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ECONOMICS OF INFORMATION SERVICES FOR SCIENTIFIC AND TECHNICAL DATA IN THE INFORMATION AGE:
The view from a national data center in Japan

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<Abstract>
Applications of information technology continue to spread throughout the academic and business worlds. The internet was developed and utilized originally within academia where scientists and technologists enjoyed the free exchange of scientific information with their peers. As business and entertainment uses of the web grew, approaches for controlling or restricting the flow of information more responsive to the economic needs of the business community developed. Yet the needs of the scientific community for continued easy and free exchange of information remain. This talk reviews information technology, government policy, legislation and business model issues surrounding the flow of academic information in the context of economic theories for information goods. The speaker presents an overall view of the problems based on his long experience in developing and managing database and electronic library systems at the National Institute of Informatics in Japan (formally NACSIS), a national center for scientific information. The lecture concludes with a recommended scheme for cooperative, effective usable data flows among scientists and technologists across the world.

1. ECONOMICS OF INFORMATION

1.1 Microeconomics of Information or Market Models with Asymmetric Information

The Nobel Prize in economics 2001 was awarded to Drs George A. Akerlof, A. Michael Spence, and Joseph E. Stiglitz for their contribution to the economics of markets with asymmetric information. Modern economics is the study of establishing mathematical models of actual economic activities and trying to propose some useful measures by analyzing the models. Here, the crucial question is what aspects of the real world should be introduced into the model. This on one hand depends on the awareness of the issues by each economist, that is, selection of the problem. On the other hand, it also depends on the easiness of modeling or formulation.

The classical approach of economics is represented by the perfect competitive market model, where both the suppliers and consumers have complete knowledge on commodities, and their prices are obtained with no cost. In this simplified world, information has no value and shared by all the participants in the market. However, in real world we should need considerable time and cost for gathering information and knowledge on commodities and their prices. These transaction costs are ignored in the classical market model, and market mechanism is assumed to work for realizing efficient resource allocation.

In 1961, George J. Stigler published a paper titles "The economics of information," where the effect of cost of gathering price information was analyzed.<1> This is said to be the beginning of information economics. The work by Akerlof, Spence and Stiglitz is characterized by its further introduction of roles and costs of information into the market model. More specifically, asymmetry of information on quality of commodities between suppliers and buyers was introduced into the model. Typical example is the analysis on lemon market or used car market, where the quality of particular car is only known by the user who wants to sell it on the market with a possibly high price. Dealers without exact knowledge on every car would buy them at the price for average quality cars, and this brings about the withdrawal of good quality cars from the market. The moral hazard problem in insurance market is also discussed in the scope of markets with asymmetric information.

Thus the market mechanism is revealed to not always bring efficient resource allocation, and it is claimed that more realistic economic institutions and policies should be devised based on the asymmetry of information. Those economics analyses might be said the information aware economics.

1.2 Macroeconomics of Information or Studies on Information Industry

Macroeconomics of information has begun with the study on knowledge industry by Fritz Machlup in 1962. In the same year, a Japanese famous ethnologist, Tadao UMESAO published a paper with the title "**Information Industry**," where he characterized broadcasting industry as selling informational commodity and pointed out uniqueness of information as an economic product.<2> He says that the word, "Information Industry" is his invention. This type of discussion was carried out along with those for the civilization at computerized society. I should say that these types of studies were much developed in Japan as discussions on the inforamatized society. We devised the word, **informatization** rather than computerization more than 30 years ago in order to depict broad influence which computer and telecommunication technology would bring to the society. The national government of Japan has been promoting the informatization by designating the first week of October, "Informatization Week," since 1972 and various types of events has been held in the week every year.

Modern economy is characterized by its orientation towards service industries, that is, services as economic products are becoming more important than traditional physical commodities. Macroeconomics of information or studies on information industry tries to appropriately analyze the modern service oriented economy. Here the characteristics of informational goods compared to ordinary physical goods are points of interest, and their production, pricing and marketing are studied.

1.3 Characteristics of Informational Commodities

Recent developments of IT make the information as the commercial products far more important and valuable in the market. The economics on informational commodities directs its attention to the characteristics of informational goods, and tries to devise some special models and theories on their production and marketing or businesses.

Informational commodities are generally characterized by its cost structure. They require large amount of money in their development, whereas they are copied at least cost for distribution. In another word, they take a large fixed cost and a small variable cost or marginal cost, and amount of sales become far more crucial than ordinary physical commodities.

