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	<p><b>The Open Access Movement in Korea's R &amp; D Environment</b></p> <p>Hyekyong Hwang Senior Research Librarian Heeyoon Choi, Director Knowledge Asset Team, Korea Institute of Science and Technology Information Daejeon, Korea</p>
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### **The Open Access Movement in Korea's R & D Environment**

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#### **Abstract**

Open Access is a new trend in the scholarly communication. The purposes of this study are to identify this new trend, to aid in the development of an open-access-based knowledge, and to introduce the activities of open access movement by KISTI in Korea. KISTI carried on several project related to Open Access in Korea's R&D environment, author research pattern, awareness of information sharing, and construction of open

access e-prints archive in physics. Especially, KISTI defined the types of research outputs that are produced as a result of R&D activities in the field of Science and Technology. Also research patterns and levels of understanding toward information sharing are investigated. KISTI and ICPR(Information Center for Physics Research) have performed a project of e-Prints archive (“Science Attic”) in the field of natural science. Science Attic is a collaborative project to implement an open access based research output archive. This paper explains the main results of the project including the system architecture, data flow diagram, and the characteristics of the system.

## **1. Introduction**

Traditionally, publishers and academic societies dominated scholarly communication. This is because, in the past, when the Internet did not exist, researchers could make public their research output solely through authoritative publishers and academic societies in the form of academic papers. However, in science and technology, where the prompt exchange of academic information and announcement of research output are crucial to the establishment of a researcher’s academic position, the peer review period of publishers and academic societies, which ranges from six months to more than one year, has been pointed out as a structural limitation.

In addition, the increase in the prices of monopolistic academic journals by their publishers has posed a major threat to libraries, which support researchers’ research activities.

With the development of the Internet and information technology (IT) and the consequent activation of communication through networks among researchers, however, this official method of disseminating scholarly communication has been changing gradually. As a result, researchers have come to construct communities in virtual space and to share their research output with fellow researchers. This signals that the scholarly communication process, which encompasses the creation, collection, and dissemination of information, has become volitional and dispersed because of researchers (authors), who are the creators and users of information.

The present paper examines Korea’s scholarly communication environment and diverse efforts in this realm amidst such paradigm shift noted above with a focus on the Korea Institute of Science and Technology Information (KISTI).

## **2. The Emergence of the Open Access Paradigm**

Scholarly communication designates the entire process through which academic information is produced by authors (researchers), distributed in the market by

distributors (publishers), managed by information managers (libraries), and used by consumers (users). As a group, researchers create, explicate, and use new knowledge; publishers, on the other hand, evaluate, edit, commercialize, and distribute knowledge produced by researchers. As for libraries and information centers, they play the role of collecting, organizing, preserving, and sharing the knowledge thus published (Jung 2004). Due to the prices of academic journals, which have escalated in comparison with the annual inflation rate, it has become difficult to collect these journals. This is clear, for example, from the price increase rate of *Nature*, an internationally renowned scientific journal: the subscription fee for the printed version has risen from US\$ 967 in 2003 to US\$ 1,925 in 2006, a nearly two-fold increase. Nevertheless, libraries and information centers have no choice but to accept such price hikes, which far exceed the inflation rate. In addition, even if the journal is purchased, it can only be serviced to authorized users due to copyright and license-based limitations. For example, even if the research output of a renowned Korean scientist is submitted to and published in *Nature*, researchers in Korea cannot read this academic paper unless they pay this high subscription fee. In particular, the researcher who penned the paper must be extremely careful when providing it to fellow researchers because of the copyright transfer agreement, which will already have been transferred to the publisher.

In the entire process from the creation to the use of specific research output, overlapping budgets are needed. The author of the research must be provided with a salary by the organization to which he or she belongs and with research funds for the project in question by the state. In addition, to use the research thus produced, libraries likewise must remit subscription fees to academic journals.

