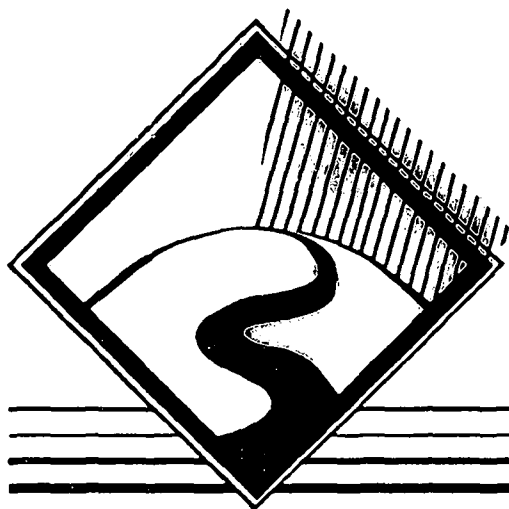


# Capacity Building for Water Resources Management



An International Initiative for  
Sustainable Development in the 1990's

May 1991

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Development Program



**CAPACITY BUILDING FOR WATER RESOURCES MANAGEMENT**

**An International Initiative for the 1990s**

by

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## Preface

This paper discusses key elements of a strategy for capacity building for sustainable development in the water resources sector in developing countries. Its purpose is to stimulate **capacity building** in the external support agencies and in the national management and local service agencies in the water supply and sanitation (WSS) and agricultural irrigation (IRR) subsectors in Asia, Africa and Latin America.

This paper originated from discussions among United Nations agencies during the annual meeting in 1989 of the Intersecretariat Group for Water Resources of the UN Administrative Committee on Coordination (ACC/IGWR). It was commissioned by the United Nations Development Programme (UNDP), Division for Global and Interregional Programmes (DGIP) and prepared by Dr. Daniel A. Okun and Dr. Donald T. Lauria of the University of North Carolina at Chapel Hill. The consultants carried out a literature survey and extensive consultations with personnel of external support agencies (ESAs) including United Nations Specialized Agencies, UNDP, the World Bank and other multilateral, bilateral and non-governmental organizations. Its first draft was reviewed by the ACC/IGWR in 1990 which concluded that capacity building is a vital ingredient for sustainable water resources development, use and management in the 1990's and that both developing countries and external support agencies would derive long-term benefits by increasing investments in institutional strengthening and human resources development which are the twin concepts underlying capacity building.

Because of the importance and timeliness of the subject, UNDP felt that a wider group of interested parties should be invited to review and reach a consensus on the key elements of the capacity building strategy discussed in this paper. For this purpose it was decided to bring together sector specialists and officials from developing countries and external support agencies in a UNDP Symposium entitled "**A Strategy for Water Resources Capacity Building**" (Delft, the Netherlands, 3-5 June 1991) organized in cooperation with the International Institute for Hydraulic and Environmental Engineering (IHE). Recommendations for an international initiative for capacity building are expected to be adopted at the Symposium.

While steps to implement the strategy are to be initiated after the Delft Symposium, the proceedings of the Symposium will be presented to the International Conference on Water and the Environment to be held in Dublin in January 1992, with the recommendations to be forwarded to the UN Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992.

That a capacity building initiative is needed, there is little doubt. While the International Drinking Water Supply and Sanitation Decade of the 1980's, initiated by the Mar del Plata Action Plan (UN, 1977), made major strides toward meeting community water and sanitation needs, it fell far short of its goal of service for all by 1990. As important, recommendations of the Action Plan concerning water resources generally and agricultural irrigation particularly were not adequately addressed. Nevertheless, numerous lessons were learned, chief among which are the interconnectedness of all water uses and the indispensability of effective institutions if water resources projects are to be sustainable and are to contribute substantially to national development.

This paper was prepared under aegis of Frank Hartvelt, Deputy Director of UNDP/DGIP. However, the contents and opinions expressed are the sole responsibility of the authors.



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## **Executive Summary**

The Mar del Plata Action Plan developed in 1977 had many objectives, including (1) water supply and sanitation (WSS) for all by 1990 and (2) assessment of water resources for the purpose of improving their development and management for domestic, industrial, agricultural irrigation (IRR) and other uses.

The WSS goal was addressed by establishment of the International Drinking Water Supply and Sanitation Decade (IDWSSD) which added service to some 1.3 billion persons for water supply and to about 750 million for sanitation. However, because of explosive urban growth in the developing countries, the numbers without service in the cities grew substantially. In addition, programs for water resources and related assessments were not widely developed despite increasing evidence of scarcity in the face of growing needs.

One significant response with far-reaching implications is that the UN Administrative Committee on Coordination Intersecretariat Group for Water Resources (ACC/IGWR) agreed to address these shortcomings through the development of a strategy for capacity building (CB), including institutional and human resources development at all levels.

The importance of capacity building in sustaining both WSS and water resources programs and projects in developing countries is well demonstrated. Capacity building, and the institutional and human resources development efforts that are integral to it, is essential to provide program and project sustainability though assuring that sound assessments of water resources availability and needs can be made on a continuing basis, that laws and regulations for the wise and efficient use of water resources can be assured, that the skills and resources of consumers be enhanced and utilized, and that funds for operating, maintaining and extending all the necessary physical facilities and institutions can be obtained.

The elements of country capacity building programs include improvement of the policy environment and, most importantly, institutional and human resources development at national and local levels, with emphasis on local community organization. Legal issues, information management, the role of international and national professional associations, multinational consulting engineering organizations and industries, also need to be addressed. Rapid assessments of national needs are proposed as an essential first step in embarking upon a program of capacity building.

Finally, external support agencies (ESAs) must themselves be committed, and be seen to be committed, to capacity building if country governments and institutions are to be stimulated to invest in capacity building.





## **Introduction**

The last half of the 20th century has witnessed a rapidly growing recognition of the problems of water supply and sanitation (WSS), irrigation (IRR), and water resources generally throughout the world and especially in the less developed countries of Asia, Africa and Latin America:

- Water-related diseases, particularly infant and children diarrheas, although completely manageable in the industrialized world, exact an increasing toll in the less developed countries;
- Women and children in urban and rural areas of Asia, Africa and Latin America are obliged to spend hours each day in fetching water for the home, time that might be put to more socially and economically productive purposes;
- While world population will have grown 150% over the half century, urban populations will have grown 300%, to a point where at the end of the century, almost half of the total population will be living in cities (Table 1);
- The number of cities of over one million population will have grown more than five fold over the half century (Table 2);
- Population growth in the developing countries is three to four times that of the industrialized countries;
- In 1950, only one of a total of three "giant cities" was in a less developed country; by the end of the century 18 of a total of 22 giant cities will be in less developed countries (Table 3);
- Because urbanization increases and concentrates the demands for water, cities throughout the world are suffering from water resource shortages; in the less developed countries they suffer as well from supply shortages, resulting from inadequate facilities;
- The explosive growth of cities in the less developed countries is generally not accompanied by provision of necessary water and sewerage infrastructure; they often experience falling groundwater tables, destructive land subsidence, soil contamination and water pollution from inadequate solid and liquid waste disposal;

**TABLE 1 Actual and Projected World Population**

<u>Year</u>	<u>Total Population</u> (millions)	<u>Urban Population</u> (millions)	<u>% Urban</u>
1950	2515	733	29
1960	2991	1030	34
1970	3592	1374	38
1980	4368	1770	40
1990	5292	2260	43
2000	6251	2917	47
2025	8466	5119	60

Source: Adapted from UN Department of International and Economic and Social Affairs, World Population Prospects, UN, New York, 1989.

**TABLE 2 Growth of Cities of More than One Million Population**

<u>Year</u>	<u>Number of Cities</u>	<u>Population (millions)</u>
1950	78	200
1960	114	299
1970	160	432
1980	222	605
1990	298	850
2000	408	1204
2025	639	2205

Source: Adapted from UN Department of International Economic and Social Affairs, Estimates and Projections of Urban, Rural and City Populations, 1950-2025: The 1982 Assessment, UN, New York, 1985.

**TABLE 3 Number of World Metropolitan Areas Over 10 Million**

<u>Year</u>	<u>More Developed</u> <u>Countries</u>	<u>Less Developed</u> <u>Countries</u>	<u>Total</u>
1950	2	1	3
1960	3	1	4
1970	3	1	4
1980	3	3	6
1990	3	9	12
2000	4	18	22

- Urban water shortages are accompanied by a growing demands for water for agricultural irrigation. In the less developed countries, the institutions for managing water resources effectively are only now beginning to be developed. (This is not to imply that such institutions are always adequate in the more developed countries.)
- By the year 2000, agricultural lands requiring irrigation will have increased about 10 percent. Many irrigation projects have not met their objectives and many have been wasteful of scarce water resources for technical and institutional reasons.
- Most water projects are still initiated by central government without the participation of the communities to be served. The people are seldom involved or even consulted. The consequences of this top-down approach is that the intended users are reluctant to pay for the service and are unwilling to contribute to the maintenance of the facilities because they do not "own" them.

The United Nations family of agencies sought to address these problems in Mar del Plata. The resultant Action Plan (UN, 1977) gave rise to the International Drinking Water Supply and Sanitation Decade of the 1980s. However, the Mar del Plata mandate extended far beyond a concern only for water supply and sanitation (WSS); it included sound management of water resources for all purposes including agricultural irrigation, industry, hydroelectric power, fisheries and inland navigation, explicitly a call for integrated water management. It recommended that, at the national level, water resources data be collected systematically, comprehensive studies of existing and future demands be made, legislation and policy with respect to efficient and equitable development and management of water resources be promulgated, an assessment of needs, including human resources, be undertaken, and applied research be inaugurated.