In addition, informational goods are very vulnerable to unauthorized duplication, or even non-excludable of duplication, and the producers have to devise various countermeasures both technically and institutionally or legally. Recent developments in establishing stronger protection regulations for intellectual properties are the movement along this line.

Another characteristic of informational goods is its nature of joint consumption, or non-rivalry. This means that the additional person can get information without decreasing the amount of information. However, in some cases, the value of information will diminish when more people get it. This would typically apply to secret information. In those situations, the value of information would be measured by its effect of offsetting uncertainty. The price of information will be equal to the value gained by decreasing the risk with the information, as in the cases of investments.

(1) Information as Public Goods

Nature of non-excludability and non-rivalry for information leads us to assume informational goods as public goods. Meteorological information like weather forecasts might be created by governments and should be made freely available by all the people. However, now we see businesses who supply customized weather forecasts on demand of particular clients. They are value-added services who convert free public information into economic commodity and sell it on a fee bases.

(2) Academic Information as Club Goods

At the middle position between economic goods and public goods, there are defined the club goods.

Information as the club goods is information shared by members of a group, where you should pay to be a member of the club. An audience at a movie theater might be considered to form the club and they jointly consume the movie information. Most of academic information might be assumed club goods as it is shared by limited academicians who participate the society or the club. However, there are businesses like commercial publishers who deal with academic information as economic commodities. We see various types of academic or scientific information which would be classified into public, economic or club goods.

1.4 Information Economics in the Process of Development

As is described in the above, economic analysis of information is not yet clearly structured and formulated. This is not only due to my inability but rather due to the fact that the information economics is still in the process of development.<3> Because economic theories had been evolved and refined with neglecting information as an economic factor so far, we should thoroughly reform those models. It is not clear whether we could utilize some of the traditional theories and tools, or we should rather adopt completely different thinking. Information economics is now searching its way to proceed further. Almost all the economic activities and phenomena are somewhat related to information, and both macro-scopic treatments and simplified model analyses would be difficult.

In addition, the progress of IT is bringing about a dramatic change in information related activities and businesses. The debate on the **New Economy** for USA around 2000 is still fresh in our memory. In one hand, IT appears to realize a perfect market as in the traditional textbooks of economics, because now we can gather comparative price information on internet sites with minimal cost and effort. Now you can easily find the best price and instantly place the order on the internet. But on the other hand, IT is giving birth to many new types of informational goods and business models, where some regulations should be introduced and roles of governments should be redefined.

Now I would like to see the historical development of governmental policies on scientific information in Japan to help us to understand the current situation and to think of the desirable future of creation and dissemination of scientific information.

2. HISTORICAL OVERVIEW OF SCIENTIFIC INFORMATION SYSTEMS IN JAPAN <4>

2.1 The Science Information System and NACSIS / NII <5>

(1) Recommendation for the Science Information System
In late 1970s the Japanese Ministry of Education, Science, Sports and Culture (MONBUSHO) began to investigate a computerized system for the whole academic information circulation, and the Science Council to the Minister produced a recommendation, "Formation of the Science Information System for the Future" in 1980. This became the basic document to lead the subsequent entire developments in academic information picture of the country.

The recommendation included the following items, early realization of which were highly expected:
1) Databases of scientific information, mainly abstracting and indexing ones from overseas, should be more introduced and utilized in universities.
2) Construction of original databases should be promoted.
3) An automated cataloging system to cover all university libraries should be constructed.
4) A center should be established to develop the necessary systems and to coordinate the above activities at universities.

(2) Shared Cataloging System: NACSIS-CAT
In 1984 an online shared cataloging system for university libraries, NACSIS-CAT, was put into operation by the Center for Bibliographic Information of Tokyo University, the predecessor of National Institute of Informatics (NII). The system is now active at NII and the union catalog database has grown to include 6.5 million tittles and 64 million holdings. The system is open to libraries free of charge, and we have already had participations from abroad such as Japanese Libraries at Oxford and Cambridge and those of European and Chinese universities.

