UNITED NATIONS
Economic Commission for Africa

INTEGRATED WATER RESOURCES MANAGEMENT:

ISSUES AND OPTIONS IN SELECTED AFRICAN COUNTRIES

NOVEMBER 1999

Economic Commission for Africa

FSSDD/ENV/044/98/Rev.

Integrated Water Resources: Issues and Options in Selected African Countries

November 1999

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1. GENERAL

Poverty pervades the African region, particularly sub-Saharan Africa. The situation in many countries of the region is aggravated by economic and political environment as well as by natural and man-made disasters. As one of the measures to avert poverty and enhance the attainment of food security, the approach of promoting integrated management of water resources is considered essential. This approach is in line with the objectives of Agenda 21 that recognizes water as an integral part of the ecosystem, a natural resource, a social and economic good, the quantity and quality of which determine its utilization.

ECA therefore, among its other areas of focus, carried out a study in five countries selected on the basis of regional distribution. The countries are Chad, Egypt, Ethiopia, Ghana and Lesotho. Of the selected countries, three, namely Chad, Ethiopia and Lesotho fall in the category of least developed and land locked countries.

1.1 Development of water resources

In three of these five countries, namely Chad, Ethiopia and Lesotho, notwithstanding some major undertakings in the fields of water supply and sanitation, irrigation, hydropower and multi-purpose programmes, hardly a dent has been made in pressing the available water to productive use in the interest of socio-economic progress of the population. The crisis, in these three countries, is one of gross under-utilization of the water resources potential. In general, the coverage for water supply for urban areas in all the countries is more than 50 percent and mostly falls much below 50% in the rural areas. The situation with sanitation facilities is much worse and is insignificant when one considers rural areas in all the five countries.

Table 1-Water and Sanitation Coverages.

Name of Country	Population million	Area x 1000 sq.km		Urban % of Total	Water Coverage Urban	Rural	Sanitation Coverage Urban	Rural
Chad	6.28	1284		21.15				
Egypt	57.8	1001		45	98	60	84	5.00
Ethiopia	56.4	1097		11.30	65	20		2.00
Ghana	18.0	239		35	76	46	61	14.50
Lesotho	2.0	30		23.00				

WSSCC, 1998

In the area of agriculture, the situation in Chad, Ethiopia, Lesotho and Ghana has deteriorated. Production of food crops has decreased and for about two decades the countries have remained food insecure albeit to varying degrees. Other water related activities have not been very successful.

The consequences of this slow progress, where water supply and sanitation as well as production of agricultural growth have fallen far behind the high population growth rate of about 3% per year, are that the population is malnourished and victims to the prevailing water borne and other diseases. The segment of the population that is most affected is the majority of the rural inhabitants who are at the same time the engines of the economic growth through farming. These rural populations are also the ones that lack other social services like health and education.

If the current trends of high population growth and environmental degradation are not controlled, the situation will become critical. It is therefore necessary to take parallel actions in reducing population growth, in the protection and rehabilitation of the environment and in taking a holistic approach to integrated management of water resources.

The general conditions in the 5 selected countries depict the following characteristics pertaining to water resources situation:

Chad and Egypt

In general, both countries fall in the Sahelian and Saharan climate zone. The climate in Chad ranges from tropical zone to (Saharan) desert climate and that of Egypt varies from arid to extremely arid except in the northern strip which has the mediterranean climate. In these countries, there is absolute moisture deficit with evaporation exceeding rainfall throughout the year. Egypt has more serious limitations for development arising from the Nile morphology and the deserts that bound the Nile valley and delta constituting a geographical barrier preventing the full utilization of the territory. The two countries are lower riparian in their transboundary basins.

Ethiopia

Ethiopia has numerous micro-relief and micro-climatic variations. It has rugged topography which is dissected by river systems generating high flow in the highlands causing severe erosion of soil. About 75% of the rain fall is concentrated in a period of 3 to 4 months and there is marked seasonal distributions of rainfall depending on location. Rainfall in the country shows high temporal and spatial variability. Six of the basins which account for 75% of the total generated surface water are transboundary and they drain into bordering countries. More than 80% of the country's surface water resources is generated by four river basins in the western part of the country which represents 40 percent of the total surface area. This poses a problem of imbalance in the proportion of land and water resources availability. In the south and east where there is plenty of land, water is in short supply. In the west, water is in abundance compared to land. In addition to the imbalance in the land and water availability, the country is also constrained by the international character of its river systems for which there are no agreements with other riparian States.

Lesotho

Lesotho is characterized by high mountains and deep valleys. The climate is sub-humid to temperate Over 85% of the mean annual precipitation falls during 7 months, and generate runoff causing high erosion. The rainfall pattern is highly variable with distinct temporal and spatial distribution. It has a unique position of being completely surrounded by South Africa and has an upper riparian position in its drainage system.

Ghana

In Ghana there are two distinct seasons; the wet season of a period of 7 months and the remaining 5 months being very dry. There is seasonal moisture deficit which is more pronounced in the northern Savannah belt during the dry season. The northern part is representative of the climate condition along the West African coast from Guinea to Cameroon. In the South, the main rainy season occurs in the period from May to August and a minor rainy season in the period January to March. The main dry season is characterised by dry "Harmattan" winds from the Sahara Desert and occurs from September to December.

Overview

From the Case Studies, a number of key issues are identified. These include:

(i) policy issues,
(ii) geographic and climatic issues such as spatial and temporal distribution of rainfall and water availability, relief and geomorphological factors
(iii) population distribution and density,
(iv) lack of water supply and sanitation services as well as infrastructure such as health, education, communication, dams, and irrigation structures,
(v) problems in agriculture concerning land ownership and food production,
(vi) poor economic growth rate, disparity in income distribution and GDP share in employment
(vii) problems of deforestation, soil destruction, erosion and degradation of water resources and
(viii) problems pertaining to peace and stability which include civil strife, war and disasters.

The impact of these issues varies from country to country depending on the status of development and the specific situation of the country in question. In their broader context the issues reflect the problems that prevail in the countries of the African region as a whole. Some of the major issues are discussed in the following sub-sections.