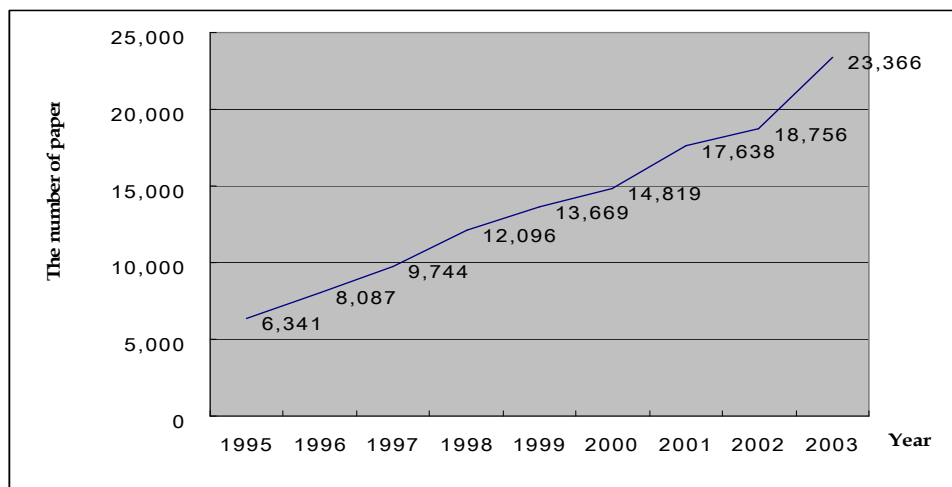
It is to react to such problems that open access has emerged as an alternative strategy. Researchers may wish to provide their own research output to fellow researchers so that the latter may use it freely. The authors of commercial movies and music files strongly demand their own copyright and, through this, direct license fees and royalties. However, research output within academia has a considerably different goal. Authors want their research output to be cited by many fellow researchers, thus strengthening its impact, as long as it is not damaged and its authors and sources are accurately indicated.

One of the most innovative changes in this context is the rise of the open access paradigm. This paradigm is based on the concept of providing academic research output to users free of charge. In other words, the open access approach claims, “The creators (authors & copyright holders) and users of research output should share information so that all users around the world may freely access information without legal, economic, and technological barriers.

Researchers can now disseminate their research output free of charge or at low prices through the Internet, which has led open access to grow as a new paradigm of academic information dissemination in a non-commercial and autonomous manner.

### 3. The Status of R & D environment in Korea

According to a Ministry of Science & Technology report(Korea; MOST 2004a), the total R & D investment amounted to more than 22 trillion won and the total number of registered researchers was greater than 180,000 in Korea in 2003. According to the KITA Survey (2003), this R & D investment amounted to 7% (US million\$ 284,584), 15% (US million\$ 135,280), and 32% (US million\$ 61,296) of its counterpart in the United States, Japan, and Germany, respectively. The research funds thus invested were used for basic research (14.5%), applied research (20.8%), and experimental development (64.7%) (Korea; MOST 2004b). In addition, the Ministry of Education and Human Resources Development (MOE 2004) announced that, in 2003, the number of academic papers published in international academic journals by Korean scientists and engineers amounted to 2,869, which was 13th in ranking. In terms of topic or field, these papers covered applied physics and materials (3,126), material engineering (1,832), and physics (1,287). According to an NCR analysis, the number of academic papers published by Korean scientists and engineers in the last 9 years amounted to 124,516 and has increased at a rate of 21% per year, thus indicating a rapid growth in Korea's academic capacity (see Figure 1).



<Figure 1> Korean academic papers published in the SCI in the last 9 years (1995-2003)

In terms of research fields, Korean scientists and engineers have published academic papers (70,105; 31.27%) and have been cited (312,236 times; 37.6%) mostly

in physics, chemistry, and earth science from among the NCR's eight fields. The number of citations for academic papers was the highest for research in life science (4.83 times) (Korea; MOE, 2004b).