(3) Establishment of NACSIS and its Database Service: NACSIS-IR

Online database services for academics began in 1975 at the Computer Centre of Tokyo University with the Chemical Abstracts as the first database. National Center for Science Information Systems: NACSIS, the successor of the Center for Bibliographic Information, established in 1986, began the database service, NACSIS-IR along with the 1980 recommendation. The service now mounts about 50 databases of 109 million records. In 2000, NACSIS was expanded to NII: the National Institute of Informatics to strengthen research in informatics, while all of the NACSIS missions remain and should further be enhanced.<6>

NACSIS-IR databases are made open to researchers in universities and academic society members or researchers in industries at a low charging scheme just to avoid wasteful usage.<7> Qualification of user to researchers was introduced in order not to pressure the commercial database services by our low pricing. Thus NACSIS-IR database might be a type of club goods.

2.2 Electronic Library Functions for Libraries

(1) Recommendation on the Electronic Library Functions

In 1996 the Science Council made a recommendation "Promoting Electronic Library Functions at University Libraries."<8> (I chaired the drafting committee.) It included the following items:
1) Promoting provision of externally supplied databases and electronic materials to university members.
2) Promoting digitization of materials in the collection and service them not only internally but also externally to general public.
3) Promoting digitization of current materials in the university including bulletins, papers and syllabuses. Here the library is expected to support researchers to prepare digitized materials, and make them organized and accessible.
4) Promoting training of librarians for information technology.

(2) Digital library Projects at Universities

In the recommendation, MONBUSHO was asked to support those libraries who would be the leading models for enhancing electronic library functions at university libraries. So far, 16 libraries were supported with additional budget for the projects.<9>

NARA Institute of Science and Technology (NAIST) as a new university established in 1991 planed to construct its library as a paperless library, and named its library "The Electronic Library." The library officially has no space for book storage and all the materials acquired would be scanned there. Though the intension was advanced and ambitious, the project seems to be not necessarily successful. This is because the project was started somewhat earlier than digitized materials had become popular, and they experienced tough negotiations with publishers for licensing.

Kyoto University Library has been digitizing their rare materials and publicizing them to general public. Kobe University's digital library includes a collection of materials related to Hanshin-Awaji Earthquake 1995 with scanned images of photos and leaflets.

Every university library is now making efforts toward enhancement of their electronic library functions. A survey by MONBUSHO in 2000 shows that 51 university library out of 99 national universities are to some extent making the materials digital, and 26 of them are digitizing rare materials and 26 are for materials produced in the university. The statistics for all the universities including municipal and private ones, 128 among 821 have digitization projects, and 63 of them are for internally produced documents and 58 for rare collections. It seems quite natural that the libraries are making efforts of digitizing rare materials and internal documents rather than journals from outside sources.

2.3 Electronic Journal Systems and Economics of Academic Societies

(1) NACSIS-ELS: An Image-based Collection of Japanese Academic Journals

NACSIS-ELS is a digital library system developed and operated at NII (NACSIS) since 1997, which mounts scanned images of Japanese academic journals. The system now mounts 4.7 million pages of 1.4 million papers from 457 journals.

In its trial stage, NII (NACSIS) had negotiations with academic societies for licensing matter. In those early days, many societies made negative responses to the system, fearing that the system would impose financial

difficulties to their publications, as it would make the contents freely available and would make the societies to lose subscriptions. Based on the situation, the system was developed with a very precise accounting function that pages were classified into several categories such as table of contents, original papers, announcements and bibliographies, and each society could set prices for individual categories as they wished.

As the system development and operation including scanning are fully covered by the governmental budget, there is no charge for the societies for the scanning and mounting. NII do not charge also for users, while societies can set the prices for users. Now more then half of the participating societies do not charge fees even for users who are not the society member. They appear to use the system an effective medium to make the societies more visible by free access to their contents and to possibly attract new members.

(2) Electronic Journal Compilation Systems for Societies

Electronification of the whole process of journal compilation from submitting to publishing is expected to shorten the time for compilation. This is becoming more important for the journals to attract quality papers and make them more competitive among journals of the field. However, financial bases of Japanese societies are so weak that many of them are not able to develop the systems. In 1998 the national government supplied budget to develop a system for society journals to Japan Science and Technology Corporation (JST). JST developed a centralized system, J-STAGE, which is in the course of further enhancement for the requirements from societies.<10>

2.4 Funding for Scientific Database Construction

(1) Financial Support for Scientific Database Constructions

In 1981 Monbusho began to fund construction of scientific databases by academics in universities and academic societies. It established new category in the Grant-In-Aid for Scientific Research program dedicated to database compilations. This is within the category to support publicizing research results, that is, subsidy for publications of monographs and society journals. In 2001, 155 databases were awarded for the fund with JPY 1,420 million in total, 25 databases of which were designated as the priority database with continuous support for 5 years, while ordinary databases are examined for their competence every year. This specialized funding scheme appears to have greatly been contributing to database constructions by universities and academic societies.

