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# PREPARATIONS FOR THE UNITED NATIONS CONFERENCE ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

## Summary of Cross-Organizational Analysis of Programme Activities within the United Nations System in the field of Science and Technology for Development

## Report of the Secretary-General of the Conference

CONTENTS

# INTRODUCTION

## A. Background

1. The General Assembly, at its thirty-third session, adopted a resolution (33/192) requesting the Secretary-General of the United Nations Conference on Science and Technology for Development to submit a report "analysing outputs, gaps and/or overlaps of present United Nations activities in the area of science and technology for development as a background document for the consideration of the draft programme of action, bearing in mind the views expressed by the Committee for Programme and Co-ordination at its eighteenth session".

2. The present document is a summary of the final report of the cross-organizational analysis, which was prepared with the assistance of a panel of consultants, 1/ and is based on tables presented in that report, which provides a fuller and more detailed picture. As several reports focus on the contributions of individual agencies, those reports provide complementary information to the cross-organizational study. The final report which contains details of the relevant programme activities, as well as summary charts showing the interrelations among programme activities of different organizations and specialized agencies, will be presented in its entirety as a background document for the United Nations Conference on Science and Technology for Development.

## B. Conceptual framework and methodology

3. In developing a conceptual framework for the cross-organizational analysis, the severe time limitation for the completion of the study and the complexity of the subject-matter were essential considerations. With respect to the subject of science and technology for development, there is no clear consensus within the United Nations system as to its scope and programmatic substance. The Ad Hoc Working Group on Policy for Science and Technology within the United Nations System has developed a definition, which has been used in the report of the Advisory Committee on the Application of Science and Technology on the harmonization of activities in science and technology in the United Nations system (A/CONF.81/PC/38).

4. According to this definition, specific activities in the field of science and technology include, but are not limited to:

> "(i) Scientific and technological research (R), which means the processes of study, experimentation, conceptualization and theory-testing involved in the generation of new discoveries in the field of science and technology;
>
> (ii) Experimental development (D), which consists of the processes of adaptation, testing and refinement of inventions which lead to practical applicability;
>
> (iii) Scientific and technological services (STS), which represents a mixed group of activities which are indispensable both for the progress of research and for the practical application of science and technology. They collect, process and disseminate the scientific and technological information needed for such purposes;

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1/ G. Jayasuriya (Sri Lanka), J. Odero-Jowi (Kenya), A. Ventura (Jamaica) and A. Zahlan (Lebanon).

(iv) Innovation, which means bringing into being a new product or process and ensuring that new ideas and inventions are used effectively in the national economy. This includes the transfer of technology whereby known products or processes are introduced in countries where they have not been utilized or produced before; and

(v) Diffusion of innovation throughout the productive sector of the economy." 2/

5. The cross-organizational analysis attempted to include not only the activities covered by this definition, but also those implied by the four main objectives of the Conference itself as stated in resolution 2028 (LXI) of the Economic and Social Council.

6. Consequently, the focus of the study has been on those programme activities that stressed the building up of institutions for the purpose of strengthening indigenous scientific and technological capacity. Needless to say, the activities of the United Nations system falling outside the framework of this study make important and useful contributions to social and economic development.

7. With these considerations in mind, the above concepts were used as the basis for the new classifications to be used to categorize the relevant programme activities in the United Nations system.

8. In its final form, the methodology for this cross-organizational analysis considered programme activity under three classifications. The first, listed in the annex as "Classification I - Areas of focal interest", has been designed to respond directly to the main concerns of Governments emerging from the preparatory process of the United Nations Conference on Science and Technology for Development as reflected in the draft programme of action. Consequently, these headings are neither functional nor purely sectoral in nature. Rather they represent a list of issues that are considered to be of fundamental importance to the process of successfully linking science and technology to indigenous national development. The "problematique" - or set of interlocking problems - associated with each of these areas of focal interest is outlined in the introduction to each of the chapters of the main report.

9. A second classification, listed in the annex as "Classification II - Sub-areas", constitutes a modified sectoral classification and has been used to provide sub-headings for the topics listed in classification I. The subheadings were used to further refine and categorize the substantive orientation of programme activities after they had been classified within one of the topics of focal interest. The third classification, listed in the annex as "Means of programme action", summarizes the primary means of action at the disposal of institutions and organizations within the United Nations system.

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2/ Report of the Ad hoc Working Group on Policy for Science and Technology within the United Nations System, first session, 1976.

10. Taken together, these three classifications form the basis for the conceptual framework of the cross-organizational analysis. This conceptual framework can be viewed as a three-dimensional perspective: the two substantively grounded classifications form the basic matrix for the classification and descriptive summarization of relevant programme activities within the United Nations system; the classification of means of programme action provides the third dimension along which programme activities within the United Nations system seek to attain their objectives. Through the use of this methodology, the relevant programme activities were recast in tabular form along functional (as compared to organizational) lines, thereby facilitating a comparative, cross-organizational analysis, in such a way as to give an indication of the cost of the activities undertaken by the various organizations in the system, the absolute and relative distribution of resources by area of activity and the means of programme action, including existing co-ordination and co-operation among the organizations involved.

C. Data for the cross-organizational analysis

11. In preparing their data for submission, many of the organizations were operating under severe constraints due, primarily, to the time limitations of the study. As a result, the data are not always as accurate and as complete as one would have liked. In cases where obvious errors and omissions could be detected, the agencies were contacted and asked to verify their submissions. None the less, certain unavoidable inaccuracies undoubtedly remain in the tables.

12. Several organizations and specialized agencies of the United Nations system were unable to submit data in a form that was fully compatible for review in this cross-organizational analysis. Furthermore, the present budgetary mechanisms of the remaining organizations are not entirely harmonized, thereby permitting some organizations to submit much more detailed breakdowns of programme activities than was possible for others. In the course of the analyses, efforts were made to compensate for the differing levels of aggregation that characterized much of the data submitted for this study. In the light of the preceding comments, however, the actual monetary figures and counts of programme activities presented in the report must be interpreted with some caution.

13. Particular caution should be exercised when interpreting the summaries of budgetary allocations which appear under the areas of focal interest. Though all of the programme activities referenced with respect to a specific area of focal interest incorporate some aspect of work relating to that topic of primary concern, relatively few of these activities have been exclusively budgeted for that purpose. Consequently, only a portion of the total budgetary allocation referenced in any chapter is actually devoted exclusively to the resolution of development problems suggested by the area of focal interest. With these caveats in mind, the data on programme activities can be reviewed as indicative of the relative magnitudes of effort within the United Nations system currently foreseen for a specified area of focal interest.

14. The data collected for this study refer to a two-year operating period (1978-1979) for most of the organizations and specialized agencies represented in the study. For some organizations, including UNESCO, however, the two-year cycle is slightly different (1979-1980), and for others the cycle is longer (UNDP, UNEP and IMCO).