On the positive side, progress was made in WSS during the Decade, particularly in giving this subsector higher international and national priority. Increased attention was given to institutional development, HRD, and to community participation and management, particularly with regard to the role of women. Applied research programs were initiated under a UNDP/WB Water and Sanitation Program directed to development of low-cost technologies. Projects have become operational.

Moreover, more than 1.3 billion people were newly supplied with adequate water supply and about 750 million with sanitation, with coverage over the decade increasing from about 45% to 70% of the population in developing countries, while sanitation coverage increased from about 45% to only 55%. The principal impact was in rural areas, with almost one billion newly served with water in the decade, an increase of about 140%.

Despite this progress, the water sector - especially irrigation, water supply and sanitation - is still faced with outdated policies, inadequate institutions, shortages of well trained people at all levels, inappropriate technology and ineffective financial mechanisms.

Illustrative of the situation is that more than 1.2 billion are still without water service and more than 1.7 billion are without sanitation. Because the increase in urban water service was only about 50%, urban growth actually resulted in a 15% increase in the unserved urban population. The urban population unserved by adequate sanitation facilities increased about 30% over the decade. To sum up, urban services in the less developed countries, despite the emphasis of the Decade, have not kept up with growth.

In 1989 the United Nations Administrative Committee on Coordination Inter-secretariat Group for Water Resources (ACC/IGWR) initiated the preparation of a comprehensive strategy for the 1990s which was most recently presented in the report by the United Nations Secretary General to the Committee on Natural Resources (UN, 1991) entitled "strategies and Measures for the Implementation of the Mar del Plata Action Plan for the 1990s." The report included capacity building among the seven areas for action within national water strategies for the 1990s: "To enhance the capacity for the development and management of water related programmes, greater efforts have to be made to strengthen institutions and develop human resources at all levels." The report further stated that "the provision of adequate human resources, with skills appropriate to many scientific, technical, managerial and administrative functions required for the assessment, development, conservation and management of water resources, is implicit throughout the strategy proposals."

The New Delhi Statement (UNDP, 1990), prepared at the Global Consultation on Safe Water and Sanitation for the 1990s, contained four guiding principles, two directly related to capacity building: "Strong Institutions are essential for sustainable development," and "capacity building is necessary to make community management effective..." The other two, environment and health and financing and technology, depend for their implementation on strong sustainable institutions.

The problems facing the less developed countries in the water sector can be categorized into two closely interrelated areas:

- (1) Water Supply and Sanitation: Inadequate performance in the WSS subsector, attributable to exploding urban growth, use of inappropriate technology, inadequate institutions, and too little attention to the people to be served.
- (2) Water Resources Management: Insufficient attention to the water resources sector as a whole. The increase in large urban centers of population, together with the rapid growth in per capita water demands in the less developed countries resulting from industrialization and improving standards of living, are creating water demands that are competitive with increasing demands for agricultural irrigation.

In response to these shortfalls in the implementation of the Mar del Plata Action Plan, the United Nations Administrative Committee on Coordination Intersecretariat Group for Water Resources (ACC/IGWR) agreed in 1987 to develop a comprehensive strategy for the 1990s aimed at addressing the Action Plan.

A Panel of Experts meeting at Challes les Eaux (ACC/IGWR, 1989) recommended that assessments of the Action Plan be prepared and that strategies be developed for the future. The recommendations were influenced at least in part by the large scale problem of water scarcity, which is particularly acute in urban areas. Proposals for several of the recommended assessments and strategies were presented by various UN organizations at the ACC/IGWR meeting in 1989 (ACC/IGWR, 1990). Also at this meeting, participants agreed to conduct a survey of training requirements in the field of water resources as perceived by their organizations. Based on these meetings and preliminary assessments, it came to be recognized that a key element in implementing the M.d.P. Action Plan in the 1990s is the need for capacity building and strengthening of water-related institutions throughout the world (ACC/IGWR, 1991).

What emerged in this study was a consensus that failures in meeting WSS service objectives and in achieving effective water resources management in developing countries lie not in the realm of technology nor even in the availability of funds. Ample evidence exists that even where adequate funds are made available and the appropriate technology involves only well established practices, projects and programs, these have not been sustained after ESA intervention ceases. The need is for establishing the capacity in a country to receive external support agency (ESA) development assistance such that local programs and projects can be expected to be sustained with indigenous human and financial resources.

### **Capacity Building**

**Capacity building** rests on two interrelated concepts: Firstly, strengthening of institutions at all levels to deal more effectively and efficiently with all aspects of sustainable water resources development including the creation of a favorable policy environment, water resources assessment (both quantity and quality), planning, management, and program and project formulation, implementation and evaluation; and secondly, development of the human resources needed at all levels including education, training, and the creation of the working conditions conducive to career satisfaction and performance. In this context, CB seeks to integrate the management of the several subsectors in the water resources sector, most particularly water supply and sanitation (WSS) and irrigation (IRR).

The importance of capacity building for water resources institutions in developing countries can be demonstrated in numerous ways: (1) the substantial demands for water resources that will exist in the 1990s, (2) the technical, financial, and institutional difficulties of planning and project implementation that prevail in developing countries, and (3) the social and economic deficiencies of developing countries, all of which combine to indicate the clear need for strong sustainable institutions.

The demands for water for urban growth as well as for agricultural irrigation will require substantial investments in projects. But the technical conditions under which water resources systems must be planned in developing countries are often more difficult than those in the industrialized countries. For example, water scarcity affects a large part of the developing world. Irregular patterns of rainfall, with monsoon seasons followed by drought, result in patterns of water availability that are nearly as difficult to handle as where water is lacking. The expected technical difficulties are exacerbated by often inhospitable and inaccessible terrain, and the basic technical data needed for planning, design and construction are generally

lacking. Highly variable geographic and climatic conditions limit the use of standardized design; most projects are site specific.

Coupled with high demands and the technical difficulties of planning are the diverse and frequently deficient social and economic conditions in the developing countries. For example, populations within the same country are often culturally diverse. The necessary institutions for planning and implementation are often non-existent or ineffective for a wide variety of reasons. Inadequate human resources are a major constraint to institutional development and capacity building.

Rural communities are frequently dispersed and not well organized. In some cases, their populations are transient, migrating from one part of the country to another with the season. Residents of these communities tend to be poor and with little education; they are often ignored by central government. Women, in particular, are by-passed although they are the most impacted by inadequate services.

The cities, with rapidly growing, often extra-legal, squatter settlements, are not easily served. Even among the higher economic and social classes, government is seen to have the primary responsibility for water and sanitation services. Industries and large commercial enterprises are generally free to develop their own supplies, without charge, extracting water from streams and underground, the latter often resulting in local shortages accompanied by land subsidence. Pollution from the cities and their industries seriously impacts upon the usefulness of water resources.

Agriculture, which uses 80-85% of the water resources in most developing countries, is often perceived as having unfettered rights to any water which is available and, because the water is "free", much of it is wasted while nearby urban settlements are obliged to invest large sums to import water from afar. The need for an integrated approach in the development of legislative and regulatory tools for the use and conservation of freshwater resources regardless of use has been well demonstrated.

Financial and human resources are sorely limited in developing countries. Subsidies are scarce. The lack of adequate training and educational institutions is a major impediment to the development of strong institutions. The absence of information management facilities reduces the benefits that can be derived from experiences elsewhere. The implementation of water resources projects is hampered by the lack of local manufacturing resources, resulting in high dependence on imports for both hardware and technical inputs.

The conditions described above all conspire to complicate the planning, implementation and operation of water resources systems in developing countries. Years of inaction in the face of rapid growth oblige huge investments that in turn require extraordinarily strong institutions if water resources systems are to be well conceived, implemented and operated on a sustained basis.

Elements of CB have, of course, been pursued over the years, but at best with indifferent success and much too often with outright failure. The less developed countries are littered with projects built with funds from loans and/or grants that fail to meet their objectives or that are abandoned. The projects may have made some provision for elements of capacity building but implementing policy change and institutional and human resources development have

traditionally enjoyed little if any priority when a project includes the construction of facilities and/or the provision of instruments and equipment. Part of the problem results from the perception in the countries that the ESAs themselves are not interested in the institutional capacity of the countries to sustain the projects. The perception that the ESAs are not interested is easily understood; they are seen to be driven by the need to meet lending or granting targets; field teams seem far more concerned with the project itself than with its sustainability. Although demonstrated failures in projects resulting from institutional inadequacies have been well documented, ESAs are loathe to condition, and thereby delay, a loan or grant contingent upon assurance that a national or local capacity exists or can be developed to use the funds properly.

This paper presents a two-fold program for capacity building for water resources management:

First, introducing a variety of approaches to capacity building in less developed countries both at the national level and at the local utility or community level in water supply and sanitation and in agricultural irrigation; and

Second, improving the capacity of external support agencies to provide CB assistance in the countries and as important, to be perceived by countries to be giving CB a high priority.