2 KEY ISSUES

2.1 Co-ordination

Institutional responsibilities for water resources planning and management are usually fragmented among sectoral ministries and administrative agencies. Consequently, there has been proliferation of authorities and overlap of activities which in turn results in wastage of scarce resources. This has been a considerable impediment to achieving

progress and to realizing integrated management of water resources within the sector itself and with other sector development programmes. This is applicable in all the five countries selected for the study.

Some of these countries are taking a new orientation while others are contemplating changes. Chad regards coordination of water activities as essential. However, it has neither a national coordinating body nor any water legislation. Chad also opts for decentralization of water activities but due to various reasons have not been able to put it in practice.

Egypt's approach follows two main trends in institutional arrangement for water use. These are:

- a degree of centralization in an attempt to internalize the effects of decision-making.

- and decentralization for implementation of sectoral activities.

Each of these trends has it's own advantages and disadvantages. Egypt believes that coordination is central and institutional setups should be considered in an integrated way with other components.

In Ethiopia, the present government has recognized the importance of the water sector by creating a Ministry of Water Resources which among other responsibilities will have a coordinating role in integrated management of water resources at the national level.

Ghana's view is that it has enough institutions for integrating water resources management at the sectoral level, but none at the macro or national level. For this reason, the Water Resources Commission which has powers to grant water rights has been set up to rectify the gap in coordinating water activities.

In Lesotho there is a proposal to establish a new Ministry of Water Resources in order to consolidate the control of water resources of the country. However, at present there is no organization which is formally and legally nominated by the government of Lesotho to undertake comprehensive planning, management development and coordination for the water sector. Lesotho views that coordination is essential and should be exercised by one central body.

The future strategy should focus on carrying out institutional reforms and establishing legal instruments in countries where these have not yet been done. Similarly, steps should be taken by governments to designate the functions of co-ordination and administration of water activities to some national focal point or centre.

At the sub-regional/river basin level, since all the countries in the case study share common river/lake basins, the adoption of a river/lake basin unit as a basic planning unit appears to be a very viable option for multi-sectoral programme implementation in a coordinated and harmonized manner. Although some progress has been made by all the countries, more effort needs to be directed to the cooperative arrangement for optimum and equitable utilization of shared water resources. Improved co-ordination should at the minimum lead to developing adequate capability for prioritising and formulating long term

plans with clear guidelines, adequate to enhancing financial management and overall manpower capacity and identifying areas for cooperation that is in harmony with national and regional policies and strategies. These activities could be realized with the support of donor agencies.

2.2 Human resources

The dearth of adequate human resources with training, skills and experience in the scientific, technical, managerial and administrative functions required for the development, conservation, and management of water resources is a crucial constraint in the development of Africa's water resources. The issue is evidently reflected in the case studies of Chad, Ethiopia, Ghana and Lesotho, where the water sector development is inhibited among other factors by the shortage or lack of competent and qualified staff. Egypt is the only country that appears to be better disposed.

The problem of skilled manpower is attributed to human resources and institutional development policies that were often unclear or non-existent and consequently gave way to frequent movement of indigenous personnel. The traditional response to the human resources problem has been to train more staff either locally or organize training programmes abroad, often in and with the assistance of developed countries. Meanwhile, the human resources needs in Africa were filled by foreign experts under the Technical Assistance programmes. The net result of this traditional approach is that, after nearly thirty years, Africa still suffers from insufficient human resources capacity for sustainable development.

A brief look into the training institutions in Africa shows that despite the fact that these institutions have their own financial and managerial problems, they are producing engineers, administrators and managers. The problem is not the number of people trained and qualified, but it is in the ability and willingness of African countries to retain and deploy the experts appropriately. It has been observed in the past that many experts have for one reason or another left the sectors for which they were trained in search of better employment opportunities, either in another enterprise in the country or another African country or ultimately in developed countries. In the five country case studies the situation in Ghana and Ethiopia and Lesotho firmly confirms this. In these countries, the water institutions have lost most of their core and highly qualified and experienced staff to the private sector and to developed countries through brain drain. The reasons for the loss include misallocation, under-utilization as well as non-utilization of human resources. A report on the regional human resources of Africa prepared by the United Nations in 1988 indicated that there were about 70,000 African professionals working outside the continent, while at the same time about 80,000 expatriates worked in Africa. The cost of this anomaly to Africa is estimated at US$4 billion per year. This is an issue of concern requiring serious attention to rectify the problem by all concerned.

A possible strategy would be giving qualified African professionals equal conditions of service as the expatriate counterparts on a competitive, market-driven basis preferably with donor support under the Bilateral programs.

2.3 Legislation Policy and Planning

The lack or inadequacy of water legislation and policies has been one of the serious stumbling blocks to integrated management and optimal use of water resources. Of equal importance is the need for formulation of enabling instruments to establish mechanisms to enforce such legislation.

In the African region, there is a growing awareness of the need for legislation, clear policy directives and good planning as prerequisites for the successful implementation of national and subregional water development activities. There have been several constraints like man-made and natural disasters as well as economic hardships and political problems which worked as "killer constraints" to the speedy formulation of comprehensive national water legislation and policies for improving water resources planning.

A persistent difficulty is faced in creating proper links between the water and other critical sectors like agriculture and rural development. The interfaces between water and irrigation, and water and livestock development are good examples of this, but health, urban development, hydropower and transportation could be cited as areas where conflicting priorities exert pressure on over-burdened public sector institutions.

The problem of water resources development has its root in the lack of clear policy directives acknowledging the high priority that must be accorded to it with due recognition to the need of strengthening the national institutions in which water development is vested. The policies should be cohesive embracing the management, conservation and rational use of water. The usual mention of water with single sectors like agriculture, health or rural development should be discontinued. The case for integrated and multi-purpose development of water should as a priority be convincingly put across to policy-makers. Emphasis should be laid on strengthening national capabilities and the implementation of national programmes as a first priority.

On the other hand, sub-regional, regional and global programmes of action provide essential inputs. At the subregional level increasing food production and the fight against drought and desertification can best be effective if groups of countries coordinated their policy and planning efforts for common goals and objectives. The activities of international river/lake basin organizations for Lake Chad, Niger Basin, Lesotho Highlands Water Project and those in the making for Nile and Volta as well as those of inter governmental bodies like IGAD and CILSS are very crucial. Activities of these organizations can be viewed as part of the planning continuum.