## D. Limits of the cross-organizational analysis

### 1. Evaluation of adequacy and impact

15. The cross-organizational analysis was designed to provide an overview of programme activities within the United Nations system concerned with science and technology for development. It has sought to indicate the distribution of programmatic effort according to the two classifications discussed earlier, and to review the means of programme action and the associated budgetary resources. Whereas this methodology can suggest the relative magnitude of effort in each of the indicated areas of focal interest, it was not conceived for the purpose of evaluating the adequacy or impact of a single programme or programme activity. Thus, the cross-organizational analysis is not an evaluation study in the sense of a benefit-cost analysis or a management effectiveness study.

16. Furthermore, at the level of the United Nations system as a whole, it has not been the intention of this study to examine the over-all "capacity", or capability, of the organizations and specialized agencies of the United Nations system to provide a particular set of services. It is assumed that the Member States will prepare their own assessments as to whether the relative intensity of activity is in agreement with their respective perceptions.

### 2. Policies and procedures of the United Nations system

17. Within the framework of the present cross-organizational analysis, it was not possible to undertake an examination of the general policies and operating procedures of the United Nations system, except in so far as they have been represented as discrete programme activities. Thus, the study has not reviewed policies for the recruitment of consultants or the granting of fellowships, even though these two issues have a significant impact on the development of indigenous scientific and technological capacity. Similarly, the study has not examined directly the extent to which contracting and consulting firms from developing countries are intentionally incorporated into the design and execution of development projects.

18. Finally, the cross-organizational analysis has not reviewed the operations of interagency boards, joint planning groups, inspection committees, or other such mechanisms that operate outside the realm of discrete programme activities.

## E. Gaps and overlaps

19. The terms of reference for this study included a specific directive to examine gaps and overlaps in the programme of the United Nations system. It is important to present a concise idea of the type of gaps and overlaps that may be examined on the basis of the selected methodology.

20. A gap occurs when an area of activity that is considered to be developmentally important is either not covered by any programme of the United Nations system, or receives a disproportionately low level of programmatic emphasis. Thus, by mapping the actual activities of the system into a schema of what ought to be done, the gaps begin to emerge. With respect to the present study, the areas of focal interest, represented by classification I, and the sectoral sub-areas, represented by classification II, suggest the matrix of activities of what might be done to strengthen the application of science and technology for development.

The identification of gaps, therefore, comes from a reasoned judgement about the relative distribution of programme activities across the conceptual matrix represented by classifications I and II.

21. Turning to overlaps, the fact that different agencies are concerned with technological problems arising from the same sector need not imply an overlap in the activities of the system. Any scientific or technological issue may be examined from different directions, or at different times, by the several agencies of the United Nations system; the diversity of approaches and perspectives may actually contribute to the enrichment of the system's understanding of the problem area. Thus, to establish a bona fide overlap is a matter of considerable difficulty and can be performed only on the basis of an elaborate analysis of project outputs and effects. The present cross-organizational analysis was not designed to undertake this type of analysis.

22. As with the issue of gaps, however, one may address the question of possible "overlaps" by carefully weighing the relative distribution of programme activities across the conceptual matrix represented by classifications I and II. In this manner, tentative conclusions on the question of "overlaps" may be derived, though it should be re-emphasized that a definitive response is not possible on the basis of the present data.

# I. POLICY-MAKING FOR SCIENCE AND TECHNOLOGY

## A. Statement of the problem

23. A major challenge facing developing countries is the assimilation and utilization of science and technology as productive instruments in the attainment of national development goals. Experience over the past three decades has demonstrated that there is no universal agreement regarding the best measures to adopt, or the most productive paths to pursue. Some Governments, however, are experimenting with the view that the process of scientific and technological development may be consciously accelerated through the utilization of policy analyses and planning procedures.

24. The preparation and implementation of science and technology policies applicable across all sectors involved in the development plan call for institutional facilities and analytical capabilities that are frequently lacking in developing countries. The present accounting methods in many of these countries may hamper the data acquisition necessary for analytical studies. and traditional management techniques may preclude innovative approaches and the effective monitoring of new programmes. Furthermore, the scientists, technologists and policy-makers involved with science and technology policy-making may lack access to information from the industrialized world, and are therefore hard pressed to keep abreast of new developments that would be of direct benefit to them.

## B. Activities relevant to the problem area

25. The specific activity of policy analysis, planning and policy formulation involves small institutions that need to be staffed by well trained and broadly experienced individuals. The design and establishment of such science and technology policy-making bodies is of considerable importance to developing countries. Although in principle, such a policy-making body need be established only once in each country, in reality such institutions undergo continuous change,and there is a persistent need to strengthen, develop and assess their institutional capabilities. External assistance is frequently helpful in these matters.

26. The preparation and training of persons capable of staffing science and technology policy-making bodies is often a difficult problem since, at the present time, relatively few institutions provide formal education in the field of science and technology policy-making. As a consequence, policy-makers in science and technology have generally acquired their expertise through practice. Thus, additional training and the occasional assistance of outside expertise can often prove beneficial to science and technology policy-makers in developing countries.

27. Science and technology policies are directed towards the attainment of long-range and complex national goals which require the gradual, though systematic, modification of current practices. In many instances the conceptualization and specification of a science policy is the function of the science and technology policy-making body, but its execution and monitoring are assigned to units of ministries, universities, industrial planners and R and D institutions. Thus a major function of science and technology policy-making is the identification of practical ways of achieving complex objectives. This requires co-ordination and co-operation through joint committees and working groups which can serve to channel information and integrate the over-all process.

28. The development of strong information channels is a vital function for the development of science and technology policies depends, not only upon a sophisticated appreciation of the problems facing a country, but also on an understanding of technical issues and their implications for readjustments in individual sectoral development policies. For example, the planned reliance on new technologies for the exploration and assessment of natural resources may have broad implications for a national education policy and the associated manpower planning.

29. Finally, science and technology policy-making should be viewed as an activity which proceeds at several levels simultaneously. Comprehensive national policies for science and technology are necessary to provide coherence and direction for developing countries with limited resources and immediate development objectives. In addition, though, it is important to develop sectoral policies in which technological planning and forecasting may play a larger role than that of science and basic research. Consequently, when proceeding with the formulation of its national policy for science and technology, a developing country may have need of assistance and suggestions from individuals and organizations with a sectoral competence as well as those who view the development process from a broader perspective.

### C. Findings of the cross-organizational analysis

30. At the level of developing and reinforcing institutions for the formulation and monitoring of national science and technology policies, there appeared to be reasonably good coverage on such activities as establishing and advising national policy-making bodies, designing and executing supporting studies touching upon both methodological and substantive issues, and the promotion of regional and international co-operation through the holding of meetings and conferences. The work of UNESCO figures prominently in these areas, with programme activities of UNCTAD and UNIDO being referenced as well.