JST is operating a program to support database constructions at national or public laboratories since 1996.<11> (I am in the judging committee.) The program is rather small scaled as it supports 2 or 3 databases a year with some JPY 100 million. Now 5 databases constructed by this program are open including Landslide Map Database at the National Research Institute for Earth Science and Disaster Prevention.

The program is unique in its scheme of funding as JST would dispatch specialists or technicians of computers and databases to the laboratories as the supporting staffs. In the background of this program, the situation exists that database constructions have not been properly evaluated and supported at those laboratories, although the research itself is highly encouraged. Valuable data obtained in the process of research have not been organized, publicized and widely utilized. Notion of the accountability that the data gathered by tax money should be returned to general public for their use, was the other motive of establishing the program.

The program is characterized by its orientation toward international contribution, that is, the databases should be compiled in English language, and the search systems should be equipped with English interface. By this scheme, the program is expected to raise presence of Japanese scientific activities in the international scene.

(2) Database Directory at NII and Current Status of Scientific Database Construction

NACSIS, now NII, has been compiling a database, "Database Directory" or DBDR on databases at universities and public laboratories based on the annual survey to them, and it now include 2,892 descriptions on academic databases. The database is serviced in NACSIS-IR system on a fee basis, but the

list of databases is open for access at NII web site.<12>

In 1999 another project started in which various types of resources including researchers, databases and facilities at universities and national laboratories are surveyed and compiled into a database called NACSIS-DiRR, Directory of Research Activities and Resources. Thus database can be also searchable on this system. According to the administrative reformation at the national government of these years, NACSIS-DiRR is to be merged into JST's ReaD, Directory Database of Research and Development Activities in 2003.

According to the 2001 survey of DBDR, 2,892 databases are registered as constructed at universities and public research institutes.<13> A breakdown by subject field show that multi-disciplinary is at top with a 43% share, then literature 12%, medicine 9%, science 5%.
It should be noted that 623 databases or 22% of total are library catalogs, and most of them are multi-disciplinary. A breakdown by the contents show that 1,628 databases or 56% are recorded only by text like library catalogs and bibliographical databases, and 1,236 are factual databases as they include numerical or image or multimedia data Here again many factual or multimedia databases are compiled for science, literature and medicine. 291 databases are registered with their URLs, which means most of them may be open to general public.

An example of large ones is DDBJ (DNA Data Bank of Japan) at National Institute of Genetics (www.ddbj.nig.ac.jp), which is jointly complied with EBI (European Bioinformatics Institute; responsible for the EMBL database) in Europe and NCBI (National Center for Biotechnology Information; responsible for GenBank database) in the USA. "Solar activity Database" at the National Astronomical Observatory of Japan (solarwww.mtk.nao.ac.jp/en/database.html) includes photos and mpeg movies of sunspots and flare explosions for years, and appears to be attractive for me as an outsider. Image Database of Japanese Bees at Kyushu University (konchudb.agr.agr.kyushu-u.ac.jp/hanabachi/) might be another example of this type.

(3) Changes in Charging Policy

Until recent years, most of databases of the above had been serviced on a fee basis, where the benefit principle at the national government that users should pay the cost of database construction was applied. However the situation seems to be changed recently along with the penetration of the internet into the society. Now we can freely access tremendous amount of information on the internet, although its quality widely varies. Based on the new circumstance, the government appears to change the idea for servicing governmentally supported databases, as those should be made freely available to general public or tax payers. In one hand, fee based services might benefit tax payers by recovering the cost. But on the other hand, databases constructed with taxes should directly be returned to tax payers by free access. To my view, both type of the reasoning would be equally good, and tendency of thinking of general public would make a choice between the two principles.

However, the situation appears to change again quite recently, that is, recent development of pro-patent or intellectual property oriented policies at Japanese government, which will be touched upon later.

