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Third session

OVERVIEW OF ACTIVITIES OF ORGANS, ORGANIZATIONS AND  
PROGRAMMES OF THE UNITED NATIONS SYSTEM

Report prepared jointly by the Secretary-General of the United  
Nations Conference on Science and Technology for Development  
and the Administrative Committee on Co-ordination

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- I. Mandates of the organizations
- II. Selected publications

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1/ The annexes will be contained in A/CONF.81/PC/19 (Part II).

## INTRODUCTION

### A. Purpose and structure of the report

1. The Preparatory Committee for the United Nations Conference on Science and Technology for Development at its first session requested the preparation of a report giving an "over-all view describing the manner in which ... /the programmes of the United Nations system/ have linked science and technology to socio-economic development and international co-operation related to the agenda of the Conference." 1/
2. At its second session, the Preparatory Committee requested that, in preparing documentation for the paper, the competent organs, organizations and bodies within the United Nations system should focus their reports on substantive issues in a number of identified areas in which obstacles might arise in the development, adaptation and application of science and technology for development.
3. The Committee for Programme and Co-ordination (CPC), at its seventeenth session, requested the submission of a report containing a cross-organizational programme analysis in the field of science and technology.
4. The Administrative Committee on Co-ordination (ACC) agreed that the report to be presented by the Secretary-General of the Conference to the Preparatory Committee should serve also as the report requested by CPC.
5. The present report attempts to analyse the activities undertaken within the United Nations system for the application of science and technology to development, in a manner that will respond to the needs of both the Preparation Committee for the Conference and CPC. Its structure is based on that of the provisional agenda for the Conference approved by the General Assembly, attention being paid also to substantive issues in the areas in which obstacles may arise that were identified by the Preparatory Committee. While such a structure would probably not have been chosen if the sole purpose of the report had been to facilitate a cross-organizational programme analysis, it was felt that CPC would prefer to examine these activities within the same framework as the Conference itself. 2/

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1/ See Official Records of the General Assembly, Thirty-second Session, Supplement No. 43 (A/32/43), annex II, decision 1 (I), para. 8.

2/ An additional paper containing information on the activities for the promotion of scientific and technological education undertaken by the United Nations system has been prepared for consideration by CPC (E/AC.51/94), in order to complete the general picture of activities in science and technology.

6. Comparable information about expenditure on the various programmes is not contained in this report. Such information would, in any event, have been difficult to collect and to present usefully: several organizations have indicated in their contributions that science and technology constitute elements of their entire programmes, which are not separately identifiable; and the time available did not permit a satisfactory solution of these difficulties.

7. The report is based upon written contributions from organizations of the United Nations system and upon interorganizational discussions. The following organizations and United Nations bodies have participated in its preparation: the United Nations (Headquarters); 3/ the regional commissions; the United Nations Conference on Trade and Development (UNCTAD); the United Nations Industrial Development Organization (UNIDO); the United Nations Environment Programme (UNEP); the United Nations Children's Fund (UNICEF); the United Nations Development Programme (UNDP); the United Nations Institute for Training and Research (UNITAR); the International Labour Organization (ILO); the Food and Agriculture Organization of the United Nations (FAO); the United Nations Educational, Scientific and Cultural Organization (UNESCO); the International Civil Aviation Organization (ICAO); the World Health Organization (WHO); the World Bank; the International Telecommunication Union (ITU); the World Meteorological Organization (WMO); the Inter-Governmental Maritime Consultative Organization (IMCO); the World Intellectual Property Organization (WIPO); and the International Atomic Energy Agency (IAEA).

8. Only brief references are made to selected activities of the organizations concerned; the background documents to be presented to the Conference by the organizations concerned will provide an opportunity for a fuller and more substantive description of those activities in relation to the items of the Conference agenda.

B. Substantive issues: areas in which obstacles may arise

9. The organizations that participated in the preparation of this report were requested to take into account certain identified areas in which obstacles might arise in the development and adaptation of science and technology for development, at the national, regional and international levels. These issues are dealt with in the six chapters of this report, which analyse the substantive programmes of the organizations; because the order of the chapters relates to the agenda of the Conference, the issues are not dealt with in the order in which they are listed in the resolution of the Preparatory Committee identifying them.

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3/ The relevant programmes are mainly those of the Office for Science and Technology, the Centre for Housing, Building and Planning (for the purposes of the present report, this name has been retained, but see General Assembly resolution 32/162, section III, concerning the establishment of the United Nations Centre for Human Settlements (Habitat)), the Centre for Natural Resources, Energy and Transport, and the Ocean Economics and Technology Office.

10. The following list indicates the chapters in which the various issues or areas are referred to:

Issues at the national level

Policies and priorities for science and technology	Chapters IV (Methods of integrating science and technology in economic and social development) and V (Support for national policy-making in the sphere of science and technology and the building up and expansion of institutional systems in developing countries for science and technology)
Infrastructure and regulation for science and technology research and development	Chapters IV and V
Systems for education and training	Throughout the report
Availability of entrepreneur and managerial skills	Chapter III (Elimination of obstacles to the better utilization of knowledge and capabilities in science and technology for development)
Human and financial resources	Chapter III
Information systems in science and technology	Chapters II (Transfer of technology, including mechanisms for the exchange of scientific and technological information and experiences significant to development) and V
Extension services for technological application	Chapters II and V
Comprehensive surveys of natural resources	Chapters I (Choice of technology, including research into new science and technology and the application of new technologies appropriate to the needs of developing countries), II and IV
Interaction between research and development producers and users	Chapters I and III
Dependency of the productive sector on imported technology	Chapter II
Systems for promoting industrial technologies	Chapter II

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Technological innovative systems	Chapters I and IV
Capability for choice of technology	Chapter I
Criteria for choice of technology	Chapter I
Machinery for evaluation of technological alternatives	Chapter I

Issues at the regional level

Identification of problems of common interest	Chapter VI (new forms of international co-operation in the application of science and technology, including economic co-operation among developing countries)
Coherent systems for educational, scientific and technological co-operation	Chapter VI
Economic and technological co-operation agreements among Member States	Chapter VI
Arrangements for common training centres	Chapter VI
Joint investments in research and development programmes of common interest	Chapter VI
Co-ordination among international organizations for regional development programmes	Chapter VI

Issues at the international level

Appropriateness of programmes for the education and training of personnel from developing countries in developed countries	Chapter III
Migration of talents and skills from developing countries	Chapter III
Need for real concern about the research and development needs of developing countries	Chapter I

International infrastructure for the development of science and technology	Chapter VI
Financial resources, the role of international financial institutions and the nature of financial assistance	Chapters III and VI
Investments in science and technology in developing countries	Chapter IV
Human and financial resources devoted to military research and development	Outside the scope of this report
Standards and practices in the transfer of technologies	Chapters II and III
Industrial property systems and licensing arrangements	Chapters II, III and IV
Relevant scientific and technological information systems	Chapter II

C. Mandates of the organizations, and arrangements for co-ordination

11. Full information on the mandates of the various organs or units of the United Nations system dealing with science and technology are contained in annex I to the report of the Secretary-General on institutional arrangements for science and technology submitted to the Committee on Science and Technology for Development at its third session (E/C.8/29/Add.1 and Corr.2). Where necessary, additional information to bring this list up to date or to focus it more sharply on the objectives of the United Nations Conference on Science and Technology for Development is contained in annex I to the present report.

12. The main co-ordinating machinery for science and technology within the United Nations system under the over-all guidance of the General Assembly and the Economic and Social Council is broadly as follows: the Committee on Science and Technology for Development, the Advisory Committee on the Application of Science and Technology to Development and, at the intersecretariat level, the ACC Sub-Committee on Science and Technology.

13. The Committee on Science and Technology for Development was established by Economic and Social Council resolution 1621 B (LI) "to provide policy guidance and make recommendations on matters relating to the application of science and technology to development". Its functions, set out in council resolution 1715 (LIII), include:

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21. In order to achieve these aims, organizations are:

(a) Helping to provide better alternatives and better mechanisms for making a choice, by means of research programmes suited to conditions in developing countries, or groups of developing countries, work on technological forecasting, and scientific and technological information systems that will be accessible to decision-takers in developing countries (discussed more fully in chap. II, below) etc.;

(b) Giving advice, at the request of Governments, when particular choices have to be made, for example, through assistance in the design of specific projects to be financed from international sources.

22. Surveys of scientific and technological activities of national, regional, international and non-governmental institutions in fields relevant to development are being undertaken by the United Nations (Headquarters); in addition, special studies of an exploratory nature on trends and developments in science and technology will cover research in non-conventional and non-polluting energy sources, in appropriate technology, in the development of waste-recycling technology and in non-food agricultural materials. The United Nations has prepared for the Committee on Science and Technology for Development a report on research and development activities in the field of non-conventional sources of energy, with a view to identifying gaps in the current activities of energy research within and outside the United Nations system. A special study is being prepared on technology assessment for development, with support from UNDP and Governments, the main object of which will be to produce information on the consequences of initiatives that are taken in scientific and technological development programmes and to develop technology assessment as a methodology and a practical tool for national development. Following an expert group meeting on concepts and criteria for the identification of appropriate production processes, management techniques and equipment design in terms of their interest to development, a special study has been undertaken to develop further criteria and guidelines for appropriate technologies.

23. The United Nations (Headquarters) has provided support on a continuous basis for research and development work on new technologies in building, particularly on materials, methods and utilities, and on the use of solar energy in low-cost housing and community facilities; regional networks of building research institutes have been established, in co-operation with the regional commissions, to promote the exchange of information and the adaptation of building techniques. A special study on appropriate building techniques has been prepared and an expert group has discussed criteria for the selection of appropriate building techniques as a first step in an action plan to be implemented with the co-operation of UNIDO, the ILO, and UNESCO.

24. With the co-operation of UNEP, rural energy centres are being established in selected developing countries; information papers are being prepared by the United Nations (Headquarters) on technological advances of particular interest to developing countries in the fields of energy, minerals and water.

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25. Under a subprogramme on marine and coastal technology, carried out by the United Nations (Headquarters) in co-operation with UNIDO, UNEP, FAO, UNESCO, ITU, WMO and IMCO, the needs of developing countries are examined, current technologies are assessed and new technology for developing countries is promoted.

26. More than two thirds of the resources allocated by UNCTAD to its programmes for the application of science and technology are devoted to activities for strengthening the technological capacity of developing countries, individually and in co-operation with each other. These activities, which include extensive advisory services to Governments, are grouped in a programme for the formulation and implementation of technology policy; they are referred to in chapters IV, V and VI below.

27. Such UNCTAD activities, referred to mainly in chapter II below, as the elaboration of an international code of conduct on transfer of technology, collaboration with WIPO in the revision of the Paris Convention for the Protection of Industrial Property, assistance to Governments in establishing national and regional centres for the transfer and development of technology, different studies on the transfer and development of technology, and the organization of training courses are directed at strengthening the capacity of developing countries to choose technology, and particularly their ability to develop new technology.

28. The UNIDO co-operative programme of action on appropriate industrial technology, approved by the Industrial Development Board in 1977, provides a framework of activities for the United Nations system as a whole, within which developing countries will be assisted in the adoption of criteria for the selection of industrial technology. Included are activities for the comparison and evaluation of alternative industrial technologies, the promotion of technological research, the collection and dissemination of practical experience, the application of technology to rural development, technology for alternative sources of energy, national and international policies related to appropriate industrial technology, institutional infrastructure and training programmes.

29. Focusing on the practical aspects of transferring technologies appropriate to the general development objectives of developing countries, UNIDO has been implementing a programme, referred to mainly in chapter V below, of strengthening the infrastructural capacity in those countries through the establishment of over 100 technological institutions, both general-purpose and specialized, which contribute to the appropriate choice, acquisition, absorption, application and development of new technologies.

30. Programmes have also been initiated by UNIDO to strengthen and promote national research institutes by encouraging the better use of existing research activities through conducting surveys of indigenous technologies in selected branches of industries, stimulating co-operation among research institutes of developing countries as well as between them and those of developed countries, and developing a common register of global research projects to promote such co-operative research programmes as well as to assist in the identification of sponsors and appropriate means of finance. These activities are designed to stimulate real concern about practical and effective research and development of relevance to developing countries.

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31. In addition, the technical assistance activities of UNIDO, carried out at the actual operational industrial level, in many cases help the developing countries to achieve a proper choice of technology and its appropriate application.

32. UNDP, proceeding from the practical needs for economic and social development in developing countries, in which both traditional and modern sectors of the economy are likely to continue to coexist for a considerable time, adopts a dual approach to technology in its technical co-operation activities and assists in:

(a) The development and diffusion of appropriate technologies to upgrade productivity in the traditional sector capable of being deployed in small productive units, requiring low fixed capital cost per worker and demanding relatively simple skills in their operation (although their development may require highly sophisticated skills);

(b) The choice, transfer, adaptation, generation, diffusion and absorption of modern technologies.

33. The global programme of UNDP is deliberately geared to research and development efforts in the interest of developing countries. Nearly 77 per cent of the global indicative planning figure, during the 1972-1976 programming cycle was assigned to scientific and technological research and development, mainly in the agricultural sector. Prominent examples of global projects were the genetic evaluation and utilization programme with the International Rice Research Institute, research and training in the development of high lysine maize, the International Centre for Agricultural Research in Dry Areas, cotton research and development, the International Laboratory for Research on Animal Diseases, water supply and sanitation and research and training in tropical diseases. UNDP has tried to ensure that its global programme will have the maximum impact through a concerted pooling of international resources (consortia arrangements) and programme networks within a systems approach.

34. The global programme of UNDP will enter new areas of research and development during the 1977-1981 programming cycle, in addition to continuing to support the major activities already undertaken. The new areas include microbiology as applied to sources of energy (biogas), the conversion of agricultural waste into protein-rich animal feed, and the stimulation of free-living soil bacteria to produce nitrogen for reducing the need for synthetic fertilizers; the development and adaptation of selected industrial technologies suitable for labour-surplus economies, improved agricultural tools and implements for small farms and better storage facilities for crops; and measures to eradicate deficiencies in vitamin A and iron and experimentation with alternative approaches to basic health delivery systems.

35. The adaptation of imported technologies will be an important area of future technical co-operation activities. It is required to scale down the size of a productive unit, to make a process more labour-intensive and less energy-intensive, to facilitate the optimum use of local natural endowments, to suit local raw materials etc. The development of an indigenous capacity to adapt imported technologies depends on the needs, skills and resources of individual developing countries, which vary widely.