### **Capacity Building In Countries**

The initiative for capacity building in the water sector in countries must come from within the countries. ESAs might well promote CB but investments in the sector are not likely to be sustained if the countries are not themselves fully committed to CB at all appropriate levels. One measure of this commitment is country readiness to participate in a rapid assessment. Identification of the policy environment, institutional resources, water resources availability, quality and demand, and human, materials, educational and financial resources are key elements of capacity building in a country. For implementation, country CB activities in the water sector may need to be approached at two levels:

1. **The national level:** National issues for CB include the policy environment, legal and regulatory frameworks, integrated water resources and river basin (where appropriate) management, water demand management, information systems, sector organizational models, and the utilization and promotion of national professional associations. National government agencies often have major roles to play in local projects and their relationships with local agencies impact on country capacity. Furthermore, international and bilateral external assistance is generally provided through national governments or, in large countries, provincial or regional agencies.
2. **The local level:** In WSS and irrigation subsectors, most projects are implemented at local levels generally through municipal water utilities and sewerage agencies, private water companies or irrigation districts, while consumer organizations and farmers associations may play roles in WSS and IRR respectively. External assistance may be given at the local level through nongovernmental organizations (NGOs), particularly for rural, village or small community projects. Most large scale



funding for local projects will be funnelled through national agencies and their success will depend upon the quality of institutions at both national and, more significantly, at local levels. The issues to be examined at the local level include local institutional resources and alternative management models, local water availability and demand, water conservation, water quality, local financial viability including funds for O&M and cost recovery, local human resources development, and consumer organizations. Integrated water management is entirely appropriate between water supply and sanitation agencies and inclusion of local irrigation districts is advantageous where water reclamation for residential, urban, industrial and agricultural nonpotable reuse is feasible.

### **The Policy Environment**

A tradition of free water for agricultural irrigation and a heavily subsidized water for household use, often embodied in policy and law in less developed countries, has placed heavy constraints on sound water management and the funding of water projects. However, even where such traditions hold sway, and national governments are in economic and political disarray, local initiatives have sometimes been able to create institutions that plan, finance, construct and manage high quality water enterprises. Not only need institutions development not have to wait on the establishment of sound policies and laws, strong local institutions can often be a stimulus to their establishment. Accordingly, it is incumbent on all involved in the sector to press for sound policy in every forum and venue possible.

Examples of the policy issues that need to be addressed are:

- Water resources, although renewable, are being depleted, limiting development. Measures need to be taken to manage water resources so as to extract the maximum sustainable yield feasible. The natural cycles of flood and drought cannot be controlled, but their impacts can be ameliorated.
- Water that falls as rain and then flows in rivers, lakes and underground may be free, but making it available for agriculture, residential, industrial or other use is costly; commitments to meet these costs are essential. This situation is little different from providing electricity to consumers, where metering and charging to meet the costs have been fully accepted from the outset.
- Realistic charges must be imposed on users to meet the costs. To encourage conservation, the charges should reflect the amount of water used. Accordingly, metering of water produced and used, a sound long-term management practice in any case, is essential. At the very least, charges should be adequate to cover the costs of management, operation, and maintenance of facilities. Because ESA funds are not likely to meet all capital costs for development, transmission, and distribution of water for agriculture, industrial or urban use in less developed countries, charges should begin to include cost recovery.

- National and local laws and regulations are necessary, and the institutions to implement them need to be effective.

### **Institutional Development**

The essential ingredient in capacity building is institutional development (ID), including the weaving of the essential fabric of all sound institutions, their human resources. Many types of institutions have been successful; but a universally suitable model cannot be prescribed. Institutions are products of a country's history and social and economic structure; the choice is a local prerogative. A major problem is too many institutions with overlapping authorities impacting on a sector; the "dragons" that dominate Chinese administration. The intention is not necessarily to add new institutions, but to assess those that exist and be open to and aware of other models that have been successful and may be appropriate. Institutions in the water sector include national and administrative agencies such as ministries, and local administrative agencies such as regional water authorities, municipal departments of public works and irrigation districts, regulatory agencies, such as water pollution control and environmental protection agencies, and utility organizations. Community consumer groups are considered separately.

The literature is replete with models for institutions, each with its advocates. They include:

- National and local government administrative regulatory and operating agencies, the most common. Administrative and regulatory agencies are generally national or provincial, while operating agencies are generally local.
- National and local but quasigovernmental agencies or authorities (called "Quangos" in Britain) which are generally financially self sustaining with their own personnel practices. While responsible to some national agency, they often enjoy greater freedom from political constraints.
- Local public utilities for water supply are the most common models with separate municipal sanitation agencies providing sewerage and wastewater treatment. Many advantages accrue when these are combined in a local public utility. A utility type service for irrigation has been proposed and is finding a place in developing countries (Frederiksen, 1987).
- Private agencies that often own and operate water supply service utilities, with regulation of the services, where regulation exists, by national government agencies. Privatization has extended to a lesser extent into sewerage and irrigation agencies.

- Another model is the public ownership of facilities with operation and management turned over to private companies under contract.
- For optimizing the potential for effective water resources management, comprehensive river basin organizations have considerable promise. They were successful in England and Wales for some 15 years (Okun, 1977) until they were privatized with many of their functions removed in 1989. Most river basin agencies have limited operating and financing responsibilities but this may well change in time.
- Planning, design and management of water-related enterprises, while at one time functions of national and local governments, are increasingly the responsibility of consulting organizations. Such organizations are generally privately owned, but in many instances government agencies themselves serve as consultants to other national or local governments that do not have in-house expertise.

Saunier and Nadeau (1989) describe innovative institutional structures that help assure sustainability but they conclude that, even with privatization and provisions for cost recovery, sustainability depends on the quality of the local institutions. All models have advantages and disadvantages which depend to considerable extent on local circumstances. Given that institutions are essentially people, major changes may be more difficult to implement successfully than a series of small modifications. All that ESAs can do, where institutional structures are perceived as constraints to effective management, is to offer a variety of options for change and support those promising changes that country officials elect to pursue. Transitional processes may be more acceptable than the upheaval that may result from pursuit of the "ideal" situation.

### **Human Resources Development**

As capacity building depends on adequate institutions, institutions depend upon human resources. The organization of an institution, the boxes and lines, are less important than the people who occupy the boxes. An idealized institutional structure with poor personnel has less potential than a poor structure with high quality people. Both success and failure have issued from all types of institutions but sound institutions along with high quality human resources are the best assurance of a country's capacity to achieve water sector objectives.

The growth in interest in human resources development (HRD) and its identification as more than just training, were contemporary with the Decade. However, an HRD study in the water sector sponsored by the ACC/IGWR revealed a general absence of attention to assessment of human resources availability, demand and needs (UNESCO, 1987). It found a general absence of attention to assessments of human resources availability, demand and needs in the sector. Various assessment models were presented, including those prepared early in the Decade by WHO (1984), the World Bank, WASH (1983), and the International Center for Public Enterprises in Developing Countries (Ljubljana). The survey report also presented its own model.

Of particular interest was the evaluation of some 22 HRD reports that were identified for DHV, the Dutch contractor that conducted the study, by the ACC/IGWR. Only a few were found to be a needs survey. Some comprise a supply inventory only. Only nine were believed to be relevant, only four of these were proper sectoral HRD need assessments, and only two of these were done on a national scale. Of the two, one was limited to irrigation training needs in Zimbabwe. The only report that fit all the criteria for a needs study was that produced by the Australian Water Resources Council "Manpower and Education for the Water Industry" (1981), and its applicability to developing countries may be open to question.

The responses by the ACC/IGWR (1990) to its own invitation at its Tenth Session in New York in 1989 for a preliminary survey of training requirements in the water resources sector indicated that a paucity of data are at hand, especially at the country level, and those data that are available can be characterized as being fragmentary, representing only bits and pieces of what is being done. Data to respond to the final item of the Terms of Reference for the preliminary survey, "An estimate of the order of magnitude of the gap between available and required human and financial resources," are not at hand. Ample numbers of prescriptions and models for national studies are available; implementing these studies for the purpose of developing sound programs seems not to have been done. Further investments in "how to do" should be replaced by "doing."

The UNESCO report stated the situation "...although the need for studies of this kind has been widely stressed, only a few are actually produced..." The report concludes that "...comprehensive and integrated HRD needs assessments... are vital for the development of policies and for decision-making that affects the position of human resources in the sector..."

This Australian Water Resources Council report, the only thorough national human resources study cited, begins with a detailed description of the water industry in Australia, including lists of the major urban authorities and their distinguishing water supply and sanitation characteristics. Close attention is given to the social and economic issues facing the water industry and the resulting impact these issues have on future planning.

The report includes a detailed supply and demand analysis for five personnel categories: professional, middle level, technician, trade, and operative. All the major categories involved in the water industry were identified with detailed descriptions of their responsibilities. The workforce was surveyed and inventoried by category and by country region, and future workforce requirements were forecast.

The heart of the report is Australia's discussion of the educational system's capacity to supply the forecasted demands, including civil engineering undergraduate and post-graduate studies, continuing education, and operator training. The study includes a list of existing faculty and trainers as well as an analysis of relevant courses. Specific policies are recommended and an administrative structure is proposed for implementing the policies.

The strength of the report is that, although it deals with "broad" issues, it does not avoid detail. Its specific recommendations, assessments, and forecasts are supported by numerous surveys and thorough investigations. The preciseness and quality of the report makes it a valuable planning tool for water authorities, educators, and government officials.

Essential elements of HRD are education and training resources at all levels which, along with methods for their utilization by personnel employed or to be employed in the sector, need to be evaluated. Included in these resources should be, in regions where they are available, members of the International Training Network (ITN), now numbering nine in Asia, Africa and Latin America, which provide resources that can assist countries in their own training efforts. A product of the UNDP/WB Water and Sanitation Program, ITN is now devoted primarily to WSS training needs. There is no reason that, possibly in cooperation with FAO, it might not cover the water resources sector, including irrigation in the future.

HRD is more than just a responsibility for improving the competence of staff. It involves employment practices, career structures, and professional and financial incentives. For example, the setting of a training program may have more impact upon improvement of a trainee's qualifications than the contents of the program. If the training program is seen by the trainee as an investment in him or her, individual self worth is enhanced and the training is more likely to be approached with enthusiasm. If better performance as a result of commitment and/or training is seen to be rewarded by increased pay and by an invitation to a higher level of training and then greater responsibility, the individual will make much greater effort than if the training and its rewards are perfunctory.