31. The data on programme activities at the sectoral level was less clearly oriented towards policy-making per se, making it somewhat difficult to draw conclusions on these topics. On the whole, however, it appeared that the sectorally based programmes for science and technology policy-making were less well developed than those at the comprehensive, national level.

32. In general, it appeared that there were three major functions round which the United Nations system could most usefully concentrate its efforts. These include:

(a) Assistance in the preparation of analytical policy studies;

(b) Provision of additional opportunities for the training of senior staff who could assume key policy-making positions;

(c) The harmonization of the science and technology policy-making activities within the United Nations system as an illustrative example of how science and technology policy-making is effectively related to other activities.

33. In particular, comparative analyses of the policy-making experiences of selected developing countries would be a significant contribution of the United Nations system. The utility of these studies would be substantially increased if the analyses contained constructive criticism as well as narrative descriptions.

34. The establishment on a sound base of the proposed International Institute for the Planning of Scientific and Technological Development should contribute to the development of national manpower in the field of science and technology policy-making. It remains to be seen whether this activity, proposed by UNESCO, will take place on a sufficiently high level and large scale to supply the required personnel.

## II. THE CHOICE AND ASSESSMENT OF TECHNOLOGY

### A. Statement of the problem

35. As recently as ten years ago, the problem of developing criteria for the choice and assessment of technologies would have been viewed largely as a techno-economic engineering problem. Given a specified productive sector with a set of development targets, the problem of selecting the most appropriate technologies for use in attaining those targets would have resolved to one of reviewing the existing "best practice" technological solutions and then selecting that package of equipment and associated skills that would meet development targets and yet remain within the existing resource constraints. This vision of technological development has great appeal in that it presents itself as functional, precise, and subject to rational management control. Furthermore, the basic optimization model rooted in neo-classical economic theory would tend to support this restricted view of the process of assessing and selecting technologies.

36. More recently, however, planners and decision-makers have been increasingly sensitive to the environmental and social effects of the implantation of new technologies, and these factors, too, are beginning to influence the choice and assessment of technologies. Experience has shown that the social and environmental effects of ill-suited, advanced technologies can involve substantial, though indirect, costs to project implementation. These social and environmental "costs" are difficult to evaluate in an explicit manner and, as a result, the predicted net benefits of major technological projects may be inadvertently overstated.

37. Finally, technological choice is subject to direct social evaluation in the form of political judgement and development planning. A nation's self-image and its vision of the future will greatly influence the options it chooses to exercise in its technological, as well as its social and political, planning.

38. In summary, the assessment and selection of technologies extends well beyond the consideration of such traditional criteria as technical reliability on the relative costs and effective supplies of "labour" and "capital". Depending upon the case at hand, additional criteria could include: the scale and capacity of current "best practice" engineering solutions; the local availability of raw materials and intermediate goods; the characteristics of the products to be generated and their potential effects on local tastes; the degree of competition in the international market; the availability of local financing and the associated interest rates; the potential for adverse social and environmental effects; and the development objectives of the national development plan. Consequently, the choice and assessment of technologies extend well beyond those of a technico-economic analysis; they necessitate careful reflection and enlightened social and political judgement.

### B. Activities relevant to this problem area

39. The preceding discussion of the general aspects of the choice and assessment of technologies suggests that three general categories of programme activities would serve to facilitate progress in this area. These would include:

(a) the collection and dissemination of information concerning existing, alternative technologies;

(b) the evaluation of technologies within specific contexts, and complementary research on the improvement of evaluation techniques; and

(c) research and development work to upgrade or generate new, contextually appropriate technologies for use in developing countries.

40. With respect to information concerning the choice and assessment of technologies both the complexities of economic theory and the realities of practical decision-making point to the need for more complete information concerning the extent of currently existing technological alternatives. Programmes that would assist in the dissemination of information relating to technological choice and assessment would fulfil a vital function in this field, provided that the prospective users were aware of such systems and were in a position to make use of them.

41. A traditional mode of programme activity for the organization of the United Nations system is the provision of technical assistance. Within the present context, technical assistance could be of direct benefit in the actual evaluation of proposed technological projects, and most particularly in the training of planners and technicians who could undertake such evaluations on a regular basis.

42. Within the methodological realm, the bulk of the work on technology assessment in developing countries is being conducted on a theoretical level that touches only directly upon actual routine, planning and management activities. The modification and refinement of benefit-cost techniques, and of related methodologies that could treat more explicitly the social and cultural dimensions of technological change, would be of great benefit to analysts and decision-makers in all regions of the world. Finally, such methodologies and new skills should be tested and refined in a variety of cultural and political settings so as to ensure their potential for broad applicability.

### C. Findings of the cross-organizational analysis

43. There are approximately 130 activities which touch upon the choice and assessment of technologies. These entries are unevenly distributed across the sectoral subheadings with as many as 50 reported for natural resources, 35 for agricultural development, and 21 categorized as having general coverage. By contrast, only 14 fall under industrial development, 5 correspond to housing and human settlements, and none apply to the development of health services.

44. With respect to the means of programme action, the emphasis is clearly placed on studies and conferences with technical co-operation projects being cited quite frequently as well. Third in frequency of over-all reference is education and training in developing countries, with education and training in developed countries cited in fourth rank (out of eight).

45. In terms of the functional types of programme activities in this area, the most typical project is that which seeks to provide information on the range of technological choices available within a given field of scientific and technological activity. Such projects often summarize recent developments in a scientific or technological field through publication of newsletters and bulletins and seek, thereby, to inform scientists, engineers, and decision-makers in developing countries of the range of technological possibilities open to them. Several of

these programme activities address themselves to the assessment and evaluation techniques.

46. Thirdly, it appears that comparatively few of the programme activities reported for this cross-organizational analysis involve the explicit evaluation or assessment of technologies and technologically oriented projects. In the light of this finding, one could argue that more of the scientific and technological programme activities of the United Nations system should address themselves directly to the task of evaluating their work in terms of the needs and priorities of the developing countries, and that the developing countries could join them in pursuing this objective.

47. Though the methodologies for performing economic and environmental assessments cannot be held to be perfected, they are considerably more advanced than those which treat the other potential criteria for the choice and assessment of technologies. It should be noted, therefore, that exploratory work is proceeding in other related areas, such as the assessment of the social and cultural effects of technological development.

48. Finally, as is discussed in chapter IX of this report, an immediate and practical concern within developing countries is the training of local specialists who might progressively undertake the choosing and assessment of technologies on behalf of their own Governments and productive enterprises. Though some organizations and specialized agencies of the United Nations system appear to have stressed the training of scientists and technologists from developing countries as a means of programme action, it seems that more could be done in this respect. In the light of the present analysis, it appears that this means of programme action should be given renewed emphasis as the United Nations system, as a whole, reinforces its efforts in the systematic conduct of programme evaluation.

