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TECHNICAL INFORMATION SERVICES FOR INDUSTRY 1/

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Introduction

1. The successful establishment and growth and the effectual operation of industrial ventures of all kinds and size are to a great extent dependent on an unhampered flow of information in all fields of industrial knowledge and experience. This flow of communication should include information on know-how and techniques, processes and equipment as well as the legislative or admininistrative measures experienced in one region or in one particular industrial sector which may be applicable to others. Such information will include also certain lessons as to difficulties and dangers; specific data and formulae for meeting recognized problems; scientific findings, including basic research; biographical information in available reports; and specialized knowledge for upgrading experts in the field.

2. To ensure a continuous output of new ideas for the benefit of industry, industrially advanced countries sustain powerful and costly research efforts in all branches of science and technology. For the rapid transfer of the results so obtained to economic exploitation, those countries have devoted more and more attention to the establishment of effective devices for storing and evaluating scientific and technical knowledge and communicating it to industry. The amount of new knowledge needed by developing countries, concerned mainly with assuring the successful adaptation of industrial activities to different local conditions, is extremely small compared to the enormous body of accumulated knowledge and experience readily available for their use in the advanced countries. Hence, an adequate communication system is of decisive importance, linking areas in the process of industrialization to the well established and highly developed technological information network of the advanced countries.

3. The rapid circulation of detailed data on recent scientific discoveries is also essential for the successful co-ordination of the organization of research and development work in developing countries on a national and international level.

4. Today it is not possible for professionals in any field to undertake research or search for information without being aware that the volume of information poured out in any one field increases steadily. The direction of this "stream of information" into some appropriate storage unit, and the dissemination of the information to those who particularly require it, has been termed the "problem of communication of information".

5. It is clear that the problem itself is not new, but what is new is the emphasis on the need for research into the many factors involved in communications. It is also clear that the problem occurs in any professional field, at many technical levels, and affects many groups and individuals. The first problem, in fact, is the complexity of the field and the need to develop appropriate techniques for its study. Other difficulties may be mentioned. One of these is the fact that, although the "need for information" is recognized, every potential user of information has a different need. Thus the scientist, the chemist, the technologist and the industrialist may all be interested in the same problem, but to discover and measure of the need and to classify each individual need is a complicated task.

I/ SCIENTIFIC AND TECHNICAL INFORMATION FOR DEVELOPING COUNTRIES

6. The crucial point in the flow of information is when and how it penetrates into industry. "Industry" itself is a vague term which covers everything from huge industrial complexes to small handicraft firms. There are the science-based industries, which are very near to the source of information in their own fields, such as electronics, or chemical and instrument engineering, but even these lack adequate information on developments in allied technologies which may vitally affect their own field. On the other hand, there are the traditional industries, which by their nature seem less inclined to keep abreast of and apply new research development. This is one of the many instances where an active approach through information services might contribute to a change of attitude.

7. The constant growth of scientific knowledge demands a closer liaison between science and industry than ever before. Information is the pipeline through which new discoveries and facts reach the technologists and the engineer as well as the managers and skilled workers in developing areas who must be provided with the kind of information they need in a terminology they can understand. They need help in selecting the right information or source of information from the mass of literature now being produced.

8. Despite the fact that there are many channels for the flow of scientific, technical and production information, such as science journals, technical magazines, supplier firms, trade associations, professional meetings, industrial fairs, documentation centres, specialized institutes and other information centres, it appears that a considerable amount of relevant material still fails to reach persons engaged in industrial and commercial development and production at the time and in the form required.

9. To speak of the professional man's need for information is, in fact, to speak of several different areas of need. It is recognized that the professional in any field must have a general awareness of current developments in his own field, and must keep up to date with every new contribution. He will also want specific facts about the project he has in hand at the moment; in fact, he will need such information daily, and will use trade material, text books, handbooks and similar resources almost continually. Besides this, he will need to maintain a broad background of information on his particular subject.

10. However, in these days, no professional can hope to know the whole of his subject; his time is limited by the demands of his work. It is impossible for any man to read all the relevant information in his field. This growth in the amount of recorded information is at the root of the "information problem"; nor is the professional likely to know exactly where to find every item which might be of use to him in his work.

11. This is particularly true today, when the technologist and the professional make use of many related fields and cannot confine their knowledge to one small area. So it is difficult to find the time even to keep up with current develop-

ments, but perhaps the biggest difficulty is to find the time and means to discover what should be read.

12. In fact, the information needs of the industrialist present yet another problem in the communication of information. At the present time, any industry, whatever it produces, is faced with a mushrooming mass of information, and the main problem is to find the answer required to a single simple query from out of the wealth of technical information available. With over half a million scientific and technical journals published in the same period, even abstract journals and services are not able to provide the answer.

13. This flood of material must be channelled to the men concerned, the scientist, the technologist, the industrialist, in a form in which it can be used. The scientist and technologist trained in a specific field, will find it easy to read a professional journal or technical report. But what of other members of the management team who must know enough to control the firm's operations efficiently, and who need certain information in a simpler form? In any industry or individual firm, up-to-date information is needed in many different forms, at many different levels, on any one working day; what suits one member of the production team may be useless to another.

14. The task of providing the technologist and industrial administrator with appropriate pre-selected information evokes the need for a composite network of communication media, information and documentation centres; none of them independently can cope with all the necessary material. Liaison and co-ordination of the present available information facilities at regional and global levels, as well as the development of new and more effective methods, are therefore indispensable.

15. The main elements of a satisfactory technical information service should include local awareness of the value of an up-to-date information service, particularly among industrialists, and an adequate, accessible collection of technical material - abstracts, periodicals, books, pamphlets - in the care of an efficient librarian. The help of a panel of specialists is also required to deal with technical inquiries and equipment for the reproduction of material to

"back-up" the biographical services. The best way to meet these requirements will vary from country to country, and the service must be planned accordingly.

16. No one service can hope to cover every industry and/or technical field. Every such service must try, however, to learn about information services for everything that is being published in any one special field of science or technology; it must collate and review the material and may even undertake special services such as the organization of abstract and bibliographical services. It should be the brain centre for all inquiries about the particular field.

17. Any service must be flexible in operation; and must have adequate initial "stock" and detailed knowledge of the resources available locally, including industrial sources. Provision for continuing liaison with industry is therefore of great importance.

18. Industrial field advisory officers, acting as an extension service of industrial research and documentation centres, constitute such a means of liaison. Skilled technologists visit individual industrial firms, exchange technical knowledge and solve particular technical problems.

19. The system of field extension officers lends itself particularly to the function of "trouble-shooting" and to fulfilling other immediate technical needs; it provides real help to individual engineers and designers by offering them the opportunity to discuss their problem with another engineer and to examine the validity of the approach to it or the feasibility of the solution.

20. Most industries have many basic processes in common, although with modifications or peculiarities imposed by their special needs. Generally, an analytical approach can reduce a complex problem to a number of basic units which lend themselves more readily to solution. It is sometimes found that a process or equipment traditionally associated with one industry may be recognized as the ideal answer to an outstanding problem in another industry. It is possible to cross-fertilise ideas even among industries belonging to different technological branches, although any ideas so passed on might require the permission and approval of the firms involved.

21. The "follow-up" visit is regarded by the field advisory service as one of its very important functions as it maintains contact with personnel in the many firms who will have had time to think about the service offered since the initial visit and, it is hoped, will have been more conscious of their firm's problems as a result. The follow-up visit is often more important than the first contact because it illustrates the interest which the institute has in following up its proposals and it establishes a more personal contact between industry and the research or documentation institute sponsoring the advisory service.

22. Providing or improving information facilities for specific technologies is of preeminent importance for developing countries which are closely tied to economic planning. As new industries are set up, advanced technological information facilities, built in from the outset, could help them to take shortcuts to new developments. In many cases the absence of research and information facilities in these countries offers the opportunity for introducing entirely new information techniques to recently established sectors of of industry.

23. In order to outline coherently the basic problems in the field of scientific and technical information and the required organisational measures arising from modern progress, a general reference to present development in science and technology appears necessary.

24. One of the main features in the development of science is its continuity and international character. Science constructs its edifice on the foundation of accumulated knowledge from past generations. If each generation had had to discover anew all the basic laws of nature and society, the development of science would have been very slow.

25. Continuity is an important factor in accelerating the development of science. Succeeding generations do not master the entire complex of scientific knowledge accumulated by their forerunners by studying original sources. For this purpose they use materials in which scientific data are given in a processed and systematized form. In order to accelerate the development of science,

therefore, each generation of scientists must produce new scientific data and at the same time systematize the sum of scientific knowledge of its own and of all previous generations.

26. Until recently, this work was conducted mainly on the basis of existing experience and individual initiative. In our day, however, the amount of accumulated scientific information and of new data being acquired by scientists is so great that traditional methods of processing and systematizing scientific information become increasingly ineffective. To cope successfully with this work today, it is necessary to elaborate the scientific fundamentals of new systems which will make extensive use of modern techniques, especially electronic computers, for processing and systematizing scientific information, thus speeding up the development of science and technology.

