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Toward a National Science Information Network in Japan

全国的科学技術情報ネットワークの進展をめざして

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要　旨

科学技術の急速な進歩は，わが国の将来の発展に重大な影響を与えるものがあるが，一方，科学技術分野の情報量は年々増加しており，膨大な全科学技術情報の中から，研究者が必要とする特定の情報を選び出すことは，ますます困難になってきた。

わが国には，国立国会図書館があるが，科学技術情報のサービスについては不活発であり，日本科学技術情報センターは設立以来12年余になるが，いまだに科学技術の全領域に対してサービスを行ない得ないでいる。

このような状態の中で，国立の農学総合図書館設立の動きがあり，また，一方では日本医学図書館協会加盟館を結び，日本科学技術情報センターにメドラーズを導入して医学情報ネットワークを形成しようという考え方も発表された。

科学技術の全領域にわたる全国的な規模の文献情報サービスを行なうことを目的とする計画は今までにいくつか提出されてきたが，おおむね，現在の日本科学技術情報センターのサービスを拡大していって，科学技術の全領域にわたる文献情報サービスを行ないうるようなセンターに仕立てあげようという構想のものであった。

最近，科学技術会議で討議されている，科学技術情報の全国的流通システム（NIST）の構想は，システム・アプローチが多分にとり入れられたという点で，今までとはかなり異る点が認められるのであるが，この構想も日本科学技術情報センターの単なる拡大案として受取られるならば，問題は依然として今後に残されるであろう。

科学技術情報の流通システム，さらにその全国的ネットワークを推進するため，わが国で解決しなければならない幾多の問題を解決しつつ，一方で科学研究者，技術者から忌憚のない意見を広く徴する必要もある。本論においては，わが国の科学技術情報システムないしネットワークに関するこれまでの進展あるいは計画を述べると共にそれらを批判し，さらに新しい全国的ネットワークの構想に関する私見を述べた。（図書館・情報学科）

I. Foreword

The amount of science information has been rapidly increasing. It is estimated that the annual total of articles in world's science and technology journals must be between 2,000,000 and 3,000,000, and that the number will double hereafter every eight or ten years. Already, Japanese learned societies, colleges and universities, and various research institutions in all fields of science and technology which contribute to the output of information exceed 10,000.

As it is obvious that growth in scientific and technological fields influences tremendously the development of the nation, it has been recognized as a national requirement that comprehensive document and information services be established and maintained so that the research worker can make rapid use of new information produced by others and thereby benefit his society.

So far, however, Japan has not developed adequate national document- and information-handling systems. In this respect, our country appears to be in an embryonic or under-developed stage despite its remarkably advanced industrial achievements. In the present paper, a few ideas or draft plans for a national network of information systems in the fields of science and technology are to be introduced and discussed.

Recognition of the importance of scientific and technical developments by the Government was signalized by the establishment of the Science and Technology Agency in the Prime Minister's Office in May of 1956. In August of the next year, under the supervision of the Agency, the Japan Information Center of Science and Technology (JICST) came into being. Since then the JICST has been engaged in such activities acquiring foreign and domestic journals in science and technology, publishing abstracts, and providing reprographic copies to meet the needs in scientific research and development.

Although the JICST's aim, as enunciated when it was created, is to serve relevant information to research workers in all fields of science and technology, its services have actually been limited to the physical sciences, and the biological sciences have been neglected. The present state and future plans of the JICST will be discussed in the following section.

In the meantime, in the fields of the bio-agricultural sciences, librarians and documentalists, working with experiment stations and research institutions, belonging to the Agricultural, Forestry and Fisheries Research Council of the Ministry of Agriculture and Forestry, have been engaged since 1965 in study of plans for a "National Central Agricultural Library". They reached a tentative conclusion in April of 1966, and since then their group has re-examined the 1966 plan and continued its basic studies. Details of their studies are to be introduced in Section III.

Medical librarianship is another field in which a national information network has been considered. Although it is the most advanced librarianship in Japan, it embraces no single medical library qualified to assume the responsibilities of serving as the national medical library. A possible Japanese pattern for a national information network in medicine was first discussed in 1968. It was then suggested that the JICST might provide a satisfactory national center for medical information in close cooperation with the Japan Medical Library Association and its 51 member libraries. Further comment on national medidal information services is given in Section IV.

The handling of documents and information on a national scale has over the past fifteen years been referred to in various reports of the Science Council of Japan, the Council for Science and Technology, the Science and Technology Agency, and other bodies and even been a subject of recommendations. This year (1969), a task force, composed of sixteen specialists on information problems in science and technology worked on this topic and drew up a report very recently

which dealt with (1) policy for national information systems for science and technology, (2) international cooperation with oversea information centers, (3) education and training for science information technologists, and (4) information-handling technology. These efforts toward national science information systems are to be described in Section V.

The various ideas and plans concerning a national system or network mentioned above came into existence rather independently, with few efforts being made to coordinate them. Therefore, there is little uniformity in their basic concepts. In the last section of this paper, an attempt is made to coordinate the different proposals.

II. Japan Information Center of Science and Technology and Its Future Plans

The Japan Information Center of Science and Technology (JICST) was founded in August of 1957 as a non-profit-making foundation under the provisions of the Law concerning the Japan Information Center of Science and Technology. The JICST's aim was to be the central organization for information activities serving the advancement of science and technology in Japan. To achieve this aim, it was expected to collect comprehensively information having to do with science and technology throughout the world, to process and store this information systematically, and to disseminate it as quickly as possible to organizations and individuals regularly or upon special request. It also was authorized to offer other far-reaching services and to encourage information workers in local organizations and assist them in solving problems difficult to tackle by themselves.

From ¥125,395,000 in the first fiscal year, 1957–58, the budget of the JICST has expanded to ¥1,373,755,000 for the 1969–70 fiscal year. Its permanent staff in the initial stage totaled 62; for 1969–70, it has 332 employees[1]. With the increases in its annual expenditure and personnel, its services naturally have grown.

In 1958–59, the JICST acquired about 3,400 journals, of which 2,694 were from foreign countries, and abstracted from them a total of 93,000 articles. By 1968–69, it was taking in a little more than 6,600 journals, of which 4,427 were foreign, from which about 396,000 abstracts were made. Other than scientific and technical journals, it has been collecting patent specifications from the United States of America, Great Britain, and West Germany, from which 23,000 to 44,000 abstracts have been made annually[2]. These abstracts of journal articles and patent specifications have been published in series titled *Current Bibliography on Science and Technology* and *Foreign Patent News*. The former is the major JICST publication. In 1958–59, only four sections, covering general and mechanical engineering, electrical engineering, chemstry and the chemical industry, and the earth sciences, mining and metallurgy, were published, but since 1968–69 the number of sections has been increased to nine with the addition of the following five fields: civil engineering and architecture, and applied physics, atomic energy (isotopes and radiation chemistry), management science, and domestic chemistry (or *Complete Chemical Abstracts of Japan*). Other JICST periodicals include *Technical Information for Small Industries*, *Technical Highlights from Overseas*, *Annual Index to Japanese Patents* and *Documentation and Information*[3]. As for the disciplines covered by the JICST's abstracts and indexes, they so far have been confined mainly to the physical sciences.

Other than publishing abstracts and indexes, the JICST has been providing such services in response to requests from organizations and individuals as reprography, translation, literature search, and special abstracting. It also maintains a reading room. From 23,504 in 1958–59, requests for reprography jumped to 334,000 in 1968–69. It also renders inter-institutional reproduction service as well as circulating periodical contents sheets. As for translation, the number of requests increased from 577 in 1948–59 to 2,148 in 1948–69. It translates

from foreign languages to Japanese and vice versa. Literature or patent search requests grew from 594 in 1958–59 to 2,148 in 1968–69[4].

Research and development activities for improvement of the JICST's services have been focussed on the designing of mechanized information storage and retrieval systems. Soon after its foundation, the JICST organized the Mechanized IR Study Committee, headed by a standing director. Its studies led to the creation in 1961 of JEIPAC (JICST Electronic Information Processing Automatic Computer), a system which used a TOSBAC 4100 as its main component. After the introduction of the JEIPAC system, further studies and experiments on information retrieval were carried out, inputting information about metallurgical articles, coded according to the ASM-SLA classification scheme. A series of other experiments on document information retrieval in regard to chemical compounds was carried out with the JEIPAC system in 1961, and the results of these experiments yielded many suggestions useful in planning future mechanized information retrieval systems. To solve problems created by the special features of the Japanese written language, which regularly consists of "Kanji" and "Kana" elements and may use alpha-numeric characters as well, research projects were carried out. One was on indexing by KWIC and KWOC in Japanese, and another on development of JAKIS (Japanese Keyword Indexing Simulator System). Both of these were begun in 1965[5].

These studies on mechanized information retrieval culminated in the installation of an electronic computer system in December of 1967, consisting of an FACOM 230-50 as the main computer with a main memory unit, an F2520B, into which may be put information expressed in 1861 "Kanji", 158 "Kana" syllables, 65 Roman letters, 66 Russian letters, 33 Greek letters, 10 Arabic and 20 Roman numerals, 199 symbols, etc. and from which may be obtained information expressed with a tolal of 3,071 linguistic elements, including different type faces. To do so, "Kanji" teletypewriters and flexowriters were combined as the input device, and a high-speed "Kanji" line-printer, JEM 3800, was newly developed as the output device[6].