3. NEW POLICY DEVELOPMENT FOR DIGITAL RESEARCH INFORMATION INFRASTRUCTURE IN JAPAN

3.1 Report of the Working Group for Digital Research Information Infrastructure

In 2001 the Ministry of Education, Culture, Sports, Science and Technology (MEXT: the new ministry established by a merger of MONBUSHO and the Science and Technology Agency) organized a working group, "Working Group for Digital Research Information Infrastructure," under the umbrella of the Council for Science and Technology. I chaired the WG, and it publicized a report "Enhancing Infrastructure for Circulating Scholarly Information" in March 2002.<14> The report covers various aspects of scholarly information including acquisition of foreign electronic journals at university libraries, transmission of information from universities and academic societies, transmission of Japanese information abroad. The governmental policies on scholarly information infrastructure in coming years will be developed along the line designated in the report as follows.

3.2 Acquisition of Electronic Journals at University Libraries

For acquisition of electronic journals, consortium arrangements have become most popular, where the contracts are made between publishers and consortia organized by libraries. In these years Association of National University Libraries (ANUL) has been active in negotiating publishers for the arrangement, and devised a new type of consortiums suitable to Japanese accounting regulation. NII got a budget for an electronic journal server on which those journals would be mounted and serviced to universities.

In the consortia contracts, various factors may be introduced like number of subscriptions of paper version, number of users (faculty and students), range of years of publication, etc. Publishers and libraries are just in the process of searching some appropriate pricing schema or business models. We should keep watching the situation and express our opinions as scientists who are both readers and authors.

3.3 Information Transmission from Universities: University Portals

Information transmission from universities so far has been done by libraries and administrative offices and also personally by researchers. Now systematic approach is needed to return information produced by universities to general public. This is considered to be useful also for promoting industry-university collaboration, which the government is now encouraging. This would effectively be realized by establishing the portals at each university, that is, the one-stop shopping type entry points. A metadata approach seems to be quite suitable for constructing portal systems, where metadata should be attached to every item from the university, enabling users to make effective search. Here university libraries are expected to play crucial roles of planning, organizing and operating the portal system.

3.4 Information Transmission from Academic Societies

Japanese academic societies are generally small when compared to the ones of USA, and their financial bases are weak. MONBUSHO has been supporting them by subsidizing journal publication costs especially for English language journals and also database compilation projects from view point of promoting international presence of Japanese societies. In the IT age, electronic publications become rapidly important for academic communication, but the weak financial bases of the societies do not allow them to make the IT related investments.

3.5 Transmission of Japanese Scholarly Information Abroad

In order to make Japanese academic information more visible abroad, the internet should effectively utilized. Before the internet, Japan is far apart from the West due to its geographical location. The internet and IT have made the world so small in terms of information exchange, and we should exploit them as the prominent medium to make the country visible in the world of science and technology. The visibility of Japanese scholarly activities would be most strengthened by establishing the portal for access from outside the country, which should be provided with metadata databases to realize effective information retrieval.

To improve circulation of Japanese journals worldwide, building up a closer connection with SPARC (The Scholarly Publishing and Academic Resources Coalition) in USA and Europe would be effective where we can expect enhanced distribution channels overseas built by research library associations. SPARC is proposing alternative way of academic information dissemination in collaborative activities by research libraries, academic societies and researchers. It is developing new business models for effective scholarly communication. NII is just investigating a appropriate program to establish SPARC Japan, which should be fitted to Japanese environment.

3.6 Reinforcement of Network Infrastructure or SINET / Super-SINET

The Science Information Network (SINET) is a telecommunication network dedicated to academic research. In 1987, NACSIS began the service of SINET to connect major university computer centers and libraries by packet switching network. This network was offered to universities free of charge and used by librarians for the cataloging system and researchers to access resources at computer centers all over the country including NACSIS databases.

In 1992, NACSIS began to transform the network system into the internet as to construct the internet backbone, and by 1994 the construction of backbone has completed. Now, SINET connects some 40 nodes through high speed communication lines. The nodes are equipped with ATM switches and IP routers. It has the dedicated lines to USA, Europe and Thailand for international accesses.

In 2002, a new project for ultrahigh speed network began with the name, Super SINET, at NII intending to promote Japanese academic researches by strengthening collaboration among leading research institutes. This is an item in the e-Japan Priority Policy Program, as is described later, and is the world's fastest Internet for research, based on 10 Gbps optical communication technology. In the first stage, the network is used as a basis for studies in the five fields of high energy and nuclear fusion; space and astronomical science; genome information analysis (bio-informatics); supercomputer-interlocking distributed computing (GRID); and nanotechnology. The Internet backbone connects research institutes at 10 Gbps and the leading research facilities in the research institutes are directly connected at 1 Gbps. The IT-Based Laboratory (ITBL) Project also uses Super SINET as its base. Its cost is fully covered by the government, and no charges are imposed to users.