Staffing patterns must be well understood and opportunities for promotion enlarged, commensurate with merit. Expertise in HRD exists and should be employed on the permanent staff of large institutions or as consultants to smaller organizations.

The potential for human resources development in the water sector depends to a great extent on the educational and related resources in the country. While improving literacy and vocational skills and developing a system of higher education are outside the purview of those responsible for HRD in the water sector, much can be done to enhance the quality of personnel through the educational system.

Many water-related educational, research and other tasks can be commissioned to local universities and other educational institutions. This helps the educational institutions obtain and retain staff in the water sector. A common practice is to have a utility provide the university with funds for professional students to undertake tasks important to the utility. The university, the student and the utility all benefit.

Twinning arrangements may be encouraged between universities in industrialized and less developed countries, which will have the advantage of providing up-to-date technical material to one and familiarity with the specialized needs in the sector in less developed countries to the other. Joint research projects between the two institutions can be funded by a research agency or an ESA in the industrialized country. USAID has long sponsored modest research programs in universities in developing countries when coordinated with a US institution.

Universities in industrialized countries may commit themselves to developing specialized programs for engineers and scientists from developing countries. The bilateral ESAs fund such programs in specific technical fields or directed to specific countries. Among the most outstanding are the Dutch-supported International Institute for Hydraulic and Environmental Engineering (IHE) in Delft which serves globally and the Asian Institute of Technology which serves their region. Finnida supports education at Tampere Institute of Technology in Finland for engineers from Kenya, Tanzania and Ethiopia. France supports CEFIGRE, an active training program. Such programs help the personnel in both the industrialized and the developing countries.

### **Community Organizations**

Too often decisions on local water-related interventions are made between ESA staff and high level government officials in the capital, neither of whom are knowledgeable about the local population or its wishes. Examples abound where water supply systems have been built with external assistance but where few of the potential customers chose to connect, leading to abandonment of the project. The customers chose for various reasons to continue to purchase water from vendors at exorbitant prices rather than to connect to a system about which they had no input and whose reliability and quality of service were suspect.

Community organizations have been perceived to be important in rural communities, but they are equally or even more important in urban communities. It is not at all inappropriate for a project to include funds for the borrowing institution to support one or more consumer organizations that would institutionalize the assessment of customer needs, ability and willingness of potential customers to pay, and ascertain their preferences with regard to levels and reliability of service. An understanding of the readiness of people in the less developed country to support a project is essential, and the establishment and financial support of a consumer organization would pay for itself by avoiding costly missteps so common today. Such an organization is particularly important, though its composition might be somewhat different, for sanitation projects.

The role of women in consumer organizations has been shown to be instrumental in their success and in the sustainability of WSS projects. The reasons are easy to understand: in the absence of WSS facilities it is they who spend substantial portions of their time carrying water and whose quality of life in the home and in the field is most affected by the unavailability of water. Women have a stake in the improvement of WSS facilities and, in many societies, in irrigation facilities as well. PROWWESS, a UNDP program for the Promotion of the Role of Women in Water Supply and Environmental Sanitation Services, has made significant progress in enhancing the participation of women, but most projects and programs still ignore and even resist the input of women. Capacity building at the local level cannot succeed without the full participation of women. Their leadership has been found to be especially important. In light of the integration of water management and the importance of agricultural irrigation in rural areas, it is not unreasonable to extend the purview of PROWWESS to include the role of women in irrigation projects, especially in countries where women share with men labor in the fields.

While most other interventions in capacity building have been appreciated if not often implemented as fully as they should be, a responsibility for the establishment and utilization of community or user organizations is relatively new and requires new insights and, what initially

may be uncomfortable, practices, if the full value of the beneficiaries is to be obtained. If fiscal responsibility is to be expected, users need to be involved early in the planning.

The importance of the role of community organizations has been recognized by the UN Secretary General (UN, 1991): "There is... a promising trend, in some countries, towards the more positive involvement of local communities in the conservation and management of their natural resources and the environment. This mobilization of the people, particularly women, with appropriate information support, and education and training programmes, may offer one of the greatest opportunities for the sustainable management of those resources, and a campaign to stimulate such action could give a strong impetus to the implementation of a national strategy."

### **Successful Institutions: Water Supply**

Community water supplies were initially local responsibilities, and in most industrialized countries they continue in this fashion. In developing countries, except for major cities, responsibility for water supply has shifted to central government although a trend to decentralization is growing. Both approaches provide examples of success. Examples of successful institutions illustrate the unique nature of institutions. Even where the environment might not be conducive to the establishment of strong local institutions, some do appear and thrive:

**Mexico:** a country in transition moving from centralized direction of WSS to decentralized operation, where municipalities and states are being asked to take primary responsibility for their own water and sanitation systems. Mexico suffers from the lack of basic data for planning and decision making, water and sanitation systems that are not financially self-sufficient, tariffs that are too low, large shortfalls in receipts that fail to cover costs, university programs in sanitary and environmental engineering that produce only modest numbers of WSS specialists, too few continuing education programs for upgrading technical skills of practitioners, high unaccounted for water (UFW) in many systems, and generally weak institutions. Indeed, these ills are not peculiar to Mexico but are more often the norm in developing countries.

Despite these prevailing conditions, the WSS company for the state and city of Queretaro is an impressive operation. Unlike so many WSS companies throughout the world, the Queretaro offices are a beehive of activity. Most desks are equipped with microcomputers that are continually in use. Staff are busily engaged, working either independently or in small groups: no idle conversations, no extended breaks, no newspapers. The key members of management obviously know the details of their system and its operation. They can, for example, produce a recent report, internally prepared, on the operation of private water vendors in periurban areas; their costs, receipts and profits; and steps the company has taken to regulate them. With respect to maintenance, the managers readily describe the numbers of vehicles and personnel that are kept in the field and on alert 24 hours per day to deal with main breaks, customer complaints, and other problems.

To better monitor the system, the company developed and constructed its own panelboard in headquarters, with lights to show the operation and problems with key items of equipment and a bank of microcomputers recording data on flows, pressures and system indicators. The board is not particularly attractive, but it works.

With so many systems in Mexico suffering from high rates of UFW and revenue shortfalls, the record of Queretaro is a pleasant exception: finances are generally adequate and UFW has been steadily reduced under new company management to less than 30% through an aggressive program of maintenance in recent years. Concerned with the high cost of network expansion, the company has turned increasingly to the use of microcomputers and mathematical optimization techniques for least-cost planning and design.

Why is Queretaro more successful than so many other systems? Clearly, the company has strong leadership, which is in the hands of bright and capable people. Most of the managers admit that it was not formal training but on-the-job learning where they developed their skills and expertise. The company obviously enjoys substantial autonomy, largely free from political pressures and appointments, which has enabled it to rise to the challenge of trying to optimize its operation. One of the most impressive aspects of the company is its strong motivation and commitment to serve the public. Many staff members enjoy telling stories about their responses to crises, including the problem at 11 PM on a recent New Year's Eve, which took many of them away from their festivities to deal with an interruption in service. Clearly, the chemistry in Queretaro is "right", and they are an example for their peers.

**Philippines:** The Local Water Utilities Administration (LWUA) was established to develop and oversee a system of autonomous Water Districts (WDs) which are directed to oversee water and sanitation projects in provincial towns and cities. Despite LWUA's corporate credo: "We build institutions for you," its early activities focused more on physical development issues than institutional issues. This approach resulted in many WDs lacking the institutional capacity to control and financially manage their projects. In recent years, LWUA had changed its approach and begun to concentrate on important CB issues such as Human Resources Development. LWUA has diverted its resources from the formation of new WDs and construction-related activities to existing WD institutional development.

LWUA has demonstrated its commitment to HRD by constructing and operating an extensive Water Supply Training Center fully equipped with laboratories, a demonstration pipeyard, and classroom area. The WSTC offers numerous training opportunities for LWUA and local WD staff including operator's certifications, cadet training, advanced technical training, and management and policy making seminars. In addition, LWUA has started to play a more prominent role in training throughout Southeast Asia, offering courses in the Philippines for system operators and others from countries in the region as well as bringing their training programs abroad.

In addition to an aggressive training program, LWUA offers its employees attractive compensation packages in order to reduce staff turn-over. LWUA also encourages its employees to pursue graduate work, with a high percentage of senior staff having been sent overseas for further training. This combination of training and employee relations has provided LWUA with a well-qualified motivated staff. While the centralized nature of LWUA has enabled it to develop its training facilities and expand its activities beyond the Philippines, this has also resulted in more political influence over LWUA than in cases where such institutions are more decentralized. Hence, LWUA is an example of a large organization with good facilities, strong programs, reasonably solid funding, but under political influence which came to bear with the recent change in governments. Queretaro, on the other hand, is relatively small, without such strong facilities and programs, but enjoys freedom from outside pressures.



**Other Areas:** Yepes (1990) describes a sample of five cases from Latin America studied by the World Bank to identify successful management and operational practices. System populations ranged from about one-half to eight million persons and included one company in Brazil, two in Colombia, and one each in Chile and Mexico. Among major results, he found that successful companies have distinctive organizational cultures where managers are held in high esteem which they perceive as a mandate for company excellence. Well-developed companies have good job stability at middle management and professional levels, free from undue political influence which, among other things, results in an institutional memory. The well-run companies are financially strong, free to set their own tariffs, and customer relations are given the highest priority.

