



Economic and Social Council

Distr.
 GENERAL

E/C.7/1987/4
 23 January 1987

ORIGINAL: ENGLISH

COMMITTEE ON NATURAL RESOURCES
 Tenth session
 6-15 April 1987
 Item 3 of the provisional agenda*

WATER RESOURCES: PROGRESS IN THE IMPLEMENTATION OF THE MAR DEL PLATA ACTION PLAN

Progress achieved and prospects in the implementation by Governments of the Mar del Plata Action Plan

Report of the Secretary-General

SUMMARY

The present report has been prepared pursuant to General Assembly resolution 34/191, by which the Committee on Natural Resources was requested to review at its regular biennial sessions during the 1980s, the progress made by Governments in implementing the Mar del Plata Action Plan. The report updates information provided to the Committee in previous sessions, and concentrates on issues concerning policy, planning, legislation and institutional arrangements; the development of shared water resources; water resources assessment; drinking water supply and sanitation; water resources for agriculture; environmental aspects of water resources; education, training and public information and participation; and research and development. Special attention has been given to issues pertaining to Africa in view of the prevailing situation in the region. The report concludes that while considerable progress has been achieved with regard to some important aspects of the Action Plan, there are still a number of constraints that are critical, including insufficient linkages in institutional structures.

* E/C.7/1987/1.

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ISBN 4709
LO: 21087WA

INTRODUCTION

1. The present report has been prepared pursuant to General Assembly resolution 34/191, in paragraph 4 of which the Assembly requested the Committee, at its regular biennial sessions during the 1980s, to review the progress made by Governments in the implementation of the Mar del Plata Action Plan and to provide continued guidance and oversight to the supporting water-related activities undertaken by the organizations of the United Nations system.

2. Accordingly, reports were prepared for submission to the Committee at its seventh, eighth and ninth sessions. The reports for the seventh session (E/C.7/117 and E/C.7/118) and for the ninth session (E/C.7/1985/6) were prepared on the basis of questionnaires sent to Governments of developing and industrialized countries. The report for the eighth session (E/C.7/1983/11) was prepared on the basis of information then available to the organizations of the system. In addition, the International Drinking Water Supply and Sanitation Decade was the subject of a more detailed report at the time of the Committee's ninth session (A/40/108-E/1985/49). The present report discusses some important issues identified in previous reports and reviews progress that is being achieved with regard to policy and planning; legislation and institutional arrangements; shared water resources; water resources assessment; drinking water supply and sanitation; water resources for agriculture; environmental aspects of water resources; and education, training and public participation. It has been prepared on the basis of information available to the organizations of the United Nations system. A Symposium on Improved Efficiency in the Management of Water Resources, convened by the Department of Technical Co-operation for Development of the United Nations Secretariat in New York from 6 to 9 January 1987, also reviewed a number of these issues in the light of developments since the United Nations Water Conference took place in 1977.

I. POLICY, PLANNING, LEGISLATION AND INSTITUTIONAL ARRANGEMENTS

A. National water policy and planning

3. The last report to the Committee concerning progress by Governments in the implementation of the Mar del Plata Action Plan (E/C.7/1985/5) stated that progress had taken place with regard to the formulation and revision of national policy statements. In fact, three quarters of the developing, and two thirds of the industrialized countries had reported the existence of such policy statements. A substantial majority of countries reported that recent revisions had taken place and further revisions were envisaged. It was then reported, however, that in many cases those policy statements had not been translated into the formulation of master plans.

4. Although the situation varies in each region, planning is frequently being carried out on a sectoral basis with no attempt being made to establish priorities or phased programmes. This type of sectoral planning, at best, has as its objective the establishment of priorities among the various investment possibilities in each sector. In general, other aspects than the expected financial and economic returns are not taken into consideration. This planning

process also fails to provide the necessary linkage between water resources and national development planning, so that water resources development may not be given sufficient priority relative to other development needs, and at times may be subjected to contradictory policies that may lead to inefficiencies and an actual slow-down of progress in water development. In the case of Africa, for instance, the all too often fragmented and unco-ordinated nature of water development programmes consisting of a large number of projects, each competing for national counterpart staff and essential services, has actually retarded development and brought about a reluctance on the part of some major donors to assist Governments in these activities.

5. In the case of Latin America and the Caribbean, there is a clear tendency to extend planning activities in a more integrated manner among the different water using sectors and to undertake longer-term planning. Planning activities take into consideration the multiple uses of water resources and the potential environmental impact of their development. In some cases, however, the expression of intent regarding the preparation of water resources development plans, or the consolidation of existing sectoral plans, have not yet been accompanied by the creation of the required institutional structures.

6. The previous report to the Committee at its ninth session (E/C.7/1985/10) indicated a lack of progress in the use of pricing policies as a means for recovering fixed and recurrent costs, and for demand management. Recent information suggests that the need for such policies is gaining increasing recognition in industrialized countries. In developing countries progress in this regard is still very limited. There is, however, a growing awareness of the importance of such policies as a means of generating the financial resources needed for water resources development.

7. It is doubtful that full cost recovery policies could be envisaged as an immediate goal in all cases, particularly in rural areas. Nevertheless, progress in the implementation of pricing policies is seriously hindered by the still widely held societal view that water should be provided as a free good, and by the often erroneous perception that users do not have the means to pay for basic services. An equally serious constraint to the successful use of such policies lies in the general inadequacy of existing institutional arrangements for their efficient implementation, including the systematic collection of revenues.

B. National water legislation

8. All previous reports concerning follow-up to the recommendations of the Mar del Plata Action Plan 1/ have systematically shown progress with regard to important aspects of water legislation. A high proportion of developing and developed countries alike have established legislation regulating the ownership and use of water. In spite of the progress achieved so far, the Asia and Pacific region, still appears to be particularly weak with regard to legislation dealing with the development and use of ground-water resources as well as with their protection. As a general rule, legislation tends to be weakest with regard to the environmental protection of water resources.

9. There is a parallel between the previously-mentioned sectoral approach to water planning and its lack of linkage with national planning and priorities, and the lack of compatibility of water legislation with long-term economic and social objectives of national plans. In fact, they are but different aspects of the same issue. As stated in previous reports, varying degrees of progress have been made in the different regions regarding the provision of legislation for establishing centralized mechanisms to co-ordinate governmental departments and organizations. Further efforts will be needed not only to establish co-ordinating mechanisms, but also to define functions and responsibilities all the way down to the project level.

