



UNITED NATIONS
GENERAL
ASSEMBLY



Distr.
GENERAL

A/34/558 *+ corr. 1*
19 October 1979

ORIGINAL: ENGLISH

Thirty-fourth session
Agenda item 55 (c)

DEVELOPMENT AND INTERNATIONAL ECONOMIC CO-OPERATION

Network for the exchange of technological information

CONTENTS

	<u>Paragraphs</u>	<u>Page</u>
I. INTRODUCTION	1 - 9	3
II. TOWARDS THE ESTABLISHMENT OF A NETWORK FOR THE EXCHANGE OF TECHNOLOGICAL INFORMATION	10 - 65	6
A. Basic premises and definitions	10 - 14	6
B. The proposed network: the approach under consideration	15 - 20	7
C. Relationship between the proposed network and other United Nations information systems and networks	21 - 29	8
1. Impact of the proposed network on United Nations information systems and networks	21 - 22	8
2. Participation of specialized United Nations information services and networks in the operation of the proposed network	23 - 24	9
3. Industrial and Technological Information Bank	25 - 29	9
D. Identification of sectors and/or subject areas for the implementation of the network	30 - 33	10
E. Directory of United Nations Information Systems and Services	34 - 36	11

CONTENTS (continued)

	<u>Paragraphs</u>	<u>Page</u>
F. Studies and assessment of information resources	37 - 60	12
1. Technological information resources in developed countries useful to developing countries	39 - 49	13
(a) Bibliographic resource	39 - 40	13
(b) Industry-specific resource	41 - 43	13
(c) Special information resource	44 - 45	14
(d) Barriers to transfer of information	46 - 49	14
2. Necessary structures in support of the network at the national level	50 - 60	15
(a) National network of technological information	53 - 56	16
(b) Functions of the national network	57 - 58	17
(c) Preparing the technological information	59 - 60	17
G. Views of the Inter-Agency Expert Group on the Establishment of a Network for the Exchange of Technological Information	61 - 65	18
III. POSSIBLE ALTERNATIVES FOR FURTHER WORK TOWARDS THE ESTABLISHMENT OF THE PROPOSED NETWORK	66 - 92	20
A. Global directory of information services	70 - 72	21
Possible further steps	73	21
B. Establishment of referral services and problem-oriented sub-networks	74 - 84	22
1. Referral centres at the national and regional levels	76 - 79	22
2. Sector-oriented sub-networks	80 - 83	23
Possible further steps	84	23
C. Communication facilities	85 - 90	24
Possible further steps	91	25

I. INTRODUCTION

1. The General Assembly, at its seventh special session, adopted resolution 3362 (S-VII) on development and international economic co-operation and suggested in paragraph 1 of section III that:

"Developed and developing countries should co-operate in the establishment, strengthening and development of the scientific and technological infrastructure of developing countries. Developed countries should also take appropriate measures, such as contribution to the establishment of an industrial technological information bank and consideration of the possibility of regional and sectoral banks, in order to make available a greater flow to developing countries of information permitting the selection of technologies, in particular advanced technologies. Consideration should also be given to the establishment of an international centre for the exchange of technological information for the sharing of research findings relevant to developing countries. For the above purposes institutional arrangements within the United Nations system should be examined by the General Assembly at its thirtieth session".

2. Pursuant to those recommendations, the General Assembly adopted, at its thirtieth session, resolution 3507 (XXX) concerning institutional arrangements in the field of the transfer of technology. In paragraph 6 of the resolution, the Secretary-General was requested:

"in collaboration with the United Nations Conference on Trade and Development and the United Nations Industrial Development Organization, to establish an interagency task force, which should use the widest possible expertise in the fields of information exchange and the transfer of technology and ... undertake a comprehensive analysis with a view to the preparation of a plan for the establishment of a network for the exchange of technological information, and to submit a report containing preliminary recommendations, through the Economic and Social Council at its sixty-first session, to the General Assembly".

3. Pursuant to the request of the General Assembly, the Secretary-General established the Inter-Agency Task Force on Information Exchange and the Transfer of Technology.

4. During the five sessions it held, the Task Force tested the concept of a network against the findings of its studies at the national, regional and international levels. It concluded that the concept was valid and that the establishment of such a network was feasible, and on the basis of this the Secretary-General submitted two reports (E/6002 and Corr.1 and E/6055) to the General Assembly at its thirty-second session.

5. After examination of those reports, the General Assembly adopted resolution 32/178 which read in part as follows:

"The General Assembly

" ...

"2. Welcomes the progress achieved thus far in determining the shape of a technological information network, useful to all countries, in particular developing countries, in studying regional and national capacities and needs in technological information, particularly in the publication of a pilot user-oriented directory of information services of the United Nations system;

"3. Requests the Secretary-General to continue the preparatory studies and assessments of existing information networks already undertaken;

"4. Further requests the Secretary-General, in co-operation with the regional commissions, the United Nations Conference on Trade and Development and the United Nations Industrial Development Organization, as well as with the World Intellectual Property Organization, the United Nations Educational, Scientific and Cultural Organization and other specialized agencies concerned, to develop alternatives for further work on the network, including time schedules, costs and user-oriented operational suggestions, together with suggestions on sectors and/or subject areas where there is a particular requirement for an international information network, using the best possible experience in the fields of identification of user needs, information exchange and the transfer of technology;

" ...

"9. Recommends that work on the network, as well as on the bank, should take into account their interrelationship and also the preparation of the United Nations Conference on Science and Technology for Development;

"10. Requests the Secretary-General to submit to the General Assembly at its thirty-third session, through the Economic and Social Council, a progress report on the work requested in the present resolution, with a view to submitting a final report to the Assembly at its thirty-fourth session".