The new computer system at the JICST is now in operation or definitely scheduled for the following purposes: the automatic editing and photocomposition for periodical issues and annual indexes of the series titled *Current Bibliography on Science and Technology*, processing approximately 30,000 abstracts a month; keywords controls and preparation of thesauri in the Japanese language; selective dissemination of information (SDI) service; keeping records of information about source documents, and processing data on routine business operations.

The JICST has grown in accordance with three expansion plans. Before the inauguration of the center, the Science and Technology Agency drafted for it a program for the three-year period from 1957 to 1960. After operation began and consideration was given to operational realities, the budget and other matters, the center set up the first expansion program[7] for the same period. In accordance with this plan, the objectives for 1960–61 were listed as follows (actual achievements in 1960–61 are shown in parentheses):

Subject fields handled: physical sciences
Acquisitions: foreign serials, 2,500 (2,461) titles
foreign patent specifications, 20,000 (21,799) items
domestic serials, 1,000 (717) titles
Information processing: foreign articles abstracted, 150,000 (145,000)
foreign patents abstracted, 20,000 (22,000)
Services: sales of abstract journals, 6,000 (5,622) copies
services upon request, 100,000 (118,857) requests

Some of the achievements were rather surprisingly in excess of the scheduled goals. In the final stage

of the plan, however, it was realized that the center still had such unsatisfactory deficiencies as the limitation of subject fields to the physical sciences, the poorness of serial acquisitions, with resultant lack of comprehensiveness in information storage, the lack of domestic information processing, and the staff's inadequacy of skill in literature and information searches.

Along lines laid down in the report and recommendations on general basic policies for the promotion of science and technology from 1960 to 1970 which the Council for Science and Technology had submitted to the Prime Minister, the JICST's second expansion plan, for the five-year period of 1961-66[8], was adopted in September of 1960. It included such new projects as addition of biology and biochemistry to the subject fields, provision of comprehensive information storage and retrieval, mechanization of information processing, handling of domestically originated information, and other information services, but most of these new projects could not be carried out as planned. Some of the planned and achieved services in 1965-66 were as follows (performances in parentheses):

Acquisitions: foreign serials, 6,000 (4,081) titles
foreign patent specifications, 100,000 (32,882) items
domestic serials, 2,000 (2,010) titles

Information processing: foreign articles abstracted, 400,000 (258,000)
domestic articles abstracted, 100,000 (27,300)
foreign patents abstracted, 100,000 (29,800)

Services: sales of abstract journals, ¥150,000,000, (¥177,741,000)
services upon request, ¥250,000,000 (¥156,463,000)

While the Council for Science and Technology was re-examining its first report, the center, reviewing its achievements, issued a ten-year plan setting goals to be reached by 1976[9]. This plan embraced the comprehensiveness of the fields to be handled, the relevancy of information to be made available, and the rapidity of information dissemination. It set the following objectives: 1) the JICST should acquire 10,000 foreign serials as soon as possible and build up the number to 15,000 by 1975, as well as an exhaustive collection of domestic titles, 2) the center should establish rationalized information processing systems by 1970, processing domestic physical science articles comprehensively from 1966, starting abstracting in basic medical and agricultural fields from 1966, and expanding the scope of the patent literature so that it would abstract a total of 700,000 articles and patent specifications by the year set as the goal, 3) the center should mechanize the processes for compilation of its indexing journals and the storage and retrieval of information by employing modern machines and equipment, and 4) the center should provide relevant information rapidly by issuing special editions of abstracts, by KWIC indexing, by rapid reviews, etc., through use of automatic equipment for reprographic services, by organization of capable translaters throughout the nation and placing translated articles in various depositories for the convenience of users, and by providing important secondary publications from throughout the world and by maintaining a strong staff for services.

In this ten-year plan, emphasis was put on 1) research on and development of information processing, 2) mechanization of all sorts of work in the center, 3) improvement of the treatment of the staff, 4) training of professional staff members, 5) establishments of more branch offices, and 6) strengthening of international cooperation.

Meantime, the special committee on science information of the Council for Science and Technology worked on the national policies for strengthening of science information activities in 1965 and its draft report was completed in Ausust of the same year. The report had considerable impact on the JICST's administration, with the result

that it reviewed and revised its ten-year plan and drew up in December of 1965 its first five-year (1966–71) expansion plan as an all-round science information center[10]. According to this plan, which currently is being implemented, the JICST is to develop into an all-round national science information center befitting our modern age, expanding the subject fields covered by it to all scientific and technical disciplines, improving the comprehensiveness, relevancy and rapidity of its services, employing mechanization on a large-scale and establishing a research institute for information science and technology and a training school for science information specialists in affiliation with the center. The objectives to be achieved by 1971 are as follows:

Acquisitions: serials in physical sciences, 10,200 titles
serials in medical sciences, 6,200 titles
serials in agricultural sciences, 1,400 titles
technical reports, 50,000 items
secondary sources of information, 500 titles
patent specifications, 275,000 items

Information processing: abstracting of physical scientific articles, 510,000 items
abstracting of medical scientific articles, 280,000 items
abstracting of agricultural scientific articles, 70,000 items
abstracting of patent specifications, 100,000 items
English abstracts of Japanese articles, 12,000 items
indexing, 1,644,000 items
micro-fiche, 910,000 sheets
storage on magnetic tape, 910,000 items

Services of the JICST in 1970–71 will be expanded in such areas as the publishing of abstracts, indexes, digests, reviews, contents sheets, English editions of abstracts, etc., reprography, translation and the fulfillment of requests. To carry out these services satisfactorily, the center will develop and introduce such mechanized devices as a large-scale electronic computer, a "Kanji" line-printer, an automatic micro-fiche filing machine, and an automatic machine for reprography.

The size of the budget of the JICST in 1971 is estimated to be 3,700 million yen, and its full-time staff will have 850 persons.

It is true that the JICST as our only national science information center has developed tremendously and widened the horizon of its services during its first ten years. As examination of the subject fields covered by it reveals, however, its abstracting journals are concerned with only part of the physical sciences. Its working collections now contain more than 7,000 titles of scientific journals, and an extension of services to the life sciences has just recently been started with the acquistion of about 900 titles of medical journals. Although it is called the Japan Information Center of Science and Technology, it perhaps should be renamed the "Japan Information Center for Physical Sciences and Engineering" unless it thoroughly expands its services to include the life sciences as is stipulated in its ten-year plan.

How the JICST may contribute to future developments in science information will be discussed in the final section of this paper.

III. Conception of the Japanese Central Agricultural Library

It was decided by the Cabinet in September, 1961, to move major governmental research institutions from the crowded Tokyo Metropolitan area to a suburban area. In accordance with this decision, 11 or 12 major ones among the 30 research institutions under the jurisdiction of the Ministry of Agriculture and Foresty have been selected to join in an agriculture research center to be developed in a large area of the foot of Mt. Tsukuba, northeast of Tokyo in Ibaraki prefecture.

In 1962, the Secretariat of the Agricultural, Forestry and Fisheries Research Council carried out a survey of the libraries and library services of the research institutions affiliated with the Ministry,[11] and, in 1963, it surveyed user needs for library materials and research information.[12] These two surveys revealed that the libraries needed more space, more trained staff members, and more funds to improve their services, and that the research workers whom they served needed and were demanding, among other things, secondary sources of information, especially domestic ones, and quick reprographic and translation sevices. As one research worker pointed out, there were many unnecessary duplicates of periodicals and other materials in various research stations, and as it was practically impossible to provide an ideally comprehensive collection of all needed materials for each institution, it was highly desirable to establish a coordinating center to give quick and efficient library and information services to all of them at minimum cost.

After inquiries, it became apparent to agricultural documentalists in the Ministry of Agriculture and Forestry that the JICST would not engage in agricultural information processing as soon as they had hoped. As a consequence, there was advocacy of steps to consider and develop a plan for establishing a central agricultural library in parallel with the planning for the new agricultural research center.

A voluntary study group was organized by librarians and documentalists of the Agricultural Ministry's research institutions in the Tokyo area, who held many meetings during the period from December, 1964, through April, 1965, to examine and discuss their problems, including the plan for a new central research library. They published in March, 1966, the results of their efforts as a draft report[13] to which was attached a separate paper titled "Draft Plan for a Central Library."[14] Meantime, working groups were organized in the Secretariat of the Council to explore possible facilities for common utilization by the personnel of the projected agricultural research center in Tsukuba. From April to June, 1966, they considered the plan which the study group had drafted and concluded that the establishment of such a national central agricultural library was essential for research.[15] Further deliberations on the plan took place from October, 1967, to February, 1968, in which attention was given to such matters as the relationship between the central library and the research institutions' individual libraries and a possible schedule for bringing the library into existence. No changes in the fundamentals of the draft plan were recommended.

The "Draft Plan" dealt with 1) the demands for the central library, 2) the favorable opportunity for the establishment of such a central library which the creation of the agricultural research center in Tsukuba offered, 3) the major services to be provided by the library, 4) its personnel requirements, 5) its administrative organization, 6) its facilities, and 7) its budget. Some of the more interesting details of the plan follow.