The weakest point is that of sector analysis, that is; the examination and assessment of the resources, needs, problems and opportunities in the sector. Insufficient cross-sectoral harmonization and reconciliation with national development targets at the macro-economic level should be corrected. The essence of planning should be perceived in the integration of sectoral plans and programmes with overall water resources management. This must be within the framework of national socio-economic objectives as reflected in the case studies of Egypt's Water Master Plans, Ghana's vision 2020, Lesotho's Highland Water Project and Ethiopia's River Basin Master Plan approach. The water sector programme like those of other sectors should from time to time be reviewed in terms of objectives, targets, plans and

resources in order to delineate the components which can be funded from national and external sources.

Another important aspect is that there should be consistency between donor aid policies and programmes. and the recipient's development objectives and goals. The international community can contribute greatly to the planning and development of water resources in a holistic manner by assisting governments to improve their planning capabilities and mechanisms and by strengthening national programmes for medium-term and long-term water resources development.

The priority target for the future must be building-up national capabilities for the proper planning, execution and management of development programmes. If this implies a slowing down in the rate of implementation of projects until proper frameworks for development have been established, it would still be preferable to piecemeal and uncoordinated programmes without solid formations which have been features of water related activities in many African countries in the past.

With institutional and administrative changes that have been or should be introduced to adequately coordinate water management, the countries in the case studies have realized the need to update their legislation and policies to match the needs and demanding circumstances.

In this regard Chad is engaged in making a review of its water, forestry and other codes. However, the translation into action of the policies and strategies of water and agriculture has not progressed since 1985.

Having a long tradition in water resources management, Egypt has kept up with a review of its policies and legislation as new issues evolved.

Ethiopia is engaged in developing its water policy. A national water code was drafted several years back but this has never been enacted into law. Similarly, there is a draft water legislation in Ethiopia which has been prepared but was not put into action. The draft code and the subsidiary regulations of Ethiopia provide comprehensive and adequate legal framework covering the essential elements for appropriate water management. The Ethiopian Ministry of Water Resources has now initiated action to modify and align the water code with the new government policy following which it will be enacted into a federal law.

Ghana also has enough laws pertaining to granting water rights, controlling pollution and protecting the environment.

Overview

The overall situation in the various countries shows that progress is underway to put in place appropriate national water policies and legislations to enable and facilitate the planning and integrated management of water resources. This will also promote the effort for harmonization of sector activities with the nexus issues of population, environment and agriculture/food security. However, the implementation is yet a long way off and there remains a serious challenge facing African countries in realizing integrated management of water resources.

In view of the fact that adequate policies at the national and subregional levels are essential to guide the proper development, conservation, administration and use of water resources, it is imperative that all countries formulate, effectively establish overall policies:

- on institutional responsibilities and coordination of water activities;
- on issuance of permits for water abstraction and use ;
- on industrial water use, treatment of effluent and their safe discharge;
- on agriculture water use, return water, limitations on pesticide and insecticide uses;
- on determining lower quality water use for various purposes;
- on rules and regulations regarding abstraction and use of groundwater;
- on tariff policies for drinking water supply agriculture, industrial and other uses;
- on international water courses and on regional cooperation;
- on land and water conservation;
- on population and family planning;
- on the role of women and on popular participation;
- on water and health questions;
- on integration of water development within the national socio-economic development planning.

What is lacking is not just the water legislations, policies and planning. These have in the past been prepared by numerous countries albeit to varying degrees of adequacy as observed in the above country case studies. It is now necessary to enact the legislation, put into practice the policy directives and implement water activities according to plans.

2.4 Water resources assessment and information, water quality and climate

Assessment and Information

In Africa as a whole, water resources assessment including the identification of potential sources of fresh water supply has not been systematically carried out. On the other hand the determination of water sources, their extent, dependability and quality as well as the impact of human activity on the available water should as a pre requisite be understood for the planning of water resources for sustainable development of water projects.

There has been little evidence to suggest that major changes have taken place in the 1990[6]. The water situation in Africa continues to worsen. The UNDP financed World Bank project on data collection system of the SADC countries concluded that "the overriding constraints are financial and managerial. Few countries now have services which can be compared favourably with those existing 10 to 20 years ago. No country has a service which is adequate as a basis for sustaining the many water developments which can be expected in the region in the coming decades" (Report of Secretary-General, 1993).

In Africa the meteorological and hydrological services which are responsible for basic network infrastructures for assessment activities have suffered serious deterioration in the past decade. The coverage, operation and maintenance of these networks are inadequate

and they have been allowed to run down since governments could not maintain them.

The situation with regard to groundwater assessment is worse. Sediment transport and water quality monitoring are done on ad-hoc-basis. In general there is lack of equipment, laboratories and other components of infrastructure needed for water resources data assessment and for computerized processing and storage.

The five country case studies (with the exception of Egypt) also led to the same conclusions.

In Chad, the networks/infrastructures for data assessment have suffered seriously from the consequences of the civil war. Some network stations have interrupted service for over five years. With SAP being implemented, recruitment of staff has not been possible which in turn had impact on the development of networks and assessment of water resources data.

In Ethiopia, the hydrological monitoring network comprises 507 gauging stations in the 10 perennial river basins. The number of hydrographic stations is much less than that recommended by WMO. It is reported that of these stations, only 67% are presently in operation. Regarding data processing and storage the situation is reported as up to date. However, the latest hydrological yearbook produced was in 1980.

In Lesotho out of a total number of 106 rainfall stations, only 86 are reported to be currently in operation and out of 85 hydrometric gauging stations 13 have been closed down for several reasons. Moreover, of the remaining 72 stations, 25 have no ratings and hence the collected data could not be processed for assessing the water balance of the country. It is also noted that hydrological data have not been published in a yearbook since 1980. It is further noted the department of Water Affairs had financial difficulties and problems in retaining its qualified staff which in turn made it difficult to keep up with the operation and maintenance of the networks for data assessment.