6. Pursuant to the request of the General Assembly, a progress report (E/1978/72) was submitted to the Assembly at its thirty-third session, through the Economic and Social Council at its sixty-third session. The Industrial Development Board has submitted through the Council to the Assembly at its thirty-fourth session its report on UNIDO's Industrial and Technological Information Bank. 1/

7. The present document constitutes a further contribution to the objectives outlined by the General Assembly in resolution 32/178. The concepts and alternatives that appear in section III were developed well before the recent United Nations Conference on Science and Technology for Development took place. 2/

1/ Official Records of the General Assembly, Thirty-fourth Session, Supplement No. 16 (A/34/16), chap. XI.

2/ For the report of the United Nations Conference on Science and Technology for Development, see A/CONF.81/16.

8. In view of the fact that a number of recommendations of the Programme of Action adopted at that Conference (which are also being considered by the General Assembly at its present session) call for the establishment of a "global and international information network", the present report should be viewed at this stage as a working paper giving an account of the progress made thus far. The concepts and alternatives outlined therein would need to be reviewed by the United Nations organizations concerned in the light of whatever action the Assembly may take on the relevant recommendations of the Programme of Action.

9. The report considers the following four principal activities for further work towards the establishment of a network for the exchange of technological information:

(a) Compilation of a computer-based analytical directory of information services in Member States and international organizations;

(b) Development of referral points at the regional commissions and in Member States and their tying into a network with major national and international information services;

(c) Establishment of problem-oriented sub-networks;

(d) Formulation of network protocols for the efficient transfer of information requests and responses using a limited electronic mail facility, to be designed and operated under United Nations auspices.

II. TOWARDS THE ESTABLISHMENT OF A NETWORK FOR THE EXCHANGE OF TECHNOLOGICAL INFORMATION

A. Basic premises and definitions

10. In all the activities undertaken towards the establishment of a network, the following premises and definitions have been used:

(a) Such a network should not replace any of the existing or planned sectoral, national, regional or international information networks. It should rather be viewed as a means of strengthening them and providing, through shared knowledge of the operations of all participating organizations, the means for their intercommunication and linkages;

(b) Technological information has been defined as information related to technology innovation, transfer and development, including, for example, information about technological expertise, the application of such expertise, minimum costs, terms and conditions, technological specifications, guarantees, delivery and implementation schedules, resources and manpower requirements;

(c) The network should facilitate access to technological information in developing countries through flow of technological information among developing countries and between them and developed countries;

(d) The network should be hospitable to a variety of technological information sources and services, the extent of which would be determined by user requirements;

(e) The network must allow for the participation of all countries.

11. Such a network is viewed as a mechanism for the world-wide coupling of problem-solvers with information services that can facilitate the access to and use of problem-solving information resources.

12. Information resources are considered to be the carriers of information and are of two basic types: repositories of recorded information and knowledgeable human experts. These resources are made available via information services agencies, and by individuals who specialize in the provision of access to information resources and in their use in the solution of specific problems encountered by their clients. Such individuals are generically termed "problem solvers". Information services are a vital link between problem solvers and information resources. On the basis of this assertion, the goal of global sharing of information resources requires an effective and intensive coupling between problem solvers and existing information services.

13. Two levels of information services should be distinguished. Level I facilitates access to recorded information - the raw data and information of science - through the services of searching bibliographic, fact-oriented and other data bases and compilations and through document delivery. In the real world of socio-economic development, however, problems which arise are not always so well-

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formed as to be disposed of by obtaining a copy of a publication; indeed, the majority of the problems are complex in the sense that they require not only access to different data types (technical, economic, managerial, personal, bibliographic, etc.) but often also additional intellectual operations on such data. Level II information services, which subsume the capabilities of level I, are intended to aid problem solvers who require more complex, analytical or consulting assistance with the use of information resources. An important aspect of the level II services is their ability to provide access to experiential knowledge. Being largely incidental and the stock-in-trade of human experts, experiential knowledge is highly dispersed and accessible typically only via so-called informal communication channels.

14. While both levels of information services are important to the problem solvers, their relative value differs in different circumstances and problem-solving conditions. Level II information services are particularly important to problem solvers in developing countries. The proposed network would require access to both levels of information service.

B. The proposed network: the approach under consideration

15. In his first report on the network (document E/5839) the Secretary-General proposed, and the General Assembly endorsed in its resolution 31/183, the concept of a network for the exchange of technological information. This incorporated the view that it should be composed of a large number of individual nodes and the links between them; the nodes could be sources of technological information at the national, regional and international level in the private or public sector, and the links would make possible the exchange of knowledge of the operations of all participants, compatibility among these operations, practical working arrangements and common aims.

16. Each participant, without losing autonomy of action, would be strengthened by its ability to have access to any other participant through the links of the network, thereby significantly improving the speed, quality and appropriateness of the technological information made available to the user. The motive force in the operation of the network would come from the users, stimulated by those other components of the network which are in direct contact with them.

17. At the national level a variety of organizations, institutions and bodies could participate, depending on the size of the country and the level of its social and economic development. These could, for instance, be national or local centres of technological information services for the transfer of technology, specialized centres, centres of excellence, technological research institutes, universities, etc.

18. At the regional level, again, the nature of the participant would vary depending on the region and could be a regional technology transfer centre, a regional technological or industrial development centre and/or the regional office of a programme providing technological information and extension service. It could also be the regional or subregional office of a regional commission.