As is clear from the figures above, Korean scientists' and engineers' rate of participation in the global academic community has increased annually. In addition, according to the Korea Research Foundation (KRF 2004), the number of academic societies in science and engineering amounted to 734, with approximately 35,000 academic papers produced through 876 academic journals in Korea in 2004. Realistically speaking, however, there is no national repository through which such valuable research output can be freely used.

#### **4. Korea's Movement to Activate Open Access**

Regarding the situation abroad, the Science and Technology Committee in the U.K. Parliament has published a report stating that it is desirable to apply open access to scientific and technological research outputs and to support the construction of a national repository to these ends. In addition, the IFLA has issued a statement supporting open access and various open access-related projects are under way, with the JISC at the center. Moreover, in Europe, the Budapest Open Access Initiative (BOAI) has been organized, the Max Planck Society in Germany (MPG) has issued a statement supporting open access, and the eDoc server project is under way. As is clear from such activities, the open access movement is active in developed nations. On the contrary, the open access movement in Korea is still at an elementary level. However, such a voluntary movement for sharing researchers' information amidst changes and trends in the international dissemination of scholarly communication must be closely heeded.

In terms of open access journals and open access repositories, the two roads proposed by the BOAI as the paths to open access, there are some differences between Korea and developed nations.

Abroad, the number of open access journals amounted to 2,208 and the number of OAI registered data providers was over 440 as of April 2006(OAI 2006). As for Korea, while there are many academic journals that can be used free of charge through the Internet, none officially endorses open access. This is most likely due to the special circumstances of the Korean academia. Because no academic journals are published by commercial publishers in Korea, unlike in other countries, copyright conflict with commercial publishers is not as serious as it is overseas. Notably, the Korea Copyright Center (KCC) has been newly established, thus raising awareness regarding copyright regulations within academia. Nevertheless, Korean researchers have not strongly

advocated their copyright in distributing their academic papers through the Internet and having them used by others. In addition, academic papers published through domestic academic societies can be used free of charge from the homepages of academic societies themselves or the scientific and technological academic information portal service operated by KISTI (“Academic Society Community”). The awareness of and the need for open access in Korea have not been intense because it is also already possible to use academic papers published in academic journals and dissertations free of charge or at low prices. In addition, it would appear that open access journals have not developed in Korea because Korean scientists and engineers have shown a preference to publish their research output in SCI academic journals abroad rather than domestic academic journals for assessing their research output.

However, according to a 2005 author study jointly conducted by KISTI and Pusan National University, Korean scientists and engineers clearly desire a national-level repository to preserve their research output(Hwang et al 2006). Consequently, KISTI has been developing the National Technical Information System (NTIS), which will preserve and disseminate all research output from government-funded research projects. The purpose of this system lies in allowing the government, general public, and researchers/developers in projects jointly implemented by industries, universities, and research centers to use scientific and technological information easily and conveniently whenever and wherever they wish. This will be realized by collecting in a portal various information resources such as research personnel, research equipment, research topics, technological information, and overseas information, thereby providing one-stop service.

### **Author Study: Patterns of Research Output Produced by Scholarly Communities in Korea**

We performed an author study on the current state of information sharing and preservation with respect to author research behavior. The purpose of the study was to identify the current state of research patterns, to develop a model, by subject area, of open access based knowledge/information flow, and to seek a way to facilitate the communication process in scholarly communities in Korea. This was a basic study to tap the possibility of open access archives in the Korean scholarly environment, especially with regard to science and engineering.

This survey was carried out in August of 2005 and involved 250 respondents. The survey briefly explored author experiences and opinions on research output, publishing objectives, awareness of copyright, information sharing, preservation of information, and trusted-digital archives.

There are many kinds of research output produced by researchers. The most popular type of research output was the technical report, followed by presentation materials. Peer reviewed papers, conference papers, proposals, patents, and conference posters followed successively. This reflects that many Korean researchers are involved in projects sponsored by the government or other funding organizations requiring technical reports and presentations.