49. As was noted, there is a markedly uneven distribution of programme activities across the sectoral subheadings within this chapter. Taking into account the differing levels of aggregation that characterize the descriptions of programme activities, it nevertheless becomes apparent that the relatively small number of entries for the choice and assessment of technologies for industrial development, transport and communication, protection of the environment, and housing and human settlements is indicative of a comparatively low level of activity in these fields. Consequently, there would be a case for the United Nations system to devote more of its energies to the choice and assessment of technologies relevant to the needs of developing countries.

## III. TRANSFER AND DEVELOPMENT OF TECHNOLOGY

### A. Statement of the problem

50. The process of economic development means that to a great extent developing countries need to acquire the technological capability required for the mass production process characteristics of industrial societies. For this purpose, it is not enough that they have access to foreign technology via the utilization of consulting and managerial services in industrialized countries. They must, in addition, develop an indigenous capability commensurate with their needs. In order to achieve this objective, developing countries require large resources of capital and skilled personnel, as well as access to the existing range of technologies under equitable and favourable conditions. This latter problem is closely related to questions of property rights and of control over their utilization and to the ability of developing countries to negotiate successfully with the suppliers of such technologies.

51. Because of differences in the availability of skilled personnel, labour and capital, and hence in their relative costs, the most recent and advanced technologies are not always best suited to conditions in developing countries, and adaptations or different technological solutions involving different mixes of the factors of production that have been evolved in some developing countries might correspond better to the over-all development policies of other developing countries. Consequently, the transfer of technology among developing countries might, in many cases, be as important as the transfer from industrialized to developing countries.

### B. Activities relevant to the problem area

52. The recent United Nations Conference on Technical Co-operation among Developing Countries (Buenos Aires, 30 August - 12 September 1978) demonstrates the international community's awareness to this issue. The Buenos Aires Plan of Action, contained in the report of that Conference, provides a blueprint for action by Governments and international organizations in this field by emphasizing the need to make the greatest possible use of local capabilities in the design, formulation and execution of technical co-operation projects, as well as the need for the agencies in the United Nations system, if they have not already done so, to reorient their internal policies and procedures in order to respond adequately to the principles and objectives of technical co-operation among developing countries.

53. Increasing attention is being given to the establishment of national and regional centres for the transfer of technology within the context of the formulation of technology policies in developing countries. Such centres assist in the evolution of technology plans and policies and oversee their implementation while helping to identify technologies that correspond to the physical constraints and socio-economic considerations of the neighbouring countries. In addition, these national institutions need to undertake or arrange for the execution of feasibility studies concerning a variety of techno-economic aspects such as the availability of raw materials, skilled personnel, existing patent rights and payments and equipment reliability, the range of suppliers who will market and service equipment of comparable specifications, and the likelihood of undue dependence on foreign sources of supply for raw material or spares.

54. All too often in the past, activities concerning the transfer and development of technology have been geared to the maximization of production with little or no concern for the social and environmental consequences of technological choices. In more recent times, however, increasing consideration has been given to the environmental consequences of technological options, to the working environment, to health, and to the plight of rural populations in many areas. Inevitably, this growing awareness is gradually being reflected in the development, adaptation and consequently the transfer of technology.

55. Issues concerning the transfer and development of technology are closely related to the availability of skilled personnel and of an infrastructure for the promotion of science and technology policy, and cannot, therefore, be considered in isolation. The matters discussed in other chapters, notably chapters I, II and IX, are highly relevant to this analysis.

56. In view of the problems and opportunities indicated above, the following types of areas appear to be amenable to international action:

(a) Fostering of discussions and negotiations concerning property rights and the code of conduct for the transfer of technology from industrialized to developing countries;

(b) Fostering of negotiations and agreements between investors and owners of technological know-how and recipient developing countries for the utilization of technologies and establishment of legislative systems in developing countries to regulate such relations;

(c) Facilitation of transfer of technology between developing countries themselves;

(d) Creation and strengthening of institutions designed to facilitate the transfer of technology and assistance in the channelling of technological transfers;

(e) Ensuring that policies and decisions concerning the assessment and choice of technologies for specific projects lead to an actual transfer of technology in the sense of increasing the indigenous capability of developing countries.

## C. Findings of the cross-organizational analysis

57. The available data indicate the existence of a concerted effort on the part of the United Nations system to provide suitable fora for the discussion of issues concerning the ownership and flow of technology from industrialized to developing countries. The activities of UNCTAD and WIPO in this area are so interrelated that there is increasing overlapping and duplication. Special attention from the governing bodies of these organizations might be required in order to ensure the continued complementarity of their activities. The data also show that the system is responding to requests for assistance in the area of legislation and agreements, which is so critical to questions of technology transfers.

58. The available data also show that the system is engaged in an important technical co-operation programme directly related to the transfer of technology in various sectors of the economy and to the environmental and social aspects of development. Nevertheless, the number and level of expenditures in such projects are only a fraction of the total expenditures in technical co-operation activities intended to assist countries in the development and production of agricultural commodities, raw materials and manufactured goods. Although such projects might not be geared directly to the transfer of technology, they nevertheless have important implications for the achievement of such transfers.

59. It was not possible, within the scope of the report, to evaluate the extent to which such projects carry an element of technological transfer within them. It can be stated, however, that if the system is to have a significant impact on the transfer of technology to developing countries, it will require a concerted effort to include such transfers as explicit goals of all projects beyond those that are specifically designed for such purposes. Only in this way can the system maximize its efforts in this area in relation to its over-all capacity to assist Governments in this and other areas.

60. The role of the United Nations system in the area of technical co-operation among developing countries is that of a catalyst through which Governments are assisting in defining areas in which such co-operation can be brought about or strengthened. Essentially, therefore, the efforts expended in this area are found at the country level where already large and increasing sums of money are being allocated for this purpose. To be effective, the contribution of the United Nations system in its supporting role need not be large in monetary terms. At any rate, increasing impetus is being given by Governments to this type of co-operation and thus a higher level of expenditures by the system can be expected in this field.

# IV. STANDARDS AND METROLOGY

## A. Statement of the problem

/The summary text of this section has been omitted because of the limited time available for translation and reproduction. The subject is covered in the full text of the report, which will be made available in a conference room paper./

# V. LINKAGES BETWEEN PRODUCERS AND USERS OF RESEARCH AND DEVELOPMENT

## A. Statement of the problem

61. Studies within the industrially advanced economies have led to the conclusion that among firms and research institutes of equal technical capability, those that are consistently more successful at research and innovation are being characterized by the maintenance of close and continuing communication between the scientists and technicians involved in the R and D efforts, on the one hand, and the groups of individuals or enterprises targeted for use of the results on the other. This continuing, two-way communication process seems to be essential to the formulation of a common definition of the problems to be resolved and to the clarification, for both parties, of the associated potentials and limitations of the activity. Consequently, the development of strong and flexible linkages between the producers and users of research and development would seem to be one of the priority challenges facing developing countries in their drive to reinforce their indigenous scientific and technological capacity.