27. Continuity in the development of science is inseparable from its international character. The majority of scientific discoveries and inventions have been made by scientists living in different countries.

28. Written documents - books, journal articles and other publications in which scientists present the results of their investigations - comprise the main means for disseminating scientific knowledge in time and space. Science originates only with the appearance of a written language since this provides continuity of development; and it is by means of written language that science acquires an international character.

29. If scientific documents are to fulfil their main function - to spread scientific knowledge from one geographical point to another and from one generation to another - it will be necessary to work out scientific principles for the preparation and dissemination of documents.

30. The role of scientific and technical information services is to ensure the most rapid exchange of information between science and applied fields of knowledge, and to maintain information linkage between science and industry. Completeness and depth of information are required, as well as speed of processing,

retrieval and communication of information.

31. To meet these objectives, traditional methods of processing scientific and technical information must be employed along with a wider use of modern highly-productive reproducing techniques and computing devices.

II/ THE SCIENTIFIC AND TECHNICAL INFORMATION REQUIREMENTS OF DEVELOPING COUNTRIES

32. The developing countries have their specific national features, different political organizations and diverse socio-economic conditions. These differing economic and social conditions make it impossible to present detailed recommendations for information activities until the economic potentialities of the respective countries are known in detail.

33. One cannot make identical recommendations on the organizational forms of scientific and technical information for an entire group of developing countries. There is no sufficiently clear scientific definition of countries to which the term "developing" is applicable. Since no single general formula can be applied, it is appropriate to present the basic principles of organisation and the structure of information work in general in some advanced countries, leaving individual countries a choice depending on their circumstances and experiences.

34. The purpose of the present report is to describe prototype structures of information agencies, of methods and forms of information activities in advanced countries together with a critical evaluation. It is hoped that this approach will help to familiarise specialists working with the developing countries with the present state-of-the-art in the field of scientific information and so assist them to select and establish national information services of their own.

35. In the management of industry and science, a large amount of information is collected which contains, alongside with valuable and useful information, some doubtful or repetitive data. The users of information, while insisting on receiving a maximum amount of information, expect special systems to be set up to collect, to analyse and process the information and to present it in

convenient form for utilization.

36. On the basis of the experience acquired by Soviet information institutions, the main requirements to be met by scientific and technical information services can be summarized as follows:

(a) Information should be comprehensive. The user must be confident that he is fully informed. However, in the vast flow of information, many banal communications of no interest are repeated and some mechanism must be set up to eliminate redundant and trivial information.

(b) Information should be objective. The user should receive objective data and judge its usefulness himself. This should enable him to be free in his judgements, avoiding the influence of recommendations which in the majority of cases are subjective, even if they are made by prominent authorities in a given field of knowledge.

37. In order to develop their industries successfully and also to save time, the developing countries should have the opportunity to use the experience, scientific and technological achievements of countries with advanced industries, employing for these purposes the various methods and means of scientific and technical information. The obtaining of technical information from advanced countries can be arranged both through direct contacts and through international organizations which can render all-around assistance to developing countries in this respect.

38. The successful application of information received from outside a country depends largely on the system of scientific information set up inside the country. It is quite obvious that the system itself does not determine the content and amount of information in the liaison channels; this is determined by the economic problems of a given country. Apart from the aspects listed above, a certain role will be played by the language barrier and the availability of specialists able to use the information obtained.

39. Taking the above considerations into account the chapter below will describe certain solutions for the informational problems of specific countries. A study of these examples may turn out to be helpful in organising information activities.

40. Some national centres in developing countries receive patent information from advanced countries which is of interest to the industries of their own countries, process this information and supply it to interested persons. The Information Centre in Cairo, for instance, has processed over 200,000 patents from various countries.

41. Information on the experience and achievements of industries of other developing countries is of great value, since the same problems will often occur and have to be solved in other countries.

42. Systematic reviews of engineering achievements in various fields of knowledge are of great interest to the developing countries. Such reviews, describing the level attained in mastering certain scientific or technological problems, can be of significant help in familiarizing specialists of developing countries with technological and scientific achievements. Such work could be organized through international organizations or through bilateral agreements between individual countries.

43. Information on technical expertise, both patented and unpatented, can be of great interest, though in many instances it is covered inadequately in technical literature, being guarded as secret because of the interest of the originating firm. Special information on production is generally transferred on the basis of agreements between the interested parties, and the equipment supplied to a developing country is accompanied by specialists who direct the installation and use of the equipment.3/

III/ EXISTING TECHNICAL INFORMATION SERVICES: THEIR STRUCTURE, METHODS AND FORMS OF OPERATION

44. While outlining the principles on which information services in individual countries are organized, we have pointed out two separate systems: the centralized method of processing information and the decentralized one. In various

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3/ Advisory Committee on the Application of Science and Technology to Development. Third Report, May, 1966, p. 30.

countries developments have taken place along different lines, and between these two polarities some intermediary solutions have appeared. Of course, these systems have been affected not only by technical but also by political and economic factors.4/

45. For the United States, the Federal Republic of Germany, the United Kingdom, France and Italy, the principle of decentralized processing of information is typical. The degree of decentralization varies from one country to another, but the notable increase in the flow of information literature in recent years has caused a trend, more and more observable, to co-ordinate information activities on a state-wide scale. In many countries government offices have been or are being set up which are responsible for co-ordinating the activities not only of governmental information institutions, but of non-governmental ones. In the United States, co-ordinating functions in the field of scientific information are entrusted to the Advisory Committee on Scientific and Technical Information of the Federal Council for Science and Technology and the Office of Scientific Information of the National Science Foundation. In France, under the auspices of the General Delegation for Scientific and Technological Studies, a committee for research in the field of documentation has been set up which worked out recommendations for establishing a national information centre to co-ordinate information activities in the country. In the United Kingdom, under the Department of Education and Science, the Advisory Committee for Scientific and Technical Information and the Office of Scientific Technical Information are responsible for co-ordination of information activities of the national government and of non-governmental information institutions and for over-all improvement of scientific and technical information service in the country.

46. In other countries, for example the Soviet Union and Czechoslovakia, the principle of centralized processing of information has always been accepted as the basic one in setting up a state information system.

4/ The term, "information system", is defined as a complex of methods of processing information; (see Fundamentals of Scientific Information by A.I. Mikhailov, A.I. Cherry and R.S. Gilyarevsky).

47. From this diversity of forms and methods it is possible to single out some general principles of organizing scientific and technical information. Existing information services are most often built according to branch or professional requirements or else they supply the industry with information as a whole. Examples of various methods of organization in several countries are presented below.

Organization of scientific and technical information in the Soviet Union

48. The experience of the Soviet Union is based on the principle of centralized information processing. We shall briefly describe the operation and work performed by separate branches of the State's scientific and technical information system.

49. General management of the information service is carried out by the USSR State Committee for Science and Technology. State branch committees, ministries and departments organize and direct the activity of their branch information services, both central and local. The network of information institutions includes:

(a) All-Union information institutes such as:

(i) The All-Union Institute of Scientific and Technical Information of the State Committee for Science and Technology of the USSR Council of Ministers and of the USSR Academy of Sciences (VINITI);

(ii) The All-Union Research Institute of Medical and Medical Technical Information of the USSR Academy of Medical Sciences (VNIIMI);

(iii) The All-Union Institute of Scientific and Technical Information for Agriculture of the USSR Ministry of Agriculture (VINTISKH);

(iv) The Central Institute of Scientific Information on Construction and Architecture of the State Committee for Construction of the USSR Council of Ministers (CINIS);

(v) The Central Research Institute of Patent Information and Technical Economic Studies of the Committee on Inventions and Discoveries of the USSR Council of Ministers (CNIIPI);

(vi) The All-Union Research Institute of Technical Information, Classification and Coding of the USSR State Committee of Standards, Measures and Measuring Instruments (VNIIKI).

(b) Institutes of Scientific and Technical Information and Economic Studies in each branch of industry;

(c) Institutes of Scientific and Technical Information (multisectoral) in each Republic;

(d) Departments of Scientific and Technical Information (or Bureaus of Technical Information) at industrial plants and in various scientific and engineering institutions.

50. These organs have divided functions. All sources of scientific information, that is, periodical and non-periodical literature (journals, books, proceedings of conferences, reports on scientific studies and patent specifications) and all technological data in the fields of industry, agriculture and transport constitute two independent flows of information.

51. The first flow, embracing all printed information sources is centrally processed and goes from the top of the system downward through all the channels of the national information service. The second flow, reflecting the technological experience of industry, agriculture and transport is initially not covered in periodicals and other publications. Information of this type is contained mainly in local official documents and is communicated from the bottom to the top through central branch information organs where it is synthesized and presented in publications of the various sectors of industry, transport or agriculture.

52. The functions of VINITI are typical of the All-Union information system. It is responsible for preparing systematic and comprehensive abstracts of world literature in the fields of natural sciences and engineering: astronomy, geodesy, mathematics, mechanics, cybernetics, physics, chemistry, biochemistry, biology, geophysics, geography, geology, mining, machine-building, transport, automatics, radio-electronics, electrical engineering, energetics, industrial economics; for compiling and publishing abstracts journals, reviews, bibliographies and reference books; for providing express information on the most interesting topics, and for organizing and fostering scientific studies, aimed at improving the existing methods and technical means used in scientific information work.