4. EXPECTED ROLES OF NII

(1) Center Function

According to the WG report, NII is expected to carry the center function for the digital research information infrastructure, to drive national policies on scholarly information circulation, and to promote related international cooperation. NII should continue to investigate on the infrastructure with NDL, university libraries and JST, where the following topics should be pursued: archiving electronic journals of Japanese origin, constructing mirror sites for foreign electronic journals, constructing world-leading databases, preparing information for research evaluation which has become increasingly required to make governmentally funded research more accountable for tax payers, and enhancing the network system, SINET and Super SINET.

(2) Portal Site System: *Genii*

NII has launched a portal system for academic contents, GeNii, in 2002 making Japanese scholarly information more efficiently accessible worldwide.<15> This should be the window of entire Japanese scholarly information. As is already described, NII has been developing scholarly databases from various aspects and various sources. NII plans to integrate all of these into one digital collection, and it also will be enhanced to cover external networked information sources.

(3) Metadata Database System

NII is launching a new system with in the scope of GeNii, that is, the metadata database system in which university libraries are encouraged to input metadata on digital materials in universities. The system is expected to form a portal for digitized Japanese scholarly information.

(4) Citations in Japanese Journals

The Citation to Japanese Papers Database (CJP), a citation index database on Japanese papers, is another important component in GeNii. NII has been compiling it since 1995. This might be said Japanese version of ISI's Citation Index, where the papers on Japanese academic society journals would be linked together with citations among them.

The database primarily provides efficient access to Japanese scholarly information by its linking function. Meanwhile, the system would be used for research evaluation, in the recent circumstance that the performance of national universities and governmentally funded researches should be subject to severe inspection. Japan has a big academic community, and the ISI's citation counts seem to be inadequate as a lot of papers written in Japanese are publicized in Japanese academic journals. Now researchers are increasingly making their papers and achievements available online, the system should be enhanced to cover those materials.

5. e-JAPAN STRATEGY

5.1 Mobile Internet Access as Japan the World Leader

According to the latest Communication White Paper released in July 2002 by the Japanese government, internet penetration among Japanese people is showing a remarkable advance in these years.<16> Japan is now the second biggest country after USA in terms of the internet population. However, in terms of per capita popularization, Japan is still at the 16th with some 44% of people accessible to the internet. However the white paper appears to be proud to state that Japan is the most advanced country in the world in "mobile internet," the internet access through portable phones.

The mobile internet, started in February 1999 by NTT DoCoMo's "i-mode", now gets more than 50 million users in these 3 years, and has 51,930,000 contracts as of April 2002. The rate of internet capability in mobile phones has reached 72.3%, which is the top of the world with Korea of 59.1% as the 2nd, followed by Finland of 16.5%. The USA is ranked at the 6th with that of 7.9%. In this telecommunication environment, various types of services and businesses are being developed in Japan including ticketing, banking, image downloading, positional information service, etc. Because this is one of the few areas Japan can claim the World No.1, the governmental policies would be developed so as to take advantage of this technology. Thus the Ubiquitous Network Society is the catch phrase for e-Japan Strategy, as follows.

5.2 e-Japan Strategy

The Japanese government established the "e-Japan Strategy" in 2001, in which the society with the **ubiquitous** information network was put in the agenda. The program aims to make Japan the most IT advanced country in the world in 2005. The history of the governmental initiative in this area goes back to 1994, when "Advanced Information and Telecommunications Society Promotion Headquarters" was established within the Cabinet, with the prime minister as the chief. In light of the internet penetration, the government enacted "Basic Law on the Formation of an Advanced Information and Telecommunications Network Society (IT Basic Law)" in 2000, and "Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society (IT Strategic Headquarters)" was established in 2001.<17, 18> The e-Japan Strategy and e-Japan Priority Policy Program are the products by the headquarters. Now we are in the e-Japan 2002 Program, and various policies are being developed along with this line at all the ministries.