As for its acquisitions policy, the library would endeavor to assemble as complete a collection as possible of the world's literature related to agriculture, forestry and fisheries but in principle would exclude patent documents. About 5,000 titles of foreign serials and 3,000 titles of Japanese would be sought.

In regard to public services, the plan states that the library would provide not only circulation of books and reproduction of journal articles but also such reference services as quick response to urgent inquiries, literature search, compilation of subject bibliographies, and publication of indexes, a union catalog and similar reference tools. The library also would promote interlibrary cooperation among agricultural science libraries internationally and domestically, acting as a national clearinghouse concerning agricultural science information.

Concerning the staff, the draft plan points out that at least 80 to 120 full-time employees would

be needed, of whom at least 10 should be highly professional in information technology and more than 20 others should be trained in general librarianship and/or subject specialities.

Speaking of facilities, the plan recommends that the site of the library be as central as possible in relation to the experiment stations and research institutions which it is to serve. It suggests about 9,000 m^2 of space, including 2,650 m^2 for reading, circulation and reference services, 3,200 m^2 for stack space, 1,200 m^2 for admistrative and business, technical processing, indexing and computer areas, and 1,900 m^2 as architectural or non-assignable space. It estimates, on the basis of 1963 prices, that the building would cost between 540 and 680 million yen.

For the initial annual budget, the plan calls for 190–200 million yen, approximately equal to 5.7% of the grand total of the 1963–64 budgets of the eleven research institutions which were then expected to move to the Tsukuba area. It suggests that the sliding system should be adopted for budgetting.

It must be noted that the conception of the national agricultural library prepared by the Agricultural Ministry's librarians and documentalists is very much like that of the U. S. National Agricultural Library, but it excludes the Library of the Ministry of Agriculture and Forestry, wheseas the American NAL includes a strong collection on agricultural administration taken over from the former U. S. Department of Agriculture Library. Those engaged in the planning for the national central agricultural library have tended to keep its services within the traditional scope and been rather hesitant to introduce new information services. Those who know the present retarded status of agaicultural librarianship in Japan will realize that any plans must be programmed step by step on the basis of actual capabilities.

When a panel on the facilities for common utilization in the Tsukuba area was organized by the Science and Technology Agency in April, 1968, however, some divergencies in thinking became apparent among the panel members. This panel's task was to explore the potentialities of a regional or local scientific information center in Tsukuba, whereas the proposed national agricultural library had been intended as a library and information center serving the entire nation and limited to the agricultural sciences.

Out of the panel's deliberations came agreement on certain basic aspects of the information center to be established in Tsukuba[16]. Its principal activity would be to render information services; it would promote interinstitutional and interlibrary cooperation on information exchange in the area; it would act as a telecommunication or switching center among research institutions and libraries in the area as well as between them and the JICST, NDL, Patent Agency, etc. in Tokyo with such equipment as a Facsimile-Telex, and it would have a computer system so as to disseminate information rapidly to its users.

This proposed information center would acquire domestic and foreign governmental documents (including patent specifications), proceedings of various conferences and meetings, reports by private institutions, standards, records of information on magnetic tapes or in microforms, and reports of a clearinghouse to be planned later. It would not collect books and journals regularly acquired by its client libraries. It would rely on the projected national agricultural library to produce secondary sources of Japanese agricultural information in addition to providing its regular library services[17].

Concerning the organizational position of the central agricultural library in the Government, the working group in the Secretariat of the Agricultural, Forestry and Fisheries Research Council suggested two patterns. One was that it might be attached initially to the Council and develop into a central library, absorbing the National Institute of Agricultural Sciences Library. The other was for it to take form within the National

Institute of Agricultural Sciences and eventually evolve into an independent central library including the Institute's library[18].

The possible place of a national agricultural libra ry and documentation center in the national informa tion network will be discussed in the final section.

IV. A National Information Network for Medicine in Japan

In the field of medicine, the Japan Medical Library Association has long been promoting interlibrary cooperative activities among its 51 member medical libraries, of which 46 belong to medical schools. Since the foundation of the association, it has emphasized interlibrary loan services, and such services have been facilitated by the compilation of a union catalog of western medical books and a union list of medical journals collected by the libraries affiliated with the association. In the 1966-67 fiscal year, 42,381 items of library materials, some of them in the form of photo copies, were provided to and by member libraries. Essential for interlibrary loans is the maintenance of up-to-date records of periodical acquisitions. Tokyo University Medical Library, which has installed a TOSBAC 3400 computer, has been experimenting with the processing and maintenance of such records, and Keio University Medical Library has developed an automatic system for the processing of serials records with a TOSBAC 5400. These two institutions are going to develop automatic programs for the preparation of a union list of medical serials and a union catalog of medical books in Japan. When these projects are fully implemented, an up-to-date union list of serials and an up-to-date union catalog of books in libraries will be maintained by the association and be available to member libraries at any time.

Meantime, the Keio University Medical Library began indexing Japanese medical journal articles under a contract with the U. S. National Library of Medicine (NLM) in July, 1966. Since then, the MEDLARS Project Section of the Keio Medical Library has annually sent input information processed from more than 10,000 articles in 128 selected Japanese medical periodicals.

Of all document services in Japan, the medical library network developed by the Japan Medical Library Association is the most advanced in Japanese library circles. However, medical information services have never been developed comparably.

For a medical information network in Japan, an essential element which is lacking is a national central medical library and information center comparable to the NLM in the United States. Also lacking is recognition by users and librarians in general of the importance of information services in the field of medicine.

An analysis of dada in a survey of medical libraries in Japan has shown that none of existing medical libraries could possibly become the national center for such a purpose. Leaders among medical librarians, therefore, are inclined to look to the Japan Information Center of Science and Technology (JICST) to assume the role of the national medical information center[19),20].

Originally, the JICST had a plan to serve the medical field from 1960. It postponed the date for this to 1967, as stated in its five-year expansion plan prepared in December of 1965, and the work actually started in July of 1968. According to a rough estimate, the JICST's present processing capacity in abstracting in all fields is 320,000 articles per year, needing an annual expenditure of ¥500,000,000 and a total of 180 full-time members on the document- and information-handling staff. If an information center with a similar capacity had to process medical information, it would need a budget of about ¥300,000,000 and 120 people on its document- and information-handling staff. Such requirements make it prohibitive to establish a new independent medical information center for a country such as Japan[21]. As a consequence, the administration of the JICST came to favor the introduction of MEDLARS into Japan to reduce the cost of medical information input. Since 1965,

the JICST has been negotiating with the NLM concerning adoption of MEDLARS to Japan. At the same time, it has been making efforts to consolidate domestic efforts through special cooperation with Keio and a few other leading medical libraries.

Would it appropriate to organize a national medical information network by connecting the member libraries of the Japan Medical Library Association with the present JICST? Such a network might not be accessible to medical research workers and clinicians belonging to institutions with libraries which are non-members of the association. Also there is some question as to whether the present JICST's policy can be applied satisfactorily to the medical field. These matters will be discussed further when the writer takes up the national scientific information network problems.

V. Plans for National Document- and Information-Handling Systems for All Areas of Science and Technology in Japan

When we consider the facilities already handling on a national basis documents and/or information in all areas of science and technology, we must turn first to the National Diet Library and then to the Ministry of Education.

The National Diet Library, corresponding roughly to the Library of Congress in the United States, has been acquiring, storing, cataloging and indexing scientific and technical materials, but its scientific information services are not very strong. It has by now amassed about 200,000 volumes of scientific and technical books and monographs, both foreign and domestic, about 10,000 titles of foreign scientific periodicals and about 2,500 titles of such domestic periodicals. Its *Japanese Periodicals Indexes* series contains a monthly coverage of natural science, but its processing of scientific journal articles is inadequate both quantitatively and qualitatively.

In the Education Ministry, the Information and (Academic) Libraries Section of the Bureau of Higher Education and Sciences has been compiling a union list of scientific periodicals collected by Japanese universities, which is a very useful tool to locate specific issues of periodicals.

The organization which took the initiative in considering a national academic library system was the Science Council of Japan. During the period of 1954–55, the Council members discussed national science library system for Japan and considered the establishment of a central science library and some specialized and regional libraries as essential components of the national system[22]. Although actual recommendations to the Government did not emerge from this discussion, it is interesting that as long ago as 1954 and 1955 scholars were aware of deficiencies in the existing systems of retrieving documents that contain needed information and that they at least gave thought to recommending to the Government the establishment of a science document-handling system of nation-wide scope. Later, the Council made two important sets of recommendations on the improvement and modernization of academic libraries in 1961[23] and 1964[24]. The 1964 recommendations, in addition to rationalization of management and operations, called for establishment of a coopertive system of academic libraries, education and training of a professional staff to handle highly academic information, adequate budgets, and creation of an adequate governmental organization capable of guiding and advising academic institutions on modernization of their libraries. In 1965, the Council made recommendations under the heading of "Five-year Plan for Scientific Research"[25] in which the humanities and the social sciences were included. This plan, to be implemented from 1967 through 1971, emphasized the importance of the development and use of computers, communication networks, and information-handling techniques and management. Among the recommendations, consisting of five sections, was one urging the establishment of regional academic information centers and specialized information centers to be

coordinated into a national academic information network. Especially noteworthy is that early in its thinking about the matters the Science Council of Japan aimed at the provision of academic libraries in which more emphasis would be put on the humanities and the social sciences. It recommended not only the development of electronic computers for library use but also more systematic consideration of the problems of academic libraries. Although its recommendations were not accepted as fully as it had hoped, its idea of connecting computer networks with information-handling systems gradually achieved recognition and came to be perpetuated in reports and recommendations made by the Council for Science and Technology.