53. At present the activities of VINITI are concentrated on three main lines: scientific information, scientific research and scientific organization. To keep specialists supplied with comprehensive scientific and technical information it issues abstracts journals, express information, reviews "Itogi Nauki" (Scientific Results), bibliographic cards and other information publications.

54. Since 1960 the Institute has published 25 separate series of abstracts which represent parts of a single abstracts journal.

55. The value of an abstract journal is determined first of all by the completeness of its subject coverage and by the number of information sources used in its compilation. As is known, the abstracting and information services of all countries, including VINITI, use as initial sources scientific and technical periodical and non-periodical literature: journals and annals; proceedings and transactions of different research institutions, universities, colleges and national academies of sciences; proceedings of international congress, conferences and symposia; patent descriptions, standards, books, monographs, handbooks; dictionaries, encyclopaedias and other publications of scientific value. These are obtained by VINITI through subscription, by international exchange or free of charge. The institute receives literature in over seventy languages, nineteen being those of nationalities living in the USSR. In 1952, the first year of its work, 3600 titles of periodical literature were received from 52 countries; by 1965 this number increased four times, reaching more than 15,000. The VINITI received original literature from more than 113 countries.

56. The main functions of the central branch information organs are to collect and systematize information about scientific and technological achievements received from lower information organs in accordance with the established rules of presentation of such information by industrial plants and institutions.

57. Proceeding from analysis, systematization and generalization of unpublished materials on new products, of results of research and development programmes or advanced production experience, and using materials of All-Union institutes

as well as information from other national and foreign sources, the central branch organs prepare bibliographies, abstracts and reviews on the most interesting topics concerning the development of a given branch; and they see that plants and institutions are supplied with them.

58. The functions of the regional information organs include generalization, dissemination and propaganda relative to advanced technology in the leading sectors of the national economy of a republic, or of an economic region. They control the use of information materials received from All-Union and branch information centres; they keep reference information storage centres supplied and have in charge methodological management and consultation procedures of a republic's industrial plants and institutions.

59. The functions of local information services are:

(a) To collect, systematize, study, analyse and generalize information according to their specialty in scientific research and development.

(b) To furnish major departments of plants, research institutes and designing bureaus with a rapid flow of information about most recent achievements of Soviet and foreign scientists and technologists in their respective topics and about progress in different scientific and industrial sectors.

60. The All-Union, central branch and regional information organs usually have at their disposal science libraries, which are regarded as an inseparable component of an information service.

Organisation of scientific and technical information in Poland

61. In organizing its state information system, Poland has adopted the principle of establishing central government co-ordinating information institutions and developing highly specialized organs of information. The present structure of the information network for the different branches of service and industry in Poland is described below.

62. The Committee for Science and Technology serves as the state administrative centre. The main functions of the Committee are to establish directions for technological development on a state scale; to co-ordinate the work of individual sectors; and to control the implementation of the decrees of the Council

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of Ministers concerning the development of all branches of engineering. Along with these functions the Committee is also responsible for organizing scientific, technical and economic information and for determining the direction of its development. Within the framework of the Committee these functions are carried out by the Office of Scientific and Technical Information and Co-operation with Foreign Countries.

63. Through this Office the Committee directs the activities of the country's main information institution -- the Central Institute for Scientific, Technical and Economic Information -- which has the following functions:

(a) To develop methods of information activities and to carry out research in the theory and practice of information;

(b) To carry out centralized information work and scientific research and development in general engineering and economics, as well as in methods of production, organization and management;

(c) To direct the Central Science Library;

(d) To conduct research in the effectiveness of information utilisation, and to work out recommendations to this effect, which are subsequently presented for discussion to the Committee for Science and Technology;

(e) To co-ordinate scientific research conducted in branch information centres;

(f) To work out recommendations for the organization of an information centre's network and evaluate measures taken to this end;

(g) To carry out methodological and special control over the activities of departmental and sectoral centres of technical and economic information;

(h) To organize the training of personnel for technical and economic information centres;

(i) To take part in working out and evaluating specifications for organization, techniques and other topics in the information field;

(j) To publish in a centralized way scientific, technical and economic information and information on the organization of production, labour and management;

(k) To co-operate with other publishing houses;

(l) To represent the Polish scientific, technical and economic information service in the country and abroad;

(m) To co-operate with scientific, technical, industrial and social as well as international and foreign organizations.

64. The Central Institute for Scientific, Technical and Economic Information is sub-divided into science, functional and technical service departments. The network of branch institutions of technical and economic information in the People's Republic of Poland consists of departmental information centres attached to ministries, central offices and organizations of similar status; and industry branch information centres, set up, as a rule, at the leading research institutions in each sector of the national economy and in large designing bureaus.

Departmental Centres

65. The departmental centres have mainly organizational and administrative functions. They are responsible for establishing and managing the departmental network of information services, for planning the activities of branch and production centres whose operations they control and for sponsoring scientific research.

66. The centres arrange for co-operation in the information field with the Central Institute for Scientific, Technical and Economic Information, with institutions of the Polish Academy of Sciences, and with universities, colleges and foreign organizations.

Industry branch centres

67. The branch centres occupy key positions in the Polish network of information services, determined by the fact that they are responsible for collecting analytical and synthetical data needed for processing and preparing information material within their respective fields as well as for disseminating it, having ensured that it offers complete up-to-date information.

68. Methodologically, the operations of a branch centre are based on directives received from the Central Institute for Scientific, Technical and Economic Information which is responsible for information service on a state scale. Activities are arranged in accordance with the specific tasks and requirements of the given sector, and they have the following functions:

(a) To supply all interested organizations and persons with complete information on the range of problems in a given branch in particular, all organizational units of the branch, irrespective of their administrative subordination;

(b) To conduct research in the field of technical and economic information, with particular regard to its effectiveness, in a given sector;

(c) To provide the organization to which it is attached with technical and economic information;

(d) To co-operate and assist in establishing production information centres at plants within the branch and to control their work.

At present, 159 such branch centres of technical and economic information are in operation in Poland.5/

69. Information centres are also set up at large industrial plants and designing bureaus, which collect and disseminate required information about the achievements of science, technology, economies, production organization, labour and management, taking into account existing standards, patent specifications and other documents of special character. They do not process technical literature independently.

70. In 1960 about 350 information centres with a staff of about 450 persons were in operation in industry.

71. In addition to these three types of information centres, regional centres of scientific, technical and economic information have recently come into being in Poland: intersectoral agencies which in their work are expected to use the material produced by departmental and branch information centres. Set up in provincial administration offices, their purpose is to supply regional offices of the State and co-operative enterprises with information, working in close co-operation with unions, societies and local organisations.

72. The Polish Academy of Sciences has its independent network of scientific information centres.

5/ W.Pirog, "Der derzeitige Stand und die Entwicklungsrichtlinien der wissenschaftlich-technischen und ökonomischen Information in Polen," Nachr.Dokum., 1965, Vol. 16, No.2., pp. 87-93.

Technical information services for British industry

73. The Ministry of Technology, set up in 1964, promotes the development of British industry by directing and controlling the activities of government and government-supported organisations engaged in scientific research for industry; and by providing firms with advice and information. The Ministry took over from the former Department of Scientific and Industrial Research the direction of ten research institutes and laboratories and it supports financially forty-eight co-operative industrial research associations.6/

74. Since April 1964, the Ministry of Technology and the Department of Education and Science have jointly engaged in setting up, at technical colleges, Industrial Liaison Centres to replace the former Regional Technical Information Centres of the Department of Scientific and Industrial Research of which there were ten to begin with, and at time of writing number approximately forty. It is hoped that by 1967/1968 there will be seventy such centres.7/ They have one or a number of Industrial Liaison officers from the technical college staff whose main function is to visit firms in their locality, with particular attention to smaller firms, and to explain to them how to make greater and more efficient use of scientific and technological information sources and reference funds of various local and national institutions, including their own technological college. Industrial Liaison officers establish personal contacts with owners and make on-the-spot studies of the firm's requirements.

75. The regional offices of the Ministry of Technology co-ordinate the work of the industrial liaison centres. These offices were set up in order to maintain contact between the Ministry and industrial firms and to expand to them assistance in technical and scientific problems. The offices collaborate

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6/ "Technical Services for Industry", Ministry of Technology, London, 1966.
7/ Ministry of Technology Press Notice, 13 May 1965.

with other government departments and represent the Ministry of Technology on the regional planning boards set up throughout the country by the Department of Economic Affairs. In these various ways, a close relationship is maintained among industry, government and academic and independent establishments concerned with research and development.