19. At the international level, organizations of the United Nations system and other organizations having substantive responsibility in the field of technological information and transfer of technology should develop their relevant activities as components of the over-all network, and in mutual co-operation they should make available their own information bases and information handling capabilities as appropriate. These include systems and services controlled or contributed by United Nations organizations such as the clearing-house for industrial information of UNIDO, the International Nuclear Information System (INIS) of the International Atomic Energy Agency, the International Information System for the Agricultural Sciences and Technology of FAO, the International Referral System for Sources of Environment Information (INFOTERRA) of the United Nations Environment Programme (UNEP) and the International Patent Documentation Centre (INPADOC) of the World Intellectual Property Organization (WIPO). Thus, these organizations could contribute to the network specialized information centres in a particular field providing an appropriate information source, facility and service to support technology transfer between countries. One example of such a specialized centre would be the industrial technological information bank referred to in resolution 3507 (XXX) of the General Assembly.

20. Several other existing information systems and services should also form components of the over-all network. These include national institutions and services and those provided by private organizations, such as the Chemical Abstracts Service of the American Chemical Society and the Information Services for Physics, Electrical Engineering and Computers (INSPEC) of the Institute of Electrical Engineers in the United Kingdom. Other information systems and services in the process of development or under consideration within the United Nations system and by other organizations may be expected to further assist in the development of the network.

C. Relationship between the proposed network and other United Nations information systems and networks

1. Impact of the proposed network on United Nations information systems and networks

21. The interaction between such a network and the specialized United Nations networks and other such services should be carefully planned and orchestrated by all sides. Participation of specialized United Nations information services and their user networks in the development and pilot operations of the network is indispensable. This is particularly the case with agency services that relate heavily to the "technological" information interests of their user communities.

22. While this section does not assess in detail the probable effects that interaction with the proposed network may have on United Nations specialized information programmes, there are four areas in which an impact can be expected. The proposed network is likely to: (a) prompt a degree of organizational co-ordination that will result in increased organizational efficiency of these specialized networks; (b) place at the disposal of their user constituencies a wider range of information services, in terms both of functions and subject scope;

- (c) result in the development and use of compatible communication protocols; and
- (d) provide a powerful and economical facility for rapid global message transfer.

2. Participation of specialized United Nations information services and networks in the operation of the proposed network

23. Programmes within United Nations agencies which concern information resources (for example, WIPO's Patent Documentation and Information System) might make their information resources, data banks, etc.) available through one or more appropriate primary network nodes. Specialized referral networks, exemplified by the International Referral System for Sources of Environment Information (INFOTERRA) of UNEP and the Information Referral System (INRES) of UNDP, are primarily, but not exclusively, "people networks" intended to support expert-to-expert communication. The proposed network, which emphasizes access to professional information services, is not initially intended to sustain direct communication (for example, having individuals as primary nodes) among the thousands of experts who constitute these systems. The network will, however, accommodate appropriate major INFOTERRA service organizations as primary nodes; the INFOTERRA central facility and some of its more active referral focal points are obvious candidates for primary nodes of the network. INFOTERRA may, furthermore, suggest other sources of its referral network as secondary nodes, thus offering them a wider range of services and much more rapid message processing.

24. United Nations information programmes that provide information services such as the Industrial and Technological Information Bank (INTIB) and the Industrial Information System (INDIS) of UNIDO and WIPO's affiliated INPADOC are obvious participants and contributors to the network as well as potential users of its services.

3. Industrial and Technological Information Bank

25. Among the United Nations information programmes mentioned above, the Industrial and Technological Information Bank (INTIB) represents a valuable and most important supply node of any such network. This was recognized by the General Assembly in paragraph 2 of resolution 3507 (XXX), whereby the Executive Director of UNIDO was requested "to continue to take ... all necessary measures to establish an industrial technological information bank as a component of an over-all technological information exchange network". In resolution 32/178, the Assembly also recommended that work on the network and the bank take into account their interrelationships.

26. A pilot operation of the bank was undertaken from July 1977 to December 1978 with activities concentrating on four of the sectors outlined in the Lima Declaration and Plan of Action, namely, iron and steel, fertilizers, agro-industries and agricultural machinery (see A/10112, chap. IV).

27. In his report (ID/B/226) to the Industrial Development Board at its thirteenth session (24 April-4 May 1979), the Executive Director of UNIDO stressed the fact that the distinguishing characteristic of INTIB was that it addressed itself to the

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question of access to technologies and to the selection process at the stage preceding the acquisition and operation of technology. INTIB was thus required to provide selected, analysed and annotated information on technological alternatives. The points at which INTIB could assist in the development of this dialogue, by providing information permitting the proper selection of technologies, were identified as follows:

"(a) Broadening the information base regarding available technologies and generating and disseminating such information;

"(b) Providing criteria and parameters for the selection of technologies, an activity which is particularly important at the pre-feasibility stage as it can strongly influence the concept of the industrial project;

"(c) Providing information on contractual implications with a view to facilitating negotiations;

"(d) Providing information on the unpackaging of technologies - another important area, as the ability of a developing country to separate the cost of know-how from that of hardware, engineering and other elements rests on its capability of assessing each disaggregated component separately".

28. Those recommendations on the future activities of INTIB have been endorsed by the Industrial Development Board which, having considered the positive experience gained from the pilot activities of INTIB, recommended that INTIB be continued as an activity of UNIDO.

29. The report of the Industrial Development Board 3/ further stresses the function of INTIB as a network in establishing links with sources and users of information relating to industrial technologies. The report also recommends that INTIB expand its sphere of activities and extend its coverage to the sectors covered by the system of consultations. Other sectors suggested for coverage by INTIB include construction and building materials, non-conventional sources of energy and electronics, as well as the sectors selected at the United Nations Industrial Development Organisation International Forum on Appropriate Industrial Technology held at New Delhi in November 1978 (see A/CCNF.81/PC/CRP.1/Add.1, part B).