The Council for Science and Technology, inaugurated in 1959 directly under the Prime Minister, has responsibility for considering and establishing policies for the promotion of scientific and technical research and development. It submits reports and recommendations in reply to inquiries made by the Prime Minister. Its first task was to prepare a comprehensive report and recommendations on basic policies for the promotion of science and technology in the 1960–70 period. Completed in October, 1960, the report[26] established objectives and recommended specific policies for the development of scientific and technological manpower, consolidation of research activities, and promotion of information dissemination, internatinal exchanges and general diffusion of knowledge. It also suggested improvements in existing systems. This report was the first to discuss science information problems and related policies at the national level in a fairly comprehensive manner. For national information handling systems, the report suggested development of a national center to handle information in not only physical sciences but also medical and agricultural sciences, with special information centers and data centers to be linked with it.

About five years after this first report was submitted to the Prime Minister, the Council took a fresh look at it. In response to new demands created by recent developments in science and technology and to changes in international and domestic circumstances, a revised report was issued in August, 1966[27], in which greater emphasis was placed on the strengthening of science and technology information services. Its Chapter 3, devoted entirely to the problems of science document and information services and related matters, stressed the importance of providing an effective system of scientific organizations charged with originating primary information and of strengthening document- and information-handling organizations. With regard to the latter, it gave major attention to a national information center for science and technology which would handle needed information comprehensively, supplemented and supported by specialized information centers to deal with information in special subject fields, data centers, science libraries, clearinghouses and other related agencies. The necessity for a national clearinghouse for scientific and technological information was stated forcefully in the revised report, and its functions were outlined. It is interesting to note that the so-called Weinberg Report, issued in 1963, stressing the clearinghouse idea, seems to have exerted some influence on the thinking which led to the revision of the report. Later, a small group called the "Discussion Meeting on the Clearinghouse Functions" was organized in October of 1966, and out of its discussions came a report which was released in June, 1968[28].

In early 1968, under sponsorship of the Promotion and Management Sections of the Science and Technology Agency, a working group was organized to analyze the current status of communication of information in science and technology in Japan, to explore possible patterns for future information services, and to formulate a governmental policy on such matters. At the end of 1968, a plan for the development of a national information system for science and technology was published as a result of the group's efforts[29]. If pointed out the

need for (1) development of a national general science information center where all scientific and technical documents would be acquired, abstracted and indexed and which would supply stored information to users, (2) development of special information centers to acquire and supply documents and information about their contents of a nature which the general center could not afford to handle, (3) establisment of data centers to collect, evaluate, process and supply experimental data, etc., (4) improvement of the services of libraries engaged in collecting, processing and preserving scientific and technical literature and establishment of a clearinghouse to provide information about such matters as the location of unpublished reports and the resources of research institutions upon request. Such a network for scientific and technical information transfer is shown in Fig. 1.

To fulfill the plan, the following suggestions were made: (1) to enlarge and expand the present functions of the JICST, developing it into the general scientific information center, with mechanization of its procedures, (2) to consider more carefully the relationship of special information centers to the general information center development, (3) to experiment with certain pilot projects, (4) to

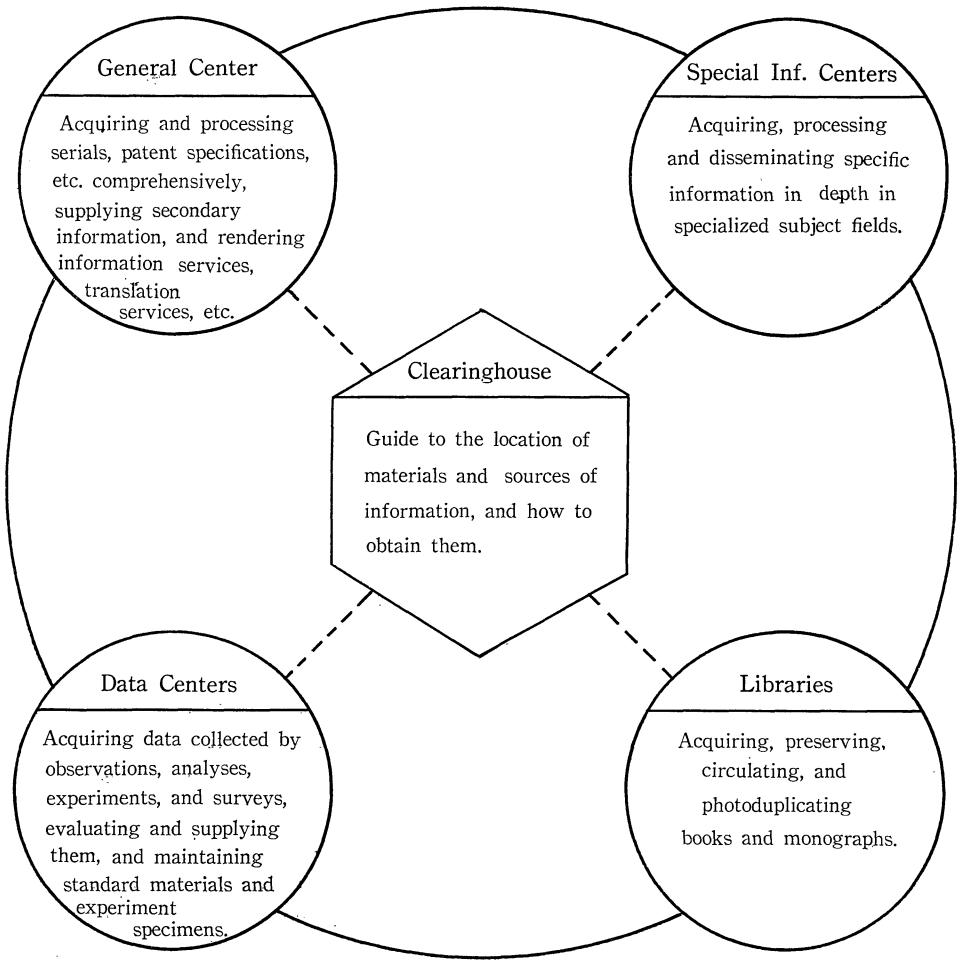

Fig. 1. A Proposed Scheme for Scientific and Technical Information Network (See B-36 in Appendix)