62. The general absence within developing countries of extensive linkages between producers and users of research and development can be traced, in large measure, to the historical process through which research and development activities have been introduced. During the period immediately following independence, those enterprises and research institutes that were in place and functioning had been founded under the direction of the former metropole. As development programmes took shape and new institutions were built up, they were often planned on a sectoral basis, leaning heavily on financing and expertise from outside. Thus the specialized training required to operate and maintain these new institutions derived, once again, from the industrially advanced countries, and along with it was acquired the implicit set of priorities and research concepts that dominated professional thinking in the northern hemisphere. Expansion of the educational system tended to reinforce this trend as specialized training and career opportunities frequently emphasized the topics and research approaches that dominated professional interactions in the developed countries. In addition, until recently, the major avenues for both professional recognition and financial reward have led outward towards the institutions and markets of the industrially advanced world rather than horizontally with a developing country or group of developing countries.

63. The policy-maker in a developing country faces the doubly difficult situation of lacking at present (a) a set of historically based, horizontal linkages among the producers and users of research and development and (b) a matrix of financial and career incentives which would act to bring these groups together. Consequently, policy initiatives in these areas must not only serve to establish the institutional mechanism through which these desired linkages might function, but must also establish a set of attractive and acceptable incentives that will bring such linkages to life. Policy initiatives in either area will most likely prove to be difficult at best, but unless the two are dealt with together, the establishment of linkages between the producers and users of research and development will have difficulty evolving as a self-sustaining feature of the national development process.

## B. Activities relevant to this problem area

64. At the level of broad governmental intervention, science and technologies policies, in harmony with the national development plan, could act gradually to reorient the focus of research and development work within the country. The publication and dissemination of studies showing priority areas of research and development within the economic and social spheres would serve as a signal to researchers, pointing out areas in which the nation's needs are greatest. In a complementary fashion, the development of skill profiles for the country's technically trained work force (surveys of scientific and technological potential) may underscore the areas in which the talent and human resources exist for the establishment of new R and D programmes.

65. Operating at the level of the individual scientist and engineer, the Government might make travel grants and traineeships available as means of building up expertise in selected priority areas. Furthermore, by fostering the establishment of professional organizations, newsletters and technical journals concerned with topics of direct consequence to the society, its economy and its development programme, the Government can provide yet another set of mechanisms by which linkages can develop among the nation's scientists and engineers and the organizations and institutions that could make use of their talents.

## C. Findings of the cross-organizational analysis

66. As part of their regular programme activities, the organizations and specialized agencies of the United Nations system have undertaken a variety of programmes that touch upon the issue of linkages between the producers and users of research and development. Under its programme in science and technology policies, UNESCO has undertaken a number of methodological studies of needs and priorities for the purpose of identifying the potential contributions of scientific and technological specialities for diverse, sectorally based development programmes. The surveys of scientific and technological potential seek to establish national registers of R and D talent and ongoing programmes as a means of facilitating both present access to research results and further planning of development-related research programmes. Support to professional organizations such as the engineering organizations grouped in the World Federation of Engineering Organizations is also relevant in this context.

67. Both FAO and WHO have developed and maintained extension services whereby the results of agriculture and medical research have been disseminated at the points where they are needed most. These extension services have also served to collect information concerning the feasibility of newly developed concepts and have provided guidance into areas where new research might prove profitable.

68. UNIDO has launched a programme for the development of industrial innovation centres to serve as institutional resources for the productive sectors of developing countries. UNIDO is also creating an integrated system of technological services to improve the technological performance of small and medium-scale industries.

69. UNCTAD is exploring the legal questions surrounding the transfer of technology, including the so-called "unpackaging" of technology so that designs and research talent of local origin can be used in conjunction with the equipment and material coming from the industrially advanced countries.

70. In abstracting from the project level to assess the broad coverage of programme activities in this area of focal interest, it appears that the present balance of programme activities could be improved. In particular, it appears that better coverage might be warranted in the areas of industrial development, natural resources and energy, protection of the environment, and housing and human settlements. When it is recalled that the total number of programme activities identified for this area was rather limited (less than 40), a case could be made for expanding programme activity in this area on a system-wide basis. If such an effort were to be entertained, the reinforcement of relevant institutions in the developing countries would be a priority activity.

## VI. APPLICATION OF TECHNOLOGY AND PROJECT IMPLEMENTATION

### A. Statement of the problem

71. The harnessing of scientific and technological knowledge for the welfare of their people is an important objective of all countries. The nexus at which this knowledge is applied into such useful forms as systems providing clean water, rural electrification schemes, irrigation, drainage projects, transportation, networks, industry and hospitals is at the project level. In the process of conceptualization, planning, designing and executing a project, there is a need for professional manpower organized and equipped in specialized institutions. The degree to which a country possesses these capabilities determines the character and extent of its self-reliance in science and technology. The problem that often faces developing countries is that indigenous institutions may fall partially or completely short of providing the necessary technical services to design and carry out a desired project.

72. Governments often face a difficult choice as to whether to depend on indigenous institutions that lack advanced technical experience or to grant a turnkey contract to a foreign firm which will assume full responsibility. In the latter case, the execution of a project through international contracting may lead to little or no strengthening of the indigenous institutions - or it may considerably strengthen the local institutions, depending on what modalities are used for carrying it out. The experience of a number of developing countries has shown that the execution of projects is in fact divisible, and that projects are generally subcontracted to a large number of firms by the prime contractor. Developing countries conscious of their technical capabilities could design their projects in such a way as to utilize their indigenous capabilities as subcontractors, and at the same time be certain of successfully completing their project on schedule.

73. Indigenous capacity to apply technology is secured through systematic accumulation of skills and experience by consulting, contracting and R and D institutions. Each project provides an opportunity for strengthening or weakening these capacities. The technology selected for solving a particular problem is in itself dependent on the persons involved in the conceptualization of the problem. National engineers acquire the capacity to utilize the resources and opportunities optimally if their expertise is given a chance to evolve. Through years of activity a society evolves an interactive relationship between the problems it faces and technical institutions capable of solving them. For obvious reasons such relationships cannot develop between a country and foreign technical institutions whose technological and cultural roots are in another society. Overdependence on foreign expertise results in a distortion and unbalanced development of the economy, and critical areas are left unattended.

### B. Activities relevant to the problem

74. The sequence of functions involved for capital-intensive and substantial development projects is the preparation of feasibility studies, engineering design, project design, selection and procurement of machinery and equipment, process research, execution of the project (civil works, erection and installation

of equipment,testing, commissioning and operating), management of production, maintenance, and inventories of spare parts. However, everywhere - and especially in developing countries - a sizeable proportion of production is by small-scale industries and individual farmers so that extension services in both agriculture and industry are considered under this topic as being a complement to the sequence of functions involved for substantial development projects. All these functions must necessarily depend on exogenous functions which consist of the supporting services of professional organizations, universities, R and D centres, testing laboratories, equipment manufacturing and of labour training institutions. Organizations in the United Nations system can also play an important role in ensuring a linkage between the endogenous and the exogenous functions.