D. Identification of sectors and/or subject areas
for the implementation of the network

30. At the fourth session of the Committee on Science and Technology for Development, the Secretary-General submitted a report (E/C.8/53) containing suggestions for the implementation of General Assembly resolution 32/178. Special

3/ Official Records of the General Assembly, Thirty-fourth Session, Supplement No. 16 (A/34/16), chap. XI.

emphasis was placed on the request made by the Assembly concerning suggestions on sectors and/or subject areas where there was a particular requirement for an international information network. Consideration was also given to the Assembly recommendation that work on the network, as well as on the bank, should take into account their interrelationship and also the preparations for the United Nations Conference on Science and Technology for Development.

31. In the view of the Secretary-General, the Committee was to choose for pilot implementation of the network one or more subject areas from those selected by the Preparatory Committee for the United Nations Conference on Science and Technology for Development in its decision 3 (II) taken at its second session: food and agriculture; natural resources including energy; health, human settlement and environment; transport and communications; industrialization, including production of capital goods; and those selected by UNIDO from the pilot implementation of its bank - iron/steel; fertilizer; agricultural machinery; and agro-industry. 4/

32. The Committee took note of the Secretary-General's report but felt that it was premature to select particular subject areas for experimental implementation of an information network at that time. Therefore it decided that the areas should be proposed for consideration after further study by the Advisory Committee on the Application of Science and Technology to Development, by the specialized agencies and the regional commissions. The Advisory Committee, at its twenty-fourth session, recommended the following subject areas for the implementation of the network: (a) agro industries, including agricultural machines and implements; (b) technologies for low-cost construction; and (c) renewable sources of energy. These sectors are included in the recommendations of the Industrial Development Board, as mentioned earlier.

33. While these recommendations of the Advisory Committee have been given due consideration, studies undertaken by the regional commissions and consultations with concerned agencies have revealed that priorities do vary from region to region and even from country to country. On that basis, it may be considered whether the proposed network should not only support the information needs in one sector or the other, but whether it should also address itself to the needs of all types of developmental problem solving in order not to exclude, a priori, some countries or some groups of problem solvers. That implies that the network design effort must start at a level of generality sufficiently high to accommodate the whole range of potential network resources and potential primary users.

E. Directory of United Nations Information Systems and Services

34. In his first report on the network (E/5839) the Secretary-General proposed the compilation and publication of a pilot edition of a directory of information services, designed to assist users in identifying services which meet their needs.

4/ Official Records of the General Assembly, Thirty-third Session, Supplement No. 43 (A/33/43 and Corr.1), annex I.

The pilot edition would be limited to already existing services controlled, contributed to or otherwise made available by organizations of the United Nations system or to services which would be available to users within a short time.

35. The Inter-Organizational Board for Information Systems (IOB), in view of its own terms of references and its activities, was invited to include the compilation of the directory as a priority item in its work programme. Accordingly, the directory was compiled and published by IOB. It contains a description of the functions of organizations of the United Nations system, a user-oriented description of each information system or service, a country index providing for each Member country the addresses of organizations and centres contributing information to the various systems of United Nations information centres and of libraries where collections of organization publications can be found. It contains also a comprehensive subject index which enables users to identify, on the basis of the field of technology in which they are interested, the services which can provide the information needed.

36. The directory thus represents a starting point towards the pilot implementation of the network. A further step might be to undertake, on the basis of the information available in the directory, a detailed assessment of the United Nations information systems and services with a view to determining gaps in both the information coverage and/or services provided.

F. Studies and assessment of information resources

37. In paragraph 6 of its resolution 32/178, the General Assembly requested the continuation of studies and assessments of information systems and services which had been initiated in order to provide a solid basis on which a plan for the future network could be founded. 5/ In that regard, the United Nations Educational, Scientific and Cultural Organization (UNESCO) has published its final report on a survey of the technological information resources useful to developing countries and which are available in developed regions of the world entitled "Information systems and networks for technology transfer" (UNESCO PGI-79/WS/2). Some of the regional commissions have finalized their studies and assessment of information resources in selected developing countries. 6/

38. This section is based on the findings of the above-mentioned studies and the recommendations contained in the draft Programme of Action of the United Nations Conference on Science and Technology to Development (A/CONF.81/L.1). 7/

5/ A progress report on the studies was included in reports of the Secretary-General (E/6055 and E/6002).

6/ See, for example, the "Preliminary study on the establishment of an information network on non-conventional sources of energy in Latin America" of the Economic Commission for Latin America (ECLA/MEX/1014) and the "Report on a network for technological information on agro-industries" of the Economic and Social Commission for Asia and the Pacific.

7/ For the Programme of Action as adopted by the Conference, see A/CONF.81/16, chap. VII.

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1. Technological information resources in developed countries useful to developing countries

(a) Bibliographic resource

39. The resource is very large -- probably some 2,000 journals of abstracts or their equivalent and over 300 computer-readable data-bases, which can be viewed as guides to the location of relevant items of information. As the total number of items referenced runs to several tens of millions, retrieval of those relevant to a particular problem area is possible only by use of the ordering structure built into printed and computer-readable data-retrieval tools (printed indexes or on-line retrieval facilities, etc.) which are available.

40. Two main difficulties surround the use of the bibliographic resource in technology transfer. First, the resulting information does not provide "know-how". The end product is a set of scientific and technical documents, designed as a means of communication between research and development scientists and engineers, not as a direct means of transferring techniques to a possibly different environment. Second, bibliographic systems provide addresses to hard information in the shape of references to articles and reports, etc., not the information itself. Its usefulness in providing actual information is therefore conditioned by the degree to which a second main component of the total scientific and technical information system, that of the location and supply of documents, is effective in the local environment.

(b) Industry-specific resource

41. This part of the total information resource is as yet imperfectly identified. It is clear, however, that it constitutes an immediately usable and highly valuable information base for direct technology transfer. A number of national organizations having information transfer programmes in various industrial sectors, and UNIDO, through its Industrial Information Inquiry Service, Industrial Research Abstracts and Guide Series, have been engaged in matching the specific information requirements of industries by creating specialized collections of information which extend further than formal scientific and technical information.