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36. Three dimensions of adaptation of imported technologies are specially suitable for technical co-operation among developing countries: the diffusion of technologies that have already been adapted, research on the adaptation of technologies shown to be of relevance to a number of developing countries, and the establishment or upgrading of joint or common facilities for adaptation.

37. It will also be necessary for developing countries to generate appropriate technologies, because developed countries will first and foremost develop capital-intensive technologies suitable for their own economies.

38. The creation of an indigenous capacity for the generation of technology is most complex, time-consuming, and expensive. It requires sophisticated laboratories, highly specialized skills and facilities for fabricating prototypes and pilot plants. It also needs plant design and related engineering services. Research and development efforts tend to be most productive when the facilities for them are part of or closely linked to relevant private or public enterprises, especially in the capital goods industry sector. The indigenous capacity has to be developed gradually and on a selective basis. UNDP assistance in the generation of such a capability will have to be given in co-operation with other sources of financial assistance, and its contribution will take the form of providing strategic skills in planning and guiding the programme and the provision of equipment and material.

39. Environmental factors are of high priority in most technological choices, and decisive in many. The activities of UNEP are aimed at assisting in the choice of technologies which, by being environmentally sound and appropriate, can contribute to an environmentally sustainable development, in harmony with the environment, directed towards the satisfaction of basic human needs and based on endogenous self-reliance. For example, UNEP is promoting the establishment of regional networks of institutions active in the field of environmentally sound and appropriate technology.

40. The choice and development of technology suitable for each country or region form an organic part of the assistance programme of UNICEF; choices are exercised jointly with the government organizations being assisted and other United Nations organizations - particularly, in the field of health, with WHO. There is a conscious attempt to introduce and maintain a level of technology with innovations designed to provide better service to the countries concerned than conventional methods.

41. In co-operation with WHO, UNICEF is constantly seeking to improve equipment and medicinals, and is assisting in the establishment of local production facilities in developing countries.

42. UNICEF is also developing village technology, the essential feature of which is the use of modern scientific technology to develop simple prototype processes and applications that can be easily replicated by rural people. Among the activities being pursued are solar drying and cooking; the design and production of water and grain storage jars and tanks and food storage silos from local materials; the design and production of more efficient tools and workshop equipment; and the use of wind

and water energy for water-pumping devices. A village technology development centre established with the assistance of UNICEF in one developing country is generating widespread interest in neighbouring countries, where plans are being finalized for similar centres to resolve local problems.

43. UNITAR is engaged in a study of technology and social change, intended, in particular to show the links that exist between technological assessment and forecasting and the problems of social planning, particularly in the light of the goal established in the Lima Declaration and Plan of Action on Industrial Development and Co-operation (see A/10112), according to which developing countries should achieve a 25 per cent share of global industrial production by the year 2000.

44. The research and technical co-operation activities of the World Employment Programme of the ILO, and of its technology and employment component, have been progressively reoriented and expanded to take account of the recommendations of the Tripartite World Conference on Employment, Income Distribution, Social Progress and the International Division of Labour held in 1976 (see E/5857). Research activities have clearly established that a range of alternative technologies exists in virtually all economic sectors, including most branches of manufacturing. It has also been demonstrated that, depending on the circumstances, many of the technological alternatives that economize on the use of capital, and are more labour-intensive, are feasible both technically and economically. The main emphasis at present is on the dissemination of the wealth of information thus assembled in order to assist national decision-makers in their choices of technology. This is done through seminars and workshops in developing countries, technical co-operation projects and an extensive publications programme. 4/

45. A special feature of the new ILO International Programme for the Improvement of Working Conditions and Environment (PIACT) concerns the relevance to this objective of technological choice and adaptation. In addition to the traditional means of ILO action - standard-setting, technical co-operation, research, tripartite meetings and information dissemination PIACT will employ certain innovative means of action of special relevance to working conditions and the choice of technology. These are: (a) the inclusion in industrialization contracts of specific clauses relating to working conditions and environment; (b) the co-ordination of research into working conditions and the environment; and (c) the use of multidisciplinary teams to advise Governments, on request, taking due account of the social implications of technological choice.

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<sup>4/</sup> See, for example, the ILO publications listed in annex II (E/AC.51/90/Add.2 (Part II)).

46. The employment consequences of technological change have been a continuing concern of the ILO Industrial Committees. The concern is both to safeguard workers against the negative effects of change and to ensure that they also benefit from the fruits of technological progress. Points of emphasis include the adjustment measures necessary to cope with changing job patterns and the choice of appropriate technology for the creation of employment in various sectors.

47. Most of the FAO programme of work is designed to build up national capabilities in the choice, adoption, transfer and application of science and technology for agricultural and rural development policies and programmes.

48. FAO has, through various programmes and expert activities in the field, helped in the selection of technologies which, with little additional research or adaptation, can be used for development purposes, for example in applied nutrition, nutrition education and training for programmes on the handling of food, food quality control and the monitoring of food contamination. The activities include the preparation of guidelines and manuals, the elaboration of standards for foods which take into account, where applicable, the specific requirements of developing countries, and commodity-oriented assistance.

49. For crop production, efforts are concentrated on the use of better quality seed of high-yielding varieties, resistant to local stress, and on the techniques to produce such seed locally. Improved agronomic practices are then recommended in order to derive full profit from the improved varieties. In the choice of technology for pre-harvest crop protection and for the control of stored product pests, emphasis is placed on the use of methods that are simple to apply, such as cultural practices and mechanical control, the use of resistant or tolerant varieties and biological control, which have to be developed in the developing countries and do not require a great deal of imported inputs.

50. For post-harvest conservation and processing of foods, the available technology can be transferred from one developing country to another or from advanced countries, traditional technologies can be improved and new appropriate technologies developed.

51. A number of programmes in industrialized nations have been initiated by FAO in order to contribute to the solution of problems of development. In the field of animal production and health, a programme of co-operation between selected research institutes and universities has been established for the exchange of information and personnel, mutual research assistance and education and training for the benefit of and application in developing countries.

52. Other examples of effective international research in the industrialized countries into problems encountered in developing countries are the breed comparison of cattle, organized and co-ordinated by FAO, and the identification and experimental production and processing of resources that might make substantial contributions to nutrition in regions where there are protein-shortages.

53. UNESCO has a wide range of activities designed to contribute to the strengthening of the endogenous scientific and technological capacity necessary for the choice, adaptation and development of appropriate technology. In addition to general programmes for research and training, involving strong co-operative links with the scientific and professional international communities, UNESCO helps member States to train their own scientists, engineers and technicians. Research is being promoted in scientific and technological fields related to energy problems, with emphasis on the different types of unconventional renewable sources of energy such as solar, biothermal and geothermal energy, hydropower and ocean energy, and on problems of energy conversion, storage and conservation. Assistance is provided for the development of regional or subregional centres for the exchange of information in that field.

54. Assistance is also provided to member States for the development of national research infrastructure in various branches of scientific and technological research and training. Special attention is being paid to the development of co-operation between institutions for training and research and local industry, with the co-operation of UNIDO.

55. Major programmes have been established for research on the environmental sciences and natural resources. Of the programmes currently under way, that on Man and the Biosphere provides an interdisciplinary focus at the intergovernmental level for improving our knowledge of terrestrial biological resources and of interrelationships between human activities and terrestrial ecosystems; it is centred on the following long-term international research projects: (a) the ecological effects of increasing human activities on tropical and subtropical forest ecosystems; (b) the ecological effects of management practices and different land uses on temperate and mediterranean forest landscapes; (c) the impact of human activities and land-use practices on grazing lands; (d) the impact of human activities on the dynamics of ecosystems in arid and semi-arid zones, with particular attention to the effect of irrigation; (e) the ecological effects of human activities on the value and resources of lakes, marshes, rivers, deltas, estuaries and coastal zones; (f) the effect of human activities on mountain and tundra ecosystems; (g) ecology and the rational use of island ecosystems; (h) the conservation of natural areas and of the genetic material they contain; (i) the ecological assessment of pest management and fertilizer use on terrestrial and aquatic ecosystems; (j) the effect on man and his environment of major engineering works; (k) ecological aspects of urban systems, with particular emphasis on the use of energy; (l) the interaction between environmental transformation and the adaptive, demographic and genetic structure of the human population; (m) the perception of environmental quality; (n) environmental pollution and its effects on the biosphere.

56. Other United Nations agencies, particularly FAO, WHO and WMO, are contributing to the programme, which receives large financial support from UNEP.

57. The International Geological Correlations Programme seeks to achieve a better understanding of the phenomena within the earth's crust that need to be observed and evaluated through international co-operation, and that have a direct bearing on the

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origin and distribution of mineral and fuel resources; international co-operation in seismology is directed mainly towards the assessment and mitigation of earthquake risk; the International Hydrology Programme, which also receives co-operation from other agencies, in particular WMO, and financial support from UNEP, seeks solutions for the chief problems relating to the use of water resources; the Intergovernmental Oceanographic Commission has been established for the purpose of promoting scientific investigation into the nature and resources of the oceans in the general framework of the Long-Term and Expanded Programme of Oceanographic Exploration and Research. Its activities include international expeditions and other co-operative investigations in the Mediterranean, in the northern part of the Eastern Central Atlantic, in the Caribbean, and in the Kuroshio region. It co-operates with UNEP in the global investigation of pollution in marine environment; and with WMO in the development of the Integrated Global Ocean Station system and of the Tsunami Warning System in the Pacific.

58. UNESCO also provides assistance to developing countries among its member States for the development of their marine science infrastructures.

59. WHO is giving particular attention to the development and application of appropriate technology for prevention and control of communicable and non-communicable diseases, family health, including maternal and child health, primary health care, community water supply, housing, education and training, human reproduction, and the development of better diagnostic and preventive methods and therapeutic (biological and chemical) products. For example, it has assisted in developing and testing the bifurcated needle for vaccination, which has markedly improved the percentage of "takes" and the economy of vaccine use.

60. In regard to bacterial diseases, WHO is promoting the use of oral rehydration by peripheral or village health workers as an element of primary health care for the prevention and treatment of dehydration in acute bacterial diseases. This approach not only reduces the ill effects of diarrhoea and improves nutritional status in children, but can reduce the need for intravenous fluid and hospitalization of seriously dehydrated cases of acute diarrhoea, including cholera in adults.

61. Again, studies are being carried out with regard to malaria, schistosomiasis and filarial infections, with a view to the development and adoption of simple methods of prevention and control.

62. The World Bank's policy on the use of technology in its projects establishes the following criteria: (a) that the technology used in the projects it finances should be appropriate to development goals and to local conditions; (b) that the Bank, by itself or in collaboration with others, should promote innovations needed to make available to developing countries technology suitable to their needs; and (c) that Bank-financed projects should develop the local capacity to plan for, select, adapt, implement, manage, and, when necessary, develop and design appropriate technologies.

63. In many Bank projects, the most advanced technologies are also the most appropriate. In other cases, the Bank seeks alternative technologies and, where they do not exist, promotes their development. Examples of the introduction of such technologies include the provision of low-cost agricultural mechanization, such as weeders or hand planters, into areas where they had not previously existed; of low-cost shelter; of simple devices for hewing wood and pumping water; and of new organizational and operational patterns for providing technical assistance to small farmers or for providing education and health care services.

64. An internal research programme, funded by the administrative budget of the Bank, supports the Bank's operational activities, broadens its understanding of the development process, and improves its ability to give policy advice to its member countries. The research is carried out by Bank staff and consultants, often in co-operation or collaboration with other individuals and groups. The results of the research are also made available to other organizations and to planning and operating agencies in developing countries. The programme now consists of 80 projects in development policy and planning, income distribution and employment, international trade, agriculture and rural development (which is being given high priority), industry, transportation, energy, water supply and sanitation, urbanization, and population and human resources.

65. One of the functions of ICAO is to obtain broad international agreement on matters relating to aviation safety. But how these agreements are to be implemented in terms of choosing actual equipment and technology is normally left to the user to decide. This policy has been chosen in order not to inhibit the development and improvement of equipment. Standardization is effected mostly at the functional specification level rather than at the construction level, the degree of detail involved being dependent upon the subject matter. In certain areas ICAO produces broad specifications with supporting guidance material to assist States in implementing them; in other areas the specifications enter into minute detail.

66. States are also given assistance to improve their capacity to choose appropriate equipment and technology through technical meetings, workshops and seminars organized by ICAO and through its technical manuals and circulars.

67. ITU, following a resolution adopted by its Plenipotentiary Conference, has created a team of engineers for the express purpose of providing information and advice to developing countries on different specific national problems in telecommunication development, particularly in network planning, the preparation of specifications and the evaluation of systems.

68. The work of the International Consultative Committees of ITU provides technical recommendations and standards upon which choices can be based for the introduction and improvement of telecommunications systems in developing countries. Handbooks have been published or are in preparation, including one on economic and technical comparisons of transmission systems, providing the necessary information to enable a choice to be made of the telecommunication systems most appropriately suited to local conditions.



69. The World Weather Watch programme of WMO, coupled with advances in computer and satellite technology, has done much to achieve the improvement in the global observation of the condition of the atmosphere, and in the transmission of the data received, necessary for meteorology to become an operationally effective world science, and open the way for the Global Atmospheric Research Programme (GARP), a joint undertaking by WMO and the International Council of Scientific Unions (ICSU). Other major programmes of WMO are the Research and Development Programme (of which GARP is part), the Meteorological Applications and Environment Programme, the Hydrology and Water Resources Development Programme, the Technical Co-operation Programme, the Regional Programmes and the Education and Training Programme. All technical and technological aspects are dealt with by technical commissions, which establish special working groups or appoint rapporteurs in specific problem areas; the actual implementation of agreed objectives is the responsibility of national authorities.

70. Through the work of its numerous technical committees and sub-committees, IMCO provides a forum for the exchange of information and data on existing and new technology in all aspects of ship development and ship operation including standards of training for seafarers as well as the prevention and control of marine pollution from ships and the prevention of marine pollution by dumping wastes and other matters. The IMCO technical co-operation programme enables developing countries to acquire and develop technologies in the marine field suited to their particular needs and reinforces or develops their capacity to comply with the highest standards of maritime safety and control and prevention of pollution from ships embodied in the various international conventions adopted by IMCO.