## C. Findings of the cross-organizational analysis

75. There are some 350 programme activities relating to the application of technology. Over a third of these activities come under natural resources, and almost 50 under health. Other key areas in the context of the application of technology - industrial development, agriculture, forestry and fisheries, transport and communications, and housing and human settlements - contain considerably fewer entries.

76. In terms of means of action, the main emphasis is on technical co-operation and on studies and meetings. Training in developed and developing countries occurs in about equal numbers of projects. Slightly fewer entries refer to pilot and demonstration projects.

77. Analysis of the data shows that there are three different sets of activities relating to the application of technology. In the first set -which comprises by far the largest number of projects - the activities include the application of technology in general, for example, the work of UNIDO, in promoting the development and application of indigenous technologies; in the third set, the purpose of the project is the application of a specific technology, for example the FAO project for improving cropping systems for rain-fed areas.

78. The data provided in the tables relating to natural resources including energy and to industrial development, where most of these activities occur, do not indicate the extent to which indigenous institutions are used for implementing projects, but they do show that a rather large proportion of the projects focuses on the building of local institutions. The second set of functions related to production by small-scale industries and farmers; the importance of extension functions in both agriculture and industry has been emphasized. In the section on agriculture, forestry and fisheries, the data show major efforts, especially by FAO, in agricultural extension activities. Many fewer entries seem to refer to extension activities in industry.

79. It should also be mentioned that since there are no data on World Bank and IDA grants and loans in this study, the information presented in this chapter is far from being comprehensive.

80. A further concern indicated in the statement of the problem was the need for training in developing countries. The analysis of the data shows that there is a considerable emphasis on training in both developing and developed countries, with training in developing countries occurring more frequently in the chapter on agriculture, fisheries and forestry, and training in developed countries being much more frequent in the area of natural resources and energy. It appears that in the latter area there could be more emphasis on training in developing countries.

## VII. INFORMATION SYSTEMS

### A. Statement of the problem

81. One of the essential components of any development-oriented activity is the acquisition and analysis of timely, accurate and appropriate information. Experience has shown that the successful execution of a project is often as much a function of the availability and accuracy of planning and technical information as, for example, the adequacy of the project budget or the efficient use of equipment and personnel. The importance of information to activities in science and technology for development is considerably greater than in other areas in that the information component of such programmes is often their most distinctive feature. Analyses of the process of the transfer of technology often conclude that the most difficult task is not the physical installation of equipment in a developing country, but rather the establishment of a continuing flow of usable information relevant to the selection, operation and maintenance of technologies commensurate with the needs and growth potential of the local economy.

82. The importance of information resources has been repeatedly underscored. Yet, as experience amply demonstrates, the development and utilization of information systems, particularly at the global level, has proven to be an exceedingly complex undertaking. Even at the national level, one can identify a recalcitrant set of problems that reflects many of the elements of the more general problem of economic and social development. In particular, the national potential for the efficient use of scientific and technological information is itself a function of the existing scientific and technological capacity. Consequently, until research programmes and technological projects have advanced to the point where the need for additional information has been both generated and recognized internally, an independent, external effort to make such information available will go largely unrewarded. Furthermore, it is not so much the quantity of information which is a determining factor in the useful application of science and technology, but rather the suitability of that information with respect to the specific problems at hand.

83. The problem is compounded by the fact that most Governments, particularly of developing countries, have not found effective ways of coping with the rapidly increasing flow of information in the broad area of science and technology.

### B. Activities relevant to this problem area

84. Member States wishing to begin a conscious programme of updating their information-processing capabilities might undertake a thorough inventory of existing information resources, both traditional and modern. This inventory would provide the basis for designing the initial policies and plans for a national information network. A modest beginning in this area was made by regional commissions when their studies of information resources were conducted on behalf of the Secretary-General of the United Nations to determine the feasibility of establishing the information network for science and technology.

85. A second area for activity would be to provide assistance in the development of the legal, institutional and financial basis for national information networks. Experts and consultants, operating within programmes of the United Nations system, could provide useful backstopping expertise in this effort.

86. Thirdly, in order to concentrate relatively limited information-processing resources on the support of priority development programmes in science and technology, an oversight group, or policy-making body, for scientific and technological information, could be established. Such an oversight group would seek to identify the most pressing needs for scientific and technological information, and outline the most effective responses. As information is most useful when its need has been recognized internally, the organizations and specialized agencies of the United Nations could assist developing countries in the establishment of such national oversight groups, and in the launching of their initial programmes.

87. In view of the existence of broad similarities in the profiles of national information needs, both regional and international co-ordination of scientific and technological information systems could prove highly beneficial as well as cost-effective. Co-ordination functions of this type have long been featured within the programme activities of the United Nations system and would appear to have a role to play in this field as well.

88. Finally, as was mentioned earlier, there is a clear need for skilled personnel, as well as equipment and facilities, for the strengthening and extension of national and regional information systems. Through the provision of fellowships and development assistance grants and loans for the training of information specialists, and the extension of grants and loans for the provision of materials and equipment, the organizations of the United Nations system could support the developing countries in their movement towards the establishment of a self-sustaining, indigenous capability for the acquisition and processing of scientific and technological information.

### C. Findings of the cross-organizational analysis

89. There are approximately 100 programme activities relating to information systems for science and technology. There are over 30 activities relevant to agriculture, forestry and fishing and 40 relevant to general coverage, but less than 10 relevant to basic sciences, the protection of the environment, and natural resources and energy.

90. With respect to the means of programme action, the emphasis, as expected, is placed upon the collection and dissemination of information and upon technical assistance, including expert missions. In the light of the aforementioned need for additional trained personnel in developing countries, it should be noted that approximately one fourth of the reported programme activities list education and training in developing countries as a means of programme action.

91. An attempt has been made to analyse the cross-organizational data on information systems with respect to central orientation of the programme activities as described in the agency submissions. In terms of the project descriptions submitted for the analysis, it appears that there are four such central orientations: (a) the development and maintenance of specific information systems and their supporting infrastructure; (b) the regular publication of abstracts, newsletters and other technical documentation; (c) the monitoring of activities in specific fields of scientific or technological activity and the publication of directories and inventories; and (d) technical co-operation projects designed to build up local infrastructure in developing countries. More than half fell under the first of these subheadings, with the bulk of the rest oriented towards serial publications and directories. Comparatively few projects seemed to be focused on technical assistance in the form of building up local institutions and infrastructure, the UNESCO UNISIST programme activities forming a noticeable exception. Given the need for additional infrastructure and trained personnel in developing countries, a case could be made for strengthening the activities of the United Nations system which focus on the reinforcement of information systems in developing countries.