76. At present eight regional offices are in operation. Their functions areas follow:

(a) To represent the Ministry on the Regional Economic Development Boards;

(b) To report to the Ministry on research and development projects in which the Ministry or the National Research Development Corporation might be interested;

(c) To promote contacts and co-operation between industrial companies, government laboratories, research associations and other academic and industrial research organisations;

(d) To maintain the established information system on industrial development studies and regional plans and to stimulate activities where necessary, through the Regional Development Board and the Ministry;

(e) To assist local authorities and government departments to make full and proper use of the advisory and research facilities of the Ministry's laboratories;

(f) To represent the Ministry on local committees of professional and trade associations;

(g) To advise institutions on the procedure and timeliness of application for research contracts, grants and awards for research out of government funds;

(h) To co-ordinate activities of the Industrial Liaison Centres.

77. In 1966 a Production Engineering Advisory Service was set up by the Ministry of Technology, planned to operate for four years at a cost to the Exchequer

of about £1 million.[8/] The service will offer technical advice, training, and assistance on new and improved production methods. Particular attention will be paid to small-sized and medium-sized enterprises. During the four-year period, over 40 per cent of the 10,000 or so engineering establishments with more than 25 employees, including virtually all those with more than 100 employees, will be served.

78. Mobile units of the service will train designers, foremen and production staff of various firms in new techniques. Initial demonstration and training visits are free of charge. The units give short talks illustrated by films and slides and, if necessary, can perform a demonstration at a machine-tool. The programme is agreed upon in advance with the firms concerned at preliminary talks with senior engineers and may be planned for an audience of any qualification level. Typically the visit lasts one or two days. Additional visits are carried out by special Direct Applications Units which provide advice and assistance in mastering new techniques or on the design and manufacture of particular products. These visits are made at the request of firms and are partly charged.

Netherlands technical consulting service

79. For over fifty years a state consulting service, promoting the development of industry, has functioned in the Netherlands. The service was set up to assist small and medium-sized firms (from 10 to 100 employees), which need information and advice but are not able to pay the cost of private consultants. The fact that this is a state service ensures the impartiality of the advice given.

80. In establishing a consulting service a choice had to be made between a

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8/ Ministry of Technology Press Notice, 14 December 1965.

decentralised service, with a core of field engineers with wide practical experience affixed to a particular region, and a centralised service, consisting of specialists in every branch of industry. The experience of many years has shown that the choice of the principle of decentralisation was correct. A decentralised service better suits the requirements for the following reasons:

(a) The relationship between a consultant and a smaller industrialist are not purely of a business nature, but are also personal in most cases. The consultant's chances of success depend in part on winning the confidence of the owner.

(b) The problems of smaller industries are seldom clearly defined. It is the task of the consultant to discover, in a visit to the firm, the exact nature of the difficulties.

(c) If the consultant wins the confidence of the owner the latter will bring forward all his difficulties, often not technical ones at all. The consultant must be able to understand these problems, give advice himself or direct him to other organisations. In these cases he assists in formulating the questions and understanding the answers.

(d) A consulting engineer who lives in a given area and knows the local conditions and difficulties can establish contacts much faster.

81. Field engineers form the backbone of the service. Offices are established in twelve main industrial towns which are, with a few exceptions, the capitals of the provinces. The twelve offices are grouped into four districts, with a field engineer acting as head of each district.

82. Apart from these twelve offices, there are a chemical engineer's office, an information office, an office of consultants on managerial problems, a consulting office for craftsmen and a research laboratory. A special chemical engineer's office is stationed at The Hague which upon the request of a consultant sends chemical engineers to visit firms for solving problems related to chemistry.

83. From the beginning it was understood that a good technical documentation library would be an absolute necessity, and initially there was a plan to

start such a section inside the service itself, but this would have required great expenditures. That is why it was decided to rely on existing technical libraries. For this reason, an office of the service was established at the Patent Office in the Hague which has a well-documented technical library. Extensive use is also made of other libraries and information centres. Small industrialists can obtain from the information office a consultation on how to apply for a patent.

84. Since many difficulties are not purely technical, but are of a managerial or economic nature and cannot be solved by engineers, in 1952 the decision was taken to set up an office dealing with managerial problems to give advice to industries with personnel not exceeding seventy. At the request of a field engineer, a member of this department visits a plant for a week or a fortnight, studies the situation and makes suggestions for improving the efficiency of operations.

85. For a few branches of industry which border on handicraft, it has been found necessary to set up a special office of consultants with rich practical experience in their particular field to advise clients who have a low level of education.

86. A research laboratory was set up in Delft in 1916 for testing certain technological improvements by field engineers. After 1945 the laboratory was completely re-equipped and has developed into a workshop for mechanisation and automation. A staff of six engineers with assistants and machine operators are designing and building prototypes of special machines and instruments for solving mechanisation problems.

87. The field engineer is confronted with a number of problems which he is not always able to answer. In such cases he should not try to make recommendations, but should confer with his colleagues from another district and from special branches of the Consulting Service. If the question still cannot be solved within the Service, the engineer applies to the Research

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Institute Organization (TNO).

88. Sometimes the service organized discussion groups on technical problems. In most cases the selection of the participants from among the district's employers is done by one of the service engineers, who lead the discussion. It has been found that many of the participants come to understand their shortcomings and difficulties during the discussions, and they afterwards request a visit of the consulting service engineer to talk over their firms' problems.

89. Advice and assistance rendered by the consulting service to small industries are free of charge. Fees are charged only for the work done in a research laboratory and for the services of the engineers from the office of consultants on managerial problems. Payments may be deferred for a period of eighteen months in case the firm is in a difficult financial situation. Field engineers are selected from persons who have broad technological and economic experiences and at least five-year practical experience in industry. As it is difficult to control the quantity and quality of services performed from a central office, the twelve field offices are grouped into four districts. Each head of a district, who is himself a field officer, is in close contact with the other engineers of his district and knows their problems and the solutions recommended. Monthly conferences are held between the director of the Consulting Service and the heads of districts, laboratories and of the office on management problems.

90. Field engineers do not compete with private consultants, but work in close contact with them and even pass difficult questions on to them. The same may be said about the laboratory where experimental types of machine and equipment are constructed, their serial production being left to private firms.

The Danish technical information service

91. In 1955-1956 the Danish Technical Information Service (DTO: Dansk Teknish Oplysningstjenste) was established to supply Danish industry and research centres with information needed for their successful functioning and to establish regular exchange of information between research organizations, laboratories (there are about 1000 manufacturing firms employing more than fifty people). This service works under the guidance of the Council for Scientific and Technical Research and carries out liaison functions between research centres and industrial firms of the country; speaking in general, it constitutes the liaison between science and manufacturing. It is an independent organization directed by a committee of six elected representatives from each of the following leading Danish institutions: the Council for Scientific and Technical Research; the Technical University of Denmark; the Royal Veterinary and Agricultural College; the Academy for Technical Sciences; the Federation of Danish Industry and the Technological Institutes of Copenhagen and Jutland.

92. In the field of information on science and engineering, the functions of the service areas follow:

(a) To collect and disseminate technical or technical and economic reports and other published and unpublished information which is of interest and may be used by the industry;

(b) To render service to the Council for Scientific and Technical Research in developing relations and strengthening co-operation between industrial firms and research institutions;

(c) To sponsor lectures, conferences and various training courses for promoting the introduction of research results and experimental and designing developments in industry;

(d) To co-operate with foreign information services.

93. The Danish Technical Information Service collects information on industrial production, commerce and commodity markets, economic conditions and management problems, in general and relating to particular companies.

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94. With the conviction that scientific research is of practical value for society only if its results are used in industry and their economic effect determined, the service follows the progress of research institutes, both national and foreign and offers reference literature on technical information sources and special reports, by such bodies as the Organisation for Economic Co-operation and Development (OECD), or the National Research Council of Canada. It keeps statistical and commercial studies on individual branches of industry, reports on the introduction of new technology, on the use of scientific research results and on modernisation proposals. It receives rare periodical literature (about eighty journals) and forwards selected articles to the interested companies and institutions.

95. Staff members of the DTO visit firms and research institutes, study their needs and advise them in organising their own information services and on the best means of handling the information they collect.

96. Assistance is rendered in establishing contact between firms and appropriate research centres or scientists. The service sponsors courses of which typical titles are: "The Manager is Responsible for Organising Technical Information"; "Using Technical Information Systems"; "Written and Oral Information". Staff members organise conferences at which information problems in an industry branch, an individual firm or a research institute are discussed.

97. The Technical Information Service collaborates with regional and international organisations: International Federation for Documentation (FID), OECD, Nordforsk, and Scandoc.

98. It is noteworthy that this Danish service is guided in its work by the principle that information on the same topic supplied to users of different levels, should be selected and prepared especially for the use and convenience of the different levels.

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The technical information service of the National Research Council of Canada

99. The Technical Information Service (TIS), established in 1945 within the framework of the National Research Council of Canada, has the main functions of providing industries with technological information and rendering consultant services. Information is supplied on the properties of materials, new technological processes, the efficient operation of manufacturing facilities and the results of scientific research; and on such immediate matters as identifying suppliers of industrial materials and trade organizations selling industrial goods.9/ Specialists of TIS have sufficient scientific or industrial experience to be able to answer information inquiries on a high level. Its representatives in the industrial centres of Canada are closely connected with the Provincial Research Councils.