71. IAEA organizes training courses in nuclear power planning, implementation and management. It carries out market surveys for nuclear power in developing countries and offers advisory services on all aspects of planned nuclear power programmes. It is engaged in a programme of development of a comprehensive set of safety standards, guides and codes for nuclear power plants.

72. IAEA co-ordinates and supports research designed, inter alia, to exploit the potential of nuclear techniques for purposes directly linked to development objectives, e.g. applications of isotope and radiation technology in food and agriculture (jointly with FAO), in health (in co-operation with WHO), in hydrology, industry and environmental research (with the support of UNEP). It offers advisory services to developing countries on the appropriate use of these techniques, which are in many cases less expensive and easier to apply than conventional techniques.

73. In summary, it can be seen that there is a consistent policy within the United Nations system, in that all the programmes examined are designed to reinforce national capabilities to select from among technological alternatives those which are most in line with national development objectives. It would seem that, on balance, programmes related to the choice of technology, and research into new technology, put particular emphasis on social and environmental issues. A number of agencies are working on the design of criteria and mechanisms for choice among technological alternatives.

II. TRANSFER OF TECHNOLOGY, INCLUDING MECHANISMS FOR THE  
EXCHANGE OF SCIENTIFIC AND TECHNOLOGICAL INFORMATION  
AND EXPERIENCES THAT ARE SIGNIFICANT TO DEVELOPMENT

74. Once a technology has been chosen from among alternatives, some or all of its components must, in most cases, be acquired locally or abroad. Technology may be acquired either in a complete package or in various components such as capital goods, skilled manpower, information etc. The acquisition of technology, particularly abroad, is sometimes subject to stringent financial and other conditions and may be accompanied by doubtful business practices, delivery constraints and hidden costs. The technological dependence of poor countries on the technology-supplying rich countries in these senses is considerable; it is often reinforced by the policies and procedures of developed countries in respect of export credit and tied aid, educational and training curricula that are those of the industrialized countries, and the predictable tendency of experts, advisers and consultants to suggest the application of technology with which they are most familiar. The damaging and often unexpected effects of the transfer of inappropriate technology, or technology that is transferred under inappropriate conditions, effects which arise for reasons such as those mentioned above, will only be diminished when national technological capability, particularly in respect of negotiations with external interests, is sufficiently developed.

75. In addition to improved national capability in technology and negotiation, developing countries need access to up-to-date information on existing technologies throughout the world and on experience in applying them.

76. The activities of organizations of the United Nations system are designed to:

- (a) Strengthen national capacities to choose technology (see chap. I above);
- (b) Improve the bargaining position of developing countries, by means of international instruments governing the transfer of technology, advice on national legislation and assistance in improving the skills of negotiators;
- (c) Provide mechanisms for the international exchange of experience;
- (d) Develop scientific and technological information systems suitable for the needs of developing countries and promote their use.

77. An interagency task force called for by the General Assembly in its resolution 3507 (XXX) has undertaken a comprehensive analysis with a view to preparing a plan for the establishment of a technological information exchange network. To assist in its analysis, the regional commissions undertook studies and assessments of information systems and needs in developing countries, UNESCO undertook a survey of the technological information resources useful to developing countries and available in developed regions of the world, and high-level missions were sent to Africa, Latin America and Asia to solicit guidance from Governments on the nature of the information and the characteristics of the proposed network that would best suit their development needs. The General Assembly in its

resolution 32/178 welcomed the reports prepared by the task force (E/6054 and E/6055) and requested that work continue on the network. A report is now being prepared by the United Nations (Headquarters) for discussion at the next session of the Advisory Committee on the Application of Science and Technology to Development.

78. In the field of building technology, the United Nations (Headquarters), in addition to its training activities and the supervision of field projects, conducts interregional seminars, produces guidelines and studies for wide dissemination and provides information on request; it has undertaken pilot projects in areas such as building materials, compost systems and solar energy.

79. Through many of its operational activities and the organization of international symposia, the natural resources programme of United Nations (Headquarters) is directly involved in the transfer of technology and scientific and technical information relating to energy, mineral and water resources exploration and development and the application of the latest cartographic and remote-sensing techniques in developing countries. A remote-sensing service facility has been established to assist developing countries, on request, in applying the latest technologies of remote sensing for the development of non-agricultural resources. A report will be presented to the General Assembly at its thirty-third session, examining, inter alia, the suitability of existing mechanisms for the transfer to developing countries of technology required for natural resources exploration and exploitation.

80. In addition to various meetings where an exchange of information takes place in an informal setting, marine and coastal technology information services are being developed. Guides to sources of information and assistance within and outside the United Nations system will be published. Indexes and abstracts of available documents on marine and coastal technology are made available to facilitate transfer.

81. The Economic Commission for Europe (ECE) is preparing a manual on licensing procedures and related aspects of technology transfer as a reference book for those, particularly in small and medium-sized firms, who are involved in the international licensing of technology and other industrial property. The manual will present, country by country, information useful to a licensor about national laws, regulations and practices.

82. Apart from its work on strengthening national capacities, referred to in chapters IV and V below, the activities of UNCTAD in this field are mainly directed towards the preparation and implementation of an international code of conduct on transfer of technology, assistance in the formulation of national laws, regulations and policies on the transfer of technology, and the revision of the industrial property system, both at the international and national levels, with regard to the economic, commercial and development aspects of the system.

83. A United Nations Conference on the Code of Conduct on the Transfer of Technology is planned for October and November 1978. An Intergovernmental Group of Experts, established by UNCTAD in its resolution 89 (IV), is well on the way

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towards elaborating a draft for the Conference. The first aim of the various drafts of the code is to prevent parties from inserting into their agreements on the transfer of technology clauses that reflect certain restrictive practices. Other aims are to assist technology-acquiring countries to decide on the technology they find most appropriate, to adapt transferred technology and to develop national technological capacities. The issue of the legal nature of the code of conduct, as well as problems relating to the applicable law and dispute settlement, have not yet been discussed. After adoption of the code, the main activity of UNCTAD in this area will be to provide the necessary support for its implementation, and possible revision, and to develop model national provisions and alternative transfer of technology contract provisions, consistent with the standards and conditions set in the code of conduct itself. Analytical policy-oriented studies will be made on the legal instrumentalities to promote the development of national technological capabilities in developing countries.

84. In accordance with its resolution 88 (IV), UNCTAD has been playing a prominent role in the revision, within WIPO, of the Paris Convention (see para. 109 below). Meetings of government experts have been convened to examine studies on the revision of the present international industrial property system (covering, in addition to questions concerning patents, the effect of trademarks in developing countries) and studies on possible national policies, within the context of the promotion of national scientific and technological capabilities.

85. Other UNCTAD activities, such as assistance, in conjunction with other United Nations organizations, to Governments in the establishment of national machinery for the transfer and development of technology, are aimed at improving conditions for the transfer of technology to developing countries by strengthening their technological capability and negotiating position.

86. Activities undertaken by UNIDO to improve the bargaining position of developing countries take the form of publications, training programmes and advisory services; the publications include manuals and guidelines on joint venture agreements, technology licence agreements and evaluation and screening; training takes place at the national, regional and interregional levels; advisory services are available on request at the time of the negotiation of technology contracts for large-scale projects. An intergovernmental meeting will be held in June 1978 to assess the impact of government regulation of agreements on the transfer of technology, and UNIDO is continuing to assist government departments responsible for such regulation and to promote contacts among them.

87. An Industrial and Technological Information Bank has been established by UNIDO as a pilot operation in four selected industrial sectors; it will rely heavily on links with the suppliers and users of technological information, since it is not expected physically to store all available technological information. In this matter the Information Bank is expected to promote the development of a network of industrial technological information on a world-wide basis. The nucleus of the initial users will be formed by the institutions already assisted by UNIDO, partly through its continuing Industrial Inquiry Service, which handles some 7,000 inquiries a year. The Information Bank will be chiefly concerned with the selective processing and assessment of technological information, in order to provide a basis

for making decisions; the information services of the Bank will be complemented by advisory and extension services for effective application, and attention is being paid to linking the pilot operations with the planned network for technological information exchange (see para. 77 above). The Information Bank also foresees the creation of a system of exchange of information among the national registries of technology transfer on the terms and conditions of technology contracts, and of a mechanism of technological co-operation between developed and developing countries in the field of small industry, where the technologies available from small enterprises in developed countries will be systematically identified to facilitate the flow of information on such technologies for the benefit of developing countries.

88. UNEP attaches particular importance to the development of effective mechanisms for collecting, analysing and disseminating information that has a bearing on environmental problems. "EARTHWATCH" is the code name for the UNEP programme for the critical assessment of the global environment. It encompasses four interrelated components: monitoring, evaluation and review, research and exchange of information. The three Programme Activity Centres set up to implement the EARTHWATCH concept are:

International Referral System for Sources of Environmental  
Information (IRS)

Global Environmental Monitoring System (GEMS)

International Register of Potentially Toxic Chemicals (IRPTC)

89. The objectives of IRS are to improve the availability of technical and other relevant information to those whose decisions or actions can affect the environment. It attempts to promote and catalyse the flow and use of such information in any effort - at the global, national or individual level - aimed at a better environment and the more rational use of nature's resources. The principal way in which this done is the regular publishing of an updated directory of sources.

90. GEMS is a co-ordinated effort by United Nations Member States, agencies and UNEP to ensure that data on various environmental elements (e.g. levels of individual pollutants, extent of forest cover) are collected in an organized manner. The purpose is to provide the UNEP Governing Council with a general picture of the global state of the environment, and particularly of the trends shown by critical elements of the environment.

91. One of the main objectives of the plan of work of IRPTC is to facilitate access to existing data on the effects of chemicals on man and his environment. IRPTC disseminates information on potentially toxic chemicals in an attempt to improve awareness of the possible hazards encountered in their production, transport, storage, use and disposal.

92. UNITAR is undertaking as part of its approved programme for 1978-1979 an analysis of optimal means for the transfer of scientific knowledge and technical experience to the developing countries, describing the main channels and forms available for the transfer of technology and comparing the economic and technical effectiveness of its various forms.

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93. The ILO assists developing countries in the transfer process by means of training programmes, advisory services, publications and information systems. Its computerized, integrated Scientific Information System (ISIS) stores and retrieves abstracts of documents; ISIS software is used by over 50 institutions throughout the world. The ILO contribution to the planned network for technological information exchange (see para. 77 above) will be principally related to small-scale and rural industries; documentation will also be prepared on technological choice in manufacturing industry and construction. Jointly with the World Bank, technical memoranda are being prepared on alternative technologies in civil construction; in collaboration with UNIDO, similar memoranda are now being prepared for industrial manufacture of mill-white cane sugar and rice milling.

94. These and other technical memoranda (e.g. on rural, non-farm activities) form part of the ILO Programme on the Dissemination of Information on Appropriate Technologies and are intended to be widely distributed, matter-of-fact and of low cost, to reach a target audience of persons involved in the actual management and planning of economic activities.

95. The question of the best means of introducing new technology to farmers is of great concern to FAO. Traditionally, most advisory services use mainly face-to-face contact between government field staff and farmers; but there are stringent limitations imposed by the volume of such contacts that can be economically organized, and also by the effectiveness of field staff in communicating technical information. The training of field staff to make them more effective communicators is one area of FAO action, as is helping Governments to work with modern communication techniques and media, such as radio, television, closed-circuit television, and other less sophisticated audio-visual means and training materials specially tailored to the needs of illiterate and semi-literate audiences.

96. In all the programmes of FAO an important role is played by the exchange of scientific and technological information through expert consultations, workshops, seminars, demonstrations and training courses and through the collection and dissemination of information in library and documentation systems. Such systems include the International Information System for the Agricultural Sciences and Technology, a co-operative world-wide information system on current agricultural literature, the Current Agricultural Research Information System, a co-operative information system on current agricultural research (institutions, workers, programmes and projects), and the Agricultural Libraries Network, a co-operative system for the exchange of services and information among main agricultural libraries.

97. All are based on national capabilities in the agricultural information sector, on the contributions they can provide to international co-operative information systems and on the linkages, in networks, of these capabilities, at the regional or subregional levels. Technical assistance field projects are undertaken for the establishment or strengthening of national and regional agricultural documentation centres, aiming first at enhancing national capabilities and then at ensuring the pooling of these capabilities in international networks.

98. The UNESCO long-term international programme on transfer of scientific and technical information, the World Science Information System (UNISIST) includes

among its objectives helping developing countries to meet their needs for scientific and technical information and taking the necessary measures for the establishment of a flexible world network of information systems and services based on voluntary co-operation. The programme is carried out through the co-operation of member States and in collaboration with the other organizations concerned within the United Nations systems, as well as with the competent governmental and non-governmental international organizations.

99. The UNISIST programme concentrates on the improvement of the tools of systems interconnexion: the strengthening and improvement of the institutional components of the information transfer chain; the training of specialized information manpower and information users; the development of scientific information policies and national networks; the establishment of regional scientific and technological documentation centres; and assistance to member States in the creation and development of their scientific and technical information infrastructure. In all these activities, special attention is given to the needs of the developing countries; UNESCO is providing assistance for the development of national infrastructures, particularly in the field of libraries and archives, documentation centres and the training of information specialists. More than 50 countries have already set up UNISIST focal points as national co-ordinating mechanisms, as well as a considerable number of UNISIST National Committees to act as liaison between national activities and the UNISIST programme.

100. Under the WHO Programme of Appropriate Technology for Health, activities are being initiated to identify and assess existing technologies, to improve them so that they can be transferred eventually with the required adaptation, and to develop and invent new technologies. In particular, the development of an information system is being undertaken by all departments of WHO, together with other institutions, in order to make an inventory of appropriate technologies all over the world that have stood the test of time and have effectively provided solutions to local problems. As part of this activity, the identification of groups and institutions capable of taking responsibility for meeting these needs is also being pursued.

101. When a project financed by the World Bank introduces new technology into an area, usually as part of a complex technical and social project package, several means are used to ensure that skills are also transferred to permit local mastery of the technology; these include providing for the training of local personnel to plan, manage and operate the project; involving, whenever possible, qualified local consultants in the development and implementation of the project; and creating and supporting institutions and programmes that can also provide such training and services.