## VIII. POPULARIZATION OF SCIENCE AND TECHNOLOGY

### A. Statement of the problem

92. It is increasingly recognized that an essential aspect of the development process includes the evolution of cultural perspectives and popular attitudes regarding science and technology. On the one hand, cultural and social values are gradually altered to fall into line with the needs deriving from social and economic progress in society; on the other hand, it is now broadly recognized that positive attitudes within the populace on science and technology serve to enhance the economic and social development of societies. It is in the context of this more conscious approach to development efforts that the popularization of science and technology comes to stand on its own as part of the effort to reshape and manage the new socio-economic structure.

93. The application of this more conscious approach must be placed within the context of the existing socio-economic conditions and cultural traditions. Both facets mentioned above should be considered in the formulation of programmes for the popularization of science and technology; as the economy is progressively restructured and the material impacts of the development process expands to affect all segments of the population, ways and means must be found to gain social comprehension and gradual assimilation of the newly applied science and technology in the newly formed social structure, which is an amalgam of old traditions and the new patterns of life; at the same time, efforts are needed to develop positive attitudes in the populace that reach out beyond the present needs, which would serve as an impetus to further the economic and social development of the society.

94. A broadly based programme for the popularization of science and technology should not only attempt to bring all segments of the society into contact with science and technology used in the development efforts of the society but would also focus on means of strengthening and supporting national efforts to develop an indigenous scientific and technological capability on the basis of existing conditions. In practice, such a programme would not only inform the general public of the more significant changes that are taking place within their society, but also help to stimulate the curiosity and inventive spirit of the people as a whole. In addition, it requires that it be closely related to a general education programme designed to generate a positive attitude towards science and technology.

### B. Findings of the cross-organizational analysis

95. According to the data reported on programme activities, the organizations of the United Nations system have maintained a comparatively modest group of programme activities in this area. Considerably more emphasis has been placed on formal scientific training at the secondary and university levels. One can point to a few programmes that have been operating in this area.

96. As a result of the Tiblisi Conference on Environmental Education held in October 1977 and the United Nations Conference on Desertification held in September 1977, programme activities have been initiated to inform the populations of selected regions of the results of research into the ecologies and climates of their areas. Similarly, the UNESCO programme in hydrology and,

most clearly, the "Man in the Biosphere" programme (MAB) seek to develop booklets, information displays, and educational materials concerning the interactions between man, the physical world and the sciences that seek to explain these processes. UNESCO also endeavours to provide planning assistance and limited financial support to national organizations seeking to build up science clubs and student science fairs and is involved in the promotion of the design, development and utilization of low-cost equipment for science and technology education. Finally, UNESCO awards on a yearly basis the "Kalinga prize" for science popularization, with a view to drawing public attention to important works in science popularization, and to encourage writers in this field. WHO, FAO and UNICEF, through the efforts of their extension service programmes, seek to bring science to the people in the form of useful applications of scientific principles that can improve health, food production and the nutritional balance of rural people. FAO is also engaged in projects designed to improve the means of producing technical information to rural audiences.

97. It is not possible to assess at this point the role that the United Nations system of organizations has played in the popularization of science and technology. This is in great part due to the fact that there are probably considerable gaps in the information made available for this report. It is also due, however, to the fact that it is impossible to assess the impact of existing programmes. It appears, nevertheless, that while the United Nations system may be able to have a significant role to play in this area, few of its activities at the present time could be said to belong strictly in the realm of popularization.

## IX. SKILLED PERSONNEL

### A. Statement of the problem

98. In considering the role science and technology play in the development of any society, the relationship between the speed and orientation of the development process and the technical and organizational capabilities of members of that society is a key factor. The ability to administer, plan and execute development projects in various areas of development is considerably facilitated if those involved in development processes and activities command the skills and the capability required to make inputs effective.

99. The development of a nation's capabilities to enable its work force to avail itself of the advantages of modern science and technology is, therefore, a vital aspect of the development process, and must be accorded the priority it deserves. This dimension of the development process has often been taken for granted in the mistaken belief that international commercial and industrial contacts would somehow automatically initiate the spread and diffusion of science and technology for the benefit of developing countries. It has, however, increasingly been recognized that this process is far from being automatic, and that deliberate efforts must be made to implant, increase and deepen the impact of science and technology on the developmental activities of all countries, and especially the developing countries.

### B. Findings of the cross-organizational analysis

100. There are nearly 200 programme activities which in one way on another bear a relation to skilled personnel. Over one half of these are evenly distributed between natural resources and agriculture, forestry and fishing.

101. In terms of means of action, the main emphasis is placed on education and training, including seminars and workshops in developing countries (included in half of the activities). Studies and conferences are being cited quite frequently as well. Third in frequency are technical co-operation projects. Only 40 entries refer to pilot and demonstration projects.

102. The data would also reflect the fact that, while there is within the United Nations system widespread response to, and acknowledgement of, the validity of the objectives of the United Nations Conference on Science and Technology for Development, there is scope for reinforcing considerably activities designed to strengthen the indigenous capacity of the developing countries through such means as increased training programmes, fellowships, and the use of demonstration projects that employ scientists from the developing countries. In this connexion, it would seem that there is room for improved interagency collaboration in certain areas of training which are essentially multidisciplinary and therefore call for the contribution of more than one United Nations agency or organization. The analysis would also point towards the possibility that there might be an over-reliance on such means of programme action as studies, manuals, conferences, symposia, and the collection and dissemination of information, which benefit people with relatively high levels of skill rather than those who are below that level of training and experience, and for whom basic training might be more appropriate.

103. Organizations of the United Nations system can play an important role in the establishment of national and regional institutions and in the training and

education of the people concerned, and in ensuring that the existing science and technology capabilities of the developing countries shall be fully harnessed in the task of national and regional development through appropriate technical co-operation activities, in as many fields of development as possible.

104. Training should be adequately supported by relevant pilot and demonstration projects, technical co-operation programmes, financial grants and loans, the provision of correct equipment and the like, and must involve the use of consultants, experts, institutions for fellowship placement of developing countries and the purchase and use of raw materials and equipment from these countries, where these are available for the relevant programmes of the United Nations and the agencies.

## X. FINANCING OF SCIENCE AND TECHNOLOGY AND DEVELOPMENT

### A. Statement of the problem

/The summary text of this section has been omitted because of the limited time available for translation and reproduction. The subject is covered in the full text of the report, which will be made available in a conference room paper. See also the study on resources available in the United Nations system in the field of science and technology for development (A/CONF.81/PC/44)./

### B. Findings of the cross-organizational analysis

105. FAO, UNDP, UNESCO, UNEP and the World Bank have been engaged in a number of projects and programmes whose thrust is the funding of scientific research in the field of agriculture. Agricultural research stations have been established in a large number of countries covering research activities, documentation services, training and extension services, and analytical testing services.