100. In the year 1964-1965, in answering information inquiries, TIS reprinted about 36,000 pages from periodicals, technical reports and books and complied with over 10,000 requests for the searching of literature and preparing of bibliographic references.10/ For more comprehensive coverage of inquiries the TIS staff consulted specialists of Canadian Government establishments, such as the Department of Industry and the Statistical Bureau, and often apply for assistance to the Technical Information Services of the British C Commonwealth, the United States and Europe. Inquiries received by TIS are regarded as confidential. An effort is made to obtain detailed information about the inquiring party and the problem in which he is interested in

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9/ National Technical Information Services, Worldwide Directory, FID, No. 359.

10/ National Science Library, Annual Report 1964-1965, National Research Council, Ottowa.

order to be in a better position to supply him with the most suitable information.

IV. INFORMATION SERVICES SET UP ACCORDING TO PROFESSIONAL OR BRANCH PRINCIPLES

101. In establishing information centres on the professional or branch principle, the purpose is to centralize the collection, storage and processing of information in a given branch of a national economy. Specialised scientific and technical literature is collected within the branch, and is made available to scientists and engineers of the same or related branches.

102. While organizing such reference services by industrial branch on a national scale, local facilities are set up to satisfy the needs, primarily, of plant personnel. The reference information service is intended for abstracting and indexing of periodicals and other continuing publications within the branch.

103. A more detailed picture of information services of professional societies is gained by considering the Chemical Abstracts Service in the United States. In the opinion of the author of this report, who visited it in early 1966, this service is of interest for its issuing of various types of publications, in particular signal information.

104. The Chemical Abstracts Service was set up by the American Chemical Society in 1907. Its main function is to publish Chemical Abstracts (CA), a periodical which covers all literature on chemistry and chemical technology. In 1965, CA published 194,995 abstracts of various publications from about 10,000 periodical and continuing publications, including 29,225 abstracts of patent specifications, taking an average time of 113 days (3.8 months) from the appearance of the original journals (for 1965).

105. Scientific and technical literature is abstracted in languages from 100 countries. Chemical Abstracts is published in the form of a summary volume and in five issues: Physical Chemistry; Applied Chemistry; Organic

Chemistry; Macromolecular Chemistry; and Biochemistry. Two numbers are issued each month, 26 numbers a year, plus two annual summary volumes are published. Each issue of a CA summary volume or regular issue is provided with an alphabetical index of key words selected from the text of the abstracts, an author index, a concordance of patents, and an index of patent numbers. The last issue of each CA volume includes the following indexes: a subject index, an author index, patent numbers, and a concordance of patents: and in addition, a formula index of cyclic systems is attached. Cumulation of indexes is carried out every five years. For index compilation use is made of two "Listematic" automatic photo reproduction devices and digital computers of the IBM-360/40 type. These devices allow quick publication of the indexes.

106. In 1965, the Abstracting Service began to produce 16 mm microfilms of CA volumes, and the whole CA set from 1907-1964 has been placed on 273 reels. Indexes are not microfilmed. Experience has shown that the use of microfilm makes it possible to speed up retrieval and reproduction of abstracts and certainly, to achieve saving of space for CA storage.

107. The service publishes also Chemical Titles, a bibliographic index of a signal type which, since 1961, has appeared fortnightly, each issue consisting of three sections: (a) an index in which key words of each title are arranged in the alphabetical order; (b) bibliographic descriptions of articles from selected journals; and (c) an author index for articles mentioned in the issue. The index carries information on contents of publications in 690 major journals on chemistry and chemical technology. These publications constitute at least 50 per cent of abstracted articles. The preparation of the index is performed with the aid of digital computers of the IBM-360/40 type and the time of compiling one issue is four weeks.

108. Since 1965 the Abstracting Service has announced subscription for magnetic tapes containing records of the index numbers. The magnetic tape,

with the text of the regular index numbers of the issue, is sent to the subscriber a week before the appearance of the issue itself. Magnetic tapes are used for computer information retrieval. The service provides all magnetic tape subscribers with programmes for information retrieval for digital computers of the IBM-360/40, IBM-1401 and IBM-1410 types. There are twenty-five subscribers to magnetic tapes, mainly large chemical firms.

109. The Service also takes care of single and continuing orders for information retrieval on its computer of the IBM-360/40 type.

110. In 1965 the service started publishing Chemical Biological Activities (CBAC), covering publications on the effect of organic compounds on animals, and plants. It appears every two weeks and issues 26 numbers a year.

111. In the CBAC express bulletin, articles of about 550 journals are abstracted. Each number is provided with an author index, an index of molecular formulae of chemical substances and with a permutation index of key words, compiled not only on the basis of publication titles, but also on the whole text of abstracts. Cumulative indexes are issued for each CBAC volume. Original models of the CBAC issues are made from tabulagrammes produced by the IBM-360/40 computer. The service sends to its subscribers magnetic tapes with the texts of the CBAC issues and performs on its digital computer single and continuing searches on orders for information retrieval in the CBAC.

112. At present the Service is also working on an information retrieval system for searches of chemical compounds from fragments of their structural formula, from nomenclature names of compounds, from their properties, chemical reactions, etc. The exact titles of publications in which each compound was described are indicated. By the end of 1965, information on approximately 250,000 chemical compounds was fed into this information retrieval system. The rate of growth of the information volume is 30,000 compounds a month.

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113. In 1964 the Abstracting Service set up a consultant bureau comprising eighteen prominent scientists, representatives of industry, universities, colleges and the United States Government. The Bureau meets twice a year. It assists the service management in preparing measures to improve the forms and methods of information services offered to the American chemists.

114. In September 1964, a five-year plan for further development of the service was adopted. It envisages the setting up of an automated information system on chemistry on the basis of the CA. The major role in implementing the plan will belong to the Research Office of the Service whose personnel lists forty specialists. The staff comprises 750 persons, 50 per cent of whom are technicians.

115. The work of the Information Office of the Central Department of the British Non-Ferrous Metals Research Association described below is of interest not only from the viewpoint of various information materials it publishes, but also from the viewpoint of various methods of disseminating technical knowhow.

116. The British Non-Ferrous Metals Research Association (London) was set up in 1920 and today unites over 630 industrial firms and organisations of the United Kingdom and the British Commonwealth.

117. Its membership consists of firms and organisations engaged in non-ferrous metal ore-extraction, in the processing of these ores and in the manufacture of non-ferrous sub-products.

118. The main function of the Association (as of 48 other British industrial research associations) is to carry out investigations in the interests of its members and to supply the Association members with corresponding scientific and technical information. An elected Council is the Association's supreme administrative body. It consists of the most authoritative representatives of the Association members.

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119. The Association's Information Office issues a monthly British Non-Ferrous Metal Research Bulletin (BNF) in which publications from 300 various periodicals are selectively abstracted. Ninety per cent of abstracts are prepared by the staff of the Information Department and 10 per cent by the staff of the Research Department. Annually the bulletin carries over 3500 abstracts. It is published about three months after the appearance of the original materials. The bulletin is available to Association members only.

120. Apart from the BNF Bulletin, the Information Department issues a monthly BNFMRA Review which carries reviews on scientific and technical reports of the Research Department of the Association's Central Board. The majority of these reviews are prepared by the staff of the Liaison and Technical Services Department.

121. In addition, the Association publishes scientific and technical reports, technical memoranda, development reports, pamphlets expounding technological experience and other information.

122. The Research Department staff is familiarised with the content of the periodicals received by the library through a system of preliminary topical marking out of the journals received, which are forwarded to the persons concerned.

123. The Association includes the Liaison and Technical Service Department whose main functions are to maintain contact between the Research Department and the Association members, to keep the members informed about research results, to answer inquiries from members, to render various technical services, and to advance pressing problems for research and development. It is noteworthy that the reference work of the Liaison and Technical Service Department is carried out by a special Technical Reference Service which provides references mainly of a technical character.

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124. An important function of the Liaison and Technical Service Department is to sponsor in the Association's Central Board the so-called "open door days" which take place once in three years and are intended only for representatives of Association members. During this period of two or three days special exhibitions are held, and examples of the industrial use of research results are demonstrated.

V. MEANS OF DISSEMINATING SCIENTIFIC AND TECHNICAL INFORMATION

125. A large number of various kinds of organisations are engaged in disseminating information about science and technology. Within the framework of the present report it is impossible to dwell in detail on the role of these agencies; a brief listing of such organisation will suffice.

126. Industrial ministries which direct the activities of research institutes, engaged in industrial research take measures to disseminate information on science and technology. Their role is especially valuable to small and medium-sized enterprises which have no information offices of their own. The ministries also may set up consulting services, as for instance in Great Britain, the Netherlands and Denmark.

127. In some countries banks and development foundations play a role in disseminating information: for instance in France, the Foundation for Development of Scientific and Technical Research, and in the United States the National Science Foundation. The latter subsidises many government and non-government information agencies.