The situation in the country studies confirms that data assessment is so inadequate that basic information needed for the planning and development of water resources could not be provided. This poses a serious constraint as no amount of assumptions can make up for lack of basic data on water resources; and the result will be delays in the preparations of plans at the regional and subregional levels. The issue is therefore one that demands urgent and priority attention.

The most recent consideration of this issue was at the UNECA/WMO International Conference on Water Resources: Policy and Assessment organised in Addis Ababa in 1995. This conference proposed a new flexible and adaptable strategy which is based on the following (ECA. 1995):

1. There should be unequivocal evidence of a national initiative for a demand driven activity.

2. Assessment should be planned and implemented within the capacity of the national economy.

3. Political will to cooperate on the river, lake and groundwater basins at the subregional, regional and international levels should be enhanced and backed by concrete action.

4. Direct linkages should be established with other water resources management strategies, such as the one being prepared at the time for Sub-Saharan Africa by the World Bank.

5. There should be willingness of the agencies in charge of the water resources information systems to improve their efficiency, productivity and to take initiatives and participate in the water resources development process.

6. Donors and UN agencies involved in water sector should coordinate their activities in the Region and align their support as much as possible, along the lines of this strategy.

7. A world-wide campaign should be launched to promote this proposed strategy, improving the awareness of the problems and highlighting water resources assessment programmes adopted by African countries.

This was then translated into an Action Plan whose main components are (UNECA/WMO, 1995):

1. Management capacity building;
2. Awareness and promotion;
3. Sustainable financial base;
4. Integrated approach to water resources assessment WRA;
5. Refined subregional initiatives and responses;
6. Role of the External Support Agencies (ESA);
7. Conference follow-up.

Water Quality

The degradation of water quality is primarily one of the fundamental problems having its roots in poor planning and management of development projects. In the past few years the problems of pollution from domestic, industrial and agricultural sources have been growing. Several countries in Africa are faced with problems of bacteriological and contaminating organic matter loads, suspended solids and nitrate pollutants. There is a threat of increased problem from agriculture with increase in fertilizer and pesticide uses. Many shallow groundwater resources appear to be contaminated by pathogenic agents largely from faecal sources and there is an absence of systematic water quality monitoring. As a result, an adverse health impact prevails among the large majority of population in Africa.

Experience has shown that uncontrolled groundwater development in the Sahel has been one of the causes of environmental degradation. Past experiences resulted in the lowering of water tables, drying of wells, salt water intrusion in coastal areas and a decrease of pressure in aquifers. The impact of over exploitation of groundwater had negative economic and environmental repercussions some of which caused permanent damages.

Climate

Climate change is increasingly recognized as having a serious impact on water resources. High temperatures and decreased precipitation lead to decreased water supplies and increased water demand. They might also cause deterioration to the quality of fresh water bodies putting strain on the already fragile supply in many countries.

Strategy

The future strategy should focus on immediate launching of a systematic programme of refurbishing existing networks for assessment of surface and groundwater quantity and quality. Water quality monitoring and sediment measurement should be carried out systematically. The data already procured as well as those generated particularly from the numerous boreholes drilled through assistance programmes from bilateral and multilateral sources that were provided to African countries since the 1980s in the framework of promoting the international Drinking Water Supply and Sanitation Decade objectives should be analyzed to update the knowledge on climate change on fresh water resources. There is also a strong need for all countries to have in place a water pollution control programme.

2.5 Water scarcity

Hypothetically, there is more than enough water to meet the development requirements in Africa. However, uneven temporal and spatial distribution of water resources prevails in several subregions. There is also a considerable seasonal variation of rainfall amounts in the subregions that aggravate the water situation and create conditions of water scarcity in many parts.

From the regional and five country case studies (in Chad, Egypt, Ethiopia Ghana and Lesotho) it is noted that there are parts of the continent where there is water crisis:

(a) on permanent basis because demand is outstripping available resources e.g. North Africa including the typical case of Egypt;

(b) on seasonal basis, in the dry season for which Ghana is a good example;

(c) because water resources are deficient e.g. Sahel which is also represented by Chad

(d) because of persistent or recurrent drought e.g. Lake Chad basin also Chad and Ethiopia are classical examples of this category. Even in Lesotho, where water is regarded as abundant , the country case study points out that by the year 2025, it will fall in the category of "water scarce" countries i.e. countries with less than 1000 m^3 per person per year.

Almost all African countries are affected by one or more of the above conditions. Further, with increasing population the use of water in agriculture, industry, and human settlement will significantly reduce the available fresh water resources exacerbating the problem of water crisis in several countries. The 1993 Population Action International Survey projects that by 2025, fifteen countries in Africa will face water scarcity and eleven

countries will be water stressed There is therefore, a major challenge for countries to launch water harvesting and conservation programmes; minimize losses through improved management and efficient use; recycle used water; develop non-conventional sources;, encourage use of inferior quality of water for irrigation and industry, and where feasible transfer water from those regions with excess water to those that are water-deficient.

2.6 Drinking Water Supply and Sanitation

There is a great challenge facing African countries to provide safe drinking water and adequate sanitation facilities for the majority of their population. The current situation of water supply and sanitation services in Africa have fallen far behind population growth. The majority of the African population reside in rural areas where safe water supply and adequate sanitation is critically scarce. In July 1993, the information was that 54 per cent of the African population did not have access to safe water and 64 percent were without sanitation. By 1994, 326 million out of a total population of 707 million people in Africa were served with safe drinking water and 293 million had access to adequate sanitation (Warner, 1996).

According to the 1996 ACC Task force on social services; in Africa, there were 4 countries with less than 80 percent of their population having access to safe water, 18 countries with 30-59 percent, of their population having access to safe water, 6 countries with 60-89 percent having access to safe water, and only one country with over 90 percent of the population having access to safe water.

The respective water supply and sanitation situation of five country case studies by ECA shows that: in Chad, the coverage for water supply and sanitation is 24 percent and 21 percent respectively; in Egypt the coverage in water supply is about 80 percent and the situation in sanitation is worse. Ethiopia has 26 percent coverage for water supply and 10 percent for sanitation. In Ghana the coverage in water supply for urban areas varies from 86 percent in Greater Accra to 50 percent in the Upper West region. It is noted that about 50-60 percent of the water is unaccounted for. In rural areas of Ghana about 50 percent have access to potable water. The coverage for sanitation in urban areas was 29 percent in 1992. For rural areas, the situation in sanitation is expressed as woefully inadequate. In Lesotho, the coverage in water supply is in the range of (34-66) percent, and that for sanitation is (0-33) percent.