10. Normally, national water legislation deals with the allocation of water resources and resolution of conflicts, either by establishing a set of priorities for water uses on the basis of social and economic criteria that can be revised periodically, or by assigning this function to one or several governmental institutions. To the extent that the existing legislation and institutional arrangements do not provide an adequate link with overall national priorities, or with the efficient management of water by specific uses, there are bound to be distortions in priorities leading to a misallocation of investments, with consequent distortions in the economic and social benefits derived from the various uses of water resources.

C. Institutional arrangements

11. While a large number of countries have established national co-ordinating mechanisms, the responsibilities and functions of such mechanisms vary widely, and in fact some of them have merely an advisory function.

12. In spite of progress in this respect, inadequacies in conceptualization and definition of the variety of management functions, together with fragmentation of responsibilities among agencies, often very numerous, and the lack of trained personnel, make the rationalization of water resources management an extremely difficult task. This situation is largely responsible for the difficulties previously mentioned: lack of institutional linkage with national planning and policy formulation on the one hand, and with efficient management of water resources at the user point on the other. The lack of clearly-defined responsibilities is a critical factor leading to inadequacies in the formulation and implementation of policies dealing with operation and maintenance, cost recovery and effective community participation, particularly of women.

13. As far as irrigation development and, to some extent, rural water supply are concerned, a distinct trend is emerging toward a devolution of responsibilities to smaller-scale institutions, which are more easily mobilized and are closer to the operational scene. This shift is sometimes accompanied by the incorporation of private sector involvement, and increasingly by the use of community and farmer associations. Far from implying a decrease in the involvement of governmental authorities, the successful implementation of this approach requires strong institutional technical and financial support on the part of these authorities, including the formulation and implementation of community and on-farm training programmes to develop skills at a middle technical level.

II. DEVELOPMENT OF SHARED WATER RESOURCES

14. In the years since the Water Conference was held in 1977, reports have shown that progress has been made with regard to co-operation in the development of shared water resources, and that significant agreements have been concluded. Nevertheless, the potential for conflict still exists in certain areas, particularly in the event of a possible intensification of irrigated agriculture involving the consumptive use of water. Although there is an increasing awareness of the importance of establishing co-operation on a basin-wide basis, there is still a tendency for effective co-operation to take place at the project level.

15. An analysis of existing agreements reveals that there is a reluctance on the part of Governments to delegate powers to international bodies over which they do not have full control. In general, mixed commissions and other institutional entities are given authority to decide only on strictly technical matters. Differences of opinion that cannot be solved by consensus within such entities are settled through traditional diplomatic procedures. While there are several sets of international principles concerning the development of shared water resources, none have gained universal acceptance. It might be recalled that the report submitted to the ninth session indicated that as of 1985, 14 countries had reported drawing upon the principles of conduct for the guidance of Governments in the conservation and harmonious utilization of natural resources shared by two or more States prepared by the United Nations Environment Programme (UNEP), and another 8 countries were planning to draw upon those principles.

16. The ability of Governments to establish successful intercountry co-ordination and co-operation procedures hinges on the strength of national institutions dealing with water resources. If national organizations are themselves weak and unco-ordinated, there is little chance for the success of supra-national programmes. The success of river basin organizations is closely related to a clear definition of these objectives and purposes. Those with clear-cut objectives have usually been supported by riparian countries and are best able to attract external financing. There is little point in promoting organizations that are not founded on definite co-operative programmes such as multi-purpose dams, river control, irrigation and transportation. Activities such as environmental control, soil conservation and reforestation are most likely to gain support within this type of developmental approach. The availability of reliable physical, social and economic data is an important element in bringing about successful co-operation.

17. It should be noted that the First African Ministerial Conference on the Environment, held at Cairo from 16 to 18 December 1985, assigned great importance to regional co-operation for the integrated development of international river basins. The Conference, *inter alia*, called for a strengthening of co-operation around the north-east aquifer in the Nubian sandstone zone, and support to the Lake Chad Commission and the River Niger Basin Authority; as well as for the study and implementation of integrated development plans for several other river basins. The Regional Meeting on Socio-economic Aspects of Water Resources Management in Africa, convened by the Economic Commission for Africa (ECA) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) at Addis Ababa, from 2 to 6 June 1986, also emphasized the need for increased co-operation in this regard.

III. ASSESSMENT OF WATER RESOURCES

18. The last report to the Committee stated that, far from being able to record steady increases in the level of activities related to water resources assessment since the Water Conference, it was doubtful whether there had been any improvement in the overall situation. The evidence there and now suggests that in many cases the level of activity has actually decreased. The scarcity of financial resources, the lack of institutional development and qualified manpower, as well as a shortage of equipment, have been identified as the major constraints impeding progress. It was then stated that the situation concerning time-dependent data was particularly serious regarding ground water, water quality and data on evaporation. The situation concerning observation networks for surface water appeared to be somewhat better. With regard to networks for time-independent data, a particularly acute situation was reported in the case of hydrogeological data, boring descriptions and well logs.

19. It is most disturbing to note that the current level of activity continues to decrease in many countries. In some cases, activities have been reduced to almost zero. On the whole, data collection activities in developing countries have not fared well in the competition for scarce financial resources, particularly during the severe economic crisis faced by the international community in recent years. To the extent that budgetary reductions are foreseen, efforts could be made to rationalize networks in the face of budget cuts. In many developing countries, however, unexpected and drastic cuts in resources have led to the wholesale disbanding of networks that were developed with great difficulty in the 1960s and 1970s. In the case of the Lake Victoria Basin on the Upper Nile, for instance, where there once were 70 stream-gauging stations, only 7 remain. These waters can no longer be assessed or monitored on an adequate basis.

20. The situation is different in each region, and may even vary within individual countries. In Africa, the lack of funds to service and inspect installations, the lack of spare parts, the shortage of technical staff, and the lack of analysis of processed data have meant that data are often inconsistent and unreliable, and are rarely in a form which is usable by project planners and designers without correction and amendment. Records kept by many hydrometeorological and hydrological services in the region are either poorly kept or non-existent.

21. The Regional Meeting on Socio-economic and Policy Aspects of Water Resources Management in Africa recognized the seriousness of the situation. In calling for corrective measures in this regard, it emphasized the need for carrying out research with regard to climate variability and its effects on hydrology and water resources. While the meeting recognized the need for increased international assistance to establish and strengthen data collection networks, it stressed the need for countries in the region to make their own contributions to ensure the adequacy of the needed infrastructure.