106. Moreover, the need for more extensive research support to developing countries led to the establishment in 1971 of the Consultative Group on International Agricultural Research (CGIAR), which consists of 11 internationally governed agricultural research institutes or programmes. These research centres provide a mix of services including research, extension services, traning and information. The World Bank chairs and acts as a lead agency for the meetings of CGIAR and as donor of last resort provides up to 10 per cent of the budget. UNDP and FAO also sponsor CGIAR along with 32 member Governments.

107. A number of programmes in the life sciences and in the area of food and agriculture are financed by IAEA. The latter projects are generally undertaken in close collaboration with FAO, and are designed to support research on soil fertility, irrigation and crop production; the use of isotopes in studies on plant nutrition and fertilizer application; the use of isotopes in studies of soil water régimes; plant breeding and genetics; and insect and pest control.

108. Research and activities relating to water are often integral parts of those relating to agriculture, environment and health. Other research activities in the field of water resources include the strengthening of institutions concerned with hydrometerological training and research.

109. In the field of energy, the United Nations system finances research activities in developing countries in the field of solar energy, geothermal resources and other new and renewable resources of special interest to the utilization of energy in rural areas.

110. UNESCO is the sponsoring agency for a number of programme elements of the MAB project, which is being implemented in close collaboration with several organizations of the system. It is not known what fraction of the $3.3 million allocated to this project is devoted to the funding of research work of scientists in the third world. The scientific work covers such topics as land use of forests in humid tropics, and management of grazing lands and arid zones.

111. In the area of industrial research, UNDP, UNIDO and the World Bank have financed the development of institutions dedicated to industrial research and development. Since its establishment, UNIDO has assisted 250 such institutions, and in collaboration with UNDP and the Industrial Development Fund, supports the development of technologies appropriate to developing countries.

112. Health and the medical sciences have consistently attracted national and international concern. It is not known, however, what fraction of the $2,755,000 expended in research contracts supported scientific research in developing countries or, for that matter, what fraction of scientific research sponsored in industrialized countries would have a spill-over effect in strengthening the scientific capacity of developing countries. IAEA has sponsored research on the more effective utilization of nuclear medicine instruments in developing countries.

113. The United Nations system has responded to the needs of developing countries in the area of basic research in a number of ways: in the field of physics, IAEA, jointly with UNESCO, has supported the establishment of the International Centre for Theoretical Physics (ICTP) at Trieste. ICTP seeks to provide some of the physicists of developing countries with the opportunity to work in a research centre, but at the same time retain an association with a home institution. UNESCO continues to provide partial support for the training programmes of the International Centre for Pure and Applied Mathematics, Nice, France, and of the International Centre for Mechanical Sciences, Udine, Italy. UNDP has contributed towards the strengthening of the scientific capability of India through the financing of a computer system for the Tata Institute of Fundamental Research and supports the International Centre of Insect Physiology and Ecology in Nairobi. UNEP and UNESCO have co-operated to establish four pilot regional micro-biological resources centres.

114. In the area of housing and building materials, UNESCO and Habitat have supported the establishment of technological research institutes.

115. On the basis of the available information, it appears that only the agricultural sciences (including water science and MAB) receive a balanced coverage. The scale of the coverage is naturally enhanced by contributions from non-United Nations agencies. Despite the limited expenditures on research and development in developing countries, WHO appears to have some balance in its coverage of the various medical and health disciplines.

116. The report presented to the Preparatory Committee concerning the level of available resources in the United Nations system from the activities contained in the cross-organizational analysis (A/CONF.81/PC/44) shows that an approximate amount of $44 million 3/ is being spent in the system to support research and

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3/ It should be recalled, however, that activities in certain fields -- in particular in industry -- are undoubtedly not fully reflected in the material on which the cross-organizational analysis is based, and thus, this amount might be slightly on the conservative side.

development institutions in developing countries. These estimates probably present a partial estimate in view of the incompleteness of data in some areas. Nevertheless, both the order of magnitude of expenditure thus obtained, and the information on the coverage of activities by the system in support of research and development institutions in developing countries, indicate that as significant as the efforts of the system are at this point, additional efforts might be required in the future to give additional support in areas that are found to be lacking.

## XI. OVERVIEW OF THE FINDINGS

**117.** Because the cross-organizational analysis was designed to serve as a background document for the United Nations Conference on Science and Technology for Development, it has adopted a perspective that is different from that evidenced in previous surveys of scientific and technological activities undertaken by the organizations and specialized agencies of the United Nations system. Previous studies have focused on scientific and technological activities from a disciplinary or sectoral approach with comparatively little emphasis given to the extent to which these activities were oriented towards the strengthening of local institutions in developing countries. This study, in contrast, has adopted as its focal concern the extent to which programme activities of the United Nations system serve to strengthen the indigenous scientific and technological capacity of the developing countries. As a consequence, the nature of the data examined and the type of conclusions drawn are different.

**118.** In order to conduct this cross-organizational analysis, it was first necessary to develop a set of classifications which represented, in the main, the areas of focal interest for the development of an indigenous capacity. These classifications are far from perfect, and substantial improvements could be made in the light of this cross-organizational analysis. Despite their weaknesses, however, they tend to reflect many of the concerns voiced in the national papers and the preparatory documents of the Conference. In reviewing these classifications and the distribution of programme activities within them, it would be incorrect to conclude that the successful application of science and technology for development would result from moving directly towards the reinforcement of programme activities in any given cell of the classification matrix. All aspects of the development process should be given their due, in the light of a critical analysis of local conditions. Thus the balance between these diverse areas depends upon the local conditions within a given developing country. What is important is not merely the volume of programme activities in any given area of focal interest, but rather the balance of activity across all of these areas, as well as the extent of the linkages between them.

**119.** In commenting on this question of balance, it should be recalled that the question at hand is not exclusively one of an absolute balance - and certainly not an equalization - of funds allocated across the areas of focal interest. The execution of certain activities, such as policy-making and project evaluation, is considerably less expensive than that of others, such as the establishment of a national health care system or the development of a global information network. Rather the balance should be struck in relation to both the services that can be uniquely provided by the United Nations system and the assessed needs of the developing countries.

120. The data collected in the course of this cross-organizational analysis suggest that, at the present time, the organizations and specialized agencies of the United Nations system are according relatively more emphasis to application, in the traditional sense (focal area VI), information systems (focal area VII), and certain types of education and training (focal area IX) than is being granted to the remaining areas. Thus a case could be made for striking a better balance in the determination of future programme activities. The determination of such a new balance could derive from the deliberations at the Conference.

121. With respect to the development of an indigenous scientific and technological capacity for developing countries, the cross-organizational analysis indicates that more could be done to shift the emphasis of the current programmes and projects executed by the United Nations system so as to make greater use of the talent and institutions of the developing countries. Within the framework of the United Nations Conference on Science and Technology for Development, the development of this indigenous capacity has been given the primary emphasis.