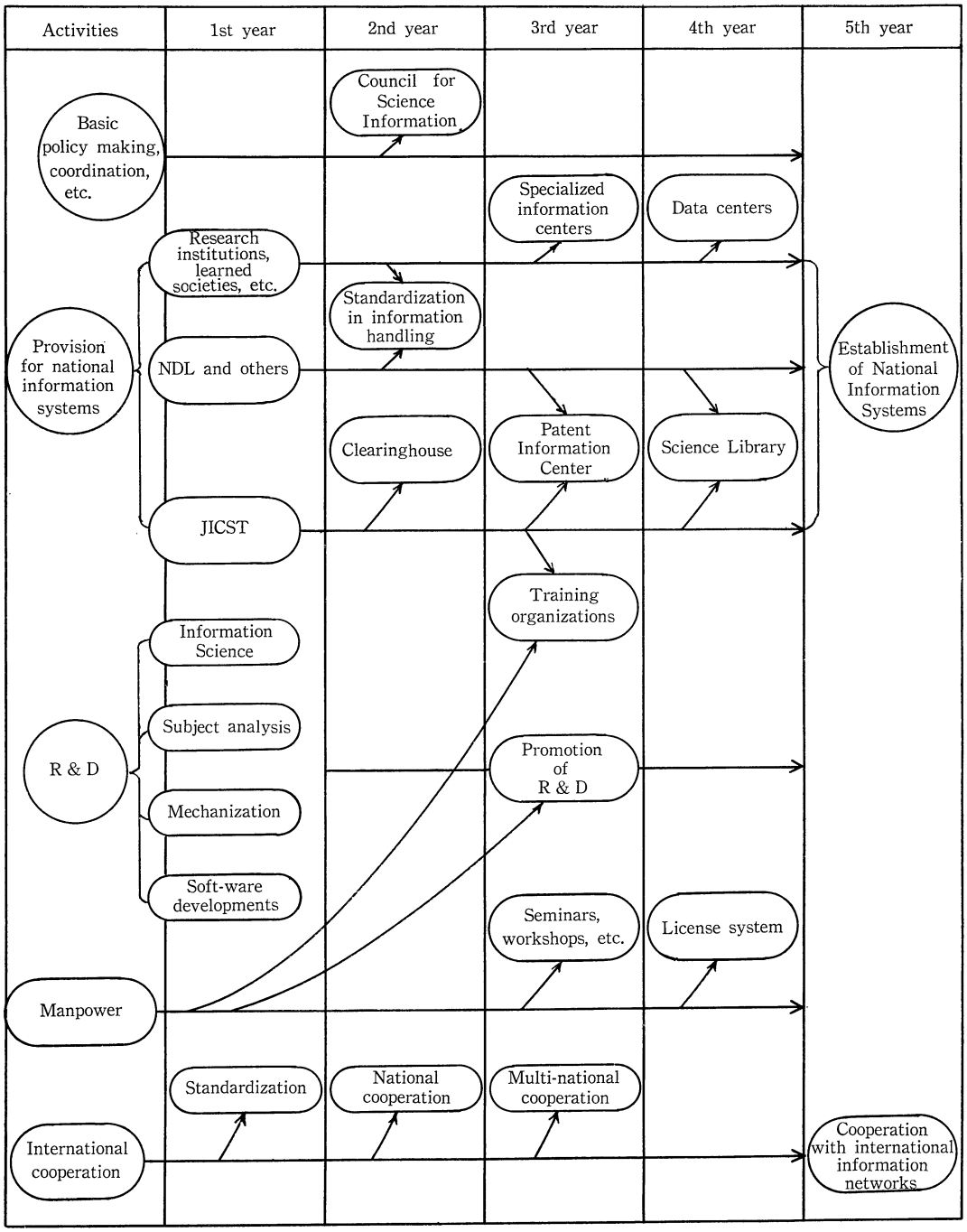

Fig. 2. A Prospective Schedule for Promotion of Scientific and Technical Information Activities

(See B-36 in Appendix)

establish cooperative programs with the National Diet Library, university libraries, public libraries and libraries of research institutions, and (5) to prepare within the JICST for the proposed clearinghouse program. Importance was attached also to the development of regional information centers to function as regional core organizations in information transfer and as liaison agencies between central systems and research workers in local research institutions. For the efficient operation of such systems, it was advocated that standardization and mechanization be promoted, that personnel be increased in number and given better training, and that international cooperative systems be improved. Visualized in Fig. 2 is a five-year schedule for improving scientific information transfer systems.

The latest move concerning national information systems for science and technology came early in 1969. A task force composed of sixteen specialists on information problems in science and technology was organized under the 4th Committee, concerned with science information handling, of the Council for Science and Technology. The group discussed various problems for about half a year and drew up a report which was submitted to the 4th (Science Information) Committee in July. The report[80], confined to basic principles and recognizing present realities, discusses the following points: (1) establishment of the National Information System for Science and Technology (NIST), (2) cooperation with international scientific information systems, (3) development of manpower concerning science information transmission, and (4) development of techniques and methods for handling information.

A functional chart of the projected NIST is shown in in Fig. 3. The main function of the NIST headquarters is to coordinate the activities of its operating centers, specialized information and data centers and regional information service centers. The headquarters also has education and training functions and research and development functions. The weak point of the concept is that the national headquarters has administrative power over only the regional information centers and not over the operating centers, special information centers and data centers.

The functions of the operating centers and specialized information centers are more clearly defined in the report. To strengthen the central coordinating functions, it is recommended that there be a council for deliberating on NIST policies and that the central agency compile necessary directories to obviate the need for a clearinghouse, formulate various standards and criteria, handle international cooperation, extend technical and financial aid to various centers in cooperation with the Government, and plan and carry out projects for research on and development of techniques for the handling of information and training programs for the personnel within the NIST network. The report urges participation in international cooperative activities related to science information services and symbolizes the NIST headquarters as a "desk at the window of the country." To develop and maintain the entire network at a high level, the report recommends the creation of superior programs in selected universities for education of the professional staff, establishment of a central training institute on the advanced level, improved treatment for the professional staff members, the training of research workers in the use of science information systems, and so forth. As to the development of information handling systems, the report points out the emergence of automation in the compilation of secondary information, use of micro-images, magnetic tape storage of information and its recovery from them, standardization of information processing techniques and the combined use of computers and telecommunication systems.

VI. An Approach to a National Science Information Network

As we have seen in the foregoing sections, there exists a center for the processing of information

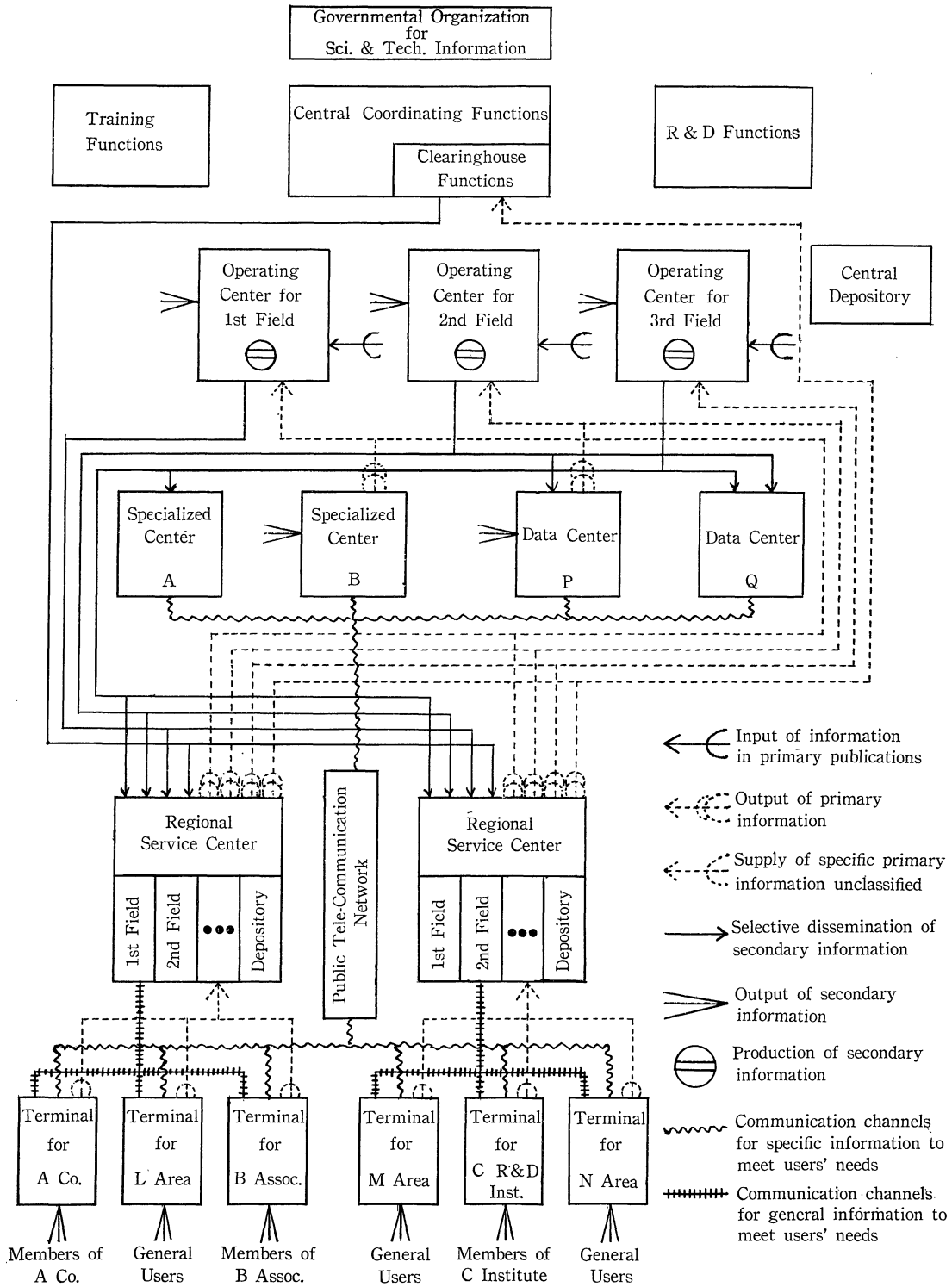

Fig. 3. NIST and the Flow of Scientific and Technical Information (See B-38 in Appendix)

documents in the physical sciences, various plans for at least concepts of parallel centers in the fields of or agricultural sciences and medical sciences, and an evolving body of policies with regard to national information systems for science and technology in comprehensive terms.

In the background of our planning to develop a comprehensive science information network for the nation, the following realities cannot be ignored:

1) The lack of a governmental agency strong enough to coordinate many small information units or systems scattered under the jurisdictions of various Ministries or other bodies.

2) The inadequacy of the scientific and technical information services of the National Diet Library (NDL).

3) The limited scope of the services provided by the Japan Information Center of Science and Technology (JICST), which do not cover the biological sciences.

4) The lack of libraries and information centers capable of nationwide service to research workers in the biological sciences.

5) The lack of some fundamental data essential for planning a national information network, such as studies of the needs of biological scientists in Japan and of the national capabilities for the education and training of science information personnel.

6) The necessity for some technical developments, not only in hardware but also in software, for use in the national information systems, and for new communication systems applicable to the national science information network.

7) The lack of knowledge and skills concerning the science information flow and use of document- and information-handling systems that should be possessed by scientists and technologists.

8) The inadequate appreciation of the importance of the national information systems and network on the part of the scientists concerned, the administrators under whom the scientists work and especially the top-level officials in the Ministries and other governmental units with responsibility for scientific and technological matters.