42. Although the industry-specific resource will contain research and development reports and articles, the special collections of information and data will also include primary sources not normally contained in research and development-oriented bibliographic collections, for example, trade newspapers, market surveys, and know-how information derived from experience in the field. The industry institutions concerned are fully aware of the fact that the provision of purely passive information, for example, the circulation of documents, newsletters and so on, does not of itself achieve a transfer of technology. Consequently, many will develop their specialized information collections in order to provide an information back-up to question-answering and consultancy services which they perform for their membership. In addition, some will create a data base, either in printed or machine-readable form, which can be consulted by users in much the same way as a normal bibliographic data base in purely scientific and technical information.

43. Industry-specific systems can be used in developing countries by information centres providing information on technology innovation, transfer and development, and by those directly responsible for technology transfer. However since those systems are mostly concerned with transfer of technology within industries in industrialized countries, there may be problems in the relevance of their findings in other environments. In that context the industrial and technological information bank of UNIDO, whose objective is to analyse, evaluate and repackage information, will be of great assistance.

(c) Special information resource

44. Several special information systems designed specifically for the transfer of negotiable technology have been identified. They include patent information systems (both commercial and intergovernmental), a reprocessed computer data base to bring out innovations in the scientific and technical literature, a computerized information exchange system bringing together vendors and buyers of technology, and a mechanized system for quickly identifying items of equipment on sale which meet the users' requirements.

45. Those systems have special uses in a technology transfer programme and are already in use throughout the world. They are, however, rather sophisticated in design and are available through computer networks.

(d) Barriers to transfer of information

46. Only rarely will it be possible for developing countries to obtain actual answers to problems in the field by direct use of the information resources available in developed countries. Availability of application of relevant information clearly implies a necessary minimum information infrastructure on the part of the receiver, which infrastructure must not only provide the necessary intermediary services to connect the end-user with the available information but must also provide for an assessment of needs which may well be unperceived on the part of the organization or individual to whom the information is transferred. Moreover, the information must be so presented that the end-user can apply it, and this implies that at some point in the transfer chain a form of repackaging will be necessary. Such repackaging could take many forms, ranging from selecting research data and merging it with practical experience in application of those data so as to provide know-how information to shifting available information in order to match the particular circumstances of the local environment.

47. The studies have also revealed that, in the area of information retrieval and information source location, the use of modern computer-telecommunications systems could be of great help to developing countries, although there are many barriers to the application of informatics which are as yet unclear. Some of the barriers can be stated, for example, the present high cost of international intercontinental telecommunications and the lack of appropriate local telecommunication systems to support data traffic.

48. In addition to the infrastructure barrier there are also cost and hard currency problems to be overcome in using existing information resources available in industrialized nations. Subscription prices, leasing fees and royalties vary from zero (in the case of a computer tape received under an exchange agreement) to several thousand dollars per year (in the case of certain journals of abstracts or machine readable versions of the contents of such journals).

49. There would appear to be a need for greater effort on the part of the United Nations system to assist developing countries in overcoming barriers to transfer of information. A systematic study of those barriers might be carried out to provide a factual basis on which assistance requirements could be better assessed.

2. Necessary structures in support of the network at the national level

50. At the national level, emphasis should be placed on strengthening the national capabilities for information handling and for the processes of technology transfer and development in such a way that they will be able to support directly the social and economic development of the country.

51. To facilitate this, it is desirable that in each country arrangements be made for the formulation of a policy of information handling, for the provision of guidance to individual technological information centres and for general assistance in the creation and operation of the national technological information network as a component of the over-all global network. The experience gained by the World Information System for Science and Technology (UNISIST) programme of UNESCO and other focal points of United Nations organizations dealing with information could be most helpful in that regard. Equally important is the fact that Governments should allocate adequate resources to support these activities.

52. The draft Programme of Action of the United Nations Conference on Science and Technology for Development includes the following recommendation: 8/

"... all countries drawing up national scientific and technological policies and plans should include in them the development of programmes and activities for national information systems and networks.

"National information systems and networks should aim to ensure access to and facilitate utilization of national and international sources of information on science and technology in order to stimulate endogenous development and national capacity for innovation and to support the assessment, transfer and adaptation of technology. This requires inter alia:

"(a) The training of specialized manpower;

"(b) The development of infrastructures including communication facilities, data banks, libraries, documentation centres, archives, back-up literature, hardware and software;

8/ See A/CONF.81/L.1, para. B.13. Since this report was prepared, these recommendations have been adopted by the United Nations Conference on Science and Technology for Development and are included in the final Programme of Action (see A/CONF.81/16, chap. VII).

"(c) The development of the necessary information-handling procedures and techniques, tools, methods, norms and standards;

"(d) The improvement of stock of primary documents in developing countries, taking into account the establishment, when this proves necessary, of central libraries or documentation centres;

"(e) That care should be taken that all countries should have access to the information systems of developed countries permitting research on line".

(a) National network of technological information

53. A technological information network should be established to strengthen and co-ordinate national capabilities to make efficient use of information. Structurally, it would comprise a national focal point in a two-way communication linkage with a number of nodal agencies represented by manufacturers and licensors, research and development institutes, documentation and information centres, industrial and engineering consultants, equipment manufacturers and suppliers, patents offices market information consultants, concerned government departments and voluntary agencies, chambers of commerce and industry, and other user organizations. It would also co-operate in areas of common interest with information systems operated by regional and international organizations. The concept of such a national network is further elaborated in paragraphs 54-60 below.

54. The national focal point could be built within an existing national organization by suitably expanding the facilities, or it could be a part of the national centre for transfer and development of technology, proposed to be set up by many developing countries.