22. A recent assessment by the Food and Agriculture Organization of the United Nations (FAO) of the irrigation potential of the region has found that the variable and even questionable quality of hydrogeological data constitutes a major problem. The situation has been shown to be particularly serious in the semi-arid areas. To some extent it appears that this situation applies to some areas in Asia and the

Pacific. This latter region, however, has managed to achieve significant progress in recent years in the use of modern technology, as reflected in the increased use of automatic collection and transmission systems for hydrological data.

23. As stated in the previous report, most developed countries have suitable investigation programmes for water resources up to 1990-2000. A relatively high proportion of developing countries other than those in the African region also have such programmes. The fact that few countries in this region have suitable programmes reflects to a great extent the breakdown of networks and data collection systems.

24. The increasing use of computer technology facilitates the collection, analysis and dissemination of data, provided that national institutions have the necessary infrastructure for its utilization. A lack of trained manpower and the existence of inappropriate administrative infrastructures may prevent the efficient utilization of computers. For these reasons, although the introduction of computer-based data-processing systems should have led to more efficient quality control, their utilization has not always been successful in many African countries. Often countries were faced with a very large backlog of data which built up while systems were being tested and introduced. In some cases the cessation of manual processing led to a decline in the efficiency of data processing and dissemination, from which countries are only slowly recovering. Initially, the lack of trained personnel and of suitable hardware and software contributed to the difficulties in introducing automatic data-processing systems. At the present time, the advent of micro- and mini-computers has brought suitable hardware within the means of most departments. However, the availability of servicing facilities remains a major problem. As shown in the previous report, computers are now being used less for ground-water data than for surface-water and precipitation data. Africa has shown the lowest percentage of countries fully or partially using computers for ground-water data. In the case of surface waters the lowest percentages are found in Africa and Western Asia.

25. The majority of developing countries continue to experience moderate to severe problems with regard to co-ordination among governmental agencies concerned with data collection. However, the problem is not limited to one of co-ordinating the work of these agencies. It also involves the overall fragmentation of agencies dealing with water resources assessment, development, management and use, and the consequent frequent lack of feedback between data collecting and user organizations. Under such conditions, it is difficult to set in motion improvements in data collection, and in general to design user-oriented short, medium and long-term programmes.

26. The available information suggests that the current level of investment for water resources assessment is well below the yearly requirements estimated at the time of the Water Conference in 1977. In fact, often institutions dealing with assessments have recently suffered from decreases in budgetary allocations. The inability of institutions to command the needed financial resources is exacerbated by the institutional weaknesses referred to above. The lack of linkages between data-generating agencies and users blurs the income-generating aspect of water resources assessment activities once the data are put to use in development schemes. Under such conditions national policy-makers are not likely to be

favourably inclined towards channeling large amounts of development financing to these activities. The continuation of the current trend could have disastrous long-term effects in many parts of the world, particularly in the African region.

IV. DRINKING WATER SUPPLY AND SANITATION

27. The Secretary-General's report to the General Assembly at its fortieth session, through the Economic and Social Council (document A/40/108-E/1985/49), assesses the progress achieved and problems encountered in the attainment of the goals of the International Drinking Water Supply and Sanitation Decade at its mid-point.

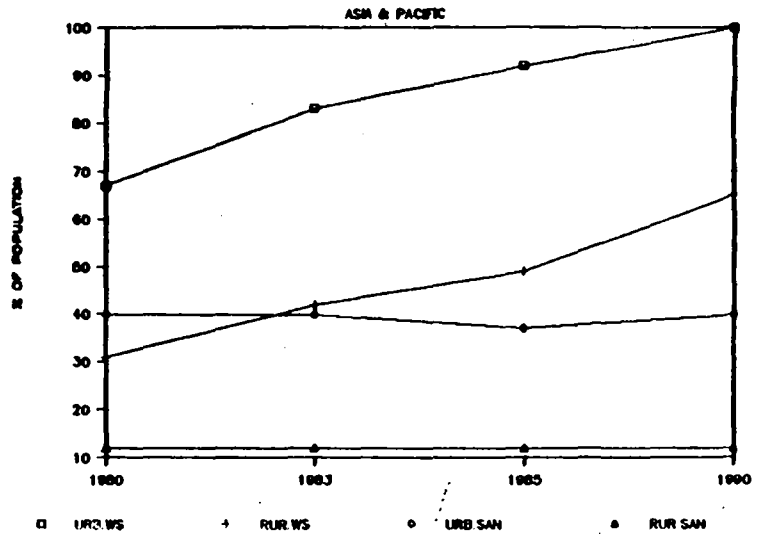
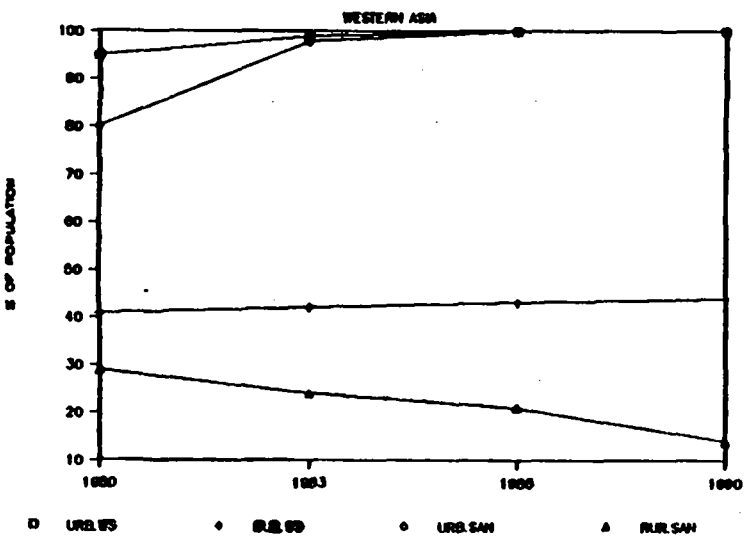
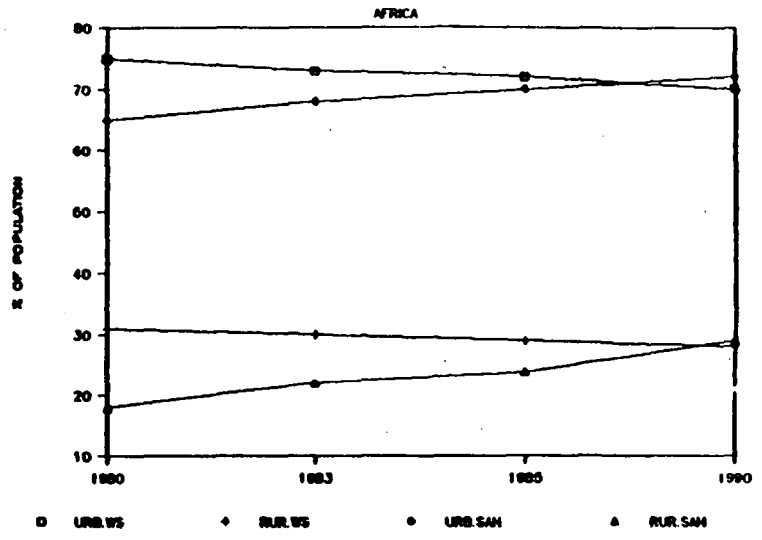
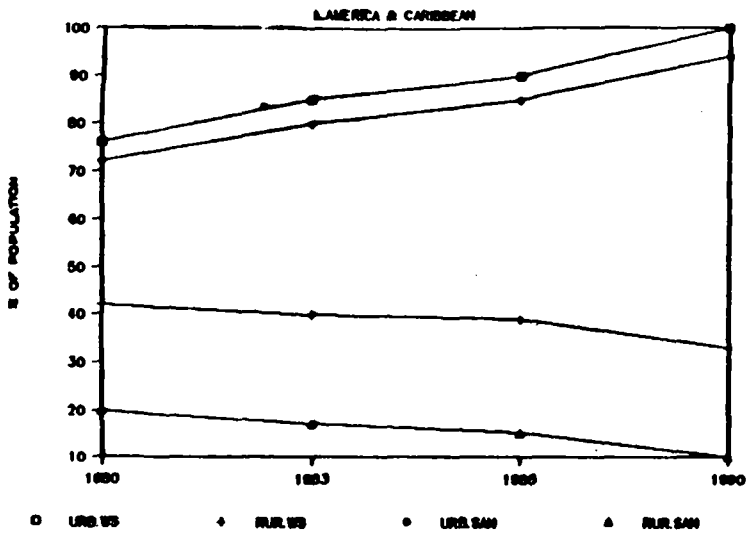
28. The figure provides a graphic presentation of the expected situation in Africa, Asia and the Pacific, Latin America and Western Asia for urban and rural water supply and sanitation, based on updated information available to the World Health Organization (WHO) through its global monitoring programme. A global perspective of trends suggests that considerable progress is likely to have taken place by 1990 with regard to urban water-supply. Progress in coverage is likely to be achieved both in terms of the absolute number of urban dwellers, and of the percentage of the total urban population to be served either by in-house connections or stand posts (from an estimated 73 per cent in 1980 to a projected 85 per cent in 1990). A similar situation seems to prevail for urban sanitation services via sewer connections or by other means (from an estimated 56 per cent in 1980 to some 66 per cent in 1990).