In all the countries of the region the rural population and those in peri-urban areas are greatly disadvantaged. These are also the people who lack other social services like health and education. The general conclusion that can be drawn from the overall regional situation as well as from the five country case studies is that there has been a widening gap of the unserved population leaving the majority to a high risk of incidence of debilitating and incapacitating diseases. It is realized that up to 80 percent of all endemic disability in developing countries including Africa is caused by water-borne diseases.

Among the major constraints to development of the sector is high population increase. Africa's population has more than tripled in 44 years between 1950 (220.3 million) and 1994 (707 million) and it is expected to reach 1115.6 million by the year 2010. Against this situation of high population increase Africa and especially, sub-Saharan Africa is expected to fall short of the anticipated progress relative to other regions of the world.

Other constraints to development of the sector include economic hardships, political problems, civil strife, natural disasters, rural-urban exodus of people, the dispersed nature of population distribution in the rural setting, the problem of maintenance and operation of systems and facilities as well as policy questions. Constrained by these difficulties, the provision and expansion of domestic water supplies have been hampered; systems have been inefficient with high leakage and much unaccounted for water thereby making the services unsustainable and unreliable. Development has, as a result, been far outstripped by population increases. Under such circumstances, it is clear that planning and development of potable water and sanitation for all will have to be targeted beyond the year 2010.

Strategy

The future strategy should be based on prioritization of population groupings to be served and should be based on setting realistic targets by governments, promoting population and family - planning policies, adopting low-cost technologies, introducing cost-sharing mechanisms and tariff policies in a phased approach, increasing community participation, particularly of women in rural areas where the need is greatest.

It is necessary to ensure that drinking water and sanitation programmes take place in the context of national planning and are fully integrated within the framework for environment and sustainable development. Privatization of maintenance and operation of water supply systems and orientation to the rural sector in the package for rural development and human settlement programmes is perceived as a sound strategy of ensuring sustainability.

2.7 Gender and Water Development

In Africa in general a sexual division of labour determined by tradition, culture, customs, region etc. exists. Essentially, women are responsible for most productive activities. African women particularly those in rural areas have the tasks of fetching water, gathering fire wood, grinding grain, cooking food, child nursing and hygiene and the chores of household management activities. In nomadic areas, women are also burdened with the added task of dismantling and setting up temporary huts. Cultural values attached to womens' tasks have resulted in their work being regarded inferior compared to men's' work. This was part of the reason for denying women the right to development and attainment of higher education which in turn meant lack of access to and control of resources and decision - making powers.

The five country case studies confirm the gender issue as a real and imminent point to be addressed. In all the countries, the burden of work on women, the unequal opportunities in terms of education, employment, inheritance right and ownership of property are underlined. With the exception of Lesotho, (where girls attain higher rate of literacy than boys) women in the other four countries, especially those in rural areas are not getting similar opportunities for education. Also generally women are regarded as minors and inferior to men and representation of women at decision - making levels is very minimal.

In Ethiopia, few women hold high positions that require graduate level education. In Lesotho men are the masters. In certain families, particularly in single families where

women are bread-winners, they could have access to land while married women must have the husband's consent for land ownership. Ghana's study points out that women are often excluded from initiation and planning of development projects. It notes that even when they are included it is after decisions are taken.

Although specific issues are raised relating to the various countries, the problems are common to all countries albeit to varying degrees. In pointing out the above problems, the case studies enlist the various efforts being undertaken to redress the current imbalance. It has become a commonly accepted fact that the gender issue remains critical for integrated management of water resources to be realized in a sustainable manner.

Many women in rural areas are caught up in the routine of fetching water from distances of 3 to 6 kilometres. A disproportionate part of the day is spent in obtaining water for the family. Regardless of the amount of water needed, there is the health implication and the depletion of the woman's energy for other activities which in some areas is reduced by 50 per cent. The role of women as the group who are custodians and guardians for food and water requirements for the household should be taken into account by planners and designers of water schemes. It should be realized that identifying and defining the needs of women would promote more effective public participation and community involvement which in turn would help towards achieving better success in the integrated management of water resources. The country case studies have provided adequate emphasis on the need for women's involvement at all levels of water resources development.

Women's contribution to socio-economic development, should be acknowledged by society as a whole and means of enhancing their productivity and effectiveness in constructing and operating water supply systems should be sought. As highlighted in the country studies particularly those of Ethiopia, Ghana and Lesotho, women should be encouraged to be motivators; and they should be fully involved in maintenance and operation of water development schemes.

It is necessary to recognize that, in the past, many schemes failed partly because women were not integrated in the development process, and they have not even been consulted. Efforts from now on should be made to ensure their participation, in order to achieve better success. Such an effort, however, presents complex configuration and requires a careful approach to safeguard traditional attitudes, customs, practices, myths and laws so as to avoid confrontation among the social orders of communities. The efforts should be carried out cautiously in different environments so that the participation of women may develop into a coherent programme of action through a step-by-step process.

The implementation of water projects would become more useful in reducing the hardships of women and in bringing about the well being of communities in areas of health, education and economic fields. It will also liberate women from time consuming, long treks to collect water. Closer sources of potable water through involvement of the community and particularly that of women would mean that children, particularly girls would be free to attend school. The "saved time" could also be used for such beneficial and income-raising projects as poultry production, soap making, pottery making, production of food crops etc.

For effective involvement of women and for their integration as promoters of integrated water management programmes in rural areas, all stakeholders should seriously

consider and examine ways and means to ascertain women's interest and potential collaboration. It is necessary for national programme managers and international staff to reorient existing water programmes and other development projects related to women so that the efforts in mobilizing them as key human resources can be fully utilized to make the projects sustainable.