Though others could be added, the discussion here will be limited to the above problems.

1. The Science and Technology Agency (STA) of the Prime Minister's Office is perhaps theoretically in a position to coordinate various scientific research efforts within the governmental organization, but in actuality it has far too little authority to surmount the traditional resistance of each Ministry to giving up any of its domain. The agency in submitting its budget request for the 1969-70 fiscal year, requested a fund to establish a new section called the "Information Section," but it was not approved. Only if there is a strong executive agency in the Government with requisite authority can we hope to have a comprehensive science and technology information network of nationwide scope. This agency could be part of the STA, but it would have to be higher in rank and larger in scale than the proposed Information Section. It would formulate necessary policies and support their implementation on the basis made by the Council for Science and Technology. It should have long-range plans and maintain public relations. And it should, of course, coordinate the information services of all branches of the Government.

2. The NDL, the biggest library of the nation, has the Science and Technology Section in its Reference Department, which acquires about 10,000 titles of foreign scientific serials. Nevertheless, it has not developed good information services for scientists. It was partly because of this deficiency that the JICST had to be established twelve years ago. The NDL's services are intended primarily for members of the Houses of Representatives and Councilors, who do not often request analyses of scientific papers in such depth as scientists require. The *Natural Science Section* of the *Periodicals Indexes* produced by the NDL is not of great use to scientists. Rather than to attempt a major change in NDL policies and practices, it might be wiser to establish a new national library, the "National

Science Library," separated from the NDL. This new library concentrates on acquisition of books, monographs, reports and major journals in science and technology and on their preservation. It would serve as the central depository of the governments' scientific documents, and as a clearinghouse. From it the NDL could receive information on scientific books and monographs for the making of printed cards and information for such indexs of Japanese scientific articles of general nature as the *Readers' Guide*.

3. As was pointed out in Section II, the JICST has not been able in twelve years to correct the inadequacies in its services to biological scientists. The policy of depending on the Government for about half of its annual budget and on users for the rest was the original reason for the exclusion of biological sciences from the scope of its services. Although it recently has been making efforts to extend services to medical fields and then to agricultural fields, it is questionable whether it can treat these two different fields equally with the physical sciences and engineering. In the writer's opinion, it is feasible and would be more effective to develop two new information centers, perhaps called the "Medical Sciences Information Center," and the "Agricultural, Forestry and Fisheries Research Information Center," in parallel with which the operational parts of the present JICST could become the "Physical Sciences and Engineering Information Center." There is another important operation that the JICST has been carrying out, that is, the processing of patent specifications of foreign origin. This function should be more closely related with the Patent Agency Library. Perhaps a "Patent Information Center" could be created in coordination with the Ministry of International Trade and Industry. The functions of a general clearinghouse and a referral center for all of the information centers might be entrusted to the National Science Library. Operation of the central mechanized system, together with other operating functions, could be installed in an operations headquarters. This operations headquarters, the four document information centers for the three major scientific fields and patents, and the National Science Library would constitute the core of the national scientific document and information system. From this core, lines of coordination, or in certain cases lines of control, might go out to specialized information centers, data centers, and local terminals. If necessary, though the necessity is not likely, regional subcenters could be established to benefit local scientists. What is needed is a core. Its precise character can be debated, and there can be flexibility in the working out of details.

4. The fact that neither national libraries nor information centers for the medical and agricultural sciences exist in Japan may impose on the document- and information-handling systems of this country a pattern different from that in the United States of America. In the medical field, it has been suggested that a national medical information network be developed without a central medical library. The JICST, it has been argued, could develop information services related to the medical sciences. To the contrary, people in the Ministry of Agriculture and Forestry are enthusiastic about creating a central library which would include exhaustive agricultural coverage when the ten or more national research institutions move to a new scientific city to be developed at the foot of Mt. Tsukuba, while theyseem not to be strongly interested in early establishment of a large-scale information center. No one can know with any confidence which of these alternatives would be more practical in the long run. It might be a good idea to experiment with both. In any case, were a central agricultural library to be established by the Ministry of Agriculture and Forestry, all agricultural scientists in agricultural colleges and agricultural departments of universities would want to receive services from the central library without discrimination between them and Ministry scientists.

In developing an information center for either

medical or agricultural sciences, a special endeavor should be made to ensure that services can be rendered without charging users as much as the present JICST does in the fields of the physical sciences and engineering. It may be necessary to subsidize use of the center by research workers belonging to non-profit-making organizations.

5. A national survey of the information needs of physicists and chemists was carried out in 1968,[31] but the needs of those who use biological information have never been measured in depth or breadth. To develop a national information center for the biological sciences, it would be essential to have the data which such a survey would disclose. It is understood that the Science and Technology Agency will carry out such a survey for agricultural scientists and technologists by the coming March.

If more subject fields are to be served, there will have to be an increase in science information personnel and a corresponding increase in teachers qualified to train them. We therefore must know how many qualified teachers are available at present and how many candidates can be counted on to develop into qualified teachers or trainers. We must also have data on translators capable of doing well in the biological sciences.

6. As the JICST has developed a computer system based on the FACOM 230-50, introduction of MEDLARS into Japan would compel us to face conversion problems. Similar problems might occur were ABLE's information storage on magnetic tapes to be transferred to Japan. In the agricultural sciences, not only such mechanical problems but also vocabulary problems are envisaged as being quite substantial. Establishment of standards in information handling is an urgent matter for not only international but also domestic reasons.

Technical aspects at communication systems should influence the policies for and the designing of national information networks. Or the flow of influence could be in the other direction. The development of data transmission systems, for example, might require changes in the governmental policy for Nippon Telephone and Telegraph Public Corporation.

7. It seems to be universally true that scientists and technologists do not fully know how to make the best use of libraries and information centers. To popularize such knowledge and impart the skills relevant to the flow of science information and the use of document- and information-handling systems, the curricula at all levels of education must be reviewed and properly adjusted. Especially in higher education, considerable effort should be made to have science professors teach their students correct skills in information retrieval. For this purpose, there is urgent national need for re-education of science professors, because more than 65,000 students now are graduating annually from the scientific departments and graduate schools of universities without a bit of knowledge about or any skills in information handling.

8. Although there is a considerable number of leaders in scientific circles who fully recognize the importance of efficient information systems for the specific sciences in which they are interested, but very few of them have any appreciation of the importance of a national science information network incorporating all those systems. Most administrators of research institutions under whom scientists and technologists require information in their work seem to be quite indifferent toward a science information network on the national level. With few exceptions, top-level officials in the governmental departments that have research institutions affiliated with them do not regard the development of a nationwide science information network as a very urgent need. There are many reasons for their attitudes, including their old-fashioned educational backgrounds, the traditional sectionalism shared by both officials and academic people, and their lack of familiarity with systematic approaches to solutions. They create problems not only in developing the national science information network or systems but also in planning any na-

tional policies which involve changes in the regulations of several departments of the Government.

From the foregoing, the following general conclusion may be drawn:

As to the capping agency to supervise the entire science information network, there would seem to be merit in establishing a new Information Agency within the Prime Minister's Office. If this is not feasible, at least a new office on the "bureau" level in the Science and Technology Agency (STA) should be established. This office, which might be called the "Science and Technology Information Bureau (STIB)," should be responsible for the formulation of policies concerning the national science information network and its component systems, on the scope of responsibilities and activities, of governmental and non-governmental libraries and information centers, and on such related matters as the national science libraries, document information centers, referral services, clearinghouse functions and document depositories. The bureau should also work out legal aspects of the national network and systems, coordination with various governmental organizations, and long-range plans for development of the network. It also would have to enlighten the people concerned and maintain good public relations.

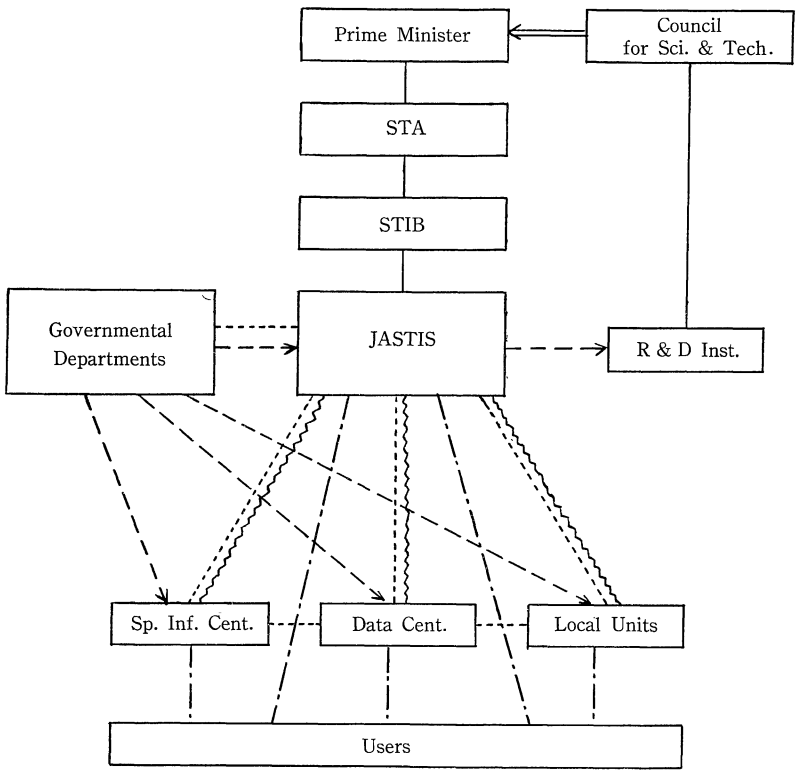

Fig. 4. Government of JASTIS and Its Functional Structure

——— line of control
-·——→ line of support
····· coordination
-·-·-·- line of service
~~~~~ communication network for science information
<═══ advisory capacity
~~~~~

As for the national science information systems, it is debatable whether they should be set up as ordinary governmental units or under a public corporation. Past experience in this country would seem to suggest that it would be preferable to establish a new public corporation which would control all the different national science information systems, on the assumption that all governmental departments concerned would be amenable to giving substantial assistance to such a corporation, whereas they probably would be reluctant to help a competing governmental organization. It could be under the jurisdiction of the STIB. It will be named here the Japan Science and Technology Information Systems (JASTIS) Corporation, to be distinguished from the present JICST or the proposed NIST. See Fig. 4.