102. In infrastructure projects (dams, ports, airports, highways, power plants, telecommunication networks, water supply systems) which require highly specialized skills for calculation and design, the Bank tries to promote patterns of preinvestment and implementation work through which local institutions, including consulting and engineering groups, learn by working with foreign experts and with each other. In large-scale industrial projects that involve the use of proprietary technology, the Bank is frequently able to assist its borrowers in arriving at

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arrangements that offer a fair and reasonable price for the technology. Projects in rural and urban development, population and education do not lend themselves to the purchase of technologies packaged abroad and require a high level of local participation even at the early stages of the development of a country's technological skills.

103. The Bank is trying to develop better ways of enabling intended beneficiaries (as well as local planners and administrators) to participate in the design, implementation and operation of the projects it supports, believing that this approach will increase their economic impact. Participation in design and implementation can lower project costs and increase local capabilities; participation in project operation, especially when institutions are created that assist this activity over a long period, can ensure that the facilities are well-maintained and operated and that they widen and make more equitable the distribution of the project's benefits. For the same reasons, a price preference is given to local manufacturers of equipment needed for projects, and the Bank encourages the use of consulting and engineering firms from the country concerned or from other developing countries.

104. A significant transfer of technology takes place within the regular programme of ICAO. Every year a large number of meetings are scheduled on technical subjects - meetings invariably attended by both developing and developed States - at which a transfer of knowledge and experience takes place. In addition, ICAO schedules workshops and seminars dealing with specialized subjects that achieve the same purpose. And finally, ICAO has a large programme for the development and circulation to all Contracting States and other interested parties of technical manuals and circulars that provide detailed guidance material on specialized subjects ranging from aerodrome design to the air-worthiness of aircraft.

105. The recommendations and reports of the International Consultative Committees of ITU, which are closely concerned with the diffusion of scientific and technical information for developing countries, represent an international consensus of leading expertise in the area of preferred technical standards and practice in telecommunication, providing a reliable technical basis for planning. In many cases, the recommendations stipulate minimum performance standards, facilitating the international procurement of installations and avoiding the duplication of research. Reference handbooks on specific subjects are prepared by specialized working parties.

106. The WMO technical commissions (open to experts from all member countries of WMO) constitute machinery for the exchange and diffusion of scientific and technical information. WMO also organizes numerous symposia, technical conferences, seminars and workshops on specific subject areas. In addition, it publishes manuals, guides, technical notes and other scientific and technical publications, including training materials, to assist members in the efficient and effective development of their services.

107. An important role in the transfer of technology is played by the WMO Technical Co-operation Programme. Expert advice and assistance in the selection, installation and operation of new technologies is provided within technical assistance projects, and counterpart training is a key component of such support.

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108. A large and steadily growing number of developing countries is taking advantage of the IMCO technical assistance programme to increase their expertise in many different technical aspects of shipping, ports and harbours and the prevention and control of marine pollution. The establishment of regional and national training facilities, a fellowship programme and the provision of regional and interregional maritime advisers and experts play an important role in this regard. The transmission of useful information and data, and the development of direct contacts between experts and technicians from many countries and organizations also take place at the numerous technical meetings of IMCO.

109. On the basis of progress made in preparatory work carried out in WIPO at meetings at the expert and intergovernmental levels since 1975, the Executive Committee established by the Paris Convention for the Protection of Industrial Property (i.e. patents, trademarks, etc.) has decided that the Convention should be revised at a diplomatic conference to be held in 1979. The purposes of the revision include the introduction of new and modified provisions of special benefit to developing countries, on the basis of an agreed declaration of objectives, which provides, in particular, that the revision should contribute towards the establishment of a new economic order in the world and that industrial property should constitute an element in the process of the transfer of technology and should contribute to new technological advances.

110. Along parallel lines with the work on the revision of the Paris Convention, WIPO working groups of government experts are preparing the texts of new model laws for developing countries on inventions and know-how, and on trademarks, to be published by WIPO in 1978 and 1979.

111. To assist in the exchange of technological information, and to contribute effectively to the network planned for this purpose (see para. 77 above), WIPO is promoting international co-operation, including technical assistance projects and training, to improve the access of developing countries to the technological information contained in the world's enormous, and constantly growing, stock of patent documents. These are reasonably standardized public disclosures, widely exchanged through intergovernmental agreements; they are organized in search files according to an internationally agreed classification system (the preparation of guides to this system for users in developing countries, in selected priority sectors, is being undertaken jointly with UNIDO); access is facilitated by a computerized bibliographical data service.

112. A new treaty on the international recording of scientific discoveries, adopted at a WIPO diplomatic conference early in 1978, will, if ratified by Governments, promote information on new scientific discoveries for the benefit of the scientific community and the world at large by instituting a system which would make descriptions of such discoveries accessible to them.

113. IAEA organizes and publishes the proceedings of a large number of scientific and technical meetings, which serve as a means of exchanging information. The International Nuclear Information System, established in 1969, collects and disseminates almost all the information published in IAEA member States and by international organizations on the peaceful uses of nuclear energy. The file of

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information now consists of some 350,000 items and is available in an abstract journal and on magnetic tape.

114. To summarize, the programmes referred to in this chapter can be broadly classified into two categories: programmes whose object is to establish an international legal framework for the acquisition and transfer of proprietary technology, and programmes, some of them joint interagency ventures, designed to improve the access of developing countries to technology and technological information. All these programmes recognize the need to reduce the dependency of developing countries on foreign know-how and capital goods by strengthening their bargaining power and negotiating capacity through the provision of information on technological alternatives and through internationally recognized legal standards.

### III. ELIMINATION OF OBSTACLES TO THE BETTER UTILIZATION OF KNOWLEDGE AND CAPABILITIES IN SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

115. There are two kinds of problems that need to be tackled in order to eliminate obstacles to the better utilization of knowledge and capabilities in science and technology for development; they can be described as external problems and internal problems; the external problems relate to the acquisition by developing countries of knowledge, equipment, and skills from abroad, while the internal problems relate to the effective application of science and technology, imported or home-grown, to national development. These two groups of problems are related and each exacerbates the other.

116. The external problems include a lack of access to information on existing technologies throughout the world, and related matters such as costs, sources etc., and difficulties, including restrictive conditions, in the contractual and other arrangements for the international transfer of technology. These problems are mainly dealt with in chapter II above.

117. The internal problems include, among others, the lack of indigenous technological capabilities relevant to the development needs of the country, particularly in research and extension services and in negotiating and decision-taking, the scarcity of facilities (including funds) for training, the migration of trained personnel, the lack of effective policies, institutions and infrastructure, and social resistance to innovation.

118. Progress in the basic sciences is an essential prerequisite of any progress in the applied sciences and technology. Advances in electronic computation and control are conditioned by progress in modern mathematics. Tapping new sources of energy will depend on new findings in the theory of physics. Increasing the output of food and preventing food losses depends on the application of modern biology and particularly microbiology. Chemistry helps to use scarce raw materials to best advantage. A sound local infrastructure for scientific research and an adequate number of well-trained research workers are therefore essential to social and economic development.

119. The programmes of organizations of the United Nations system referred to in this chapter are designed primarily to eliminate obstacles by tackling the internal problems listed above. The policy and institutional aspects of these internal problems are dealt with more fully in chapters IV and V below.

120. The surveys of scientific and technological activities and the special exploratory studies on trends and developments referred to in paragraph 22 above are part of the contribution made by the United Nations (Headquarters) to the elimination of obstacles to a better utilization of knowledge.

121. In addition, interregional seminars are organized on the management of construction projects, with emphasis on time, quality standards, labour productivity and economy in the use of building materials, and manuals are prepared for technicians and professionals on the use of local building materials,

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labour and technologies, to provide incentives and acquaint them with possible ways of action in their own countries by which their capabilities can be fully utilized, thus preventing migration to other nations. In the physical upgrading of slums and squatter settlements, a multidisciplinary approach and extension work techniques are used, with the full participation and involvement of the population, working in close contact with expert technologists, and local youths are trained in the application of building technologies to neighbourhood improvement programmes.

122. In the field of marine and coastal technology, the United Nations (Headquarters), in addition to disseminating information, seeks to promote effective interaction between national planners and decision-makers, on the one hand, and national and international technologists, on the other, in order to help the former to increase their knowledge of potential new uses of the seas and coasts; seminars and training courses on coastal area development and the publication of manuals dealing with its techno-economic and legislative aspects are intended to contribute to the knowledge of technologies for assessing and controlling complex interactions and to help to equip administrative units to deal with the multidisciplinary and intersectoral problems in this field.

123. Activities undertaken by UNCTAD with a view to eliminating obstacles through the strengthening of national technological and scientific capacity are, to a large extent, concerned with the formulation of policies, the building of institutions and regional co-operation; they are therefore referred to in chapters IV, V and VI below.

124. UNCTAD has recently convened a meeting of government experts on the reverse transfer of technology from developing to developed countries, represented by the migration of skilled people ("brain drain"). The group adopted conclusions and recommendations underlining, among other things, the need to analyse problems at the levels of both developing and developed countries, to improve the responses of countries that import or export skills, and to carry out further work on concerted policy-oriented action at the national, regional and international levels in order to help developing countries to find solutions to the problem. It called also for an examination of the proposal to establish an international labour compensatory facility, and of ways and means of improving the responses of developed countries to the question of migrants' social security benefits, pension rights, taxation benefits and facilities for remitting earnings to their country of origin; it also urged that better data on skilled migration should be built up through the collection and dissemination of statistical and tax information. The group recommended that further work should be undertaken on international resource flow accounting at an expert level, with a view to clarifying the methodology of the concepts and procedures to be developed for its practical application, and on the modalities for promoting greater co-operation among the developing countries themselves in the utilization and exchange of their skilled manpower resources on a planned basis.

125. To help developing countries to improve their negotiating capacities, UNCTAD is preparing a handbook entitled Transfer of Technology, dealing with aspects of the subject other than those covered in the WIPO Licensing Guide for Developing Countries referred to in paragraph 151 below.

126. UNIDO activities for entrepreneurial and managerial development are designed to include both short-term activities to improve management performance and the long-term development of national management resources. In addition to its technical assistance activities, UNIDO conducted management clinics, meetings and studies on the use of consultancy services, has carried out a study on management and the transfer of technology, and maintains a roster of consultants.

127. UNIDO is undertaking various types of training and fellowship programmes to upgrade human resources and capabilities. Its Investment Co-operative Programme Office co-operates closely with the World Bank and with regional financial organizations in seeking to link more effectively feasibility studies, finance and technology. Under the auspices of UNIDO, Governments are undertaking a joint study of methods and mechanisms for diversified financial and technical co-operation that are geared to the special and changing requirements of international industrial co-operation, as well as of a general set of guidelines for bilateral industrial co-operation.

128. At the country level, UNDP is devoting much of its technical co-operation in science and technology to the development of skills, to scientific, technological, engineering and agricultural and industrial extension services and to agricultural research and development covering crop production and varietal trials, soil-testing and fertilizer evaluation, seed multiplication and certification, plant protection, soil and water management and post-harvest technologies. Research and development activities in modern industrial technologies find a place in the country programmes of some countries only.

129. Most of the areas of activity covered by UNEP contain an education and training component. Special efforts are being made to promote training for environmental management and to increase the awareness of professionals in the different disciplines of the importance of considering environmental issues during both the planning and implementation of development projects.

130. UNICEF helps countries to overcome such obstacles as the lack of knowledge and understanding of the implications of new technology, the passive attitudes of the population concerned, especially towards the maintenance and repair of equipment, the lack of government policies and the lack of funds for the procurement of the appropriate supplies for introducing and applying new technologies. The first two obstacles, in particular, are being tackled by means of the UNICEF projects for village technology development referred to in paragraph 42 above.

131. Training activities constitute a major ILO programme. Special emphasis is laid on training for rural development, small industries and sectors with high employment-generating potential, as well as on measures to improve the access to training of the poorest sectors of the population.

132. These activities provide a major means of furthering the technological capabilities of developing nations and eliminating obstacles to the application of technology to development. Some 400 ILO experts are involved in vocational training projects in over 80 countries, and in management development projects in about 50 countries. Vocational training projects are particularly directed

towards the development of additional skills and the upgrading of the existing skills of workers; in management development projects, the trend is away from the traditional general training of middle-level and upper-level managers, in favour of more development-oriented curricula. Special projects are being developed and implemented for the training of managers and supervisors for the transportation, distribution and construction sectors and, also managers for rural development programmes and small-scale entrepreneurs.

133. The migration of manpower has long been a concern of the ILO. The Tripartite World Conference on Employment, Income Distribution, Social Progress and the International Division of Labour included in its Programme of Action (see E/5857) recommendations concerning measures designed to avoid the need for workers to emigrate, measures against migrations in abusive conditions and in favour of the promotion of equality of opportunity and treatment, and multilateral and bilateral agreements to avoid, lessen or solve the problems associated with migration.

134. At their request, the ILO provides technical assistance to the countries and regional organizations concerned, to make it possible to prepare and implement these measures. In addition, studies are undertaken on the economic and social effects of different kinds of migration for employment, on the reintegration of migrants upon return to their country of origin and on the special problems of migrant workers who have not been regularly admitted or who lack official papers.

135. FAO has a number of activities designed to eliminate infrastructure obstacles. Large-scale projects and educational activities such as seminars and workshops are carried out to improve the capabilities of national personnel so that they can fill the credibility gap between the research institutes on the one hand and the Government and the user on the other.

136. Other related FAO activities include a global assessment of soil degradation, with the support of UNEP; expert consultations to promote soil conservation activities in developing countries; publications and a workshop on soil conservation; examination of new methods in hydrology and hydrogeology; the preparation of a draft manual for computer programmers on user-oriented ground-water models; a draft report on the application of systems analyses to the planning of water resources and a paper on new research priorities in irrigation and drainage; in co-operation with the World Bank, a study of the situation of small farmers in the country to provide micro-farm data and information for use in designing workable small-farmer investment programmes in a relatively short period of time; the development of a computerized Farm Management Data Collection, Analysis, Storage and Retrieval System; the preparation of a Farm Management Research Manual for small farm development; a study of methods for the prognosis and control of soil salinity and sodicity; an analysis of the interrelationships between socio-economic aspects of development and demographic trends; and the preparation of research publications and manuals to assist planners to take greater account of these interrelationships.

137. FAO, in common with many other organizations, is taking steps to remedy the lack of accurate information on food and nutritional matters among and on behalf of the so-called vulnerable group (especially young children and nursing mothers)

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by setting up programmes for the promotion of sound nutrition, by training nutrition educators and trainers, by practising extension methodology and by issuing publications on nutritional matters. In the food trade, the elaboration and acceptance procedures for international and regional food standards, as well as codes or practice, contribute to an awareness of food-related science and technology.