55. The national network should be organized and should operate on the basis of a two-way flow between the national focal point and the nodal agencies, so that all points in the network are as much "suppliers" to the information system as they would be its "users". Thus, a manufacturer, a consultant or a research institute might draw upon the centre for technical information relevant to its needs. That would not imply dilution of the main emphasis from the needs of the small and cottage-scale entrepreneur. It is essential that the system be open ended, the sense that it should not only permit but encourage and promote direct contacts between the various nodal agencies. The system should also have a built-in flexibility for structural modifications to respond to changing needs and growth in size, number and functions of the nodal agencies.

56. From the viewpoint of functional efficiency, the centre should be equipped with sophisticated storage and retrieval systems in terms of microfilms, microfiche and computerized operations. The centre should be manned by competent staff trained in the latest information techniques and should help in the training of personnel for nodal agencies and sub-network centres. It is equally important to have a staff capable of preparing technological information in a form usable by the small cottage-scale entrepreneur, especially in rural areas.

(b) Functions of the national network

57. In keeping with its objectives, the network should be capable of discharging the following functions:

- (a) Anticipate and identify the needs of the users for technological information;
- (b) Establish and maintain communication linkages with nodal agencies and other sources of technological information;
- (c) Collect, maintain, classify, store, retrieve, update and disseminate information;
- (d) Prepare the information material in accordance with the needs of the users;
- (e) Provide provisional referral services and communicate information in an appropriate manner to the users and be capable of receiving feedback;
- (f) Publish technical bulletins, newsletters, reviews, etc.;
- (g) Train personnel;
- (h) Link with other national, regional and international organizations.

58. For the successful functioning of the network, the national focal point has a core-function. It would be responsible for forging linkages and establishing communication with sources of information; making competent arrangements for processing of technological information, its preparation and dissemination, in accordance with the user requirements. In some countries which are large and have diverse languages and cultures, it may be necessary to have sub-focal points located at geographically convenient areas suitably interlinked with the national focal point. The main usefulness of the sub-focal points would lie in:

- (a) Securing technological information from the national focal point;
- (b) Communicating information, suitably prepared in accordance with needs of the user, in local language, through discussion or documents;
- (c) Obtaining feedback on the acceptability and usefulness of the information supplied in relation to needs and transmitting it to the national focal point.

(c) Preparing the technological information

59. Many of the international systems of technological information remain grossly under-utilized. In some cases, the recipients have found the information supplied through these systems to be of limited usefulness and they have to approach the primary sources, to whom they are referred, further in order, to secure the requisite data. Most of the systems do not provide for screening, scrutiny and

preparation of data in accordance with user requirements. The national focal point should have capability both in terms of referral to primary sources or specialized sub-networks and in the assembly and preparation of an informal package which would contain adequate detail for choice of technology appropriate to the factor endowments of the entrepreneur and the location.

60. The focal point would have to depend not only on directories, technical and trade journals and publications, but also draw on live technological information based on actual experience of manufacturers and licensors of technology, market information on demand of the products, etc. Thus its coverage would extend beyond published information.

G. Views of the Inter-Agency Expert Group on the Establishment of a Network for the Exchange of Technological Information

61. An Inter-Agency Expert Group was convened at Geneva from 27 February to 2 March 1979 to provide guidance for further work on the proposed network. The meeting was attended by representatives of the regional commissions and concerned organizations, as well as by experts invited in their individual capacity.

62. In its report (IESA/S and T/AC.12/9/Rev.2), the Group stressed the fact that the design and development of the proposed network should draw upon the experience of the UNISIST programme of UNESCO, which had developed policies and practices in the methodology of information handling as well as guidelines for the establishment of national information infrastructure. The United Nations had also already established a number of networks and services, many of which were similar or relevant to the proposed network, and it was recommended that the experience, both national and international, gained in developing and operating those systems should be taken fully into account. The impact of the network on those networks and services should also be determined.

63. The Group also emphasized that relevant initiatives taking place at the national level needed to be taken into account in designing and establishing the network. That applies in particular to the regional centres for the transfer and development of technology, and to non-United Nations initiatives such as the Technological Information Network (TECHONET ASIA), and sectoral extension services such as the ones being set up in the pharmaceutical field in the Caribbean.

64. The immediate objective of the network would be to refer information seekers to information resources, particularly those relating to the transfer, adaptation and development of technology and to stress the development of transfer mechanisms for transferral of information, including directories, description of information seeking problem solvers (information demand nodes) and economic modes of channelling the flow of information. The following could be anticipated as long-term objectives in the development and establishment of the network: provision for more advanced data management, information retrieval and communication functions between information demand and supply nodes, including facsimile transmission, direct data-based management-searching facilities and electronic mail. To reach that objective the Group agreed that emphasis should be placed on the following areas:

(a) The need to build up and strengthen national infrastructures, particularly in respect of capabilities to collect, store, analyse and disseminate information, exchange experience and make it available to end-users in particular, through extensions;

(b) Ensuring close co-operation in the development and operation of United Nations information systems and services and the individual networks developed around them; that, applied at the country, regional and international levels. Co-operation among the existing national focal points should also be strengthened;

(c) Provision of linkages by United Nations information systems and services between the systems and services, thus facilitating efficient information flow between sources and users;

(d) Development of more consistent protocol for the access to existing systems.

65. The point was also stressed that during the planning for the establishment of the network, particular attention should be given to the initiatives now underway in restructuring the activities of the United Nations in the economic and social field and, in particular, to the emphasis being placed on decentralizing activities to regional commissions and strengthening their role in the dissemination of technological information.

