit publishing

Based on the above examination of the various situations, this article will present more concrete proposals for a Japanese model of not-for-profit publishing in the age of electronic journals.

6-1 A proposal for integration of publishing organizations

First, in order to create economies of scale in the electronic journal business, various academic societies should integrate their publishing arms, forming an organization that can publish dozens of journals. However, organization of the editorial staff and review policy should basically be left up to each academic society so that the personality and originality of each journal is preserved. Support should be provided so that editors-in-chief can operate for long periods in order to fully develop their leadership potential. Even if, as described above, integration of academic societies does not take place, this relatively loose kind of alliance is realistic. Because the Science Council of Japan has recently begun full-fledged examination of the role of academic societies following their becoming public-benefit corporations[59], it is important to remain in step with that discussion. As for an estimate of the scale of integrated publishing, in the case of scientific, technical, and medical journals receiving the above-mentioned Grants in Aid for Scientific Research for Publication of Scientific Research Results (periodicals)[60], 82 of them received such aid in FY 2006. These are journals of sufficient quality to sell copies overseas. Their annual page count is about 110,000, and the amount of aid they received totaled approximately ¥770 million. This amount is the portion of assistance that went towards publishing and printing, and so publishing on a scale larger than this amount can be expected. According to a report by a research committee of the Matsuo Foundation[50], of the 19 academic society English-language journals surveyed, total business costs per page were calculated at ¥33,000, so a business scale of ¥3.6 billion can be estimated from the above page count. This new publishing organization would provide electronic submission and review services, post-review electronic journal publishing services, collaboration with various databases, subscription management, and public relations activities. In addition, it would also have a journal evaluation function, a survey function for the opening of new markets, and copyright and other legal management functions that have been difficult for individual academic societies to handle. Furthermore, in order to raise Japan's global presence, it would carry out international PR activities targeting authors and readers overseas and forge close links with the publishing industry in Europe and the USA. Actively working to improve, it would seek the next forms for its editing, manufacture, and publicity from these new functions. Positioning these editing and publishing activities as new career paths for postdocs would also be an effective approach.

6-2 Operation of an integrated organization

Looking at the status of the electronic journal business outside Japan as discussed in chapter 3, this kind of publishing organization could be operated in either of two ways.

(1) Commercial operation

First, there is autonomous operation similar to the example of large academic societies in Europe and the USA. Thus, for example, at first, the organization would receive government support for five years, while working towards autonomy, seeking to become the core of Japan's scientific, technical, and scholarly information service industry. Because this type of operation would immediately be in direct competition with publishers in Europe and the USA, risk would be high. With the close relationship between activities and outcomes, however, the publishing organization's staff would have a sense of pride, and if this is fostered over the long term, the result could be a Japanese international commercial publisher.

(2) Public operation

The other operating method would be to become a not-for-profit information transmission entity as part of national policy. In other words, it would follow the principle of open access, electronic journals would be free of charge, and the national government would pay operating expenses including various types of databases, links, and reviews. Having the organization generate a certain portion of the research funded from the national budget is an idea worthy of consideration. At this time, the organization operating J-STAGE is closest in character to this one, but it would be necessary to consider its development into a more comprehensive body that could carry out editing and production, as well as subscription management and public relations. In the event this approach were to be adopted, however, the issues would be how, with the government funding it, to give researchers the incentives to consistently provide quality content and give staff the incentives to provide better service and actively engage in public relations activities.

7 Conclusion

The discussion in this article was based on the premise that the importance of peer review by fellow researchers of articles submitted for publication will not waver in the short or medium term. One must add, however, that if entry into the web 2.0[61] era, particularly interactive evaluation through large numbers of readers after electronic journals are opened, changes the nature of research evaluation[62], then the current review system will at least be influenced. In fact, the above-mentioned PLoS launched an electronic journal called PLoS One in December 2006. It operates not based on meeting high editorial standards, but rather on meeting the minimum standard of containing no scientific mistakes, and is then broadly reviewed by readers on the Internet. The future of this electronic journal, which even the operator acknowledges to be a large experiment, is worth watching[63]. In any event, the provision of primary information via electronic journals and its surrounding environment will continue to change as will the methods employed to support researchers' information gathering and distribution activities. This field will therefore need to be monitored through periodic trend surveys.

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