138. The social consequences of translating science and technology into its practical application are subject to constant change, and the question therefore needs to be kept under continuous review. UNESCO is thus studying the interaction of science and society, with emphasis on the human implications of science and technology. Studies are also being carried out on the conditions pertaining to the transfer of knowledge, on social factors in integrated rural development, and on the influence of transnational corporations on development; other studies are being pursued with a view to preparing recommendations on the emigration of high-level specialists from developing countries and their return to those countries.

139. The UNESCO programme is designed to encourage the development of scientific research and training and to promote international and regional co-operation with a view to increasing endogenous scientific and technological capability.

140. International co-operation in scientific research and training is encouraged through the association of advanced research institutions and through the creation of interregional networks. Its aim is to facilitate the advanced training of scientists from developed and developing countries and co-operative research efforts in some specific research areas. UNESCO has also supported the creation of international and regional centres and networks, such as regional programmes of co-operative research and networks of existing research institutions, in order to increase the qualified research manpower in the region and to assist in pooling the resources of manpower and equipment available in the region for specific projects.

141. UNESCO assists science faculties and university research laboratories, particularly in developing countries, and, at the regional level, assists member States through its system of post-graduate training courses, so responding to the most immediate needs in terms of trained manpower in specific fields such as informatics, chemistry of natural products etc.

142. UNESCO activities for the development and promotion of general environmental education are designed to help member States in their efforts to incorporate environmental education into formal and non-formal education for the public in general, with a view to providing a better understanding of environmental problems and teaching people to behave and act in a way that favours the preservation and improvement of the environment. In this context, and taking into account the recommendations of the Intergovernmental Conference on Environmental Education held in 1977, priority will be given to the formation and implementation of policies for the development of environmental education, the training of personnel, research on an interdisciplinary approach to environmental education, the development of teaching and learning methods and materials, and the establishment of national and regional mechanisms for concerted action for the development of environmental

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education. These activities will be undertaken in co-operation with UNEP and other United Nations organizations concerned and with appropriate intergovernmental and non-governmental organizations.

143. Under arrangements established by WHO some 5,000 persons in developing countries benefit each year from training courses, varying in length from weeks to years, to produce auxiliary health workers, laboratory technicians and even fully trained physicians and specialists to meet the great manpower needs of these countries. The main emphasis is being placed on the lower level subprofessional class of trainees. The training is frequently carried out in co-operation with UNICEF, FAO and UNDP, and financial assistance is often supplied by government and voluntary agencies in the more wealthy countries.

144. World Bank projects are carefully prepared so as to ensure that the most appropriate technology is used, to attract resources and to make sure that the institutional and other capabilities for implementing the projects are available.

145. The Bank's rural development projects often create credit mechanisms to aid the smallholder to purchase livestock, machinery and other inputs such as improved planting materials. These, combined with technical assistance, training, delivery systems for inputs and marketing systems for outputs, increase his productivity. In the industrial sector, the Bank is attempting to expand financial and technical assistance to small-scale enterprises, partly because of their potential for creating employment, through projects which provide credit along with technical assistance and training. Through its country economic and industrial work, the Bank also promotes changes in policies and regulatory measures that may have encouraged undue capital intensity in investments and inhibited the ability of small-scale enterprises to function effectively.

146. The Bank uses over 1 per cent of its funds for specialized managerial, technical and operational training in sectors such as industry, agriculture, energy, water, telecommunications and transportation. It provides technical assistance in analysing sectoral manpower needs and in developing training methodologies to meet them, and advises on both international resources and local facilities that can be used for training. In addition, the Bank supports training in general skills in industrial and agricultural schools.

147. The Bank also supports the creation of local institutions that can carry out preinvestment studies and provides for counterpart training on projects so that there will be increased capability for project development. In addition, short courses are given to middle-level and senior officials of developing countries in problems of development planning and management, and in designing, appraising and implementing projects. About two thirds of these courses are now conducted in developing countries in co-operation with local and regional institutions.

148. In the field of civil aviation, the main obstacles to the better utilization of technological knowledge are the lack of facilities and funds for technical training and for recruiting and retaining technical staff, the shortage of expert assistance, particularly for advice on planning, supervision and management,



and inadequate financing for the purchase of technical equipment. The availability of additional financing, both externally and internally, would be of considerable help in eliminating obstacles to the better utilization of knowledge and capabilities in science and technology.

149. ITU focuses its training efforts on the creation of training centres or telecommunication institutes on a national or multinational basis, the holding of specialized seminars, the organization of fellowships, the preparation of teaching materials, the sending of experts to advise on planning and developing teaching activities, the interchange of information among experts in professional training, and interregional projects for the development of vocational training courses.

150. IMCO attaches great importance to the education and training of the personnel who operate ships and provide the related services; no marine establishment can be properly maintained without adequate training facilities to secure the constant flow of skilled personnel. Particular attention is paid to the training of seafarers in maritime safety and the organization of training courses and workshops on the prevention, control and abatement of marine pollution from ships.

151. Obstacles to the full application of technology to development include unreasonably restrictive conditions in transfer agreements, attributable in part to a lack of experience and skill on the part of the acquirer of technology in concluding adequate legal arrangements. WIPO promotes international co-operation in the sharing of relevant experience and in training. Meetings of experts from all regions have assisted in the preparation of a guide on the legal aspects of the negotiation and preparation of industrial property licences and technology transfer agreements appropriate to the needs of developing countries. This Licensing Guide for Developing Countries was published in 1977; it has been widely disseminated and well received. It will also be used as background and training material at meetings and workshops organized in developing countries and regions.

152. IAEA is carrying out several programmes to assist developing member States in manpower development and in the training of specialists. Training courses in nuclear power planning and implementation and in the management of power plant construction are organized in different parts of the world, with the co-operation of member countries and the exporters of nuclear power stations. By the end of 1977, 471 participants from developing countries had attended these training courses.

153. In summary, this chapter shows that the overwhelming emphasis in eliminating obstacles is on programmes to develop human resources, implemented by various United Nations organizations in their respective areas of competence. These programmes include activities such as extension services, seminars, expert meetings, fellowship schemes, and formal training courses.

154. In addition, the problems associated with the migration of skilled manpower are being examined and measures are being identified to counteract adverse effects for developing countries. ACC at its spring session in 1978 decided that, in view of the multidisciplinary nature of the problems of co-ordination in this area,

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co-ordination should be entrusted to an ad hoc group of specialists, whose report would be reviewed in the first instance by the Sub-Committee on Education and Training. In accordance with General Assembly resolution 32/192 on reverse transfer of technology, the Secretary-General, in co-operation with UNCTAD and the ILO, is undertaking an in-depth study of the "brain drain" problem. A progress report on this study is being submitted to the General Assembly at its thirty-third session through the Council at its second regular session, 1978.

#### IV. METHODS OF INTEGRATING SCIENCE AND TECHNOLOGY INTO ECONOMIC AND SOCIAL DEVELOPMENT

155. The full utilization of the potential of science and technology in economic and social development implies recognition of the value of each, both as tools for development and as areas to be developed. It will be necessary to appreciate in what areas of economic and social development scientific and technological inputs should be strengthened, what type of inputs will be needed, and what degree of support should be granted for the national resources in science and technology, to enable them to provide these inputs. At the same time, the relative advantages and disadvantages of importing technology or know-how will need to be weighed against the development of national solutions.

156. A careful balance has to be kept between short-term investments, and the investment of funds in long-term ventures which - while slow to bear returns - may prove essential to the generation of a research and development infrastructure fully geared to finding appropriate solutions to national situations and problems. It should be added that such an infrastructure appears to be the only way, in the long run, to give to a country the technological capability necessary to support its bargaining power in the world technology market.

157. National policies in science and technology need to be fully integrated into national development policies, and an adequate supporting infrastructure needs to be built up, in order to maximize the potential of science and technology for development.

158. The organizations of the United Nations system assist Governments in a variety of ways, for example, by elaborating a methodology and training personnel in budgeting and planning for science and technology; by advising Governments, at their request, on policies and implementing legislation and administration; by providing consultants and organizing special conferences; and by furthering the exchange of experience in this field among developing countries.

159. In its resolution 1823 (LV), the Economic and Social Council drew the attention of Governments to the World Plan of Action for the Application of Science and Technology to Development, prepared by the Advisory Committee on the Application of Science and Technology to Development (ACAST) with the co-operation of the organizations of the United Nations system, pointing out that it might be of assistance in the selection and preparation by decision-makers and the scientific and technological community of specific projects relevant to the needs of their countries. It commended the Plan's objectives and scope as guidelines and broad programmes suggested to Governments, subject to their own individual priorities as established in their national development plans. In resolution 1900 (LVII) the Council urged on all Governments the importance of drafting and implementing national science and technology policies and of giving high priority to the establishment of at least one centre for providing advisory services in the field of science and technology policy in each region. It requested the Secretary-General in co-operation with other international organizations, to promote effective assistance in that field and in particular to strengthen such activities at the regional level.

160. The United Nations (Headquarters) is working on preparations for the updating of the World Plan of Action by ACAST, and is assisting the regional commissions in revising the regional plans of action; its programme includes the preparation of a report to ACAST and the Committee on Science and Technology for Development on the application of management sciences to the integration of science and technology into development planning processes, and continued study of the question of the application of computer science and technology to development.

161. The objectives of the UNCTAD programme in this field are to contribute in a direct way to strengthening the national technological and scientific capacity and to promote the formulation and implementation of technology policies designed to contribute in an integrated fashion to the achievement of the economic, social and environmental objectives of developing countries.

162. The activities of UNCTAD are intended to contribute directly to the linking of technology to socio-economic development and international co-operation; it co-operates with and assists the developing countries in the preparation of national technology policies and plans and their implementation in co-ordination with other relevant economic policies and plans; the establishment of national centres to deal with the transfer and development of technology (see chap. V below); the establishment of subregional and regional centres for the transfer and development of technology, and of appropriate linkages among them, as well as centres in sectors of particular interest to developing countries (see chap. VI below); the techno-economic, legal, commercial and development aspects of technology transactions; the evaluation of the economic and development aspects of technological and related information, including patents and other forms of industrial property; the establishment of co-ordinated training programmes at the national, subregional, regional and interregional levels; and the organization of seminars and exchange of government officials dealing with the transfer and development of technology.

163. UNIDO attempts to stimulate on the one hand policy-makers and decision-makers, enterprises and research institutes in developing countries to promote the application of appropriate industrial technology, and, on the other hand, suppliers of technology and equipment in industrialized countries to undertake the necessary adaptation and redesigning to suit the needs of developing countries. It encourages Governments and donor agencies in industrialized countries and in developing countries with sufficient financial resources at their disposal to allocate more funds to co-operative programmes on appropriate technology and seeks to mobilize existing research capacity in developing countries so as to promote the adaptation of available technologies and the development of new technologies where necessary.

164. With this in mind, UNIDO will organize an international forum for appropriate industrial technology and will also continue to sensitize policy-makers through the development of an integrated view of industrial strategy and appropriate technology. It is proposed to undertake studies on the interrelationship between industry and technology, and the manner in which this interrelationship can be woven into the broader fabric of the goals of economic and social development.

165. National self-reliance and the collective self-reliance of developing countries represent the basic future orientation of UNDP technical co-operation in science and technology. UNDP will continue its dual approach of contributing to both the traditional and the industrial sectors of the economy. The scope and limits of national self-reliance in science and technology vary, and depend on the present and potential range of facilities for scientific and technological education and training; research and development; scientific, technical, engineering and extension services. The latter in turn are influenced by the size and the rate of growth of the gross national product (GNP), population and the accessible markets and the scale and quality of natural resources endowment. The time taken to realize a goal of national self-reliance depends among other factors on the current stock of scientific and technological facilities and manpower, and deliberate and sound policy planning and programming of scientific and technological development interwoven with economic and social development and as an integral and vital part of development planning. Policy planning for science and technology will become an increasingly important and strategic area of technical co-operation; it will encompass both traditional and modern sectors, and will include, inter alia:

(a) Education and training in science and technology with increasing emphasis on specific needs, relevance and quality;

(b) The popularization of science and the spread of scientific culture;

(c) Guidelines on the choice of technology suited to natural resources endowments and factor proportions;

(d) The regulation and adaptation of imported technologies in relation to the use of foreign patents, licences and brand names, including restrictive clauses, transfer prices and use of indigenous personnel;

(e) The decomposition of the total cost of technology transfer into individual components such as payment for royalty, payment for services (pre-investment studies, plant design, project management, training etc.) and payment for plant and equipment;

(f) The development of scientific, technological and engineering infrastructure and services;

(g) Agricultural and industrial extension services;

(h) Technological information services;

(i) The selection of areas in which technological self-reliance is desirable and feasible;

(j) The building up of research and development facilities for the adaptation of technologies and the generation of new technologies;

(k) Financial, fiscal, tariff and other policies to promote the defined goals in the field of science and technology; and

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(1) Co-operative arrangements with other developing countries for collective self-reliance in selected areas of training, services and research and development.

166. A leading aim of the UNEP programme is to provide Governments, especially in developing countries, with information and methods for integrating environmental concerns into economic and social development. Its two functions of environmental assessment and environmental management are central to the entire programme of UNEP, in which, because of the broad nature of environmental issues, the Governing Council has selected the priority areas listed below.

167. Human settlements. The planning and the management of human settlements are playing an increasingly important role in the development process. UNEP programmes in this area are aimed essentially at the establishment of regional networks of institutions, the upgrading of slums and marginal settlements, the training of administrators and the development of basic approaches to planning and environmental strategies and programmes for rural settlements.

168. Health. The environmental origin of disease is receiving increasing recognition. It is apparent that control of communicable and non-communicable diseases may best be achieved by control of environmental factors and media. Environmental health management programmes should be an integral part of development programmes. UNEP activities in this field include the assessment of the impact of pollutants on man and the environment through:

(a) Studies on the relationship between exposure to pollutants and human and environmental health;

(b) A review of pathways and the transformation of pollutants from source to receptor (model case of sulphur oxides);

(c) Studies of, and in due course recommendation for, pollution control including economic and legal aspects; methods for the protection of food and water from pollutants; measures to provide protection from nuclear radiation; research and training aimed at obtaining suitable environmental tools for control of communicable and non-communicable diseases and methods for early detection of health deterioration caused by exposure to occupational health hazards.