29. The global situation with regard to rural water-supply and sanitation is in sharp contrast with that of urban areas: while some modest increases are likely to take place regarding the total number of dwellers provided with adequate services, the actual percentage of the population provided with such services, as well as the number of inhabitants without adequate sources of supply, is expected to remain the same. As far as rural sanitation is concerned, the percentage of total rural population with adequate services would actually decrease by 1990.

30. In spite of the projected progress for urban water-supply and sanitation, the estimates shown above imply that a large, and possibly growing number of urban dwellers would only have access to minimally adequate or substandard facilities as a result of high rates of population growth compounded by urban migration. Many urban centres could be confronted with a serious problem, often a growing one, of providing adequate basic services to the poorer strata of its population which are least able to pay for them. Likewise, as a general rule, progress will be slowest or nil in the poor rural areas where the population also has a limited capacity to pay for services.

31. Services to peri-urban areas is particularly difficult in that it requires the expansion of municipal system capacities in order to provide services to those city dwellers who are least able to pay for them, with consequent increases in investment and operating expenses. This makes the implementation of full cost recovery policies more difficult and in turn is likely to slow down increases in services. The implementation of full or at least partial cost recovery policies is often possible, however, even where there is a growing demand for the extension of

Figure: Rural and urban drinking water supply and sanitation: estimated coverage in four regions to 1990



Source: World Health Organization.

services to the poorer strata of urban populations. The available evidence suggests that there exists among dwellers in these areas a minimum capacity to pay for basic services. In fact, payments exacted by public water utilities are often below those paid to private entrepreneurs.

32. Progress with regard to rural drinking water supply depends on whether operation and maintenance procedures are adequate to prevent the deterioration of existing services and whether efforts continue towards the implementation of policies designed to promote the utilization of suitable low-cost technology. The issue of operation and maintenance has traditionally been a source of major concern. In 1984, for instance, assessment by the United Nations Children's Fund (UNICEF) on the state of a hand-pump installation and maintenance programme in a region in Asia estimated that nearly 36 per cent of the hand-pumps inspected in 589 villages were in a state of disrepair, and that pump maintenance was nearly non-existent. In addition, 70 per cent of the pumps had poor or badly constructed platforms, and 9 per cent had no platforms at all.

33. Considerable progress is being made with regard to the design of low-cost reliable pumps, the organization of proper operation and maintenance procedures, including the availability of spare parts, the training of personnel, and community participation, in particular the participation of women. While all these efforts by themselves contribute to the solution of the problem, their full impact is felt in cases where Governments embark on the formulation and implementation of widespread programmes for the establishment of suitable organizational structures at the community level for the development, operation and maintenance of water-supply facilities, including their financial management. Experience shows that decentralization works best where the first line of responsibility is established at the community level, in a form not unlike a public utility. At the same time, however, there is a need for strong central technological and organizational support. Community co-operatives and carefully regulated private enterprises can also play an important role in the development of rural water-supply services. Under such circumstances the implementation of pricing policies aiming at full or at least partial cost recovery is often possible. In such cases, financial governmental support need not always be in the form of direct investments and can, under the right circumstances, take the form of soft loans.