Proper organization of a community and incorporation of an adequate training component will provide impetus towards successful realization of water projects. Further, women as a group most affected by lack of water, work with great zeal to have a reliable supply. The Dodota water supply scheme in which local Women's Association in Dodota district of Ethiopia is a sustainable project of the early 80s which can be cited as a successful scheme initiated, planned, executed, implemented and managed by women. In 1995 the project was supplying adequate and safe water to a large population. Mio Gasera is also another typical community-based and sustainable water supply scheme in Ethiopia. Dodota and Mio Gassera supply water to population of 56,000 and 60,000 respectively including those rural people living along the pipe lengths of 100 and 114 km respectively. These projects relieved a total of 17,000 women from the drudgery of fetching water. Numerous such success cases could be cited in various African countries to demonstrate the benefits of sustainable water supply schemes constructed and managed by the beneficiary communities and particularly women.

As a result of the infrastructures for water supply and irrigation, health, education and roads which are allowed to run down in most countries of Africa, rural women's issue is not close to a solution. The problem in most sub-Saharan Africa is worsening because not only infrastructures are getting dilapidated and disproportionally few new installation are put in place, but also many are destroyed by war, and civil strife. The issue of women should therefore, be viewed in the context of economic performance of countries, the policies and commitments of national governments to improve the social services and infrastructures for irrigation as well as rural development, the preparedness of countries to manage crises such as drought and flood, actions being taken towards good governance and the efforts to reduce civil strife and war that is rampant in many countries in Africa. These are deep rooted problems requiring relentless efforts by the countries of the region and the international community. The problem is one requiring long-term solution and is not within easy reach.

2.8 Water and Agriculture

It is recognized that there is need to increase food production in Africa through improved irrigation and water resources management. However, a number of problems encountered by African countries prevent them from achieving food security. Some of the major issues constraining development are reflected by making reference to five country case studies.

Globally, the per capita utilization of water resources varies widely between continents, from 1,692m^3 per year in North America to only 244 m^3 per year in Africa. (Report of the Secretary-General A/51/43, 3 September 1996). This figure shows that there is a relatively gross under utilization of the potential water resources in Africa.

As shown in table 1, in Africa fresh water resources is primarily drawn for agriculture purposes which represents 85 per cent of the total withdrawal, and this figure varies considerably between the various parts of the African continent. Almost all the agricultural water use is for irrigation.

In arid areas of the African continent, where irrigation plays an important role in agriculture, total water withdrawal is the highest. Accordingly, the northern region accounts for more than half of the agricultural withdrawal of the continent. Egypt is a typical example on the country case studies. The humid regions of the Gulf of Guinea and the Central region have 62 per cent and 43 per cent agricultural withdrawals respectively.

In the specific five country case studies, the water withdrawal for the agriculture sector is as follows:

Chad: In Chad, the water withdrawal to irrigate 8000 ha is 1 billion m^3/yr. and for livestock it is 1.2 billion m^3 /yr. The water withdrawal for agriculture (1987) in Chad according to FAO was 82 percent.

Egypt: Of the five countries selected for the case studies, Egypt has the highest amount of water withdrawal for various uses. Among all the sectors agriculture represents the largest component and all agriculture in Egypt is irrigated farming. For the total cultivated area of 7,800,000 acres (which is 3 per cent of the territory of Egypt) in 1996, an amount of 53 billion m^3 /yr. was required. By the year 2010, for the planned aditional 2,500,000 acres to be cultivated, the estimated amount of additional water required is 15 billion m^3. Irrigation represents 80 percent of the total water withdrawal of Egypt.

Ethiopia: Ethiopia has an irrigation potential of 3.7 milllion ha. Of this, only 150,000 ha or only 4 per cent is developed. The total water consumption for this is estimated at 1.5 billion m^3. Agricultural water withdrawal (1987) in Ethiopia was 86 per cent.

Ghana: In terms of potential, Ghana has a cultivable area of 10,000,000 ha. and the area under cultivation in 1994 was 1,140,000 ha. The potential for irrigation is 1,900,000 ha which is 19 per cent of the cultivable area. The area under full/partial control of irrigation was 6,374 ha. The water withdrawal for agriculture (1970) was 52 percent

Lesotho: In 1994, only 2720 ha were under irrigation. Topography and availability of arable land and distance from water sources limit the expansion of irrigation development in Lesotho. Agricultural water withdrawal (1987) was 56 per cent.

Overview

For all the five countries, agriculture is the core of economic development and main activity of the large sector of the population. In Egypt, which is among the most advanced countries in irrigation development in Africa, agriculture contributes 20 per cent to the GDP. It plays a major role in the national economy and is the basic fulcrum for food sufficiency. It is the main source of raw materials for the productive sectors, for generating foreign currency and for offering employment to many people.

Population pressure has resulted in urban encroachment of farm lands that led to loss of between 30,000 to 50,000 feddans of best agricultural land annually over the past 20 years. Decrease in land ownership, low population growth and rural/urban migration, low return from agriculture, development of new economic sectors supported by government, escalated living standards, free provision of water to farmers, degradation of water quality, water intensive cropping, inefficient uses of water resulting in low (30%) irrigation efficiency in some sandy lands at field level, leakage in systems and excessive water application have put pressure on land and water resources in Egypt resulting in over exploration and further degradation of scare resources. This situation is perpetuating the problem of per capita land share and low yield per unit of water and consequently induce increased dependence on food inputs.

Table 2: Regional Distribution of water withdrawals

	Withdrawals By sector					
Region	**Agriculture**	**Communities**	**Industries**	**Total**	**As % of total**	**As % of internal resource**
	X10^6 m^3/yr	**x10^6 m^3/yr**	**x10^6 m^3/yr**	**x10^6 m^3/yr**	**%**	**%**
Northern	**65 000 (85%)**	**5 500 (7%)**	**5 800 (8%)**	**76 300 (100%)**	**50.9**	**152.6**
Sudano-Sahelian	**22 600 (94%)**	**1 200 (5%)**	**300 (1%)**	**24 100 (100%)**	**16.1**	**14.2**
Gulf of Guinea	**3 800 (62%)**	**1,600 (26%)**	**700 (12%)**	**6 100 (100%)**	**4.1**	**0.6**
Central	**600 (43%)**	**600 (43%)**	**200 (14%)**	**1 400 (100%)**	**0.9**	**0.1**
Eastern	**5 400 (83%)**	**900 (14%)**	**200 (14%)**	**6 500 (100%)**	**4.1**	**2.5**
Islands (1.0)	**16 400 (99%)**	**200 (1%)**	**20 (.)**	**16 620 (100%)**	**11.1**	**4.9**
Southern	**14 100 (75%)**	**3 000 (16%)**	**1 800 (9%)**	**18 900 (100%)**	**12.6**	**6.9**
Total	**127 900 (85%)**	**13 000 (9%)**	**9 020 (6%)**	**149 920 (100%)**	**100.0**	**3.8**