169. UNEP is also concerned with the control of agricultural pests and disease vectors, and feels that a more comprehensive approach to pest management is needed. Pest management systems should combine all relevant control techniques within the one framework of the pest/host ecosystem, so as to produce favourable economic, ecological and social consequences.

170. Arid and semi-arid lands. Several forms of extensive land use, such as shifting cultivation, nomadism and seasonal grazing, have been maintained for centuries without destroying the ecosystem; however, when population pressure leads to rising demand for food and hence to more intense land use, these traditional practices become increasingly destructive, lowering the productive potential of the land. Several studies are being carried out with UNEP support on ways and means of combating desertification. These activities have received a considerable boost

from the United Nations Conference on Desertification, and UNEP is actively involved in the implementation of the Plan of Action adopted at that Conference (A/CONF.74/36, chap. I).

171. Tropical woodlands and forests. In recent years, the impact of man on the humid tropics has entered a new phase because of large-scale lumbering and tree monoculture, conversion to grassland for cattle, construction of roads and airstrips, intensified hunting, and herbicide spraying. If present trends continue and conservation efforts are not greatly increased, most of the tropical forests will be destroyed or replaced by simpler communities by the end of the century. UNEP is concerned inter alia with the updating and regionalization of knowledge of tropical woodlands and forests; the establishment of field pilot projects to test the application of existing knowledge about ecologically sound forms of management; the promotion of a world-wide programme of tree planting and protection; the promotion of manpower training to implement integrated and ecologically sound management practices.

172. Soils. Misguided human action has contributed greatly to the destruction and degradation of soils. The total area of destroyed and degraded soils is estimated at 20 million square kilometres, which is more than the entire area used for arable agriculture at present. Special emphasis in UNEP programmes is given to the global and regional assessments of soil degradation and erosion; measures for combating soil erosion and degradation; the development of techniques to restore, maintain or increase soil fertility through new agricultural practices; a demonstration of how fertility can be restored, maintained or increased by non-polluting means of soil fertilization, and in particular, promotion of the increased use of biological and organic sources of soil fertility.

173. Water. The development of water resources is closely related to development activities of a wider scope, e.g. agricultural development, industrialization, urbanization, soil preservation and energy production. Major water resource projects have important consequences for public health, social and economic structures, public administration and climate, which go beyond the direct benefits of water use. Among the activities supported by UNEP are the promotion of improved water availability through the prevention of deterioration in the quality of water by ecologically sound measures, encouragement to search for additional sources of water, and efficiency in utilization, by field actions in Africa, Asia and Latin America; the promotion of education and training in water resource management and development through field action and support for co-operative investigation and action in the management of African lakes and of river basins shared between countries; demonstration of the protection of water sources from eutrophication and promotion of the rehabilitation of eutrophied waters in an industrialized country to serve as field training in water protection and conservation.

174. Marine environment. UNEP is supporting a number of research programmes to identify the sources, pathways and effects of marine pollution on the marine environment. Similarly, special efforts are being made to support education and training programmes for the conservation of living marine resources.

175. The UNEP Regional Seas programmes are based on the following components:

Environmental assessment, including:

- (a) Evaluation, research, monitoring and information exchange, leading to a report on the state of the marine environment and its living resources;
- (b) Assessment of the impact on the marine environment of development policies for industry, agriculture, urbanization, fishing, maritime transport, exploitation of mineral and energy resources, tourism etc.

Environmental management, including:

- (a) Arrangements for the elaboration and conclusion of legal instruments to protect the marine environment;
- (b) Preparation of guidelines for environmentally sound development and for the protection of the marine environment, to be included in general guidelines for environmental management of the regional sea and the areas adjoining it;
- (c) Arrangements for the control of pollution by oil and other harmful substances;
- (d) Plans for the management and conservation of living resources (e.g. marine parks, aquaculture).

Supporting measures, including:

- (a) Identification of technical assistance, training, education and information exchange needs;
- (b) Provision of information for the general public.

176. Energy. In this area, special emphasis is being placed on the environmental effects of the production, transportation and use of all sources of energy and on the harnessing of renewable sources of energy to improve the human environment in rural areas in developing countries.

177. Industry. Studies are being carried out on the environmental effects of specific industries, working environment and siting of industrial plants.

178. Various ILO programmes are designed to assist Governments and their decision-makers in the development of policies. One way in which this is done is by trying to demonstrate how a great variety of policies, often not directly related, can influence, for example, the choice of technology. Thus, studies are undertaken to establish the effect of economic policies (interest rates, prices and wages, taxes, foreign exchange rates, etc.) or environmental policies, or consumer-protection or advertising policies, on a country's technological mix.



179. Governments are similarly assisted in the design of policies and legislation relating to working conditions, occupational safety and health, and workers' participation in management.

180. For FAO the main method of integrating science and technology into economic and social development is making the locally practicable results of research available to farmers of developing countries. Regardless of the quality of research and development work, it will have no value in increasing production unless applied by the small farmers. There is a need to reinforce interdisciplinary research with a strong socio-economic bias in order to understand farmers' needs, their abilities to accept new technology, and the constraints on their doing so. This must include the testing of research results under farming conditions and especially a feedback of information from the field to the research stations.

181. UNESCO assists member States at their request in establishing, strengthening or operating their national policy-making bodies for science and technology, guided not only by the World Plan of Action and the regional plans but also by its own experience, gained through the granting of this assistance and through the organization of a series of governmental expert meetings and of five regional conferences of ministers in charge of scientific and technological policy. This experience has been further expanded in UNESCO publications entitled Science Policy Studies and Documents, and synthesized in a book called Science for Development.

182. Most modern States, and the majority of developing countries, are now equipped with appropriate government structures for the formulation of their policies for science and technology. But almost all of the 30 or so least developed countries still lack such structures. As for decision-making bodies - such as those which define objectives or draw up major national programmes and budgets for concerted research work - they are still finding it difficult, in certain countries, to carry out their tasks because of the lack of adequate analytical methods or statistics on the national and international situation with regard to science and technology.

183. In the group of least developed countries, where the scientific infrastructure is minimal, there is very seldom any form of government machinery for the formulation of a national policy for science and technology nor any readily identifiable scientific and technological component in their over-all development plan.

184. In order to remedy the present deficiencies of the international exchange of information on the management, transfer, assessment and application of science and technology, UNESCO has launched the SPINES pilot programme with a view to establishing a world-wide Science and Technology Policies Information Exchange System.

185. Country monographs, prepared by the government authorities responsible for policy-making in the field of science and technology, are published periodically by UNESCO. Particular attention is paid to the link between scientific and technological activities and the socio-economic development goals of the countries concerned.

186. Assisted by specialists, UNESCO carries out intellectual and normative work aimed at putting at the disposal of its member States the appropriate procedures and techniques for formulating national scientific and technological policies. This work covers such fields as the role of science and technology in economic development, the evaluation of the effectiveness of research units, the study of optimum working conditions for research workers, surveys of national scientific and technological potential, methods of scientific planning, modern techniques for the management of national scientific resources etc.

187. Detailed surveys have been carried out in a number of developing countries with a view to determining the most urgently needed scientific and technological activities arising out of the national socio-economic development priorities. These surveys are designed to help member States in the preparation of national development plans, and may also serve as a basis for UNDP country programming operations.

188. A principal objective of WHO is the attainment for all by the year 2000 of a health level conducive to high social and economic productivity. In working towards this goal WHO gives great emphasis to the development of the health components in the evolution of a New International Economic Order as outlined in General Assembly resolution 3362 (S-VII) and the objectives of the United Nations Conference on Science and Technology for Development.

189. The very nature of the work done by WHO means that its programme and activities are permeated at all levels with scientific and technological components. These activities include the choice and transfer of technology appropriate to the needs of developing countries, and the research into and development of new technologies and their application in these countries. In implementing the activities that have a bearing on these problems a primordial consideration is the development of an indigenous infrastructure so that countries can attain the greatest possible self-sufficiency assisted by technical co-operation with both developed and developing countries.

190. The criteria used for selecting priority areas for promotion of research by WHO indicate the contribution made to policies for the integration of science and technology in development; they are: (a) the magnitude of the problem, especially in the developing countries; (b) the suitability of the problem for international collaborative research efforts co-ordinated by WHO; (c) the priority of the problem as perceived by individual countries themselves; (d) the relevance of the problem to the socio-economic development of member States; (e) the probability of finding solutions (or important clarifications) and the feasibility of applying them nationally, including the time and costs required; (f) the availability of manpower, facilities and funds to carry out the research to ensure as far as possible the achievement of significant results; (g) the involvement of the countries themselves, especially their scientific communities and facilities, in the research efforts to be undertaken, preferably where the problem exists, so as to upgrade national research capabilities; (h) the level of continuing research efforts, both nationally and internationally, to solve the problem; (i) the benefits that would accrue from the application of the results of successful research efforts, especially in the developing countries; (j) the potential usefulness of the results of the research in the solution of other problems.

191. Projects financed by the World Bank require a large-scale mobilization of technology, along with other inputs, in order to reach the development objectives agreed upon with the borrower. The Bank assists this integration of technology into development with staff advice and external technical assistance.

192. For the integration of technology into the rural economy, the Bank supports national agricultural extension services, particularly through the "training and visit" system, which provides for the training and regular supervision of village-level extension workers.

193. In industry, the Bank assists enterprises in developing countries through technical assistance to intermediary credit institutions, which often provide technical and managerial advice to the entrepreneur, and encourages the commercialization of indigenous innovation by financing government programmes that share the costs and risks of launching new products based on local technologies.

194. The Bank, in collaboration with research institutes and consulting firms in developed and developing countries, has developed and is testing efficient labour-intensive techniques intended to reduce the cost of rural road construction and at the same time to provide employment in areas where jobs and capital are scarce.

195. The Bank is providing policy advice and technical assistance in the development of national energy sector plans and of the institutional capabilities to carry them out. It is also examining the feasibility of using alternative energy sources in rural areas.

196. Increases in fossil fuel prices have made fuel wood, in particular, an even more important energy source. The Bank is funding project components which support reforestation and the establishment of fuel wood plantations on private and government lands. These project components have also demonstrated the value of conservation in attaining large potential savings in fuel wood consumption through such means as improved wood-burning stoves and simple wood preservation systems in buildings.

197. New technologies are required to reduce investment costs for the provision of adequate and convenient supplies of safe water. A Bank research project has shown that there are feasible alternatives in the area of sanitation and is also producing designs for improved mechanical waste-disposal devices; pilot projects are being established for alternative storage, collection and transportation systems, for composting and land application systems, and for final disposal systems.

198. Bank urbanization projects give slum-dwellers access to technology for the provision of water supply, storm drainage, sanitation and other basic amenities.

199. The Bank frequently uses remote-sensing systems, especially by means of earth-oriented resource satellites, in project identification, and is aiding developing countries to use such systems in project preparation and implementation; it assists in the organization or establishment of remote-sensing agencies for

such applications as regional planning, the evaluation of soil and water resources and of agriculture and livestock potential, and mineral and forest exploitation.

200. Civil aviation is a vital tool for economic and social development, and ICAO provides continuous support to Governments in their national policy-making in the sphere of science and technology through technical assistance programmes designed specifically to assist in the highly specialized field of civil aviation - both government services and airlines. It has carried out a comprehensive survey in one developing region to show the further contribution that civil aviation could make to the economic and social development of the countries concerned. Some 40 States were surveyed, and several hundreds of projects for potential growth were identified. However, progress in implementing many of the recommendations has been slow, principally because of a lack of funds to carry out many of the further detailed project studies proposed, which could have resulted in capital investment and, subsequently, in considerable additional earnings for many of the poorer countries in that region.

201. Meteorology and operational hydrology are of help in tackling such development problems as meeting the food requirements of ever-increasing populations, ensuring the availability of adequate supplies of water, pollution of the air, oceans and waters, the devastating effects of tropical cyclones, desertification, and the threat of climatic changes. They have a considerable economic and social impact when applied, for example, to housing, building and human settlements and shipping and aviation, as well as to the possibility of artificially modifying the weather. WMO, through its technical commissions and special expert panels and committees, is active in all these fields and member Governments are kept fully informed through the issuance of various reports and technical publications. A number of specific publications, including a compendium of lecture notes, for training purposes, on the applications of meteorology and operational hydrology to economic and social development have been prepared and circulated. On the operational side, expert advice is provided on the establishment and organization of meteorological and hydrological services. Numerous guides on meteorological and hydrological practices have also been made available.

202. Giving legal protection to inventions is one of the methods available to Governments for the integration of science and technology into economic and social development. The main purpose of a patent grant is to reward inventiveness and to stimulate the application of its results in industry. To achieve this purpose a country requires legislation that is up-to-date and suited to its needs, together with an efficient administration, including the means of testing the validity of applications for protection. WIPO assists developing countries in this respect through its programmes for the preparation of model laws (see para. 110 above), the strengthening of national and regional infrastructure, training programmes, regional meetings for the exchange of experience, and advice and assistance, on request, in specific cases.

203. In addition, the entry into force in 1978 of the Patent Co-operation Treaty will give developing countries the possibility of receiving, with applications for patents, technical reports prepared by international authorities for search and preliminary examination.

204. WIPO is also promoting the establishment or encouragement by Governments of arrangements for the stimulation and support of national innovators; such arrangements, in a variety of forms, exist already in many countries. WIPO is conducting a study of them with a view to recommendations being made concerning action that could be taken in the field of industrial property to strengthen capabilities for the creation, adaptation and application of suitable indigenous technology.

V. SUPPORT FOR NATIONAL POLICY-MAKING IN THE SPHERE OF SCIENCE AND TECHNOLOGY AND THE BUILDING-UP AND EXPANSION OF INSTITUTIONAL SYSTEMS FOR SCIENCE AND TECHNOLOGY IN DEVELOPING COUNTRIES

205. The institutional arrangements necessary to support policy-making and implement policies to enhance national capability in science and technology will vary from country to country. However, such arrangements will have certain features in common. Institutions will generally be needed for education and training and for research and development, and Governments may establish agencies such as national technology centres, which would have a co-ordinating function in respect of policies regarding the choice, transfer, adaptation and development of technology.

206. The programmes of the organizations of the United Nations system are directed towards the study of suitable institutional arrangements and practical advice and co-operation, at the request of Governments, in strengthening or creating them at the national level. Programmes concerned with the actual nature of scientific and technological policies were discussed in chapter IV above.