WHO and the Swedish International Development Authority have produced a series of case studies focussing on HRD, two of which are mentioned herein. *People in Focus* (WHO, 1989) is about SANEPAR, Brazil's WSS company in Parana State. In 1979, emphasis in the company shifted from "producing water" to "serving people", both customers and water company staff. To accomplish this shift, SANEPAR borrowed concepts from the private sector, e.g. management by objectives and the need for a strong data base for decision making. They adopted various indicators (e.g. number of customer complaints per month), which helped them to judge their performance. Before the shift in 1979, technical issues had been given highest priority whereas afterward, the focus shifted to financial aspects, especially self-sufficiency. Also, staff training became a key item. Descriptions were written for essentially all the jobs in the company, and training needs were examined individually based on personnel qualifications. This emphasis on the importance of staff resulted, among other things, in increased motivation and improved performance.

### **Successful Institutions: Irrigation**

From the earliest days of irrigated agriculture, the facilities were built and maintained by associations of farmers. Their gravity flow open channels are to be seen throughout the world and the practice is still wide spread. However, with the growth of irrigation to produce increased yields, the large amounts of water required led to the intervention of national agencies with responsibility now largely devolving upon ministries of agriculture or even ministries of irrigation. The International Irrigation Management Institute in Colombo reports on the recent creation of commune systems in the Philippines and farmers organizations in Chile and Argentina (IIMI, 1991). Others are presented below:

**Colombia:** Plusquellec (1989) reports on two successful irrigation systems in Colombia where management was transferred to Water Users Associations in the 1970s as part of a national program of decentralization. While governed by a board of directors from several public institutions and presided over by the Ministry of Agriculture, the management and financing responsibilities lie with the associations. Criteria for success include "highly motivated and trained personnel, good management, and adequate transportation and communication facilities".

**Nepal:** Farmer-managed or communal irrigation systems ranging from several hectares to more than 5000 hectares characterize irrigated agriculture in Nepal. These operate with little or no input from central government or other outside agencies. Yoder and Martin (1991) report

on a study of 25 systems in the hill country of Nepal, where farms are small, which revealed that the systems were well-organized and managed, resulting in intensive agricultural production. A diversity of organizations were found to be equally effective; some were informal while others were highly structured with many functionaries. While the functionaries are responsible for execution of the work, major decisions are made only at meetings of all the members.

Two basic methods of water allocation are used. The most common is to allocate the water according to the land area to be irrigated. A more interesting approach is the selling of shares to farmers, with each share representing a fixed portion of the total water available. If a farmer has more water than is needed, and another farmer needs more water, shares can be sold. Additional shares can be sold to obtain funds to increase the yield of the system. This approach provides an incentive for efficient use of the water as well as a mechanism for increasing the area irrigated.

The principal characteristics of these systems are

- The irrigation system creates the need for organization, which in effect becomes the basis for a user group;
- The systems are effective in their timely delivery, allocation, and distribution of water, in their mobilization of labor for maintenance of the system, and in building extensions to their facilities;
- Ownership of the systems affects the farmers attitudes and behavior, creating a sense of responsibility for the systems and their operation.

Lessons from these systems may very well be applicable to community water supply and sanitation systems in Nepal and elsewhere. Integrated water management has a place even in rural areas.

### **Rapid Assessments**

Among early tasks of developing countries, with the participation of external support agencies, would be to undertake, where appropriate, rapid assessments of their resources and needs. It is essential that these assessments be based on a collaborative and integrated approach among all the ESAs interested in providing development assistance to the countries. Also, country institutions need to be committed and actively involved. It would be highly desirable to involve community organizations as well in order to obtain views from user communities. Country readiness to participate, as demonstrated by the identification of a lead agency and key personnel, may well be a criterion for early selection for support by ESAs.

The term "rapid assessment" is used purposely to denote the limited period of time (3-6 months) set aside to carry it out. The assessment is meant to be the first step in the process of planning for the water sector. It would be beneficial to the country and the ESAs as well to institutionalize the assessment process. In view of the different conditions and levels of

development, the assessment will vary from country to country. It is particularly important that the assessment team be comprised of specialists provided by both the governments and the ESAs, with the former constituting the nucleus and corporate memory of the planning process in the country.

Rapid Assessments need to be tailored to the local situation. Among the subjects to be covered are the following:

- Water resources in the area, including the impacts of pollution;
- Needs for water for agriculture, industry, and water supply and sanitation as well as needs for sewerage and wastewater treatment in urban areas;
- Facilities available for providing WSS and agricultural irrigation as well as other water-related activities;
- Policy climate;
- Institutional resources at national and local levels, including user organizations;
- The need for human resources and facilities available for their development;
- Legal and regulatory tools and constraints;
- The financial situation with regard to capital and O&M requirements for WSS and IRR, including the potential for cost recovery; and
- Identification and solicitation of ESAs that are likely sources of technical and financial assistance.

UNESCO and WMO have joined in the preparation of a Handbook for National Evaluation for Water Resource Assessment Activities (UNESCO/WMO, 1988). While including very useful methodologies for assessing water resources data, institutional frameworks and manpower, education and training, it omits any assessment of existing or future water uses or demands which need to be determined at the same time to identify the country needs for CB.

Rapid assessments are intended to be accomplished in only a few months to identify the situations that are most critical and that need to be addressed while longer-term needs, programs, and projects are being assessed. Gaps in knowledge concerning water, financial, and human resources will be a challenge to rapid assessments, as will the inertia to be overcome in launching such studies.

The steps in undertaking the rapid assessments should include:

- (1) The creation of a team with representation from national, metropolitan, and/or local agencies based upon the perceived urgency of their problems and their readiness to take initiatives.
- (2) The team should include representatives from funding ESAs or their executing agencies as well as from ESAs that are prospective participants.
- (3) Team members should represent the several professional fields necessary to the particular situation, including especially individuals with an interest and expertise in human resources and institutional development so essential to capacity building. It may well be appropriate to include representatives from among the constituencies to be served.
- (4) The team should contact all the national and local organizations with an important role to play in water resources, including the promulgation of laws and regulations and, especially means for their implementation.
- (5) Criteria should be developed and used to provide a basis for establishing priorities for both immediate action and for longer-term studies.
- (6) Projects should then be prioritized within categories for immediate action and for implementation over a longer time span.
- (7) Finally, terms of reference should be prepared for the highest-priority projects.

### **Legal Issues**

When fresh water was abundant and sufficient to easily meet all people's needs, legislation for its management was not important. When water became scarce, organized society interceded. Ancient civilizations codified their water management practices where water was limited. Laws are fruits of political systems which are generally dominated by special interests. Traditionally, water for domestic purposes enjoyed priority, but agricultural interests have become powerful, putting constraints on water urgently required for rapidly growing urban and industrial metropolitan areas. The fact that laws and regulations exist in many places has not resulted in equity; their absence, however, assures anarchy.

A common complaint in industrialized countries is that legislation and regulations have overwhelmed the water sector. Users are in conflict and resolution increasingly lies with the courts. In less developed countries, laws and regulations are often inadequate and, more importantly, where they do exist they are seldom enforced. Laws and regulation are necessary but not sufficient to assure sound management of water-related activities. This is a responsibility of the institutions.

However, institutions also have a responsibility for the promulgation of appropriate laws and regulations. They need to have the professional expertise, both administrative and technical, that can advise on legislation and regulations that are appropriate and

implementable, recognizing existing constraints. It can also be said that institutions are necessary but also not sufficient. Sound and implementable laws and regulations and sound institutions are essential.

A major constraint to water resources management in most countries is that the institutions for water were created to serve particular constituencies such as municipalities, agriculture, flood control, etc. and their objectives may well be in conflict with one another. The capacity building initiative and the rapid assessment may identify such institutional disabilities and begin a process leading to integration of water management.

An FAO/WHO Working Group on legal aspects of water supply and wastewater management "...emphasizes (inter alia) the need to insure that governments have the legal power to allocate and reallocate water reuse rights..." They suggest a "water rights administration" (WHO,1990). Many other recommendations are made, among which are:

- Integrated water resources planning
- Mechanisms for community involvement
- Enhancement of the capacity of water agencies and users' associations to manage water systems
- Control of allocation and use of wastewater
- Protection of downstream users from upstream withdrawals
- Encouragement of user charges
- Need for institutions to achieve sustainability

The Working Group explicitly recommended that assistance be offered to developing countries for implementation of these recommendations. Extension of these recommendations to agricultural irrigation was implicit.

An example of new legal problems that arise is associated with wastewater reclamation and reuse for nonpotable purposes in urban areas, industry, and agriculture. Such problems have not yet been adequately addressed in industrialized countries where water reuse is beginning to be well developed. Who has ownership in the reclaimed water? Where separate agencies are responsible for water supply and sewerage, which one should have responsibility for the nonpotable reclaimed water service? Local water institutions will have to be adapted to deal with this important new resource.

Laws and institutions are particularly important today in the less developed countries where water for urban and industrial growth and agricultural irrigation exceeds available resources, which is nearly everywhere. Water for domestic purposes has traditionally enjoyed priority. However, because agriculture uses about 80 to 85% of water resources, agricultural interests have become the dominating power in water resources management in arid and semi-arid areas. Agriculture agencies hold dominion over water resources in most countries,

including the United States, and the provision of waters for growing urban and industrial needs has been seriously constrained, despite the fact that the market value of water in urban use is considerably greater than in agricultural use. A major objective of this water resources capacity building initiative is to integrate water management through policy, legislative and institutional modification to insure that water resources serve country economic and social development needs most effectively.