III. POSSIBLE ALTERNATIVES FOR FURTHER WORK TOWARDS
THE ESTABLISHMENT OF THE PROPOSED NETWORK

66. As requested by the General Assembly in paragraph 4 of resolution 32/178, some possible alternatives for further work on the network have been prepared on the basis of:

- (a) Studies and assessment of information systems and networks in developing and developed countries referred to in paragraphs 37-60 of the present report;
- (b) The views of the Inter-Agency Expert Group on the Establishment of a network for the Exchange of Technological Information referred to in paragraphs 61-65 above;
- (c) The concept of a network as defined by the Secretary General and endorsed by the General Assembly in its resolution 31/183 and referred to in paragraph 15 above.

67. Where possible, recommendations contained in the draft Programme of Action for the United Nations Conference on Science and Technology for Development were also taken into consideration. However, since the present report was prepared before the Conference took place, suggestions contained in it would need to be carefully reviewed in light of the recommendations of the final Programme of Action as endorsed by the General Assembly.

68. The alternatives cover three principal activities for further work towards the establishment of the network, whose functions are seen as being the referral and transmission of information. The activities would be as follows:

- (a) Compilation of a computer-based, analytical directory of information services in Member States and international organizations;
- (b) Development of referral points at United Nations regional commissions and in Member States and tying them into a network with major national, regional and international information services; and development of problem-oriented sub-networks;
- (c) Formulation of network protocol for the efficient transfer of information requests and responses using a limited electronic mail facility to be designed and operated under United Nations auspices.

69. Activities (a) and (b) could represent one alternative; activities (a), (b) and (c) another. However, these three activities may also be seen as necessary sequential and evolutionary steps that should be undertaken in order to establish the proposed network. Also, once agreement has been reached on the alternative to adopt, proposals would need to be prepared for the initial operation of the network on an experimental, pilot scale.

A. Global directory of information services

70. A common directory in compatible form and format of information service organizations in both the developed and developing countries and those in international organizations might be compiled as an important tool for making information resources available to problem solvers. The directory could contain indexed listings of hundreds or even a few thousands of information service organizations. To facilitate updating and maintenance and to allow for easy production of regional, subject and sector-oriented sub-directories, the central directory file should be computerized and maintained by the co-ordinating office of the proposed network. It is also envisaged that that office would also be responsible through the collaborating national agencies for keeping the directory current.

71. Prior to compilation of the directory, a common scheme for the description of information services should be agreed upon. In addition, a set of criteria must be developed to assist in the selection of information services to be listed. Apart from the traditional information services specializing in information search (data base vendors), particular emphasis should be directed at identifying and describing non-traditional services in the member countries: information analysis centres, professional groups active in development-oriented information work and the like.

72. A number of national and other directories, such as the United Nations Directory of Information Systems and Services, already exist and should be inventoried for input to the global directory.

Possible further steps

73. In this project phase, the following tasks might be carried out by a designated network co-ordinating office:

- (a) To elaborate, for the purposes of the United Nations network, an operational definition of "information service", including the desirable characteristics that the listed organizations should possess;
- (b) To develop a conceptual framework that will permit a description of information service organizations adequate for the purposes of the network referral function;
- (c) To invite the Member States to furnish a list of information services that correspond to that definition and to characterize those services in terms of the conceptual scheme developed for that purpose. (In countries where they exist, UNISIST focal points might be the appropriate mechanism for the compilation of a national list of information services in the public and private sectors. In countries where such focal points or other suitable bodies do not exist, the United Nations regional commissions could be instrumental in surveying appropriate information services.) The results of those surveys would be aggregated into the global directory, a principal tool for the network operation;

- (d) To design and implement a data base software system for the maintenance and retrieval of the global directory.

B. Establishment of referral services
and problem-oriented sub-networks

74. The primary motivation behind the network concept is to facilitate more effective information flow from sources to problem solvers. The simplest form of demand/supply flow is directly between nodes. In some situations such non-directed network organizations provide for efficient communication. However, since many of the demand nodes may not be informed as to which supply nodes are most appropriate, effective communication will also require the use of a "referral" service.

75. In order to consolidate the proposed network, the following two steps may be necessary: (a) the establishment of referral services at the national and regional level and (b) a gradual formation of co-operative problem-solving sub-networks.

1. Referral centres at the national and regional levels

76. Primary referral nodes might be established at the national and regional level in order to direct demand nodes to appropriate supply nodes. These nodes could be located at the national level at the focal point. At the regional level, consideration should be given to the establishment of the referral nodes at the regional centres for technology transfer of the United Nations regional commissions. It is envisioned that in time, as individual countries develop their information capabilities and national referral services become fully experienced, the need for regional referral services will decrease.

77. In addition to carrying out the referral function, national and regional nodes would be responsible for the maintenance of their respective portions of the United Nations directory of information services. While it is not anticipated that these nodes would handle services other than referral, local conditions would dictate the extent of other information functions that might be assumed; for example, a regional commission might decide, commensurate with the needs of national information sectors within its region, to operate a translation service. Such additional services are viewed as being ancillary to the network concept as formulated here.

78. The United Nations and national referral services would be provided with the global directory of information services, as described in the previous section. The regional United Nations referral nodes would, in addition, be provided with the necessary hardware for the directory; national nodes could be expected to acquire their computational facilities or work with published versions of the directory.

79. In order to simplify the operation of referral centers and their communication with the network nodes, a common form or forms for inquiry submission would be desirable. Some of the existing instruments used in INFOTERRA, TECHNUNET ASIA, and other information services may be adapted for the purpose of the proposed network. The use of such forms would contribute to the efficiency of the telecommunications arrangements proposed for the network in the next section.

2. Sector-oriented sub-networks

80. Sector-oriented sub-networks may be viewed as a mechanism for further structural consolidation of the proposed network. Problem-oriented sub-networks are loose organizational arrangements of problem-solving institutions that have common interests, missions and/or problems. Sub-networks of this type have come into being for research-oriented institutions, both on a global scale and on a regional scale, such as TECHNOMET ASIA. As a rule, sub-networks are capable of better defining and intensifying the information exchange flow among their members, including information demand-supply flow.