Meanwhile, as for the motivation for publishing, the main reason many Korean researchers gave for publishing their research output was fulfillment of the requirements of their respective affiliations (65.2%). Other reasons included obtaining academic reputation (61.2%) and sharing research output (52.0%).

#### Intention to Use Research Output Openly

88.4% of respondents were willing to open their research output. 91.0% were willing to allow access for non-profit use. 75.2% of Korean researchers thought that it was helpful to share their research output with colleagues before publication. While Korean researchers preferred to share their research output offline (29.7%), diverse online sharing tools such as e-mail, personal homepages, online communities, and affiliated homepages and intranet were also used.

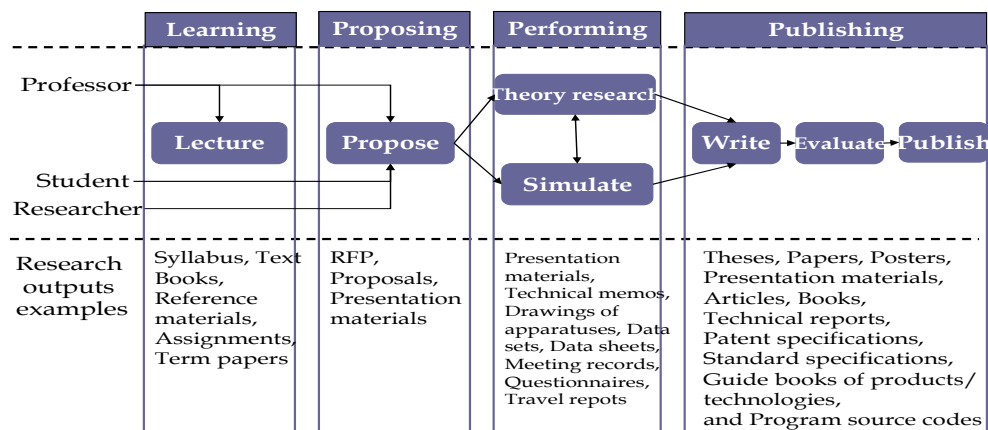
Korean researchers preserved their research output mainly in the memories of their personal computers (48.3%). In relation to trusted digital archives, many Korean researchers wanted institutional repositories for preserving some of their research output. As for the authority of trusted digital archives, they preferred their own resources and governmental organizations to other bodies.

#### **Collaborative Open Archive Project: The Science Attic**

The Science Attic(<http://science-attic.org/>), the first subject-based e-prints archives to be developed in Korea, was jointly developed by the Information Center for Physics Research (ICPR) at Seoul National University and KISTI to promote the free use of basic science academic information. Its basic concept is to contribute to scientific and technological development through the free use of research output. Research output collected in the Science Attic adheres to a creative commons license (CCL), and OAI-PMH protocols and Dublin Core metadata are used as indispensable elements for smooth information dissemination among OAI-based repositories.

In addition, to develop the prototype of the Science Attic, KISTI defined research phases and research output produced at each phase: learning, proposition, performance, and publication (see Figure 2). The final research output, generated through this process,

takes various formats including academic journal papers, final R&D reports, and so on. It is then disseminated and serviced through diverse channels including publishers, academic societies, libraries, and research centers. Researchers can use this research output to generate new research output. As a result, final research output such as academic journal papers, final R&D reports are important media through which researchers can officially transmit their output in the process of disseminating research results.