### **Information Management**

Information is a crucial resource for effective water resources management. For example, design of a water supply reservoir is little more than a guessing game without adequate, long-term runoff data. Information management systems are necessary to ensure a reference base that allows continuous updating and monitoring of water resources data and integration of documentary information on water resources management, both of which are essential to strong institutions. The International Reference Center (IRC) in the Netherlands has been instrumental in helping promote information management systems in countries. The INFO-IMPACT workshops, initiated by IRC at the request of the Steering Committee for Cooperative Action for the IDWSSD to address this issue, resulted in the "Framework for Technical Information Exchange (TIE)" (IRC, 1989). The Framework is based on an incremental build up of information exchange capacity at country and project level, through interaction between four interconnected elements: assessment of needs and resources; product development; capacity building; and promotion.

Following endorsement of the Framework by the Steering Committee, the Water and Sanitation Collaborative Council included technical information exchange as one of the key components to be incorporated in the future water and sanitation projects. Technical information exchange, project/sector information, management information and public information and promotion as elements of comprehensive information management, were affirmed as matters of priority importance in CB for the provision of sustainable water supply and sanitation programs in developing countries. IRC has already expanded its coverage and might well incorporate water resources information generally and irrigation specifically in its purview in the future. The Country External Support Information System (CESI), which already enjoys increasing country level interest, can be expanded to include CB and the integration of water management. TIE and CESI are expected to make significant contributions to ESA collaboration in the water resources sector (IDWSSD, 1989).

### **Professional Associations**

National and international nongovernmental professional associations have long played an important role in enhancing the capacity of industrialized countries in the water sector. As Rietveld (1991) points out, they have contributed in manifold ways:

- They provide a mechanism for reporting and updating technical knowledge in the sector and making it available to professionals in the field through publications, conferences and short courses;
- They work with national decision-makers in defining policy and setting standards of all types;

- They can provide a link between public agencies, consultants, manufacturers, industry and the public;
- They promote national and International exchange and cooperation in training, research, technology, and in sector development.

These professional associations depend upon contributions of their members through payment of dues and, much more importantly, through contributions of time. Manuals of design, operation, and methods of analysis are all products of professional contributions to the associations. Not incidentally, those who participate in the committees that prepare such manuals feel that their professional gains repay more the the value of their time.

While well established in the industrialized countries, they are non-existent or very weak in most less developed countries. Important contributions to national capacity building in the water sector can come from ESA assistance as well as from initiatives by international professional associations which in general are dominated by representatives from the industrialized countries. The International Water Supply Association, through its Foundation for the Transfer of Knowledge, made a commitment to "Building and Strengthening National Capacities for Sustainable Water Supply and Sanitation Coverage" at New Delhi (IWSA, 1990). It is prepared to contribute to the strengthening of national professional associations. National associations in the industrialized countries can also reach out to assist like types of associations in the developing countries by making special arrangements for distributing their publications which, because of foreign exchange difficulties, are generally not easily available in the less developed countries. ESAs can assist financially in the distribution of publications by working through national associations and they can also help by sponsoring professionals to attend conferences which are not easily accessible because of the limitations in foreign exchange.

While the IWSA is operative in the WSS subsector, the International Water Resources Association might well be called upon to address the water resources sector as a whole, assisting in the creation of national associations in the irrigation subsector.

### Twining

The growth of the "sister-city" concept, or twinning, can well be nurtured and focused on WSS services. Management and operating staff of a utility or an authority, or even a national agency in an industrialized country can exchange visits with their counterparts in a developing country, generally already selected by virtue of some commonality. Visits can be made by individuals or by teams representing a wide range of services. Such enterprise fosters international understanding as well as technical exchanges and have the advantage over project interventions in that they can be long-term. Bilateral ESAs can identify and promote such activities in their own countries. Because these efforts are generally individually financed, at least on the industrialized country's side, a little financial assistance can make a big impact.

### **Multinational Corporations**

Multinational manufacturing corporations have production facilities throughout the developing world. They generally require services for water supply and wastewater and solid waste management and disposal. Whether they locate in an urban area and receive services from the municipality or provide their own services in a city or in the countryside, they are closely involved with local and often national institutions. They may want to contract and pay for local WSS services but find that the water supply is unreliable and the pollution control facilities are inoperative. If they perceive the problem before siting their plant, they may opt for a location away from the city despite the advantages that accrue from an urban location. In any event, multinationals have a stake in the quality of the WSS institutions that serve them. If the utility is having trouble with the maintenance of its equipment, a common problem in the less developed countries, the corporation might offer to use its own facilities for equipment repair. While helpful, this intervention has only short-term benefits; a better contribution would be to help train the utility management and operating personnel in the development of preventive maintenance programs. Such large corporations in the industrialized world have close working relations with the utilities that serve them in their home country. They might promote twinning between utility personnel that serve their home country plants and the utility personnel that serve their developing country plants. The engineering consultants they employ from their home country on in-plant water operations might be asked to offer technical and management assistance to the water-related utilities where appropriate.

Multinational corporations are an important presence in developing countries and their resources can be harnessed in their own interest and in the local interest. Professional associations can be a facilitating instrument in such endeavors as multinational companies are major contributors to the development of their national professional associations.

### **Consulting Engineering Organizations**

Consulting engineering firms from industrialized countries are major actors in both WSS and IRR projects. They are generally employed by clients in the developing countries but the ESAs are often involved in their selection when they are the source of funds. Consultants are often selected for their technical competency with little attention to the role they can or should play in capacity building both with the institutions they serve and with local consulting engineering organizations. The "joint-venture" of an expatriate firm with a local firm on a project is often a marriage of convenience, the local firm helping secure the contract and being thereafter involved in "housekeeping" rather than professional obligations.

It should be the responsibility of the ESAs to incorporate in the engineering assignment a responsibility for institution building with particular emphasis on human resources development. The latter should include development of the staff and, in addition, of local engineering and other professional personnel involved in the project. An expatriate consulting firm selected on the basis of its commitment to human resources development as well as its technical responsibilities would be eager to use its professional staff to assist with training and support of local professional associations. They exercise such functions in their home countries as an inherent professional obligation. However, if the ESAs who review the performance of the consulting firm on the project appear only to be interested in the pace and quality of the



technical phases of the project, both the consulting firm and the client would be little inclined to give priority to HRD. The lead time for training the staff for a project may be as long or longer than the time required for completing the capital facilities or the project, so HRD obligations should be initiated at the outset or earlier through a separate project. Furthermore, it is good practice to employ the permanent staff during design and construction phases of the project so they can be familiar with the project literally from the ground up.

The expatriate consulting firms can be the key to developing a wide range of HRD-related activities. In the process they might learn something about indigenous resources and practices and so avoid some of the more egregious examples of inappropriate technology.

### **Capacity Building In External Support Agencies**

Applications for loans and grants in the more developed countries, whether from commercial banks, from central government or from private foundations, are accompanied by assurances that the applicant has the capacity to use the funds effectively and to assure sustainability. When these applications are appraised, the potential lender or grantor examines the applicant to ascertain whether the capacity does, in fact, exist.

Problems arise when the lender or grantor has objectives other than only assistance to the applicant. Among ESAs, the level of lending or granting may have been established to justify the existence and continued funding of the agency itself or to enhance the status of the agency among the family of similar agencies whether international, bilateral, or nongovernmental. Among some bilateral aid agencies, and to some extent the international lending agencies, the driving force for granting or lending may be political or diplomatic or commercial, with certain countries targeted irrespective of the expressed needs of the countries. Within agencies, competition among sectors or departments to achieve high levels of lending or granting may result in loans and grants being made without too much concern for whether the capacity exists to use the funds effectively and to assure sustainability. In the event that a loan or grant is evaluated for its effectiveness in meeting its avowed objectives, an oft-omitted part of the process, this occurs so many years later that the staff responsible will have long departed the scene.

Other problems with implementing CB projects are that investments in processing a loan or grant for CB are not so rewarding as investments in capital projects which move larger blocks of money. Also, CB is not so visible as capital projects. They are not amenable to dedication ceremonies and plaques nor can they memorialize national leaders.

### **World Bank Experience**

The World Bank, through its Policy, Research and External Affairs Unit, sponsored a Conference on Institutional Development in December 1989. Participants included Bank managers and staff and representatives from ESAs and the academic community. Paul (WB, 1990) found a positive correlation between project sustainability and ID. Although increased attention has been given to (ID) issues in Bank projects, the quality is uneven. He attributes the poor record to the mismatch between the complexity of institutional development (ID) issues

and the staff assigned to it. He recommends that task managers take more interest in ID issues and supplement their ID skills. Institutional assessments should be accepted practice by the Bank and the country.

In a review of 84 Bank projects approved by the Board in 1988 (WB, 1990) it was reported that 33% of the completed projects were weak in ID. Of the people working on ID issues, 44% were technical specialists; 27% were economists; 18% were lawyers, financial analysts, project officers, and country officers; and only 11% had had specific ID training. The authors concluded that technical and institutional specialists perform better ID work than economists, and that those with more years of experience outperform those with less experience. An important conclusion of the report was that the best ID work is done by task managers committed to ID goals. The authors recommended including ID specialists on the staff of country departments.

Sullivan (WB, 1989) analyzed the existing Bank structure relating to its capacity to perform ID work and concluded that "Consideration should be given to preparing an operational directive that would guide the staff in preparing country ID strategies and in undertaking institutional assessments...." and that "Resources are a major factor determining a staff member's willingness and ability to deliver a sound product. Guidelines on budgeting time and resources for ID work, based on different types of ID experience, would help staff plan appropriately for ID-related work."