81. In the context of the proposed network, it is envisaged that problem-oriented sub-networks will ensure an exchange of experience and information between countries of the region on availability and experience of technology, equipment, expert and consultancy services, research and development programmes, promotional effort and policies in interested fields. Indirectly, this flow of information and exchange could provide the basis for identification of programmes for technical co-operation and co-operative efforts for research and development or joint projects between different countries.

82. Typically, each sub-network may have a "lead" institution which may eventually take over, on behalf of the sub-network, the referral service function from the regional centre.

83. The centres for technology transfer of the United Nations regional commissions are in an excellent position to foster the establishment of problem-oriented sub-networks in their region in addition to those which already exist. To do so, they can take advantage of the recommended directories of information resources in their region and identify from them the analogous institutions, agencies and firms in both the private and public sector, and subsequently encourage these groups to constitute informal sub-networks.

Possible further steps

84. This alternative could include the following actions:

- (a) Establishment of four regional referral services associated with the United Nations regional commissions;
- (b) Assistance to Member States in establishing national referral points;
- (c) Development of operating protocol for the interaction of the different node types;
- (d) Organization of the network by stipulating the necessary characteristics of primary and secondary nodes and by identifying and inviting (through United Nations contacts at the national level, such as the focal points of the General Information Programme (PGI) of UNESCO, and at the regional level, through the regional commissions) information demand and supply organizations in Member States to join the network as primary or secondary nodes;

/...

- (e) Assistance in the establishment of problem-oriented sub-networks;
- (f) Mounting a publicity strategy and programme to promote the network services.

C. Communication facilities

85. Once a mechanism is established to couple problem solvers with information services, the question arises of the manner in which they will communicate, that is, exchange messages such as requests for information and answers to them. The network could be considered sufficiently advanced for the time being if it accomplished the coupling function only. On the other hand, there is a strong argument in favour of examining the communication aspects of the network as well; the customary media of postal and voice communications have serious drawbacks and improving them may go a long way toward optimizing the utility and impact of the two most precious resources of mankind, human problem solvers and knowledge.

86. In recent years, important achievements have been made in the field of digital satellite communications. The present is not a propitious time to propose a major commitment and investment in these technological facilities. However, a selective, economical application of current digital information technology, the object of which is to advance the network part of the way toward the eventual communication scenario, could be considered. The later transition from this intermediate to the advanced form of communication will be natural and relatively straight-forward.

87. A computer-based message system for the communication of textual messages (requests for bibliographic searches, assistance in analytical problems, information sources and documents, quotation of price, etc.) between primary demand and supply nodes could be envisaged. The conditions for becoming a primary node would include the capacity to process and transmit messages and the capability and willingness of the node to be physically connected to electronic mail facilities. Primary nodes would consist of three functional types of organizations: (a) information demand nodes, which are organizations in Member States that expect to need to use the network services; (b) referral services, which are national and United Nations organizations whose purpose is to guide an undirected (not addressed) inquiry to one or more relevant information services; and (c) information supply nodes consisting of selected major information services. Secondary nodes would be those organizations of information demand and supply which do not meet the primary node conditions and hence could gain access to the network only via a primary node.

88. At the hub of this communications network, there might be a "switching centre", an automated message switching minicomputer located in a city that had both long-distance telephone data phone and access to international dial-up digital data networks. The purpose of this computer would be twofold: to provide an interface between voice-grade dataphone and dial-up digital networks (neither of which is available in all countries) and to provide simple information processing functions of the network.

89. The network might function as follows. A secondary node generating an information request (or answer) would forward it by the best method (telephone, telex, pouch, mail) to the designated primary node in its region (typically, a regional or national referral service) using recommended form(s) and format(s). For indirect (not addressed) inquiries, the referral centre staff using the on-site global directory of information services would determine the relevant and appropriate supply node and proceed to address and transcribe the inquiry for storage at the local terminal (unless the inquiry was addressed to another secondary node within the same region or country).

90. The minicomputer switching centre (located in Geneva, for example) might call out once a day, via telephone or digital network, each of the primary nodes for the content of their message stores. When received in Geneva, the messages would be sorted and automatically forwarded (during the next poll) to their addresses, again via a dial-up digital network or long distance dataphone. Since some of the addresses might be those of secondary nodes, their messages would be forwarded via designated primary nodes (e.g., regional and national referral points) which would have assumed responsibility for the delivery to their final destination. The virtue of such a network would reside in the fact that a demand node, unaware of the information resources that can assist it, has its inquiry channelled rapidly to one or more relevant supply nodes.

Possible further steps

91. If it were decided to proceed with a computer-based message system for communication of textual messages between primary demand and supply nodes along the lines described, the following further steps would be involved:

- (a) Systems analysis and design to determine the feasible communication media in the regions and Member States and to derive precise cost estimates;
- (b) Implementation of the "switching centre" facility, including the development or modification of software;
- (c) Testing and evaluation of the network communications involving the regional referral centres, a sample of national referral centres and a sample of other primary nodes.

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92. In its resolution 32/178, the General Assembly requested that the present report should include estimates of costs and time schedules for the establishment of the network. In the light of the many complexities and uncertainties that surround this subject, and particularly in the light of the further recommendations recently adopted by the United Nations Conference on Science and Technology for Development held at Vienna, the Secretary-General has not deemed it advisable to present any concrete proposals for immediate action on the foregoing alternative approaches or on the further steps outlined above. He also considers that it would be premature and perhaps misleading to attempt to estimate costs and work out time schedules before the basic concepts of the network have been established.