207. In addition to its activities to promote generally the implementation of the World Plan of Action for the Application of Science and Technology to Development, the United Nations (Headquarters) provides assistance to Governments in institution-building in such fields as building research and technology, cartographic and geological surveys, and water and energy planning.

208. An advisory service has been established within the UNCTAD secretariat to provide advice and technical and operational co-operation to developing countries - or groups of developing countries - upon their request, on matters pertaining to the transfer and development of technology. Preparatory assistance with a view to establishing national centres and laying the foundations for the formulation of an integrated set of policies relating to the transfer and development of technology has been provided, on request, to countries of various types and at different levels of development.

209. Recommendations by the missions providing preparatory assistance are mainly concerned with adequate implementation by national institutions - be they comprehensive centres or interlocking institutional arrangements - of, inter alia, the following tasks:

(a) The registration, deposit, review and approval of agreements involving the transfer of technology in the public and private sectors;

(b) The evaluation, negotiation or renegotiation of contracts involving the transfer of technology;

(c) Assistance to domestic enterprises in finding alternative potential suppliers of technology in accordance with the priorities of national development planning;

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(d) Arrangements for the training of personnel to staff institutions concerned with the transfer of technology;

(e) Laying of the foundations for the formulation of national technology plans and policies, and their implementation in the context of the over-all development strategy.

210. Follow-up assistance for the implementation of recommendations by the preparatory missions is being provided.

211. UNIDO assists Governments, at their request, in reviewing, formulating, improving, through comparative studies of national experience and the provision of methodologies and mechanisms, their policies, regarding the development of national technology. Assistance projects start with a survey of the actual conditions in the country concerned, followed by an expert workshop with the participation of local policy-makers. An international meeting of experts and policy-makers from developing countries will be organized to discuss their experiences and arrive at broad guidelines for national action.

212. Judging from the number of requests, national institution-building for the development and transfer of industrial technology is an important element of the technical assistance activities of UNIDO: about 250 projects for this purpose have been implemented. The institutions are both general-purpose institutions, providing services to all industries in such areas as testing, metrology, product development and general advice and information (including the identification of investment opportunities, the preparation of feasibility studies and the evaluation of investment and technological alternatives) and specialized institutions in areas such as iron and steel, leather, textiles, cement, building materials, petrochemicals etc., sustaining the technical capacities of the specific industries they serve. In many developing countries, these institutions constitute the major elements of the scientific and technological infrastructure. UNIDO avoids fixed and monolithic institutional solutions for all countries, and pays particular attention to the effective location of institutions in the governmental structure of each country, and to the formation and maintenance of active links among them and with the decision-making processes in the Government and in industry. A recent survey of institutional infrastructure for industrialization in several developing countries, and the ongoing joint UNDP/UNIDO evaluation of the effectiveness of technical assistance projects in establishing or strengthening industrial research institutes, and their impact, are expected to provide further guidance to UNIDO in its technical assistance activities for institution-building.

213. Current UNDP assistance for technological self-reliance is confined chiefly to developing capacities for undertaking feasibility studies, carrying out repairs and maintenance and enforcing product and process quality control. However, the focus of future UNDP operations for realizing technological self-reliance is likely to shift to the development of capabilities for plant and product design engineering, construction engineering, project management, the adaptation of imported technologies, and the generation, on the basis of the adaptation and assimilation of imported technologies, of new indigenous technologies.

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214. These capabilities should be developed within the framework of well-defined and effective institutions with the necessary skills, know-how and facilities. Consulting engineering firms, which provide plant design and related engineering services, occupy a strategic place in the network of these institutions. Their functions include the identification of all production and auxiliary facilities, the specification of all items of equipment, plant layout, detailed designs and working drawings of construction works, the preparation of bills of quantity and contract documents, the evaluation of bids, the procurement and inspection of equipment, supervision of the installation of plant and equipment and commissioning and start-up. They also undertake, at the option of their clients, the evaluation of operating manuals, the monitoring of construction work, the recruitment and training of manpower, the organization and management of construction and the procurement of materials.

215. Plant designs and related engineering services constitute the most important source of industrial information on alternative product and process technologies, and on alternative sources of proprietary technologies and of equipment. They select and, if necessary, arrange the adaptation of foreign technologies to suit local physical and factor endowments, industrial and technological infrastructure and cultural attributes. They bring about a more effective and speedier diffusion of technology and over a period of time they strengthen the bargaining power of indigenous entrepreneurs through their technological information, knowledge and accumulated experience.

216. They can also help to achieve economies of source diversification in the procurement of plant and equipment. They make a valuable contribution to the planning process in the form of realistic estimates of project costs and gestation periods for the construction of industrial projects, and the realization of related capacity outputs and assessment of linkage requirements. They constitute a vital link between the local manufacturers of plant and equipment and their users.

217. Finally, they provide valuable services to the local industrial and technological research and development establishments engaged in designing new products, processes and equipment in the following areas: the identification of research and development projects of potential commercial value, the building of pilot plants and the fabrication of prototypes, the enlargement of laboratory/bench-scale processes to commercial scale, the engineering of prototypes for commercial production and transference of new product/process technology to the industry users.

218. The technical co-operation programmes of the ILO include activities to provide support for institutions in developing countries, including workers' and employers' associations, concerned with science and technology. Advisers are provided to national councils for science and technology, and to universities; direct support to research centres is given through the subcontracting of research projects. The main emphasis is placed on supporting Governments' efforts in the creation and strengthening of training institutions.

219. FAO supports, on request, national science and technology activities through institutional building on the basis of discussions held with national planners and

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research directors in order to identify national needs. Such support includes guidance in the planning, programming, administration and establishment of appropriate institutions, new programmes, training in research management, information, seminars and other supporting activities. However, as no two countries are alike in their problems, goals, policies and institutional structures, there is no stock solution to the problem of developing national research systems. FAO has assisted some 40 countries over the last decade, either by giving advice on the organization and management of research, or by establishing and co-operating in the operation of national research institutions. It will continue to pay particular attention to the appropriateness of research activities to farmers' problems and to the strengthening of training institutions to provide, at the national, regional or even international level, appropriate frameworks and facilities for the application of science and technology.

220. Over the past 15 years some 60 member States have been advised by UNESCO on the setting up or strengthening of science and technology policy-making (and implementing) bodies. More than 20 countries have adopted new legislation in this connexion following the visits and reports of UNESCO advisory missions and reports.

221. UNESCO is currently co-operating in the setting up or strengthening of national institutions for science and technology through projects in nearly 40 developing countries. The institutions deal with such subjects as science and technology policy and research, management of research and development, building, engineering, mineral exploration, mining, industrial design, public works, biology, chemistry, geology, hydrology, oceanography, seismology, scientific instrumentation, solar energy and arid zones.

222. The Research Capability Strengthening Working Group established under the Special Programme for Research and Training in Tropical Diseases is one example of work done by WHO to build and expand institutional systems in developing countries. The Working Group promotes institution-strengthening and training activities as an essential prerequisite for the development of research capacity. Only national or regional institutions in tropical countries are eligible for Special Programme support, and those with a significant percentage of foreign staff receive support only if such staff members are doing work for which qualified local personnel are not available and if there are definite plans to train local counterparts.

223. Institutions from non-tropical countries are asked to train research workers from the tropical countries and to collaborate with local institutions in strengthening research activities and training, particularly through various types of "twinning" agreements.

224. These institution-strengthening activities focus upon creating a network of centres that will collaborate with the Special Programme in the tropical countries. The centres are intended to be focal points for strengthening the research capabilities of the countries concerned, and should become increasingly capable of performing specific research and development activities. Training will constitute a very important component of the activities of the Special Programme

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network and, whenever possible, the network centres will also be sites for training activities.

225. The World Bank supports institutions that generate information and deliver technology at the national level in developing countries, and provides advice and technical assistance in the creation and operation of such institutions. Bank-financed projects train researchers, promote interdisciplinary research, and strengthen research management and co-ordination, as well as supporting the conduct of research.

226. The primary purpose of the Bank's agricultural research projects is to strengthen national research and extension programmes in developing member countries and to improve the capabilities of the national organizations that manage them in order to provide Governments with better technology, both to increase production and to bring more benefits to the poor. The research components of rural development projects are aimed mainly at increasing agricultural output by strengthening the indigenous capability to generate, diffuse and adopt information required at the farm level. Frequently these projects have units which monitor, evaluate, guide and direct the research programme to focus it on the needs of the smallholder. Over half of the Bank's agriculture and rural development projects now have agricultural research components; the Bank has aided developing member Governments in this way in more than 200 projects in some 50 countries.

227. The Bank is supporting industrial research, testing and a standards institution in one country and is studying the merits of different approaches to the problems of providing information services and technological assistance to entrepreneurs in other developing countries. The Bank has also been preparing as a prototype a project that would provide support to industrial firms for the improvement of their technology. It is supporting programmes in two relatively advanced developing countries for the launching of new products based on local technology in order to strengthen demand for indigenous technology and has helped in the preparation of a project to expand the first venture capital company in another country.

228. The principal assistance provided by ICAO has been the development of regional training institutions or large-scale national training institutions, dealing with various aspects of civil aviation, which, in all its spheres, is highly specialized and technical and, therefore, wholly reliant upon well-qualified technical personnel, both within government departments and within airlines.

229. Within the WMO Technical Assistance Programme experts are sent, at the request of developing countries, to advise on the establishment, organization and expansion of meteorological and related hydrological services. The WMO compendium of the applications of meteorology to economic and social development (see para. 201 above) is directed not only at meteorologists and hydrologists but also at agriculturalists, agronomists, planners, economists and government authorities, among others. WHO also offers technical advice in the form of manuals and guides as well as technical regulations. A large proportion of technical assistance provided from various WMO sources is directed towards the improvement and

expansion of meteorological and hydrological facilities, including the provision of viable modern equipment for the collection, processing, dissemination and archiving of meteorological and hydrological data.

230. National laws and institutions concerned with industrial property are instruments of national policy for development in the field of science and technology. The competent government departments therefore need to be adequately linked, formally or informally, with other departments responsible for science and technology policy and its implementation, and to be able to demonstrate a capability to advise on policy and to execute it effectively. In order to assist in strengthening the relevant institutions in developing countries, WIPO is conducting two studies and a survey designed both to support its continuing programme of advice and assistance to Governments, including training of government officials, and to provide a framework for the international exchange of experience in this field. One study is concerned with existing arrangements and future possibilities in the field of industrial property for the promotion of technological innovation (see para. 204 above); the survey is providing facts about the functions, administration and role in the governmental structure of industrial property offices in selected developing and developed countries; the second study, based on the said survey, will analyse possibilities open to developing countries and suggest functions and structures, both at the national and at the regional levels, with particular emphasis on relationships with other services relevant to the strengthening of technological capacity.

231. IAEA provides direct assistance to individual developing countries in support of policy-making in the field of nuclear power, mainly through planning surveys, analyses of prospects and market surveys. Assistance is also provided in the exploration and processing of uranium ores, programme evaluation, safety evaluation, and other topics of interest to developing countries.

VI. NEW FORMS OF INTERNATIONAL CO-OPERATION IN THE APPLICATION OF  
SCIENCE AND TECHNOLOGY INCLUDING ECONOMIC CO-OPERATION AMONG  
DEVELOPING COUNTRIES

232. International co-operation in science and technology has long been mainly the concern of private or semi-private bodies, organizations, or firms, and their role remains of great importance. However, the magnitude of the cost of modern research, necessitating the intervention of government agencies financed by public funds, the need to co-ordinate activities at the subregional, regional and interregional levels, and the development of national and international legislations, have resulted in a growing role of intergovernmental co-operation in science and technology research, development and transfer. Their intergovernmental structure has led the United Nations organizations, agencies and programmes to develop to a great extent the possibilities of co-operation between Governments in these fields.

233. While during the first years of the United Nations system the co-operation was mainly between developed countries, the accent was soon put on co-operation between developed and developing countries - as stressed in the relevant paragraphs of the International Development Strategy for the Second United Nations Development Decade (see General Assembly resolution 2626 (XXV)). Mutatis mutandis, the possibilities of such formulas as have proved successful between developed - or between developed and developing - countries, are being explored for co-operation between developing countries, this becoming a key element in future international co-operation.

234. The international and global exchange of technological information, and documentation systems to support it, are being developed by many agencies in their respective sectors, to facilitate co-operation between member countries. These programmes, and the links between them, are described in chapter II of the present report.

235. New forms of international co-operation are being developed, particularly at the regional level, as is reflected in the programmes of the regional commission; and in their important role in promoting co-ordination in their regions of the activities of the organizations of the United Nations system. Problems of common interest to the countries of the region are identified, systems are worked out for co-operation, including economic and technical co-operation agreements, and joint activities and investments are promoted in, for example, training and research and development programmes.

236. Though the essence of strengthening the technological capacity of developing countries is provided by action at the national level, much is to be gained by co-operation among developing countries themselves in the context of a policy of collective self-reliance in the field of technology. It is in this respect that regional and subregional centres could have a major impact in promoting the technological transformation of developing countries. Their establishment represents one of the major forms of new international co-operation.

237. UNCTAD, UNIDO, UNESCO and other organizations in the United Nations system have been assisting the countries of the ESCAP region and the ESCAP secretariat in the establishment of a Regional Centre for Technology Transfer, inaugurated in 1977, and in devising and implementing a fully-fledged programme of action in the field of transfer and development of technology. The establishment of the Regional Centre forms part of the programme of ESCAP in respect of the development and transfer of technology, designed to deal with a number of specific priority projects in the field of the application of science and technology to industrialization. These include assistance in the formulation of national science and technology policies, measures to strengthen national science and technology capabilities, the promotion and development of national, subregional and regional institutional machinery, facilitation of the transfer and absorption of technology, and development of the technological skills to implement development programmes. Special attention is to be paid to the development and evolution of technologies required in critical areas, such as food and agriculture, rural industrialization and small-scale industrial projects, and to determining technological requirements for labour-intensive manufacturing processes and for the improvement of basic sector manufacturing performance. The programme components consist of scientific and technological policies and institutions; the development of indigenous capabilities to generate, select and adapt appropriate technology; the transfer of technology from developed to developing countries and among developing countries; and technical information systems. In connexion with the latter programme component, the object is to assist in compiling information on existing technological capabilities at the national and regional levels, and eventually to secure an effective regional information network.