The JASTIS Headquarters would have components for such administrative functions as planning, controlling, staffing and for such operational services as central computer processing, printing and disseminating of information and translation. It would support an institute for research in and development of information science and technology which should be supervised by a special committee of the Council for Science and Technology.

Formulation of basic policies for the development of Japan's science information systems and network not only is an urgent national matter but also cannot be neglected from the international standpoint, because the nation has been originating a great amount of information in science and technology which is of worldwide value. To handle and coordinate international matters, JASTIS should have an office to receive and send out information internationally.

As document-information handling subsystems, JASTIS would have the following information centers: the Physical Sciences and Engineering Information Center (PHEIC), doing largely what the present JICST is doing; the Medical Sciences Information Center (MESIC), handling medical, pharmacheutical, psychological and perhaps veterinary information; the Agricultural, Forestry and Fisheries Research Information Center (AFFRIC), processing agricultural, forestry and fisheries research information recorded in documents except for agricultural engineering and perhaps veterinary information and the Patent Information Center (PIC), looking after not only domestic but also foreign patent information available from patent specifications, of which the latter now is being processed by the JICST. In the future, still another center, devoted to documentary information concerning management science, economics, law, politics and other social sciences, might be developed. Pending the emergence of such a substantial social sciences information center, information about industrial management and agricultural management perhaps could be processed by the PHEIC and AFFRIC respectively.

Functioning as a central depository for scientific and technological documents, the projected new National Science Library (NSL) probably could satisfy the needs of scientists and the document information centers of JASTIS as well. The NSL could be a segregated division of the NDL or an entirely new establishment. It probably would be simpler and less troublesome to create a new library under the jurisdiction of the STIB. The National Central Agricultural Library (NCAL), planned by the people of the Agricultural, Forestry and Fisheries Research Council of the Ministry of Agriculture and Forestry, and other national libraries already in existence in or by such governmental bodies as the Industrial Science and Technology Agency and the Patent Agency probably ought to be amalgamated into the NSL or at least closely coordinated with it.

The core of JASTIS and its satellite information centers, together with the major national libraries, would constitute the national information systems as shown in Fig. 5.

There will be need for data centers in close relationship to research institutes, experimental stations and observatories. At least in so far as they

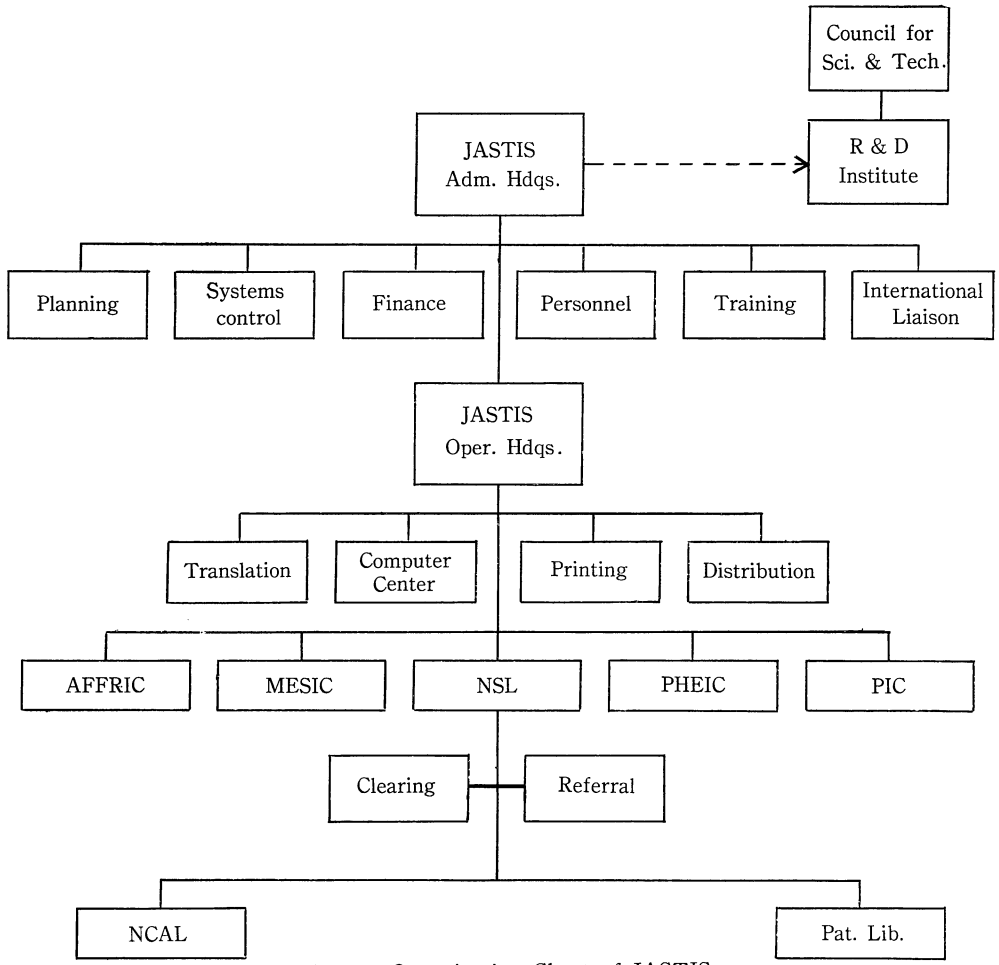

Fig. 5. Organization Chart of JASTIS
——— line of control
– – – → line of support

concern themselves with data acquisitions, processing, storage and retrieval, they should be under JASTIS supervision.

With regard to communication technology, the Japan Telegraph and Telephone Public Corporation has an important role to play in formulating the national science information network. Its facilities and equipment should be utilized to develop information networks. Data transmission techniques must be designed to meet the demands of the science information network.

Concerning regional or district subcenters for science information, the writer's opinion differs from that found in all plans issued so far. The recommendations and suggestions for science information systems and networks have, without exception, claimed that it is essential to have regional or district information centers as subsystems of the national systems. Why do we need such regional centers in this small and homogeneous country? Geographically, our land has considerable length, but it is smaller than the State of California. If we wisely utilize modern tele-communication capabilities, inquiries from local research workers can be more satisfactorily and relevantly handled directly by the national centers than through regional subcenters.

Whatever else may be decided, however, if JASTIS is to come into being, there are certain major problems which must be faced squarely and solved. First of all are the manpower problems. We have very few professionally trained document and non-document information specialists. To meet the potential information demands of all Japanese scientists and technologists it is estimated that we shall need in 1975 at least 7,000 professional, sub-professional, and non-professional people for all aspects of information handling, of whom about 10–20 per cent will be necessary at the initial stage of the national systems. No time can be lost, therefore, in ensuring that we have enough qualified teachers and well-equipped graduate schools of library and information science.

A second group of problems demanding early solution is concerned with our governmental machinery and the attitude of the public toward it. Scientists and governmental officials tend to look upon the existing division of duties and responsibilities within the Government's structure as entirely natural and not subject to change. It is extremely difficult, therefore, to coordinate various related matters coming under different departments of the Government. This is the main reason for the writer's insistence that there be a really strong capping agency for the science information network. Only with determined exertion of authority can the things be done which must be done. For example, bureaucratic red tape must be cut to provide substantial support for scientists working in non-profit research institutions so that the nation may benefit from their increased utilization of document information center. Bio-medical-agricultural information centers cannot be operated on the same financial basis as those for the physical sciences and engineering, where most of research workers are employed in industries and are usually better supported in their use of information than biological scientists. Various ministries of the Government should provide appropriate subsidies for individual scientists and scientific groups or scientific and technical information centers so that scientists and research workers in research institutions will have equal opportunities to make use of information centers. For example, the Ministry of Education and the Ministry of Public Welfare could join in providing funds to support research staff members in medical schools and clinicians in hospitals when they need medical or related information from the MESIC, and agricultural research workers at public agricultural experimental stations as well as those in academic institutions could have easy access to the AFFRIC if the Ministry of Agriculture and Forestry and the Ministry of Education gave supports. In short, there is great need for a policy to provide appropriate support for research workers in non-profit organizations so that they may acquire the information they need in their research at a reasonable cost or without any charge at all.