128. Industrial and Trade Chambers sponsor fairs and exhibitions of industrial products, providing information on the state of the market at home and abroad, on the activities of competing firms and so on. The Chamber of Technology of Eastern Germany may serve as an example of an agency supplying enterprises with information.[11/]

129. A great contribution to providing specialised information is made by professional scientific and engineering societies which publish many abstracts journals, and scientific and technical periodicals. For instance, in 1960, 700 scientific societies of Japan published 611 journals on science and technology.[12/]

130. At present, written documents — books, journals, scientific reports, reviews and other publications — constitute the main means of disseminating scientific and technical knowledge. The enormous growth of information sources

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11/ Documentation, 1962, 9, No. 5, 139-141

12/ Universities, Colleges and Research Institutions in Japan, Moscow, 1961.

over the past few years has resulted in a rapid increase of the number of abstracts journals in all fields of knowledge. Lately such new kinds of publications have come into being as express information bulletins, science summaries, and various signal information publications.

Primary scientific and technical documents

131. Primary scientific and technical documents directly record the content and results of research, experimentation and designing. To this type of information belong the majority of books, papers in periodical and non-periodical publications, special kinds of technical literature and dissertations.

132. Periodicals are the most widely used information carriers and they publish by far the greatest amount and variety of data. Newspapers and journals are the traditional forms, the journals occupying the first place among sources used by scientists and engineers. Journal articles account for 60 per cent of all scientific documents on electrical engineering. Vocational journals constitute 70 per cent of sources used by electrial engineers of Great Britain. Study of the bibliographic requests of a few thousand American scientists has shown that journal articles account for 68 per cent of these inquiries.[13/]

133. Journals carry information in the form of articles, notes and communications on current scientific problems. They describe experiments and tests. Along with major articles, some of them publish brief notes on new products, international conferences, national and foreign standards, patents and books.

134. The "Code of Good Practice in the Field of Scientific Publications", adopted in 1961 by the International Organisation for Standardisation and approved by UNESCO, divides articles in journals on natural, exact and technical sciences into three categories:

(a) Original scientific papers which permit scientists, without referring to other sources, to reproduce experiments carried out by an author, repeat his observations, and verify the accuracy of his observations and conclusions;

13/ R. Shaw, Pilot Study on the Use of Scientific Literature by Scientists, Washington, 1965, p. 15.

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(b) Preliminary publications and notes which might contain the elements of scientific novelty, but do not meet the conditions formulated in (a);

(c) Exposes de mise au point, (state of the art reviews) which do not contain new scientific information, but analyse and discuss the data published earlier.14/

135. As compared to books, journal articles have the advantage that they are published much more promptly.

136. According to the Library of Congress, about 30,000 scientific and technical journals are at present published throughout the world, carrying annually up to 2.1 million articles.15/ Other sources indicate that the number of scientific and technical journals has now reached 50,000 and it continues to increase at a rate of 8 to 10 per cent annually.

Patents

137. Patent literature is one of the most valuable information sources of a special type. The patent is a juridical document certifying the rights of the inventor or his legal successor to a monopoly use of the invention for a specified term. A patent description or specification is attached to the patent or the author's certificate. Descriptions of inventions are usually published in the form of booklets or separate sheets for each invention. An annotation is also given in which the character of the invention and fields for its application are indicated. Drawings of individual elements of the invention are included.

138. The description of the invention indicates typical features and the essence of the new device, product or chemical compound and its principal units and components, and includes an explanation of their functions and interaction, as well as references to their positions in the drawings. Usually at the end of the specification the subject of the invention (the patent claim) is given, with stress on the most important points which are regarded as the invention proper and are the object of legal protection.

14/ "Code du bon usage en matiere de publications scientifiques". UNESCO Bulletin for the use of libraries, 1963, V.17, No. 1, pp.30-34.

15/ C.P. Bourne, Methods of Information Handling, New York, John Wiley and Sons, 1963, p.2.

139. The value of the patent specification as an information source is based in the first place on the fact that, as a rule, the data contained in it are unknown to a wide circle of users. Application for a patent is forwarded before any publication appears concerning the invention and usually before industrial implementation has taken place. As a rule, patent specifications contain new technological solutions, since in most countries patents are granted only after strict consideration of the invention's novelty by a group of experts.

140. Regular study of patent information prevents wasteful effort on technological problems that have already been solved, and makes it possible to proceed, taking into account the existing solutions and the main tendencies of technological development, in other words, to work on the most recent level of world experience.

141. Patent literature is extensive. Annually over 300,000 patents and author's certificate specifications are issued.16/

Books

142. Books as information sources are distinguished from articles chiefly in that they contain more synthesised information and give comprehensive, all-round coverage of scientific and production problems. Of special value are monographs, which often contain clearly formulated and comprehensively substantiated materials on methodology, laws, theories and hypotheses.

143. The annual world output is about 75,000 books on science and technology.17/ As stated at the All-American Conference held in September, 1962 in Seattle, in the United States a scientific book running to 10,000 copies is considered to be a great success. In the Soviet Union a technical book may run to 50,000 or even 100,000 copies; consequently they are cheaper than in the United States. It was also emphasised that the "progress that the Russians have been capable of making in technical subjects is related to the fact that they have made good use of a book as a means of exchanging information".18/

16/ The Fundamentals of Scientific Information by A.I. Mikhailov, A.I. Chernyi, R.S. Gilyarevsky, Moscow, 1965, p.98.

17/ C.P. Bourne, Methods of Information Handling, John Wiley and Sons, New York, 1963, p.1.

18/ Science, Technology and Management, Ed. by F.E. Kast and J.E. Rosenzweig, McGraw Hill Book Co. Inc., 1963, p.303.

144. Of the enormous book output the number of books on natural science is only 8 per cent; a somewhat larger number, 13 per cent, concern engineering, agriculture and medicine. Taken together, they do not constitute even half the number of books on social science which amount to about 50 per cent of all books.[19/]

145. The role of a book as an information source is reduced by the several years it takes to write and print it. Much of the data contained in books lags three to five years and often turns out to be obsolete.

Secondary documents and publications[20/]

146. Secondary documents and publications, reference literature, reviews, abstracts and annotations, bibliographic references, express information, and bibliographic indexes, are prepared as a result of processing primary information sources.

Reference literature

147. The mission of reference literature is to provide a fast supply of information of the character of pure science, applied science or education. Reference literature contains the results of theoretical generalizations, basic scientific facts, production material characteristics, and as a rule tables, graphs, drawings and formulas. Production manuals and compendia, which are concise reference books, are efficient means of disseminating information required by specialists, and undoubtedly serve to broaden knowledge and facilitate engineering progress. Vocational, specialized handbooks belong to this class, for instance, "A Chemist's Handbook", "A Machine-Builder Technologist's Handbook", "A Metal Worker's Handbook", "Hütte's Handbook" (in German) and others; also manuals on materials and equipment, on the economic problems of production, and on the organization and protection of labour. There are also reference books on standards and specifications.

19/ R.E. Barker, Le livre dans le monde: Etude sur le commerce international du livre, Paris, UNESCO, 1957.

20/ Secondary documents on science and technology represent the final results of analytical and synthetic processing of secondary documents. (Fundamentals of Scientific Information by A.I. Mikhailev, A.I. Cherny and R.S. Gilyarevsky).

Reviews

148. Over recent decades reviews have occupied a prominent place among secondary scientific documents. They account for about 30 per cent[21] of all information publications. Usually they are published in the form of collections of papers edited by prominent experts. Reviews enable scientists and engineers to keep themselves informed of the main lines of development of their scientific disciplines.

149. There are two kinds of reviews: analytical and summary abstracts. An analytical review is an all-round analysis of primary scientific documents. It contains argumented evaluation of the material and makes well-grounded recommendations on further development and use of scientific and engineering achievements.

150. A summary abstract review has less analytical depth and is based on extraction and systematization of data from primary scientific documents. As a rule, it contains data on the latest achievements of national and international science and engineering and makes it possible to make a judgement on the status and tendencies of development in a separate branch of science or a problem.

151. The All-Union Institute of Scientific and Technical Information publishes review yearbooks, such as "Summaries of Science" on natural sciences and "Summaries of Science and Technology" on engineering sciences in the form of series devoted to specific branches of science and technology, and consisting of issues covering definite sections of a given field.

152. The yearbooks synthesize the major achievements in various fields of science and engineering and are based on materials published over the year in the abstracts journal. 1966 saw the publication of 44 volumes dealing with the branches covered by the different series.[22]

Abstract journals

153. The abstracts journal of today is a major type of secondary information publication. It serves as a means of disseminating information on new scientific and technical achievements, and as a retrieval system for information on a specified

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21/ T.V. Muranivsky. Basic Methods of Processing Documental Information Sources, Moscow, 1966. p.58.

22/ Prospectus "Summaries of Science", 1966.

problem. Abstracts publications deal with secondary scientific documents of three kinds: abstracts, annotations and bibliographic descriptions.

154. Abstracts are compiled for the majority of publications mentioned in an abstracts journal. They are laconic in style and abbreviations of well-known terms are employed. They outline the gist of a problem and give the main factual data and conclusion.

155. Annotations outline as concisely as possible the essence and character of a publication and are usually compiled for publications of secondary importance.