The World Bank through its Operations Evaluation Department (OED) reviews the strengths and weaknesses of Bank operations annually and evaluates all of its projects after their completion. OED has become increasingly concerned with capacity building issues, such as institutional development and human resources development. In its most recent review, "Evaluation Results for 1988, Issues in World Bank Lending Over Two Decades" (WB, 1990), CB issues facing the Bank are highlighted, with ID and HRD issues being cited as critical indicators of project success. OED concluded that "In a large number of the unsatisfactory operations, the principal determinants of performance were institutional." In terms of sustainability, a measure of project success, OED listed six important sustainability determinants, three of which are related to CB: institutional development, management competency, and level of commitment.

In an OED review of irrigation projects (World Bank, 1990), McPhail pointed out that, while 80% of 124 projects in 1974-88 had been judged satisfactory, performance dropped to 61% in 1988. In the same periods in the Asia Region, satisfactory performance dropped from 89% to 41%, with only eleven of twenty-four projects judged satisfactorily in 1989. Because these evaluations were made before the performance of the projects has been fully demonstrated, a series of twenty-one impact evaluations were undertaken covering all regions. Projects had been approved between 1961 and 1978 and were completed during the period 1970-86. The following is a summary of several of the parameters.

	<u>% Satisfactory</u>
Irrigation Performance	
Status of Irrigation Systems	39%
Equity in Water Distribution	63%
Institutional Performance	
Operations	58%
Maintenance	22%
Extension Service	53%
Agricultural Credit	75%
Cost Recovery	32%

Several findings regarding institutional issues were instructive. The division of responsibility for the projects among several ministries and poor coordination among institutions were common problems. For example: "Water authorities remained engineering-oriented with little knowledge of agriculture (while) agricultural services were ill-prepared to advise farmers on irrigation techniques." Only about 50% of the projects evaluated achieved even short-term sustainability. One important conclusion was that the Bank and the country governments disengaged too early so that "...most of the projects under review will not reach their expected useful life and already require rehabilitation and modernization." On the positive side, water user associations were found to be effective and their adoption is encouraged as an institutional investment in sustainability.

In the WSS sector, recent OED reports illustrate the importance of institutional capacity with CB issues frequently cited in the "Lessons Learned" section of each report. Several WSS projects evaluated in FY 1989, but begun about 10 years earlier, are summarized below:

**Managua Water Supply III Project (WB, 1988):** The project completion report stresses the impact a strong institution can have on success. One of the "Lessons Learned" states: "The completion of the Managua III project demonstrates that when an institution is strong, enjoys autonomy, and has a motivated experienced staff, a project can be successful in spite of great political changes that may occur in the country."

**Egypt: Water Supply and Sewerage Engineering Project (WB, 1988):** Unlike the Managua Project which benefitted from an existing strong institution, the Egypt project met with limited success due to institutional problems. NOPWASD, one of the institutions responsible for the project, had six different chairmen over the course of the project. While the project included a major institutional development component, it was judged to be limited partly due to the Bank's approach to institutional development. One of the "Lessons Learned" advises that "...the Bank should adopt a more pragmatic approach to complex institutional change..." The report also concludes that "...the project appraisal underestimated the complexities of the Egyptian decision-making process in matters relating to contract award and decisions on engineering and institutional options."

**Cotonou [Benin] Water and Sanitation Engineering Project (WB, 1988):** This project emphasized the necessity of addressing institutional issues throughout a project and not just in the early "studies" phase. The initial phase of the project included an institutional study. Followup, however, was devoted principally to technical areas. Several components of the project had to be dropped due to what the OED described as "...the absence of reliable institutions." In the "Lessons Learned," the report stated "Retrospectively, it appears that the

institutional and resource mobilization issues should have been addressed prior to launching ambitious technical studies." The Benin project demonstrated that institutional studies while necessary are not sufficient to insure that measures will actually be taken to improve existing institutions.

Based on assessments of some 125 World Bank WSS projects, Buky (1990) found that adequate management and staffing are essential to success. He emphasized, furthermore, that capacity building needs to occur prior to, rather than during, project implementation. Success was achieved "...where the Bank had the fortitude and patience to prepare the ground... by insisting on pre-project action for the build-up of institutional competence."

### **Lessons Learned - Ten Years of the WASH Project**

The Water and Sanitation for Health (WASH) Project, established ten years ago by the U.S. Agency for International Development as its principal contribution to the IDWSSD, is operated by a private consulting organization, Camp, Dresser and McKee International, Inc. It recently published "Lessons Learned From the WASH Project" (WASH 1990). Subtitled "Ten Years of Water and Sanitation Experience in Developing Countries," it identifies the major issues which have contributed to WSS project success. The report begins by identifying a four-component project methodology consisting of (1) skills transfer through technical assistance, (2) linkage of related development activities, (3) sustainability and (4) shared responsibility for development outcomes. Capacity building issues, including institutional development and human resources development, are important to each component.

The first lesson listed in the report refers to the effectiveness of technical assistance: "Lesson One: Local institution-building is the key to transferring sustainable skills." The problem with many technical assistance programs "...is one of not perceiving institution-building as a major purpose of technical assistance and thus of not structuring the assistance so that this takes place."

WASH cites sustainability as the most important measure of project success. To achieve sustainability, WASH believes projects must address institutional development: "...all of the institutional systems (i.e., operation and maintenance, administration, commercial, technical) should be addressed simultaneously and should involve people at the top, middle and bottom of the institution." This focus on individuals recognizes that "Dedicated, well-trained people will find a way to get the job done whatever the structure..." and that seemingly sophisticated institutional organizational charts "...will have no impact if the people... do not have the will and capability to implement the program." The report cites human resources development as the key to providing institutions with the necessary "dedicated, well-trained" people.

### **Role of External Support Agencies**

The UN organizations, the regional development banks, and the bilateral ESAs active in the water sector face the need for competence in capacity building. Because UN agencies are major actors and often set the tone for new initiatives, their commitment to capacity building should be highly visible. In large project-oriented agencies, there might be a central office and even regional offices; in agencies with more limited water-related programs, capacity building

might be a focus located in an appropriate office in the the agency.

Many of the CB activities will be common to all of the organizations. They may have to develop guidelines and procedures for capacity building and provide oversight of projects. They might take the lead in conducting studies and applied research in institutional and human resources development, and they will have to see to the development of their own staffs.

The UNDP and the World Bank in particular will be expected to play a major role, especially at the outset. They provide multisectoral funding; they are world-wide; they are the source of major funding in the water sector; and they each have a special focus, the UNDP on human development and the World Bank on poverty. Their tasks would be to provide high visibility and leadership.

One approach, now being implemented in some projects, is to commit a certain percent, say 5 to 10%, of the total funds to be allocated to capacity building. While highly desirable, this alone might fall short of providing the help needed. In many countries, new projects place heavy burdens on national and local institutions, burdens which they are often ill-equipped to handle. To require that CB and ID initiatives be undertaken in addition is much to ask. Investments in CB should must be made prior to embarking upon implementation of large projects and continued during the project.

If an ESA is to promote CB, it itself must be staffed adequately with knowledgeable personnel in appropriate executive and operating positions to assist in capacity building within the ESA and its field staff and with client countries. A country is not as likely to implement the CB portion of a loan or a matching grant unless it perceives that the ESA is itself committed and that future investments of the ESA are likely to be contingent upon country capacity in the sector.

In larger ESAs, such as the World Bank (WB), the Food and Agriculture Organization (FAO), the regional development banks and the larger bilateral agencies, there may need to be CB personnel at a central policy or administrative level as well as in departments that operate in the field appraising specific loans or grants. In specialized agencies and in smaller ESAs, a single focus for CB may be adequate.

The Food and Agriculture Organization (FAO) has formulated an International Action Programme on Water and Sustainable Development (IAP-WASAD) within the framework of the ACC/IGWR (FAO, 1990). While identifying five specific actions, including efficient water use, drainage, water quality management, small-scale programs, and scarce water resources management, attention is also given to institutional development which provides a basis for CB. In arid and semi-arid areas, the Programme recognized that "Because of scarcity, rational and equitable decisions on water allocations must be made among various water users and uses. Such decisions can only be properly made and implemented within the functional and institutional frameworks." The document goes on to point out that "There have been many initiatives in data collection, land use zoning, and control of over-exploited water resources, yet many plans remain unimplemented or controls unenforced..." In addition, in arid and semi-arid regions where urban and industrial growth has created new water demands, insufficient attention appears to be given to joint efforts with others in the water resources sector. With agricultural irrigation currently using about 80% to 85% of the world's fresh water resources, the

*bigger burden for sound management falls on agricultural enterprises.*

The Programme includes important supporting actions including institutional strengthening and human resources development. If integrated water management is to be promoted in a client country by agencies that operate in the water resources sector including both WSS and agricultural irrigation, as of course it should be, CB would require that efforts be made to overcome subsector barriers within the agency so that differences in WSS and IRR policies not be promoted by the ESA within the separate agencies in the country. Such a process has already begun in the World Bank with the establishment of committees representing WSS, IRR and environment, which may well be a focus for CB activity in the regions. The ultimate objective would be to encourage countries to promote integrated water management agencies themselves.

### **Water Resources Management**

Of all the shortcomings in implementing the Mar del Plata Action Plan, the failure to address the water resources issues facing the developing world are the most threatening. The traditional approach to water supply, whether for community or agricultural use, is to estimate demands (if an assessment is indeed made) and to assume that the resource is available for the taking. Over-exploitation of groundwaters by abstracting at greater rates than recharge can take place results in "mining" water, which means that the supply cannot be sustained, leading to escalating costs for meeting demand. Whoever has the funds is generally free to extract water from underground or from streams virtually at will. In industrial countries, local water shortages have been met by gigantic water transfer projects. This approach is beginning to encounter political obstacles because watersheds are no respecters of governmental boundaries. In addition, the threats to communities that are to be flooded by major impoundments, threats to flora and fauna resulting from excessive abstraction from streams, and excessive groundwater abstractions causing land subsidence that threatens urban structures and increases the potential for flood damage are, and should be, inhibiting the easy acquisition of new sources and the over-exploitation of existing sources.