Source: FAO Irrigation in Africa in figures, extract from Water Report 7, Rome 1995

The regions are:
Northern: Algeria, Egypt, Libya, Morocco, Tunisia
Sudano-Sahelian: Burkina Faso, Cape Verde, Chad, Djibouti, Eritrea, Gambia, Mali, Mauritania, Niger, Senegal, Somalia, Sudan
Gulf of Guinea: Benin, Côte d:Ivoire, Ghana, Guinea, Guinea Bissau, Liberia, Nigeria, Sierra Leone, Togo
Central: Angola, Cameroon, Central African Republic, Congo, Equatorial Guinea, Gabon, Sáo Tome and Principle, Zaire
Eastern: Burundi, Ethiopia, Kenya, Rwanda, Tanzania, Uganda
Indian Ocean Islands: Comoros, Madagascar, Mauritius, Seychelles
Southern: Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, Zimbabwe.

Contribution of agriculture to GDP in Chad is 44.1 percent, in Ethiopia its contribution to GNP is 57 percent, in Ghana the contribution of agriculture to GDP is about 41 percent and in Lesotho it is 10.1 percent. In the four countries: Chad, Ethiopia, Ghana and Lesotho, agriculture is predominantly, subsistence and is represented by peasant farming, low technology, low input, low yield, poor infrastructure setting and rainfed farming. It is however, the main means of subsistence for 70 to 85 percent of the population. The underlying problems in agriculture is attributed to policy issues and to the priority accorded to the development of the sector.

Chad

In Chad, 99 percent of the rainfed agriculture is affected by climatic changes. With the area devoted to food crops being 1.3 million hectares, in good years local requirement of food can be met but generally external aid is needed to meet the requirement. The food-deficit situation in Chad has been aggravated by increasing population pressure, destruction of the environment due to encroachment of farms into fragile zones, difficult road access, limited state intervention, and political instability. The climatic effect on agriculture has been very severe. It is noted that due to the effect of drought, fish export was reduced from 140,000 tons in 1960 to less than 60,000 tons at present. Cereal production dropped from 345,000 tons in 1984 to 100,000 tons in 1985 worsening the food insecurity situation in the country. Agriculture development in Chad has at best been static. For example, the area for cotton that was cultivated before 1979 which has been averaging at 293,000 ha has with the war situation come down to almost nil falling to 180 ha. In general, Chad is claimed to have 19 percent of its territory as arable land, i.e., theoretically 5 million ha being arable of which 10 percent was put to use; 1.2 million ha for cereal and 220,000 ha for cotton. The country has persistently remained food aid dependent. The impact of weather has also perpetrated its fragile economy affecting the export revenue from the major items of livestock, cotton and fistto very low.

Ethiopia

Ethiopia is a country with enormous potential of fertile land and water resources. However, policies to land holding; and agriculture and water resources development as well as low priorities accorded to these sectors have been the root causes for the poor state of development. Of the 113 million hectares of the territory of Ethiopia 68 percent is potentially arable and actual cultivated area is only 15 percent of the estimated arable land. Rainfed crop production is the basis of all subsistence farming and accounts for 95 percent of the land area cultivated annually. Agriculture employs 90 percent of the labour force.

The land holding system in Ethiopia is evidently dominated by small-holder farming practices and state farm ownership is no more active except those few already in existence. At present, two types of land policies are practised in the country. In urban areas, land is being leased by the government and in rural arid areas, land is redistributed for small holders. This policy of redistribution is expected to further fragment rural farm areas and this is already under implementation.

The highland area lying 1500 meters above seas level and occupying 50 percent of the area of Ethiopia is the part which is densely populated. This part has 88 percent of the agriculturally suitable area and contains 80 percent of the human and 56 percent of livestock population. The irrigable potential land area is estimated at 3.7 million hectares out of which 150,000 hectares representing 4 percent of the potential has been developed. The dissected nature of the landscape, the poor state of the economy which has a high level of aid to its GNP, the differential in potential availability of abundant water where there is less land and vice versa, the concentration of as much as 75 percent of rainfall in 3 to 4 months followed by dry spell, the high population growth rate of 3 percent per year, the traditional/archaic technology of peasant farming, the lack of inputs and extension services, the poor infrastructure (access roads, water supply, health services etc,) had the cumulative impact of poor agricultural performance. This has been exacerbated by rainfed crop production being pushed into marginal lands and by erosion which is estimated at 1.9 billion tons of top soil loss/yr.; with annual soil loss of 100 tons/ha or an annual loss of 8mm loss in soil depth depending on altitude and agro-ecological zones. It is estimated that the land degradation at present rates could destroy farmlands of some 10 million highland farmers by 2010. It is also noted that over 14 million hectares are seriously eroded and that 6 million hectares are in a state of being completely withdrawn from agriculture. This indicates that the effects of the growing population pressure on the natural resources base and on the environment in general is very severe in Ethiopia. One could see that the state of deforestation in the last 50 years in Ethiopia was very serious. In the early 50s, 16 percent of the land area of the country was covered with forest; in the early 80s it came down to 3.6 percent and in 1989 it was reduced to 2.8 percent. This had a further consequence on aggravating erosion and accelerating the depletion of fertile soil. The effect of deforestation on the quantity and quality of available water resources has been considerable and its implication in constraining agricultural development was very serious.