156. Bibliographic references are placed immediately before each abstract or annotation but can pose as independent secondary documents; they include the full bibliographic specification of a document, the ordinal number of a publication in the abstracts journal and a UDC classification.

157. The number of abstracting and indexing services throughout the world, according to some calculations at present, is approximately 3,500, including about 550 in the United States.[23/]

158. According to other sources, over 300 various abstracts journals are issued all over the world, each of which specialises in a separate field. In the United States over 90 abstracts journals are issued, in Great Britain over 40 and in the Federal Republic of Germany, 27.

159. To date the abstracts journal published by VINITI (USSR) has appeared in 162 issues, out of which 127 will form 25 summary volumes and 35 will be published independently. In 1966 over 800,000 publications will appear in it. The value of an abstract journal is determined in the first place by the comprehensiveness of its coverage of the literature in a specific field. Bulletin Signaletique, an abstracts publication issued by the Documentation Centre of the National Scientific Research Centre of France has 24 series and covers all the main branches of science and engineering. The Bulletin Signaletique carries over 400,000 publications annually and covers about 9000 journals (Data for 1965).

23/ C.P. Bourne, "The World's Technical Journal Literature, an Estimate of Volume, Origin, Language, Field, Indexing and Abstracting". American Documentation, 13 April 1962, No. 2. pp. 159-168.

160. Along with their advantages, abstracts journals have the shortcoming that an abstract appears no less than four months after publication of the article. To increase the efficiency of an abstracts journal it is necessary to reduce considerably the time of its preparation, to broaden the coverage of world scientific and engineering literature, to improve the scientific level of abstracts and further develop the index system. The time needed for indexing should be reduced through application of automation techniques.

Express information

161. Taking into account the big gap between the time of publication of an original scientific document and its coverage in an abstracts journal, information services resort to parallel publication of "express information" (EI).

162. Of late, this term has been applied to bulletins with expanded abstracts and translations (abridged or complete), to publications on major inventions, discoveries or studies. Express Information issued by VINITI is of this type. It contains sixty-eight series which cover information in major industrial sectors and individual problems of key importance. Each series has forty-eight issues, four issues per month. Every issue contains from five to ten abstracts. Thus each series annually features 300 to 600 secondary publications.

163. Express Information is a periodical devoted to the most significant problems of science and engineering reported in foreign publications. Expanded abstracts or abridged translations of articles or patents are presented along with corresponding illustrations, graphs and drawings are given. Express information material can be issued three or four times faster than abstracts journal, within forty-eight to sixty days, and usually makes it unnecessary to become familiar with the original document. It serves the purposes of a wide range of engineers, technicians and highly skilled workers, as well as scientists, teachers, post-graduate students and students in universities and colleges. To facilitate the use of EI materials, issues No. 24 and No. 48 of each series are provided with subject indexes covering all abstracts published during the past six months.

164. All of the above publications have one feature in common: they are intended to speed up information on new publications.

Signal information

165. Another new type of publication information issued to apprise specialists swiftly of developments in their field is signal information. This has become possible only since the appearance of automated facilities. "Signal information" refers to the various types of bibliographic indexes giving titles from the main journals received by the Abstracting Service. Such indexes are compiled in from five days to six weeks. For example, the American Chemical Abstracts service, along with an abstracts journal on chemistry, publishes a permutation index of key words, of titles from 600 basic chemical journals (Chemical Titles). The Biological Abstracts service publishes, besides an abstracts journal, the B.A.S.I.C. bibliography index.

166. Although the publishing of signal information is something relatively new and is in its initial stage of development, one can be sure that it will win wide popularity in the near future.

167. A consideration of various information sources cannot be separated from the methods of processing these sources, that are aimed at obtaining the optimal forms of publications. A continuous increase of literature on science and engineering as well as the expansion and complication of information enquiries, have resulted in a situation whereby rapid and comprehensive information can be ensured only by using new methods and automated facilities for processing, storing and retrieval of documental information.

168. A modern information service should ensure:

(a) The comprehensive collection, analytical and synthetical processing of documents for rapid information of research workers on achievements of science and engineering;

(b) The storage of documents in information retrieval systems, ensuring rapid retrieval of required data, both comprehensive and according to diverse subjects;

(c) The processing of information in logical systems in order to obtain new information. The necessity of using new methods and facilities here becomes evident since logical processing cannot be achieved by traditional methods and facilities. A specialized information system of a cybernetic type, capable of performing the necessary operations of comparison within small fractions of a second is needed.

169. In disseminating technical knowledge along with published sources of scientific and technical information, films on technology, placards and exhibitions, as well as seminars and conferences, occupy a prominent place.

Exhibitions

170. Exhibitions are one of the most effective means of offering graphical, accessible, current and concrete popular information on science and engineering. Exhibitions may be stationary or mobile, permanent or temporary.

171. Topics and forms are determined by goals and aims. Stationary exhibitions may be devoted to a single specialized theme such as an achievement in a field of science or in engineering or production; or to a number of topics; or to a whole complex of problems. Mobile exhibitions are, as a rule devoted to one topical subject. Preparation of exhibitions includes preparation of topical and expositional plans, collection and arrangement of exhibits, and aesthetic decoration of the exhibition.

172. There are international, national and local exhibitions. Exhibitions may be universal in content, representing the produce of all branches of national economies or they may specialise in the technological, industrial and agricultural fields.

173. The USSR Permanent Exhibition of Economic Achievements plays an important role in engineering progress: topical exhibitions held within the framework promote exchange of practical know-how between enterprises of the country.

174. The purposes of exhibitions differ. Enterprises may sponsor them in order to popularize and disseminate scientific and technological knowledge. Industrial exhibitions are intended to demonstrate industrial products, articles and raw

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materials or to characterize technological progress, and organization of production. International exhibitions are of educational value, but sometimes are held for commercial and publicity purposes as in the case of exhibitions-fairs, at which goods are sold on the basis of presented samples and standards. Quite often at such fairs, trade agreements are concluded on delivery of equipment, samples of which have been exhibited. Examples of large periodical fairs are the Leipzig Fair (which is held both in spring and autumn) in the German Democratic Republic, the annual Brno Fair in Czechoslovakia, and the Plovdiv Fair in Bulgaria.

175. At present there are a large number of international industrial exhibitions and fairs sponsored by different countries. In 1966 alone, the countries of the Council of Mutual Economic Assistance held fourteen exhibitions on such topics as modern electronics and modern agricultural machines.

Films

176. Technology films are among the most efficient means of introducing to achievements of science and engineering into national economies, disseminating knowledge, and keeping specialists informed about the latest advances. They are a good medium for transferring technological knowledge to engineers, and technicians in industry.

177. It is necessary to differentiate technical films serving to popularise advanced engineering experience from advertising films which are produced for publicity. Numerous technical films are released annually in different countries. In the Soviet Union, for instance, films on technology are made not only by the Ministry of Culture studios, but by many amateur studios set up at plants.

Meetings and conferences

178. Scientific, production and technical meetings and conferences also are effective in disseminating industrial information to the appropriate persons. They may be international, national or regional, and may be held within a single plant, or industry sector.

179. To guarantee the success of conferences and meetings a general theme and a range of problems for consideration have to be determined in advance. A one-day meeting might not need formal planning, but to organize a conference lasting for several days it is desirable to set up an organization committee where the programme is carefully discussed and approved in advance, indicating the place of meeting, the days and hours of its sessions, the main topic and the titles of reports and other communications to be dealt with. Not later than one or two weeks before the opening, the programme, abstracts of reports and invitations are sent to all participants.

180. The main reports are usually delivered at plenary meetings. Detailed discussions of specific problems take place at section sessions. Decisions, recommendations, and suggestions adopted by sections of the conference are submitted for approval by a final plenary meeting. They are then printed and sent to all organisations concerned, especially to those that had sent their representatives to the conference.

181. If an exhibition is held simultaneously with a conference at which exhibits are displayed, reflecting the latest achievements of science and engineering, the organisation committee applies in advance to the enterprise for exhibits: natural size exhibits, models, mock-ups, photographs, diagrams and drawings.

182. A questionnaire distributed to a large number of workers in industry, shows that 21 to 25 per cent of valuable information is obtained by them as a result of participation in the work of meetings and conferences. 24/

183. During the last three years, under the auspices of the United Nations Educational, Scientific and Cultural Organisation (UNESCO), a number of international conferences were held on specific problems of scientific information. In September, 1963 a meeting of UNESCO Working Group 1 was held on scientific publications; in November of the same year another meeting was held in Moscow with the topic, "Automation of Information". In September 1966 a UNESCO symposium on the automation of abstracting and indexing was again held in Moscow, of great significance for the exchange of opinions on computer problems. Valuable

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24/ A.Ya. Pridman. Scientific and Technological Popularisation, Moscow, 1965.

recommendations were adopted concerning short-term and long-term research programmes in this field. On the whole, the meeting was very useful for development of co-operation between Soviet scientists and their colleagues from the West working in the scientific and technical information field.