238. With regard to the evaluation, development, use and management of energy resources, the programme component for problem-solving and the transfer of technology consists of assistance to the countries of the region in identifying and solving problems associated with the proper development and management of their energy resources, and in stimulating the use of appropriate new or improved technologies.

239. The organizations of the United Nations system, particularly UNCTAD, UNIDO, the ILO, FAO and WIPO, have also been actively engaged, mainly through country missions, in assisting in the establishment of a centre for transfer and development of technology in the ECA region. On the basis of an ECA report on the country missions, the establishment of the Centre was approved by a meeting of African plenipotentiaries in November, 1977. ECA, in addition to serving on the Council and Executive Board of the Centre, will serve as its interim secretariat until such time as the Centre assumes this responsibility. In fulfilling its many functions, the Regional Centre will give high priority to helping Governments to establish national institutions or centres for the development, transfer and adaptation of technology, to the provision of advisory services on questions such as the identification of sources of technology, choice of technology, unpackaging of technology, the effective use of the international code of conduct, to training and to the exchange of technical information. Related to these would be activities within the secretariat directed to strengthening national machineries for policy-making and planning science and technology.

240. The secretariat of ECA expects that the African Regional Centre for Technology, and the African Regional Organization for Standardization will become fully operational during the period 1978-1979. In addition, other multinational programmes related to science and technology (e.g. for the establishment of centres for marine science and technology) are planned.

241. ECWA has also organized missions in its member countries, and has convened two interagency meetings as part of a feasibility study on the establishment of an Arab centre for the transfer and adaptation of technology. This work takes into account the follow-up activities recommended by the Conference on Industrial Property and Transfer of Technology for Arab States, held at Baghdad in 1977. It is being co-ordinated with the similar activities of ECA, and benefits from full co-operation with other organizations of the United Nations system. It forms part of the ECWA's science and technology programme for the period 1978-1979, which includes activities concerning regional co-operation in science and technology (the promotion of co-operative research and technology projects, programmes and institutions at the national, subregional and interregional levels, and the integration of science and technology planning in the over-all national and regional planning for development), the transfer, development and choice of technology (institutional mechanisms for the transfer and development of technology, and selected aspects of technology choice - the object being to assist in strengthening technological capacities, through the promotion of national policies regarding the transfer of technology and the development of national institutions as well as their regional and interregional linkage and the formulation of policies and procedures for the selection of appropriate technologies), and the application of science and technology in selected sectors (technologies for the development and management of land and water resources, computer technology applications, the application of appropriate technologies in the transport sector, and science and technology at the farm level).

242. UNCTAD and other organizations in the United Nations system have also been associated with the work now being carried out in Latin America with a view to establishing regional and/or subregional mechanisms for the transfer and development of technology.

243. The programme of work of ECE in science and technology is aimed at promoting the exchange of experience between member Governments and formulating proposals for international co-operation. The areas of work within the programme include the exchange of information and experience relating to the transfer of technology through the use of commercial channels, and on models for identifying and transferring technological and scientific developments, and activities relating to measures to promote the transfer of technology between member countries, including studies on institutional, administrative, economic and legal factors affecting the transfer of technology in the region; reviews will be prepared of scientific and technological research in selected problem sectors, such as improvements in existing energy technologies, research on new energy sources and the development of such sources; a study of possibilities for expanding and promoting multilateral co-operation includes the possibility of the preparation of a guide on the organization and management of international co-operative research.



244. UNCTAD is also working on the transfer and development of technology in selected specific sectors of critical importance to the developing countries. Programmes of co-operation are being developed in several sectors, designed to improve the formulation of policies and promote adequate institutional arrangements in developing countries, individually and in co-operation among themselves. The sectors in which work has progressed up until now are pharmaceuticals, food processing, fertilizers, petro-chemicals, electronics, energy, design, engineering and consulting services, telecommunication and capital goods, including machinery and machine tools. In some of these sectors, such as pharmaceuticals, interregional programmes have been mounted jointly with other organizations such as UNIDO, UNDP and WHO. In the majority of these sectors exploratory studies, including country case studies, are being undertaken. The work in some sectors, notably pharmaceuticals, has reached the stage of in-depth studies focused on specific issues identified in the exploratory phase. At a later stage the focus of the work will be on the formulation of policies to strengthen the capabilities of developing countries, including the establishment of subregional and interregional centres by the developing countries in sectors of particular interest.

245. In the context of new forms of international co-operation, an important point of the UNIDO co-operative programme of action on appropriate industrial technology (see para. 28 above), apart from the implementation of specific programmes, is the consolidation of efforts, and the mobilization of world-wide interest, to bring about a fuller and more effective utilization of existing resources. For the mobilization of interest, an international forum for appropriate industrial technology will be held; policy-makers at the ministerial level, practitioners, organizations of the United Nations system, and donor and aid agencies will be invited. A Consultative Group on Appropriate Industrial Technology has held its first meeting and is expected to be convened once a year. Ways and means of promoting international co-operation in this field, particularly at the policy-making level, will be discussed. In January 1977, a round-table Meeting of Ministers of Industry was organized by UNIDO at New Delhi to explore how developing countries could co-operate among themselves to achieve the goals set in the Lima Declaration and Plan of Action on Industrial Development and Co-operation (see A/10112). The specific areas of co-operation identified include the improvement of local technological capabilities; a data bank on the acquisition and transfer of technology, including considerations related to joint purchase of technology; industrial training; the establishment and strengthening of institutional framework; co-operation in applied research and development activities; development of concrete plans for the creation and use of engineering and consultancy capabilities; collective action for negotiating more equitable economic relationships and for the acquisition of technology; and the strengthening of certain reputed technical institutions in the developing countries so as to make them centres of excellence that will provide services to more than one country.

246. The system of sectoral consultations organized by UNIDO, as called for in the Lima Declaration and Plan of Action, represents a new form of international co-operation among all countries. These global consultations between and among developing and developed countries, at governmental as well as private levels, on specific industrial sectors are expected to lead to greater international

technological co-operation and the development of an indigenous technological capacity in the developing countries. UNIDO also promotes, between institutions in developing countries, co-operative and joint research and development activities for equipment suitable for use in such countries.

247. The present and planned contribution of UNDP to TCDC is fully documented elsewhere, particularly in the draft Plan of Action prepared for the United Nations Conference on Technical Co-operation among Developing Countries. Among other things, it will help to promote the economic use of limited human, technical and financial resources through the development of common research and development facilities by developing countries for the autonomous generation of new technologies in selected areas, such as non-conventional energy, biological fertilizers, high-yielding varieties for dry crops, communications etc., which have long gestation periods and require sophisticated facilities and highly specialized skills.

248. UNEP is at present undertaking a major co-operative research project to assess the state of the global environment and its evolution over a 10-year period. This project links research institutions in all regions of the world in a co-ordinated effort to gather, analyse and evaluate scientific information with a view to identifying trends in the various sectors of the environment and to providing a firm scientific basis for programmes of action.

249. In addition to the regular regional meetings of Ministers of Labour, the ILO Industrial Committees provide a unique forum for Governments, as well as employers and workers in specific economic sectors, to meet and discuss problems associated with the choice and application of technology. Although the problems of developing countries have not generally been dealt with separately, the recommendations made by the Industrial Committees in respect of technological change have been developed through tripartite discussions involving representatives from both developed and developing countries. Thus, issues have been discussed which are directly relevant to countries in the earlier stages of development. For example, the Building, Civil Engineering and Public Works Committee has paid specific attention to appropriate construction technology in developing countries and has also discussed the training of managers and workers in the construction industry, particularly in the light of technological change. The Metal Trades Committee has considered, inter alia, the employment consequences of scientific, technological and structural developments in the metal trades of industrialized and developing countries. The Second Tripartite Technical Meeting for the Food Products and Drink Industries will discuss an item entitled "Appropriate technology for employment creation in the food processing and drink industries of developing countries". The Petroleum Committee is to examine the training of nationals as technicians and workers in the petroleum industry of developing countries, including continuous training and retraining in the light of technological progress. The Advisory Committee on Salaried Employees and Professional Workers will consider the effects of technological and structural changes on the employment and working conditions of non-manual workers with special reference to the improvement of working conditions and, in particular, occupational safety and health and ergonomics.



250. For several years, FAO has organized research co-operative programmes on an ecological zone basis, a concept that has since been adopted by other organizations and programmes as a basic framework for international and regional co-operation. For example, in co-operation with UNEP and UNESCO, FAO is carrying out an international programme in the ecological management of arid and semi-arid lands. It is continuing to promote research networks and the sharing of research facilities, expertise and findings, including the joint planning of research and experimentation on crops, livestock, soil, water use, fertilizer mechanization, forestry, fisheries, pest control and food losses, post-harvest technology, farm waste and use of by-products, food and agricultural processing, and improved combined inputs in farming systems among groups of countries with similar problems.

251. Through government co-operative programmes, increasing links with universities and research institutes in both developed and developing countries (e.g. the joint FAO/IAEA programme, FAO collaboration with national aid programmes, subcontracts with universities in developed countries, the establishment of research networks between scientific research institutions and universities within the framework of the European Commission on Agriculture etc.) and through the development of research networks and "outreach" programmes of international centres, FAO invites advanced countries and institutions to develop more scientific approaches and research in regard to problems of importance in developing countries.

252. Linkages with research institutions and universities for the joint implementation of research and training projects, part of the work being done in the developing country and part in the developed countries, with secondment and exchange of staff, contractual agreements for specialized services or facilities etc., are being given high priority by FAO and many other agencies.

253. UNESCO is developing regional networks for scientific research and advanced training, linking institutions and facilities, and co-ordinating programmes in order to orient research to meet regional needs. In the UNESCO intergovernmental programmes dealing with hydrology and the rational utilization and conservation of natural resources and oceanography, the organization helps Governments to co-ordinate their activities in scientific research programmes launched on a global, regional or subregional scale, with the participation of other United Nations agencies (in particular FAO and WMO, and often with the assistance of UNEP). Special mention should be made of programmes calling for co-operation between member States in a well-defined area (the Caribbean for instance), in which, in addition to joint research, a component of training and infrastructure-building contributes to the development of research capabilities in the less advanced participating countries, in part through assistance from the more advanced participating countries and in part through assistance from UNESCO.

254. WHO has developed specialized forms of international co-operation for the promotion and co-ordination of research, particularly at the regional and global levels.

255. The technical units of the organization receive guidance from experts, including the Advisory Committees on Medical Research at the Geneva headquarters

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and in each of the six regional offices; the latter guide the research programmes of their regions, which are linked to a network of governmental and academic research institutions (there are some 500 WHO collaborating centres world-wide). In this way, institutional development is encouraged, and interregional and global collaborative research can be implemented. Priorities of research are established according to the particular needs of each region.

256. Under the WHO Programme of Appropriate Technology for Health, a network of collaborative institutes has been established, comprising centres and institutions involved in the development of health and health-related technology. These institutions carry out research in the development or adaptation of technologies for use in the health field in collaboration with, and on behalf of, WHO. Contracts have been negotiated to carry out research into certain technological areas such as village obstetrics, oral electrolytes for rehydration, vitamin A and anaemia screening, and certain species of immunization technologies.

257. The World Bank, UNDP and FAO are sponsors of the Consultative Group for International Agricultural Research, which finances 11 international agricultural research institutes. The centres have extended their work beyond their original biological research concerns into the areas of economic and social aspects of the improvement of farming systems. One of their aims is to strengthen the capabilities of national programmes without which the international centres cannot be effective. The institutes and programmes are: the International Centre for Tropical Agriculture in Colombia, the International Maize and Wheat Improvement Centre in Mexico, the International Potato Centre in Peru, the International Centre for Agricultural Research in the Dry Areas (to be established in three sites in the Middle East and North Africa), the International Crops Research Institute for the Semi-Arid Tropics in India, the International Livestock Centre for Africa with headquarters in Ethiopia, the International Laboratory for Research on Animal Diseases in Kenya, the International Institute of Tropical Agriculture in Nigeria, the International Rice Research Institute in the Philippines, the West Africa Rice Development Association, and the International Board for Plant Genetic Resources (Genes Board) with headquarters at Rome.

258. In addition, the World Bank, along with the Rockefeller Foundation and UNDP, which has the lead role, has developed a proposal for a new intergovernmental organization to be called "Cotton Development International", which would undertake a programme of research, training, marketing and promotion aimed at improving cotton production techniques and expanding the use of cotton, the most important non-food crop grown in developing countries, in the textile industry. The Bank has also agreed to act as a sponsor, with WHO and UNDP, and as fiscal agent for a special programme for research and training in tropical diseases, which has as its principle objectives the development and application of effective low-cost methods to control tropical diseases, the training of scientists and technicians and the strengthening of research institutions in the countries affected by the diseases, thus increasing their capability to deal with the problem.

259. WIPO is assisting Governments of developing countries in seeking new forms of international co-operation for the sharing of scarce resources of specialized manpower in the administration of their industrial property services, including

the provision of technological information. The setting up and management of intergovernmental institutions in this field also provides an opportunity for regular meetings among the government officials concerned, at which policy questions can be discussed and experiences exchanged.

260. One such institution, whose members are French-speaking countries, already exists; with international co-operation through WIPO and the assistance of UNDP it is now enlarging its functions and services. An intergovernmental agreement has recently entered into force to provide the basis for similar co-operation among English-speaking countries in Africa. In addition, WIPO has been requested by a number of Latin American countries to establish a Latin American data service on industrial property and the transfer of technology; the service will start its operations in 1978.

261. The programme of WIPO includes support and assistance measures for co-operation among developing countries. Guidelines have been adopted for activities to promote and support such co-operation: such activities are closely co-ordinated with those of other organizations and complement, in agreement with them, those of the regional commissions and of intergovernmental regional organizations outside the United Nations system. For example, subregional co-operation in providing patent documentation and information services is closely linked to, and supports, regional centres for the transfer and development of technology established under the auspices of the regional commissions.

262. The IAEA co-ordinated research programmes bring nuclear scientists from developing countries into contact with colleagues from developed countries. A number of laboratories do research on different aspects of a common topic over a three- to five-year period. IAEA gives financial assistance to participating developing countries and pays the travel costs for attendance at research co-ordination meetings. A more extensive form of regional collaboration is the IAEA-sponsored Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology for South Asia, South East Asia and the Pacific, and the Far East.

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