34. On the whole, rural sanitation has suffered from a striking lack of progress. Insufficient attention is being given by Governments to the provision of sanitation in rural areas in spite of efforts to promote greater awareness of the importance of the health and environment benefits, and towards the promotion of low-cost sanitation. More often than not, the supply of services has not been forthcoming. Where it has, the type of services provided has not always met the requirements of the local population. Much higher levels of investments will be required if any meaningful progress is to be made. It does not appear likely, however, that many Governments would be inclined to channel large amounts of scarce development financing for this purpose, unless they are faced either with manifestly strong demands for these services coupled with demonstrable socio-economic benefits, or with the likelihood of major health and environmental problems. It is further unlikely that much progress will be made without the generation of strong grass-roots movements designed to create an effective demand for services and to

organize the communities with a view to achieving as much self-sufficiency as possible. The main role of Governments may be that of providing for community education and organization. Beyond that, Governments would need to provide technical support and supplementary financing above those resources that can be generated at the community level.

35. Without a doubt the major achievements so far in the Decade are to be found in the realm of very significant changes in perceptions and approaches to drinking water supply and sanitation, which are at the very basis of achieving the objectives of long-term sustainable progress. The International Drinking Water Supply and Sanitation Decade is bringing with it increased emphasis by Governments and the international community alike, on the need for strong operation and maintenance procedures and related organizational requirements, the use of low-cost suitable technologies, community participation, in particular the participation of women in all aspects of drinking water supply and sanitation (see paras. 66-70), and in general on the need for strong institutional arrangements with well-defined linkages and responsibilities at various levels of action. External support agencies, both within and outside the United Nations system, including bilateral and non-governmental organizations, have significantly increased their efforts in terms of the level of technical and material assistance. They have also played an important role in bringing about these changes in approaches and perception. In particular, there have been notable efforts in conjunction with Governments in order to bring about more concerted approaches for the development of sector programmes and strategies via national or regional consultations.

V. WATER RESOURCES FOR AGRICULTURE

36. The previously reported slow-down of growth in the proportion of agricultural production due to the development of new irrigation or to the rehabilitation of existing schemes has continued to date. The situation in Africa has been a source of increasing national, regional and international concern. At the present time, a sizeable part of irrigation investments, particularly in Asia, is being channelled towards the rehabilitation or improvement of existing irrigation schemes. Nevertheless, some countries are making substantial development plans to increase the area under irrigation. Brazil, for instance, is planning to develop 1 million hectares over the next 10 years. With some exceptions, the possibilities for expansion of irrigation into new areas are more limited in South-East Asia and Latin America than in Africa.

37. There are several reasons for this situation. In many cases the inaccessibility of international loans because of high interest rates or large external debts has been the main cause. In addition, increasing costs of irrigation development and the lack of qualified manpower have been responsible for this slow-down. Poor management has led to low returns, and on frequent occasions to loss of soil productivity through salinization and waterlogging. Increases in productivity through irrigation require not only the proper management of water resources, but also that of other inputs such as fertilizers and pesticides, as well as the use of certain types of technologies. As shown in the World Development Report 1986, issued by the World Bank, 2/ the economic viability of

agricultural production, and consequently of irrigated agriculture, is affected by policies concerning such questions as international trade as well as taxation and pricing policies. In many cases the compounded net effect of all policies on agricultural development has been negative.

38. The efficient management of agricultural development, and consequently that of irrigation, has suffered from the previously mentioned lack of linkage with overall economic development policies and priorities, and from institutional inadequacies concerning such issues as the formulation and implementation of policies concerning human resources development and the efficient utilization of the various inputs, including water. The lack of delineation of responsibilities, and the generally persistent fragmentation of responsibilities among various agencies and departments are serious constraints to agricultural development. Nevertheless, it is expected that the trend towards a devolution of responsibilities should bring with it greater efficiency in the use of water for agriculture, as well as improvements in operation and maintenance procedures and cost recovery measures.

39. In April 1986, FAO organized at Lomé, Togo, the Consultation on Irrigation in Africa, in order to evaluate the progress made and the future role of irrigation in Africa. The deliberations and recommendations from these consultations are particularly pertinent in view of the United Nations Programme of Action for African Economic Recovery and Development 1986-1990 adopted by the General Assembly at its thirteenth special session in May-June 1986. 3/

40. From these consultations it became evident that irrigation in Africa plays a more important role than had been assumed. Although irrigation accounts for only 6.5 per cent of the total cultivated area in the region, it accounts for more than 20 per cent of total value of agricultural production. This is particularly true with regard to cereals. In spite of the high cost, the participants to the consultations concluded that irrigation in Africa could be viable, particularly as it contributed to the objective of achieving food self-sufficiency and import substitution through the extension of agriculture into arid and semi-arid areas, and to the rain-fed areas during the dry season. The consultations favoured particularly small-scale irrigation with wide peasant participation, although, where appropriate, large-scale irrigation might be favoured for high value commercial crops. The need for ensuring the complementarity between rain-fed agriculture and irrigation and the links with over-all agricultural strategies for crop and livestock production was emphasized.

41. In this regard, it should also be noted that it was decided, at the First African Ministerial Conference on the Environment to "apply all available African skills and experience to seek economically feasible, environmentally sound and socially acceptable solutions to the complex problems of grass-roots development, in a hundred and fifty villages (three per country) and thirty semi-arid stock raising zones (one in each of thirty countries), ... with the goal of assisting those hundred and eighty communities to become self sufficient in food and energy within five years from the start of the implementation of the present decision".

42. No strong trend in the choice of technology was noticeable at the Consultation. Gravity supply and surface application were likely to remain the

most common methods, but many examples were quoted of the extremely successful use of more modern techniques where these did not demand excessively advanced technology to maintain them. Their use in labour-short areas was an acceptable option. There was a need for the sound design of whatever type of water-supply system was selected, and for the incorporation of features that could ensure low maintenance costs.

43. Recent efforts to collect and analyse statistics related to the actual use of water resources for agriculture in Africa have highlighted the deficiencies in the data bases in respect of the extent of development under different forms of irrigation and the inadequacies of physical data on soils, surface water and ground water. Nevertheless, an evaluation of the irrigation potential in the African continent, recently carried out by FAO using computerized analysis and digitized mapping, has shown that there are a large number of watersheds where careful planning of water resources use is needed if foreseeable future demands for irrigation are going to be met. The study shows that the most suitable soils for irrigation generally occur in the same regions where there is still a potential for rain-fed crops, thus stressing the need for careful evaluation of rain-fed development alternatives before initiating any irrigation development plan in these areas.