Even though water is a renewable resource, fresh water resources are being depleted by withdrawals from surface and groundwater sources at a greater rate than they are being replaced by rainfall, although the amounts replaced on average with each cycle of rainfall are relatively constant. (Obtaining the average is itself a daunting management and technical problem). Except for desalination of seawater, which is beyond the financial capabilities of all but a few countries, there are no "new" sources. All countries will have to live with what they have, or can negotiate from others; arid and semi-arid countries and semi-arid regions of otherwise humid countries are already facing serious limitations. Even cities in rain-rich countries are now experiencing local shortages.

Up to now, few measures have been instituted to husband existing water resources or to devise mechanisms for effective allocation of these resources. Even in the industrialized countries where these problems have already been widely recognized, the institutional and regulatory responses do not offer much guidance. The paucity of institutional and human resources and the almost complete absence of governmental frameworks for water resources management require starting from much farther back than was the case with WSS. The

challenge is exacerbated by the inherent conflict for domain over the resource between agricultural and urban demands, between country and regional needs, and even between countries. Conventional WSS projects in developing countries seldom stir public or political controversy; on the other hand, many constituencies, most generally at odds with one another, become involved in water resources projects. Accordingly, a priority task is the development of policies, legislation and regulations for management of this resource along with the creation of institutions capable of establishing mechanisms for allocating water, including the development of financial tools necessary for implementation of these policies.

While spearheaded by UNDP, several of the UN agencies have been focussing on these issues. For example, in a report on water management lessons for the 1990s, the UN Department of Technical Cooperation for Development (UN/DTCD, 1991), listed the common problems of water management:

- A dominance of unregulated use of water resources,
- Inadequate and ineffective water resource management,
- A high degree of inefficiency in many water-related public utilities,
- A failure to retain trained staff of all types,
- Overcentralization and bureaucratization of decision-making authority, and
- Inappropriate and inadequate water legislation.

The report concluded "...centralized national planning has failed as a tool for achieving optimum use of the water resource..." It stated, further, that "...institutions must be appropriate to local conditions and not centrally imposed... (they) should reflect the overwhelming priority of local responsibility and of the need for local, not just central, coordination."

However, national planning and source methods of allocation may be necessary where water resources are scarce. The report of the UN Secretary General (UN, 1991) cited an example: "The preference of farmers for water-intensive crops, despite an adverse water balance overall, and mandated allocative arrangements and sanctions, is seen in the cultivation of sugar cane in Maharashtra. This crop is favored because it can be sold at a guaranteed price that is remunerative - net income per acre was two to nine times higher than that for other crops in the early 1980s. However, the popularity of sugar does not mean that its cultivation is socially preferable. Data show that this crop takes six to eight times as much water but generates much lower product value per unit of water than alternative crops."

Shortages of water supplies for cities and their high marginal cost have led to development of programs of "demand management" in urban areas of the industrialized world. Demand management involves both technical tools, such as reduction in unaccounted-for-

water, and water reclamation and reuse, and institutional measures, such as sound pricing policies. The UN Secretary General's report (UN, 1991) emphasizes the importance of demand management: "The low efficiency of water use is a subject of concern to a majority of countries. This relates to all sectors, as it indicates excessive demands on the resource itself and on investment in infrastructure and operational costs. Because of the heavy water requirements of agriculture - particularly for irrigation - this sector represents, for many developing countries, a key to the rational overall use of water. Demand management, even if it gives only marginal savings of water, may have profound benefits when applied to agriculture, in the large volumes it releases for other uses, or in the costs avoided for additional resource exploitation."

As a report by UN/DTCD (1991) points out "Urban water agencies, particularly in developing countries, often lack many or all of the programs and policies... prerequisite to demand management." Moreover, and what is more important when considering overall water resources management is demand management in agricultural irrigation with 80% of water used for agricultural irrigation, 20% reduction in irrigation use would yield four-fold the amount of water as a 20% reduction in urban use. In fact, in some regions it has been demonstrated that more efficient agricultural irrigation would release sufficient water to meet all additional urban needs.

The Interagency Action Programme on Water and Sustainable Agricultural Development (IAP-WASAD), a strategy for the implementation of the M.d.P. Action Plan for the 1990s led by FAO (1990), is an example of this initiative. Among the many elements of the program are institutional strengthening and human resources development with special attention to addressing issues of water scarcity.

In its International Hydrological Programme Plan for 1990-1995, "Hydrology and Water Resources for Sustainable Development in a Changing Environment," UNESCO (1989) includes, in addition to research, a major commitment to the management of water resources for sustainable development, education, training, transfer of knowledge, and public information. Within this rubric is the provision of methodological guides for the assessment and integrated management of water resources, including integrated monitoring of soil and water systems in supporting groundwater resources assessments. A cautionary note might be introduced: projects should not be limited to "how to" make assessments, but should include the actual "doing" of selected country assessments.

UNESCO's program addresses the education and training of senior technicians through regional networks of water resources training centers. It also projects assistance with university education at undergraduate and post-graduate levels and with policies for and establishment of continuing education systems.

WMO, in its turn, has a highly developed program offering regional training courses, seminars and workshops conducted world-wide, as well as short and long-term fellowships supported in part by UNDP. These programs are dedicated to specialized fields for fairly high-level technical personnel in hydrology, meteorology and related areas.

The education and training offered by UNESCO and WMO in various aspects of water resources technology are well documented in agency publications. The persons undergoing this professional development are generally associated with national and local water-related



secondary (biological) treatment and filtration are required for market crops and for urban irrigation, toilet flushing and most commercial and industrial uses. The latter are attractive because they are not consumptive and the wastewaters generated can be reclaimed again. Urban irrigation and evaporative cooling are consumptive uses but they offer an opportunity for wastewater disposal that does not pollute receiving waters.

The high cost of retrofitting reclaimed water lines in cities where high-rise residential and commercial buildings have been provided with potable water but without adequate sewerage and drainage is daunting. Hence, the use of reclaimed water is best initiated for serving individual large users in or near urban centers and in newly developing urban areas where services can be provided during construction. One advantage does accrue to cities without fully developed sewerage systems; the collection systems can be laid out and treatment plants sited with reuse markets in mind.

The potential for reuse does highlight the need for research on urban sewerage to reduce its cost. One promising approach is modification of the design standards developed in industrial countries where heavy capital investments can be justified to reduce maintenance costs. Because of the backlog in sewerage in developing countries, the objective should be to minimize capital costs even if it results in higher labor costs for maintenance. Labor intensive solutions are economically and socially appropriate in developing countries. Extensive studies in this direction have already begun in Brazil.

In Sao Paulo, Brazil, the first unit of a secondary treatment plant (3.5 m<sup>3</sup>/sec) plant came online in 1988 in the western part of the city near rapidly growing urban and industrial developments. The effluent was of such high quality that SABESP has undertaken pilot plant studies for reclamation of the water for industry and urban irrigation (Okun, Crook, 1989).

The World Bank, UNDP, FAO and WHO are engaged in joint studies for water reclamation and reuse in the Middle East and North Africa region (World Bank, 1990). Among the developing countries where water reuse appears to be attractive are Cyprus, Egypt, Jordan, Morocco, Syria, Tunisia, Turkey and Yemen.

Nonpotable reuse of municipal wastewaters has been extensive in the U.S. for urban irrigation, industry, power plant cooling, and many commercial uses in the arid areas of the southwest and in Florida, a state with more than 1300 mm annual precipitation. The use of reclaimed water for toilet-flushing has recently been introduced in commercial buildings in California, but has been widely used in residential building for many years in Singapore and Japan (Okun, 1990).

Water reclamation for urban, industrial and agricultural use is an option that will become increasingly attractive in urban areas when costs are compared with other alternatives for obtaining new sources of water. In evaluating this option, the policy enunciated by the UN Secretary General (UN, 1991) needs to be considered:

"Water must also be seen as a commodity, with an opportunity cost, not simply as an input to agricultural production. The fact that its value is not truly recognized in most irrigation schemes does not reduce its value for other uses. A reduction of allocation to irrigation may be attainable at a

cost to agriculture... which is far less than the marginal cost of developing new supplies for domestic or industrial purposes. Similarly, an exchange of high quality water being used for irrigation, in return for adequate waste water, may be a sound principle of resource management."

## **Conclusion**

Despite major commitments by countries with the assistance of external support agencies, water resources development including water supply and sanitation for urban areas and water for irrigation in agricultural areas are not keeping up with demand. Furthermore, many investments that have been made have not been sustained. The major constraint has not been the availability of water resources technology or funds but an absence of capacity in the less developed countries to develop and utilize the resources available.

Strategies for capacity building for water resources management are proposed as an initiative for sustainable development in the sector in the 1990s. They require that the ESAs themselves establish their own resources for capacity building to insure that timely loans and/or grants can be made to enhance the potential for successful and sustainable interventions in the water sector. The principal thrust of the strategies is to assist the countries to initiate capacity building through rapid assessments in the sector. Improvements in the policy environment and institutional and human resources development would be undertaken based upon the findings. Specific actions focussed on both national and local institutions, as appropriate, would include the enhancement of information, education and training programs in the sector and in utilizing, inter alia, professional associations, twinning, multinational corporations, expatriate consulting engineering companies and consumer organizations in innovative ways to assist in the program. ESA-supported programs would also be major actors in the capacity building process. Particular attention needs to be given to more effective water resources management to encourage integration between water supply and sanitation and irrigation subsectors at national and local levels.

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