In the strategy, Japan is going to establish a world fastest network, and on this infrastructure, e-commerce, electronic government and IT education are to be promoted. In its background, there is the notion that Japan is delayed in the internet utilization, and this is a cause for the economic recession of the last decade. The e-Japan strategy is one of the important political measures toward the economic recovery. Of course, some people are very suspicious for this straightforward notion and the admiration of the new economy.

5.3 Shift to Pro-patent policy

The government established another board, "Strategic Council on Intellectual Property" in 2002, aiming to strategically protect and utilize the results of research and creative activity as intellectual property, and to enhance the international competitiveness of Japanese industries and revitalize the economy.<19> The council decided that Japan should be a **"Nation Built on Intellectual Property"** and produced the report, "Intellectual Property Policy Outline."

According to the report, the government is going to enact Basic Law for Intellectual Property in 2003, and universities and public research institutes are expected to play crucial role for the realization of the Nation Built on Intellectual Property. Technology transfer from universities to industry would be promoted, and the protection of intellectual property would be reinforced.

They see the success of the Bahy-Dole Act of 1980 in USA as the model, and would like to realize the same type of institution in Japan. So far, intellectual property rights at universities are attributed to the individual researchers and not smoothly transferred to industry. The recent policy is going to change this generous or equivocal custom at research institutes, and TLOs should acquire the rights and actively sell them to industry. Thus industry-academia collaboration would be encouraged.

5.4 Science and Technology Policy

Council for Science and Technology Policy of Cabinet Office, another authority to lead science policy

headed by the prime minister, decided the Science and Technology Basic Plan for 2001-2005, where the four priority fields were designated: 1) life sciences, 2) Information and communication technologies, 3) environmental sciences and 4) nanotechnology and materials. Here again international competitiveness is the important aspect, and industry-academia collaboration is to be promoted.<20>

A part of the researchers are very much worrying that these political developments would suppress basic research which might not result in practical or profitable applications, and weaken the research power over a long period of time. However, those opinions tend to be suppressed in the deepening economic difficulties of Japan. Nevertheless, the governmental movement towards the pro-intellectual property may be good, so long the legislation on scientific information would be explicitly established and the balance between proprietary and free aspects would be appropriately ensured.

6. UNIVERSAL CONTRIBUTION OR NATIONAL INTERESTS

As is reported at a Monday session on legal issues by Prof NAEMURA, in 2002, the Science Council of Japan, an assembly of prominent scientists, publicized an official pronouncement on the sui generis right for legal protection of databases in response to the WIPO (World Intellectual Property Organization) inquiry on a Draft Database Treaty, where a sui generis regime for legal protection of database investors designated in the European Union Directive should be implemented as an international treaty.<21> The statement says that the Science Council of Japan reaffirms the necessity of full and open exchange of data in the conduct of scientific research and education, and opposes legislation based on the sui generis right in addition to the existing copyright legislation from the standpoint of the advancement of science.

Data obtained from experiments, observations, or surveys that have been conducted with public funds should be released after a prescribed period of proprietary use by the investigator, because it is a duty of scientists to return the benefit of their research to society by making the data and results of research available to others. Though the pronouncement represents opinions of Japanese scientists, the idea of free access does not appear influential in front of the recent political climate in Japan.

It is said that academic research has no national boundaries, but the results has national boundaries. When national interests or strategy or competitiveness becomes great concern, proprietorial aspect of research results is significantly emphasized. Due to the long recession, general atmosphere in Japan appears to go as follows; Fruit of governmentally subsidized research should be treated as economic goods and shared by the industry of the nation and be utilized for the development of national economy and competitiveness, rather than to be shared among scientists all over the world.

Deregulation, commercialization, privatization and competitiveness seem to be the keywords to lead national policies not only for Japan but for many countries in the recent world of global economy. In addition, the distance between science and industry is becoming small due to the advancement of science.

Here scientists are required to make a great effort to explain significance and universality of scientific research in order to get correct understanding of general public, and thus prevent excessive commercialization of scientific activities. It must also be noted that market mechanism is not necessarily workable especially for informational commodities, as summarized in the beginning of this paper. and suitable regulations should be introduced. Thus, scientists could contribute to the development of economics of information by actively expressing their views on scientific information.

In this respect, international collaboration of scientists would be quite important for promoting free access to scientific information. As is covered at a Monday session on the public domain in scientific data, OECD, UNESCO and CODATA are working on the free access problem. I hope CODATA with its authority based on a long history and achievements, will lead the discussions towards the proper direction for the future in collaboration with those international organizations.

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