44. In order to improve the situation of the quality and quantity of data, the participants in the Consultation on Irrigation in Africa considered that the following future actions will be of particular importance:

(a) Assessment of land and water resources potential at regional, national and basin levels;

(b) Establishment of suitable methodologies for collection and analysis of data, and data banks;

(c) Establishment/improvement of systems and methodologies for monitoring of resources, land use and crop production, including the setting up of data banks. 4/

45. Regarding the planning of irrigation development, those countries that already had an appreciably irrigated area were emphatic on the need for an inventory of physical resources, societal and manpower data as a planning tool. The planning process, it was stated, must extend at the national level over the range of potential water uses, identifying objectives, priorities, complementarities and potential conflicts among those uses. It was recognized that the physical data base was often weak, but an equally serious defect in planning was neglect of properly assessed social values which determined community preferences and requirements for life style, employment and leisure, foods and even food varieties.

46. It was stressed that the formulation of irrigation plans and policies, was an indispensable condition for the continuity of irrigation programmes. Without national plans it was unlikely that Governments would commit substantial resources to that sector and successful irrigation develop. Therefore, participants of the Africa Consultation recommended that the following programmes be implemented with priority:

(a) Assessment of available potential for irrigated agriculture and establishment of medium- and long-term role of irrigation;

(b) Development of suitable criteria for the planning, appraisal and priority ranking of schemes, with particular reference to social benefits;

(c) Establishment of policy guidelines for promotion of, and support to, small-scale and farmer self-help schemes;

(d) Preparation of a national plan for investment in irrigation and land reclamation;

(e) Establishment of policies to promote the profitability of irrigated agriculture, including guidelines for the sharing of investment and recurrent costs by Governments and farmers;

(f) Establishment/reinforcement of institutions having responsibility for the implementation of irrigation policies.

47. The Regional Meeting on Socio-economic and Policy Aspects also recommended the preparation of guidelines for the promotion and support of small-scale irrigation and self-help initiatives; the provision of incentives for increased production, including, where appropriate, pricing and marketing stimulants; the development of adequate marketing structures; and the provision of equitable access by all farmers, men and women, to agricultural credits schemes.

48. The participants in the Consultation on Irrigation in Africa were extremely concerned about the shortage of trained and experienced staff at all levels, representing a serious constraint to irrigation development in most countries. To overcome this serious problem they have recommended that the following actions be initiated or strengthened:

(a) Assessment of present and long-term manpower requirements, and subsequently of training needs;

(b) Establishment of a national policy for human resources development, and introduction of training programmes with particular reference to farmers' participation in small-scale schemes;

(c) Establishment or reinforcement of institutions having particular responsibility for farmers' training and extension.

VI. ENVIRONMENTAL ASPECTS OF WATER RESOURCES DEVELOPMENT

49. The water-related environmental problems of developed countries due to industrial production have been a source of concern for a long time. These problems range from surface water pollution due to industrial wastes and sewage, ground-water pollution increasingly due to toxic waste disposal, and, in recent years, acid rain.

50. The water resources related environmental problems of developing countries, though somewhat different in nature, are not necessarily less serious than those of the industrialized countries. These problems are often compounded by the perception that their solution has to take a back seat to policies designed to promote economic growth. Although, on the average, industrial production in developing countries accounts for no more than about 10 per cent of total water utilization, as compared to 40 per cent in industrialized countries, growth in industrial production, particularly if coupled with a continued lack of priority attention to environmental problems associated with it, will bring about increased pressure on the environment. The rapid growth of urban population in developing countries brings with it increasing demands for the expansion of sewage treatment plants, which in turn create a burden on their institutional, technical and financial capabilities.

51. The environmental impact of agricultural production upon water resources is also a growing source of concern owing to non-point contamination from agricultural chemicals affecting both surface and ground waters. In many areas, downstream detrimental changes in water quality render them unsuitable for other uses. Owing to soil deterioration, massive tracts of irrigated croplands are going out of production nearly as fast as the amount of newly-irrigated lands are being brought into production. In many cases the development of irrigated agriculture has also led to increases in water-related diseases, such as malaria and schistosomiasis. In Africa, for instance, the introduction of irrigation schemes for the cultivation of high yielding Asian-style paddy rice has provided ideal breeding grounds for malaria carrying mosquitoes. The potential seriousness of the problems was stressed by the Regional Meeting on Socio-economic Aspects of Water Resources Management in Africa, which recommended the development of special programmes aimed at educating and training extension workers in the use of proper protection techniques; at increasing the awareness of policy-makers and managers; and at developing relevant research activities. The uncontrolled and often indiscriminate exploitation of ground-water resources has often led to increased problems with the lowering of ground-water tables and salt water intrusion.

52. The capabilities to adequately assess changes in water quality and to monitor ground-water resources are critical elements in the environmental management of water resources. A lack of adequate monitoring capability both with regard to surface and ground waters is a limiting factor in the ability to formulate and implement suitable legal and economic policies. Yet, as mentioned before, these two areas constitute the weakest point in the overall assessment capabilities of developing countries. The previously reported ongoing deterioration of assessment capabilities is likely to further weaken their capabilities.

53. As a result of socio-economic development, management of the environmental impacts of water resources development and utilization is becoming increasingly complex as are the interactions between environmental conditions, human activities and fresh-water ecosystems. The previously mentioned tendency towards a sectoral approach to water planning, with emphasis upon financial and economic returns, fails to provide a comprehensive approach to water resources project management in the environmental sense. Instead projects are undertaken in a series of individual steps, the objectives and timing of which do not necessarily interrelate. In

consequence, management decisions are confined to a number of measures either individually isolated one from another or restricted to specific stages of the project or aspects of a water resources use. As indicated previously, legislation in developing countries is particularly weak with regard to water quality and the control of ground-water uses. As in the case of the use of pricing policies for cost recovery and demand management purposes, the use of economic incentives and penalties as means of effluent control has not become widespread in developing countries. The fragmentation of governmental agencies dealing with water resources and the poor definition of functions and responsibilities seriously inhibit the formulation and effective implementation of adequate environmental protection measures.

54. The problem of transboundary pollution is becoming increasingly serious in industrialized and developing countries alike. Co-operation with regard to pollution control has become the major focus of attention for co-operation in the context of shared water resources in Europe. Likewise in Asia and the Pacific region, there have been recently a number of agreements aimed at the conservation of water resources of the region, such as the seven nation Colombo Declaration, and the Manila Declaration of the ASEAN Ministers of the Environment in 1981, and the 19 nation Rarotonga Declaration in 1982. In Africa, the First African Ministerial Conference on the Environment, in 1985, emphasized the need for regional co-operation in water resources development.