Another important preliminary problem is that of the present curricula and educational methods in the various disciplines of science in our higher education. To make younger scientists familiar with the use of local and national scientific information systems can not be accomplished without re-education of their teachers in scientific disciplines about the effective use of modern information systems. This cannot be done in a short period. Perhaps as a stop-gap measure some intensive method to enlighten both young and older scientists about science information transfer systems can be devised. At the present moment we have no single promising conclusion to offer in relation to this problem.

Also a problem requiring early solution is that of improving the present local document-handling units that are supposed to be components of the national science information network. The capability of the network as a whole will depend upon the capabilities of each component. Even in the medical sciences, in which librarianship has been highly developed in Japan, the average medical library still lacks the capability to meet the infor-

mation demands of doctors that have to be answered locally. It is imperative that local library and information units be enabled to meet local needs so that the national document information systems can display their proper capabilities without being hampered by need to give excessive attention to local needs. Many scientists are apt to think that if there is a fully equipped national scientific information system then no effort to develop better local libraries or information units will be required. As the laboratory worker needs his working collection in his laboratory, the scientist will always have to have his own well-developed collections that will answer his needs directly. The national scientific information centers will serve to overcome the shortages in local units but cannot replace them. Were the national efforts to develop various national information centers reduce the financial resources for development of substantial local libraries, construction of the national information network would be severely damaged.

The technical aspects of the national information systems and network are another area of important problems. Among them, connected with development of hardware and software, are the highly difficult problems of semantics and the standardization of the structure of information. What makes them especially difficult is the specific language used in this country, and it requires that greater effort be made in this country than in Western countries. In this connection, a strong research and development institute should be considered.

Although the topic of a high-level institute for information science and technology has been left to the last, it is certainly not the least in importance. Such an institute has not yet been developed in any university in this country, except in the limited sense of computer science with emphasis on hardware. Covering both hardware and software, a new institute for information science and technology should be established. It could be maintained and supported by the headquarters of JASTIS but should be independent from its control. It probably should be administered by members of a special group provided by the Fourth (Science Information) Committee of the Council for Science and Technology. Utilization of the institute's facilities and equipment for research and development purposes must be available to project research workers assembled from various academic institutions, information and/or data centers, or science libraries. While engaged in research work at the institute, they should be released from their ordinary work for one to two or three years until they have achieved their objectives.

The Council for Science and Technology will complete its report and recommendations by the end of the coming fall and then submit them to the Prime Minister. It is the writer's hope that its plan for the NIST, whatever it may be, will be broadly publicized and that before it is put into effect it will be shaped to reflect the views of the scientists who are to use the NIST.

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29) "B-36."
30) "B-38."
31) 科学技術庁. 計画局. 科学技術研究者等の情報利用の実態に関する基礎調査報告書. 1968. 5. 30 p. 同報告書(別表)増補改訂版. 1969. 5. 119 p.

Appendix: Selected Bibliography on Japanese National Science Document and Information Centers or Systems

The items listed in this bibliography are limited to literature of importance written or reported by Japanese. There are five categories corresponding to the following divisions of the paper: I) General background information, II) JICST, III) National central agricultural library plan, IV) National medical information network, and V) Plans for national information systems covering every field of science and technology. Items are listed in chronological order in each category.

I. General Background Information

B-1 Japan Documentation Society. *Science Information in Japan.* [1st. ed.] 74 p. and 2nd. rev. ed. 192p. Tokyo, The Society, 1962 and 1967 respectively.

B-2 Kikuchi, Toru. "Scientific and Technical Information in Japan," *American Documentation*, vol. 18, no. 4, p. 250-252, Oct. 1967.

B-3 Kobayashi, Yutaka. "Development of a Comprehensive Network for Scientific and Technical Information in Japan," *Library Trends*, vol. 17, no. 3, p. 258-266, Jan. 1969.

II. JICST

B-4 日本科学技術情報センター. 第2期拡充5カ年計画 (昭和36-40年度) 1960. 9. 34 p.

B-5 日本科学技術情報センター. 第1期拡充計画の成果および第2期拡充計画の展望. 1961. 8. 11 p.

B-6 Japan Information Center of Science and Technology. *The Present Status and the Future Programme.* Tokyo, The Center [1963] 19 p.

B-7 日本科学技術情報センターの長期計画について (昭和50年を目標とする10カ年計画). 1965. 4. 7 p. (非公刊)

B-8 日本科学技術情報センター拡充5ヶ年計画 (案). 1965. 12. 12 p. (非公刊)

B-9 Japan Information Center of Science and Technology. *The Japan Information Center of Science and Technology.* Tokyo, The Center [1967] [15 p.]

B-10 Fukudome, Takao. "The Japan Information Center of Science and Technology (JICST): Its Organization and Function," *American Documentation*, vol. 18, no. 3, p. 146-152, July 1967.

B-11 日本科学技術情報センター十年史編集委員会. 日本科学技術センター十年史. 1967. 9. 322 p.

B-12 日本科学技術情報センター. 電子計算機の導入. 1968. 4. 11 p.

B-13 Japan Information Center of Science and Technology. *The JICST Computer System.* May 1969. 20 p.

B-14 日本科学技術情報センター. 業務の概要. 1969. 5. 15 p.

B-15 日本科学技術情報センター. JICSTにおける情報検索サービス計画. 1969. 5. 18 p.

III. National Central Agricultural Library Plan

B-16 Sawamoto, Takahisa. "Agricultural Science Libraries in Japan," *Library Science*, no. 3, p. 107-119, July 1965.

B-17 農林省. 農林水産技術会議事務局調査資料課.「図書管理運営に関する研究会」報告(未定稿). 1966. 3. 107 p.

B-18 農林省. 農林水産技術会議事務局調査資料課. 総合図書館設置試案(「図書管理運営に関する研究会」報告(未定稿)別冊). 1966. 3. 8 p.

B-19 Ishihara, K., Ito, T., and Sasaki, T. *Agricultural Library Network in Japan.* (Paper presented at the 11th Pacific Science Congress, Tokyo, etc., 3 weeks from Aug. 22, 1966) (Unpublished)

B-20 農林省. 農林水産技術会議. 共同利用施設(図書)に関するワーキンググループ報告集. 1968. 4. 161 p.

B-21 伊藤 全. 農学総合図書館構想の概要(研究・学園都市共同利用施設設備研究会第五パネルへの提出資料). 1968. 5. 30. 11 p. (非公刊)

B-22 伊藤 全. 農林水産関係の情報流通網についてのメモ. [1969]. 6 p. (非公刊)

IV. National Medical Information Network

B-23 津田良成. Information Network の動向と資料管理(富士フィルム, ミニコピーシステムによる情報管理). [1968]. 8 p.

B-24〔座談会〕医学情報活動の未来を語る. **情報管理** vol. 11, no. 4, p. 192-201, 1968. 7.

B-25 津田良成. "医学情報の全国的ネットワーク (National Information Network in Medicine)", *Library and Information Science*, no. 6, p. 1-26, July 1968.

B-26 津田良成, 藤井和夫. "医学情報活動のネットワーク". **医学図書館**. vol. 15, no. 3, p. 197-209, 1968. 9.

B-27 小林 胖. "医学情報ネットワークにおける日本科学技術情報センターの役割と可能性". **医学図書館**. vol. 15, no. 3, p. 211-215, 1968. 9.

V. Plans for National Information Systems Covering Every Field of Science and Technology

B-28 北川敏男. 日本学術会議の行なってきたこと(日本学術会議. 学術情報研究連絡委員会. わが国の今後の学術情報体制のつり方についてのシンポジウムにおける講演. 1968. 5. 27)

B-29 科学技術会議. 諮問第1号「10年後を目標とする科学技術振興の総合的基本方策について」に対する答申. 1960. 10. 90 p.

B-30 日本学術会議. "勧告—大学図書館の整備拡充について". **日本学術会議月報**. vol. 2, no. 5, p. 14-16, 1961. 5.

B-31 日本学術会議. "勧告—大学図書館の近代化について". **日本学術会議月報**. vol. 5, no. 9, p. 18-20, 1964. 11-12.

B-32 科学技術会議. 第4部会情報分科会報告. 科学技術情報活動の強化に関する方策(第2次案). 1965. 8. 30 p.

B-33 日本学術会議. 科学研究計画第1次5か年計画について(勧告). **日本学術会議月報**. vol. 6, no. 7, p. 18-19, 1965. 11.

B-34 科学技術会議. 科学技術振興の総合的基本方策に関する意見. 1966. 8. 98 p.

B-35 科学技術庁. 計画局. クリアリング機能検討会報告書. 1968. 6. 138 p. or **科学技術調査**. no. 60, p. 1-65, 1968. 12.

B-36 科学技術庁. 振興局. 科学技術情報の流通—その意義と促進策. 1968. 12. 28 p.

B-37 科学技術庁. 調査局. 研究学園都市共同利用施設設備研究会第五パネル報告. (44計 研究学園 1). 1969. 4. 10 p. and 同参考資料. (44計 研究学園 2). 1969. 4. 8 p.

B-38 科学技術会議. 第4部会専門分科会報告書. 1969. 9. 130 p.