Seminars

184. At seminars where basic problems of production are discussed, information reviews outlining the state-of-the-art are presented, and prospects of development formulated in a certain branch of an industry or of the industry as a whole. Seminars are held within a particular production field or a technological field, in order to familiarize a wide range of workers with experience in production. Narrow specific production problems are also considered.

185. Seminars are also held in connexion with topical exhibitions. Preparation of seminars consists of the following stages: definition of a topic; definition of the programme; selection of reporters, consultants and reviewers; publication of abstracts; and organization of excursions to industrial facilities. At the end of each communication, practical conclusions are drawn and recommendations made.

Exchange of specialist delegations

186. Missions of engineers, technicians and highly skilled workers to plants, research institutes and other establishments are a means of information. In organizing production and engineering trips, use is made of information about advanced experience of the plant to which specialists are sent, and about advanced technology published in literature on science and engineering and in the periodical press, reports and advertisements. The aim of trips and of any exchanges of delegations of specialists is to obtain up-to-date information about advanced technology and equipment, to exchange experience and to establish co-operation between countries in various fields of science and technology. Of paramount importance is the establishment of personal contacts among specialists during the trip and the possibility of familiarizing themselves on the spot with the state-of-the-art in a specified field.

187. After returning from a trip a technical report is compiled which answers in detail the questions of the technical assignment. In a technical report the positive aspects of observed practice are noted, together with the drawbacks. Technical documentation obtained during the trip is attached to the report.

Consulting services

188. Of great importance to small and medium-sized firms are consulting services similar to those of the Netherlands Consulting Service which has been functioning for more than fifty years, or of the Technical Consulting Services in Great Britain. A consulting service is set up to serve the needs of firms of small and medium-size unable to set up information offices of their own, or to pay as large firms do for the services of private consultants.

189. A consulting service uses science and technology libraries and information centres in its work, but its real effectiveness lies in its personal contacts which can be very much more effective than communications in a written form. Consultants or information engineers visiting a firm can better understand difficulties of a technical character and either give advice themselves or refer the industrialist to the organizations where he had best apply. Finally, a consultant engineer who is also the information specialist better knows local conditions and more easily maintains personal contacts.

VI. TRAINING OF SPECIALISTS IN THE SCIENTIFIC AND TECHNICAL INFORMATION FIELD

190. Defining the role of information on science and engineering in the general process of scientific and technological development offers an opportunity to formulate its basic goals. As has been pointed out above, they consist in the first place in rapid transmission of information within science itself. No less important is the task of the specialist in the information field to establish contacts between science and other kinds of human activities.

191. Success in disseminating scientific information, as in any other scientific activity, depends on the availability of educated, competent personnel. However, in contrast to other branches, the professional aspect of scientific information work is not confined to the qualifications of the information specialist. A high level of efficiency depends on the awareness of all scientists and specialists of the possibilities of scientific information and on their ability to find and use the information acquired in the process of work of a whole generation, or a longer period. Training in the processes and methods of research is important and consumers of scientific information are often given training in these matters at universities and colleges. Thus, the matter of handling efficiently information on science and engineering has two independent aspects: first, to train information specialists, and second, to train information consumers.

192. Having studied the development of information work in some countries, and taking into account world experience, one may conclude that the success of setting up scientific and technical information services is determined mainly by the availability of specialists who are not only aware of the needs of users, but who also know how to establish optimal science information contacts and satisfy the needs of users for information. Proper financial support and computers are certainly important factors, but it cannot be overemphasised that specially trained cadres are the decisive factor in the success of technical information services. The training of qualified personnel for the scientific and technical information field should have top priority on the list of problems for developing countries.

193. At VINITI in the Soviet Union there are courses for raising the qualifications of information specialists. The best way of training such personnel is to provide independent facilities with special curricula and programmes envisaging the adequate training of persons with university or college education for all forms of scientific and technical information service. This method is practiced in a number of universities of the United States, the USSR, the United Kingdom and France. In addition, at library science schools, special courses have been introduced for teaching new techniques of work in the information field. The system of training is not changed, but new training courses are introduced as in the case of Columbia University and at higher schools of library science in Chicago and Cleveland.

194. The development of specialized education in the scientific and technical information field in no way excludes the necessity of training users of information. Some universities and colleges in Europe and the United States have been more alive to this than others. In the USSR, a beginning has been made by setting up special chairs at higher educational institutions. In the training of users, as in the training of personnel proper for information services, only the first steps have been taken. Experience has not yet been accumulated, and a search for optimal forms and methods has yet to be carried out.

195. In connexion with this, we consider it would be valuable to convene international, regional and national seminars in order to exchange information on practical achievements and to discuss the problems of education in this field.

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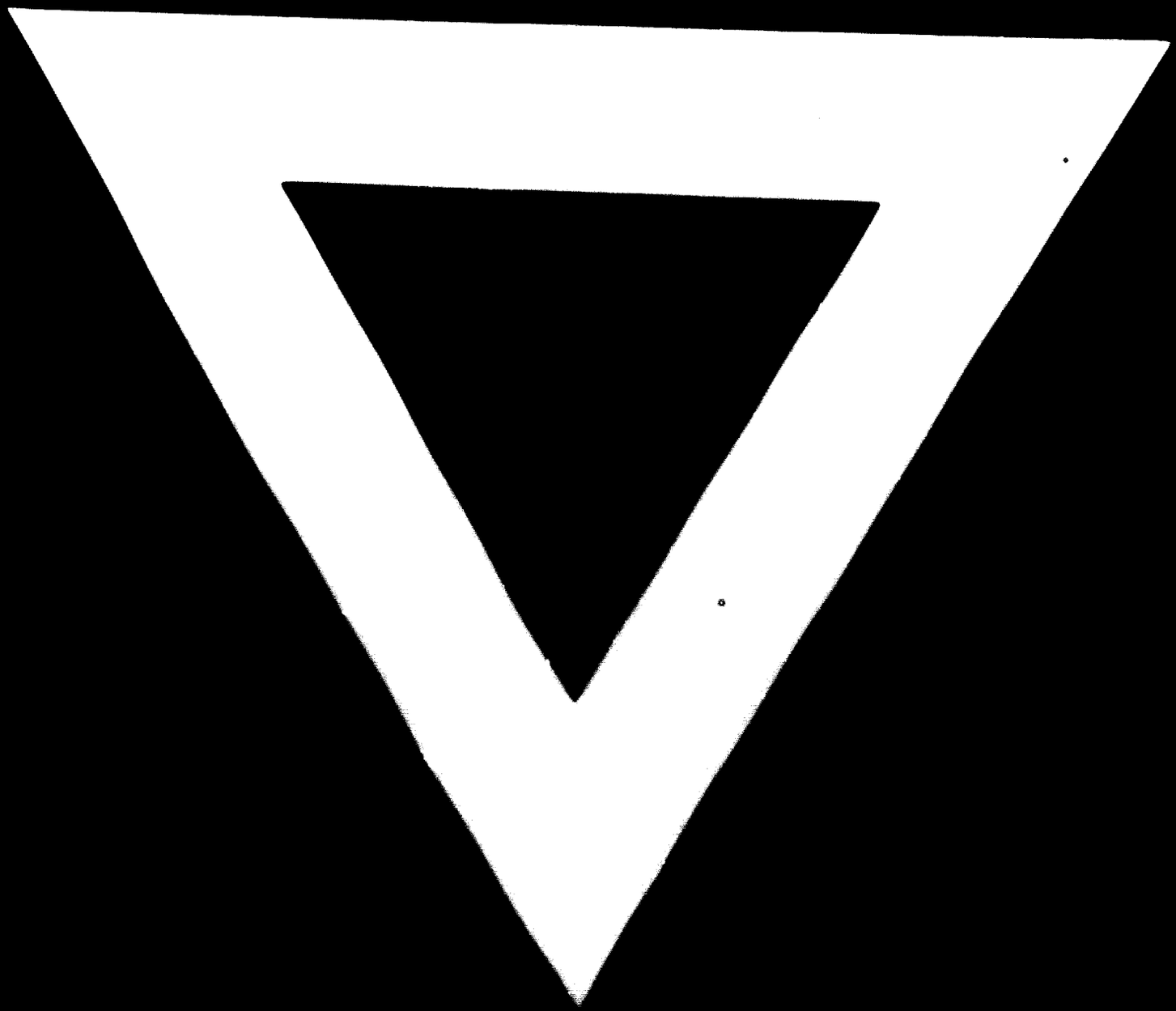
Conclusions

196. Summing up, one can conclude that the main problem at present is the demonstration and popularization of basic ways of optimal information work, using the channels of various international information organizations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Federation for Documentation (FID) and the International Council of Scientific Unions (ICSU). International exchange of experience in the scientific information field should be extended and special attention should be devoted to the problem of training information service personnel.

197. There are too few journals in the world which describe the experience of different countries in the information field, and there is an absolutely insufficient amount of serious literature in the form of reviews on specific information problems. It would be expedient to set up in some countries study groups which under the auspices of UNESCO would organize work in this field.

198. Textbooks should be published which would play a major role in training personnel in different countries.

199. It should be stressed once again that personal contacts, exchange of specialists and probationers, as well as topical seminars are of paramount practical importance.



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