VII. EDUCATION, TRAINING AND PUBLIC INFORMATION

A. Education and training

1. Assessment of manpower needs

55. It will be recalled that the Mar del Plata Action Plan recommended that countries should accord high priority to conducting surveys to determine national needs for administrative, scientific and technical manpower in the water resources area, and that such surveys should be comprehensive in nature. The replies to the 1984 questionnaire, reported on at the Committee's ninth session, indicated that over half of the responding countries had not executed comprehensive water resources manpower surveys since the United Nations Water Conference, as recommended. In addition, it is estimated that very few of the manpower surveys executed were comprehensive in the sense that they covered all aspects of water resources development at all technical and management levels.

56. However, the fact that comprehensive surveys have not been carried out by many countries does not necessarily mean that Governments are not assigning high priority to the issue of human resources development. Manpower surveys are difficult and costly to execute and in many cases it is not absolutely necessary to carry out comprehensive surveys in order to determine existing bottle-necks at a given level of expertise, as well as the need for specific education and training programmes for these critical areas.

2. Availability of manpower and adequacy of skills

57. The responses to the 1984 questionnaire indicated that while there had been an increase in the number of countries reporting improvements with regard to the availability of human resources and the adequacy of skills, there had also been an increase in the number of countries reporting a deterioration in these respects. The situation was estimated to be critical in more than 20 countries. This deterioration is closely related to deficiencies in the amount and quality of primary and secondary education available in many developing countries. In addition, however, the situation has often been exacerbated by the economic difficulties experienced by them in recent years.

58. The water resources manpower situation is most difficult in a number of African countries. In many of these countries, where the situation is evaluated as critical by the water services, there are no clear plans to improve the manpower situation. The constraints mentioned are the lack of equipment and teaching aids, the limitation or lack of qualified teachers, lecturers and professors and limitations in the general national infrastructure. In this regard it may be recalled that the First African Ministerial Conference on the Environment decided to establish or strengthen eight specialized regional networks, one of which is to deal with education and training which in time should have a positive impact on the skills needed in water resources development. The Regional Meeting on Socio-economic and Policy Aspects of Water Resources Management in Africa called for countries in the region to publish an inventory of national water engineers, scientists, technicians and other relevant experts.

59. Improvement of the manpower situation is necessarily a lengthy and costly process. The emphasis on training rather than on education, in the period since the United Nations Water Conference, has not always been positive and it has become more and more apparent that trainees need a minimum technical education in order to profit from training courses and on-the-job training.

60. A positive development is the increase in educational institutions for middle-level or higher water resources development technicians. Their education can be completed in three years, as a continuation of partly completed secondary education, with or without an extra preparatory year to make up for deficiencies in primary and secondary education. Graduates from these institutions can carry out many of the tasks of the professional engineer.

61. External assistance and co-operation can help to alleviate manpower problems, in particular, through the provision of teaching aids, equipment, books and teaching staff. In the case of educational institutions a long-term, relatively small amount of assistance appears to be more effective than a short-term heavy investment.

62. The number of possibilities for post-graduate engineering and management training in the developed countries for specialists in the water field from developing countries has increased considerably over the last five years. There is also an increase in international post-graduate training courses in the developing countries.

B. Public information and participation

63. The 1984 questionnaire indicated a substantial increase, over the last five years, in the planning and execution of programmes for national information campaigns concerning the proper utilization, protection and conservation of water by both developed and developing countries.

64. Very few replies were received to a request for information from the national water resources services in the developing countries for these national programmes. This could mean that the information activities, if executed, were either too isolated or not part of a comprehensive programme and did not cover general water resources development and conservation issues.

65. In particular, for specific economic sectors, such as drinking water supply and agricultural water use, a substantial amount of information material is internationally available. Much of this material is specific to a region but in order to make a substantial impact it should be even more adapted to each specific situation which can only be done at the national level.

66. The most striking progress that has been achieved in the area of public participation has been with regard to the role of women in the development and utilization of water resources. The importance of this question was not yet fully realized at the time of the Water Conference. The Action Plan makes only brief mention of this issue by indicating that "in the field of community water-supply and sanitation, special emphasis should be given to the situation and role of women". In 1980, however, the World Conference of the United Nations Decade for Women: Equality, Development and Peace, in its resolution 25, called upon "Member States and United Nations agencies, including specialized agencies, to promote full participation of women in planning, implementation and application of technology for water-supply projects". 5/

67. The promotion of the role of women in drinking water supply and sanitation has been the subject of concerted action by the United Nations system of organizations through the Steering Committee for Co-operative Action and the ACC Intersecretariat Group for Water, and a number of workshops and seminars have been organized (see document E/C.7/1987/10 for a description of systemwide activities in this regard).

68. Still more significant has been the impact of policy-level initiatives on operational activities of Governments and development assistance agencies. UNDP established in 1983 an interregional project entitled "Promotion of the Role of Women in Water and Environmental Sanitation Service" (INT/83/003) which is carrying out demonstration activities involving women in 10 countries of Africa and Asia, as well as providing advisory services to agencies wishing to carry out such activities themselves.

69. In its assistance to Governments in implementing rural water supply and sanitation projects in Bangladesh, Ethiopia, India, Nepal, Pakistan, Philippines, Sri Lanka and Thailand, UNICEF has been trying out various ways of securing women's participation, especially training them as hand-pump caretakers and involving them in health education activities. UNICEF has also issued three case studies on

projects in Burkina Faso, the Philippines and Senegal, and has produced a film on the Nepal experience in collaboration with the Government of Nepal and the UNDP project.

70. In projects supported by various donors, women have participated in village water committees in Guinea Bissau, Kenya, Thailand and the United Republic of Tanzania, while women's organizations have been involved in Ethiopia, India, Niger and the United Republic of Tanzania. In Ethiopia, Mali, Senegal and Sri Lanka women have been trained to manufacture simple hand-pumps; and to assume responsibility for village-level operations, maintenance and simple repair in Kenya, Malawi and Zimbabwe. In most projects which include health education, women have been the main targets of these activities. The rising awareness of the importance of women's participation has also been reflected in the policy of donor Governments which provide significant bilateral assistance to developing country water supply and sanitation projects. Awareness of the importance of the role of women is not limited to drinking water supply and sanitation; it is also growing in other aspects of water resources development and utilization, such as in the case of irrigation, and in particular small-scale irrigation.