<figure 2> Research output type to be saved in the Science Attic

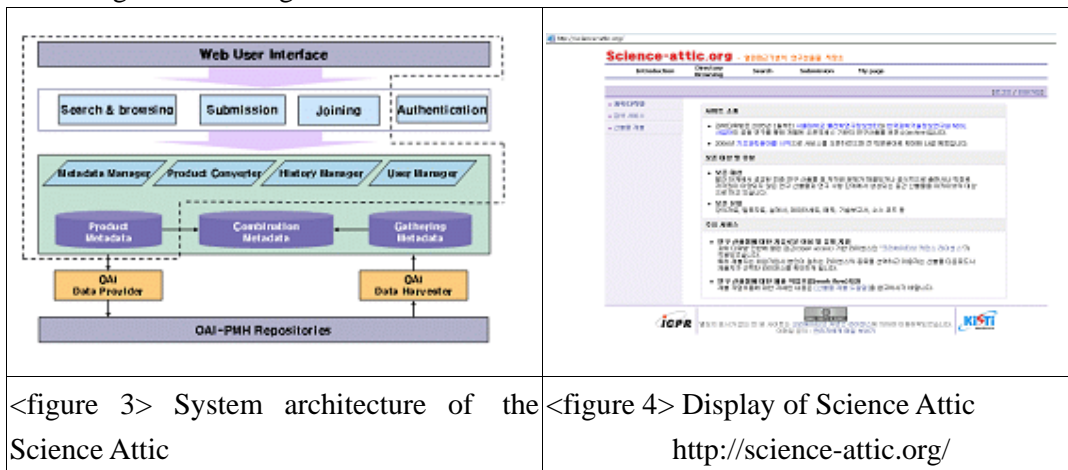
However, because the copyright for the final research output is usually transferred to publishers or academic societies, the free use of the final research output becomes difficult. Consequently, researchers may even have to obtain permission from publishers and academic societies to submit their own research output to repositories for free use. In addition, the peer-reviewed period needed to publish the final research output can impede the prompt dissemination of academic information in the ever-changing world of science and technology.

Accordingly, the Science Attic archives the following: final research output generated at the publishing phase whose copyright issues have been resolved; research output whose copyright has not been transferred to publishers and academic societies officially; output generated at the performing phase; and lecture materials, published materials, design plans, data sets, surveys, experiment notes, technical reports, source codes, and academic papers. Figure 2 shows the research output that is to be preserved in the Science Attic at each phase.



### The System Architecture of the Science Attic

Figures 3 and Figure 4 show the overall system structure and the first screen of the Science Attic, respectively. The dotted line in the overall system designates systems that were developed in 2005; the remainder are systems under development in 2006. At present, system-oriented development is under way to define and realize workflow that can generate and submit research output and to realize self-archiving of research output generated by professors, students, and researchers. In addition, policy and strategy for activating use are being established.



Users use output through output search and browsing (directory, basic/advanced search) and can confirm the license policy established by the submitter when downloading output. The submitter in turn submits output according to procedures demanded by the output process (basic information input, metadata input, input information confirmation). When output is submitted, authentication for this output (output ID, output password) is generated simultaneously through output transducers, and the information thus generated is e-mailed to the submitter. The overlapping classification, type of output, and the relations to the output submitted can be configured after the output has been submitted. Managers can add/modify the input data format per output type through metadata managers and, if necessary, manage and revise the history of the output submitted.

In the future, systems will be developed with a focus on the construction of an authentication system for qualitatively enhancing output that has been submitted through self-archiving and metadata systems that use OAI-PMH.

The rate of scientific and technological development will accelerate if researchers can access desired high-quality scientific and technological information more promptly while conducting their research.

By collecting, managing, preserving, and disseminating basic science research output, the Science Attic may very well become a catalyst for more scientific and technical information dissemination.

## 5. Conclusion

The present paper has examined the research environment in Korea amidst rapid changes in scholarly communication. In Korea, where academic journals are not published by commercial publishers, research on researchers' research patterns, awareness of information sharing, and construction of open access e-prints archives in physics has been conducted to promote the development of scholarly communication that is appropriate to the unique situation in Korea without blindly following trends in developed nations amidst global changes.

The 21st century has witnessed the rise of open access, which aims at the free sharing of academic information, together with developments in digital technology. At this point, Korea must, based on its advanced Internet environment and IT industry, construct a scientific and technological knowledge sharing system that will heighten the accessibility and usability of knowledge/information resources and focus diverse research and efforts on world-class scientific and technological information sharing.

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