VIII. RESEARCH AND DEVELOPMENT

71. In order to evaluate progress since the United Nations Water Conference, the 1984 questionnaire requested information on the existence of water resources research institutes and asked whether action had been taken, or was planned, to strengthen water resources research. The responses to the questionnaire showed that more than half of the countries in Africa do not have any research institutes or centres dealing with one or more aspects of water resources. Moreover, little is being done or is being planned in the region to improve the situation.

72. The situation is better in Latin America and the Caribbean and in Asia and the Pacific although several countries lack institutes dealing with certain essential water sciences disciplines. Overall, the lowest percentage was scored for water supply and waste treatment and the highest for hydrology and water resources assessment.

73. Applied water resources institutions are essential for the adaptation of knowledge and technology transferred from abroad and for providing the Government as a whole as well as the government services with independent scientific advice.

74. It was noted that, in general, the major constraints in the developing countries were the lack of financial resources and equipment. While foreign aid is, in principle, available for the establishment of institutions, it is generally very difficult to obtain assistance for consultancies and for the replacement of essential equipment for an existing institution.

75. A positive sign is the support that UNDP has been giving over the last few years to the co-operative regional activities of scientific and technological institutions which, in the case of Africa, include the field of water resources. Besides fostering regional co-operation and technical co-operation for development,

such projects also allow for small inputs to national institutions. As with educational institutions, assistance to research institutions is best spread out over a considerable period of time instead of being forced into the customary four or five years.

76. Applied research, as well as planning and design, requires easy accessibility to information on methodologies and research results and, in particular in the field of water resources, information on the natural resources of the country itself. The situation regarding information on national water resources and the related natural environment in many developing countries is very critical. It can be said that in many countries information is lost more quickly than it is generated and that more information can be gathered in international institutions than in the country itself. It is essential that national water information/documentation centres, services or systems be established and supported internationally.

77. Research thrives on frequent international contacts. Possibilities for such contacts exist and have certainly improved since the United Nations Water Conference. However, in the developing countries with well-established research infrastructures, it is often very difficult for the young scientists who have received their post-graduate training in the country itself to obtain invitations for international activities.

78. Scientific and technical non-governmental organizations provide a very useful international contact system through meetings and the exchange of technical reports. However, although membership in developing countries has increased, it is still very, very low. For example, the International Association for Hydraulic Research has less than 10 members in the whole of Africa below the Sahara. A similar situation exists with regard to subscriptions to scientific and technical journals. Possibilities, such as the UNESCO Coupon scheme, exist to overcome the difficulties of obtaining foreign currency, but these possibilities are not sufficient. In fact, the Regional Meeting on Socio-economic and Policy Aspects of Water Resources Management in Africa, in noting the difficulties often encountered in this respect, recommended that the United Nations system investigate ways and means of enabling the purchase of such professional publications in local currency.

79. One of the most significant operations in recent years relates to the development of low-cost pumps that are easy to operate and maintain at the community level, particularly by women, who often are the main users. The UNDP/World Bank hand-pump project has now identified two types of pumps that are particularly suitable for rural areas in view of the low cost, simplicity of design, ease of operation and maintenance, and reliability. The evidence gathered as a result of the first five years of operation of the project yields some measure of confidence in the sustainability and replicability of hand-pump programmes for village-level management and maintenance. It is envisaged that the project will now shift emphasis towards promotion of local manufacturing, demonstration of village-level operation and maintenance, improvement of borehole design, construction and maintenance; promotion of hand pumps for small-scale irrigation, and widespread dissemination of results. Low-cost sanitation technologies are also gaining increased acceptance as options for rural and peri-urban areas.

IX. CONCLUDING REMARKS

80. The Mar del Plata Action Plan provided a comprehensive blue print for action at the national and international levels for the development, utilization and conservation of water resources. The recommendations contained in it, as well as those stemming from ensuing General Assembly and Economic and Social Council resolutions, remain as valid today as they were 10 years ago.

81. Considerable progress has been achieved with regard to some important aspects of the Action Plan, particularly for drinking water supply and sanitation. It is now clear, however, that there are a number of particularly serious constraints which are critical in terms of achieving further progress.

82. In general terms, the most serious problems faced by many countries continue to be attributable to the fact that the type of interrelated management systems and related legal and institutional structures needed to maximize the socio-economic benefits derived from the development and uses of water resources has yet to be developed. Ideally, this type of management system would cover the whole spectrum of issues that arise, from the identification of the demand for water as an input to human and economic activities, to the actual operation and maintenance of specific projects. Broadly speaking this process would start with a definition of demands in terms of quantities, type of services and geographical coverage for water from different economic and social sectors, and a harmonization of national, regional and local objectives. All of this should then become integrated into river, lake or ground-water basin development programmes which also take into account their physical characteristics. In turn this process would lead to the formulation and implementation of integrated projects, as well as to the definition of requirements for human and financial resources. Finally, the efficient operation and maintenance of specific projects requires that a management structure at the project or community level be established.

83. In reality this process seldom takes place. At best, as is increasingly the case for water supply and sanitation, there is a degree of integration within one water use. On the whole, however, water resources development is carried out on a piecemeal basis. Efforts have often been made by a number of Governments to co-ordinate activities among various national organizations dealing with water resources. and in a number of cases improvements have been made. Significant progress however, will only be achieved if the necessary linkages referred to above are established, and responsibilities are clearly defined at each level of management.

84. Human resources development, and the mobilization of financial resources also remain critical as factors affecting progress in the development, utilization and conservation of water resources. The development and implementation of policies and programmes aimed at producing sustainable progress in these areas is also closely related to and depends on the development of well integrated management and administrative structures.

Notes

1/ See Report of the United Nations Water Conference, Mar del Plata, 14-25 March 1977 (United Nations publication, Sales No. E.77.II.A.12), chap. I.

2/ See World Development Report 1986: the Hesitant Recovery and Prospects for Sustained Growth (published for the World Bank by Oxford University Press).

3/ Official Records of the General Assembly, Thirteenth Special Session, Supplement No. 2 (A/S-13/16), resolution S-113/2, annex.

4/ See Report of the Consultation on Irrigation in Africa, Lomé, Togo, 21-25 April 1986 (Rome, Food and Agriculture Organization of the United Nations, 1986).

5/ Report of the World Conference of the United Nations Decade for Women: Equality, Development and Peace, Copenhagen, 14-30 July 1980 (United Nations publication, Sales No. E.80.IV.3 and corrigendum), chap. I, sect. B.