Ethiopia has been facing reduced crop production and food insecurity for about two decades. The annual growth rate of the agriculture sector during the past two decades or so has remained below 2 percent while population was growing at 3 percent per year leaving an absolute deficit. In order to curb the situation the present government is taking a series of policy measures. The current economic policy of the Government encourages private sector participation in almost all sectors of the economy including water resources development. For the agriculture sector, the government has adopted a strategy of an Agricultural Development Led Industrialisation (ADLI). In the context of its ADLI strategy, the government supports small-holder agriculture by constructing micro-dams for drought-prone areas of the country. This initiative is expected to enable farmers one crop in dry years and possibly two crops in good water years. This effort along with a series of other parallel efforts would take some time before the impact is felt. To a large extent it also depends on how effectively the government policies and peoples practices are translated into action.

Ghana

In Ghana about 68 percent of the people live in rural environment. The problems of poverty, disease, illiteracy, ignorance are generally to be found in these areas. At the same time this part continues to be important to the economy of Ghana which depends on primary products dominated by agriculture and extractive industries.

In terms of potential, Ghana has a cultivable area of 10,000,000 ha with the potential for irrigation being 1,900,000 ha representing only 19 percent of the cultivable area. In 1994 the area under irrigation was 6,374 ha. This figure gives an indication of the degree of underutilization of land and water resources for agriculture development in the country.

Agricultural production in Ghana consists of food crops (cereals, roots, pulses and vegetables) and industrial crops (like cocoa, coffee and shea butter). These products rely on low levels of investment, subsistence level technology and almost entirely (about 99 percent) on the weather, particularly the onset, duration, amount and spatial distribution of rainfall. Water control to assure production targets have been minimal and foreign exchange earnings from exports are dependent on the commodity markets and external terms of trade. Moreover, poverty is predominantly a rural phenomenon (though the incidence of poverty also exists in urban areas). 80 percent of the people classified as poor (subsisting on less than two-thirds of the national average) live in rural areas to the determent of agricultural performance, where it is the most important occupation for both men and women. Notwithstanding the fact that a majority of rural women are engaged in agricultural activities only 25 percent of the women are farm owners and they have limited access to land and face severe difficulties in obtaining credit from banks. These factors negatively impact on the development of the sector.

In the field of irrigated agriculture the, management of the irrigation schemes is being passed by the government to farmers. However, the issue of non-viability of projects arising from low production, cost of farm inputs, lack of credit, lack of markets for produce are among the constraints which must be removed for policies to work. These are probably biggest challenges the agriculture sector faces to achieve the objectives of vision 2020 in Ghana.

Land degradation through erosion and loss of structure, fertility, and degradation through deforestation and overuse are critical environmental concerns. In about 90 years (1900-1990) Ghana's forest reduced from 8.2 million hectares to 2.1 million hectares. This has induced loss of organic matter which in turn has meant reduction in water holding capacity and decrease in filtration and hence increased runoff further aggravating the erosion process. Land clearing for new farm land and the practice of using fire to clear fallow land has also resulted in loss of vegetation. Thus the chain process of erosion, soil deterioration/degradation, and deforestation added to the problems of salinity have persisted and affected development of agriculture.

As pointed out earlier, although Ghana has a considerable irrigation potential it does not have the investment capital needed because the cost of irrigation projects are too high. For example, local contractors with experience in irrigation construction are not available and mobilization costs of foreign contractors represent a high percentage of total cost. This issue prevails in Chad and Ethiopia in this study and holds true for most sub-Saharan African countries.

In Ghana, the effectiveness of the irrigation schemes in raising crop production has been disappointing. Average yields of rice less than 2 tons paddy compared to potential 5 tons and double cropping is rare. In general, farmers particularly in the north do not have the tradition of irrigated farming and their agronomic skills and

management capacity are well below the requirement to enable deriving full benefits from irrigation investments.

The importance of an effective arrangement for transfer of irrigation technology to farmers cannot be overstressed. This explains the paradox that while an initial motivation for adopting irrigation has been high, the hope of increasing food production, by large/medium sized irrigation schemes has not satisfied the food security situation of the country as is also the case in Chad, Ethiopia and Lesotho.

In 1996, a growth rate of 4 percent for agricultural production was achieved. For 1997, a target of 4.3 percent was set. Several policies and strategies were announced in order to achieve the agricultural growth rate for 1997. The total amount of funds from both domestic and donor sources available to support the programme is about 12.2 percent lower than the amount provided for 1996. The country is therefore growing to rely heavily on foreign assistance (88.5 percent) to provide public support for agricultural development in 1997.

A number of economic reforms have been initiated, including removal of subsidies, full or partial cost recovery on social services, liberalization of the economy to market forces, divestiture of state from production and distribution, private sector encouragement as the engine of economic growth and decentralization of administration to districts. In agriculture, the new strategy is aimed at transforming it into a highly productive and responsive sector capable of achieving and sustaining 5 to 8 percent overall economic growth over the medium term (1991-2000) period. The objective is to ensure abundant and all year round availability of reasonably priced food and agricultural raw materials which are prerequisites for financial stability and economic growth and development and above all, poverty reduction. Towards this end Ghana intends to:

(i) bring more land under irrigation in order to stabilize food production;
(ii) increase the present 6300 hectares to over three fold to 22,000 hectares by the year 2000 and 136,000 hectares by 2020, and
(iii) implement land use policies to assure farmers and investors of security in their titles to land.

Lesotho

Lesotho has relatively abundant water resources but from irrigation point of view the availability is not sufficient at the right time and place. Irrigation water is only enough during the wet season in places adjacent to river banks. The topography of the country constitutes an obstruction to irrigation development as most of the potential arable lands are situated too far from a water source or are found at high elevation. Irrigation is regarded as means of achieving food security. Unfortunately, in Lesotho, the track record in irrigation does not show good results. Some of the constraints to development of irrigation are reported to be top-down approach, political interference, cultural attitudes, land tenure system and financing mechanisms. Arable land is affected by rampant soil erosion, human pressure on land and mismanagement of natural resources. It is estimated that the country's annual loss of soil through sheet, rill and gully erosion amounts to 40 million tons with an average loss of 1320 tons per square kilometre. The figure increases due to progressive erosion of land as a result of over-grazing and only about 9 percent of the total land area can be considered arable

as compared to 13 percent in the 60s. Despite the small potential for development, agriculture still remains the backbone of the economy and absorbs a large portion of the labour force in Lesotho.

Small-scale farming approach is presently recommended for Lesotho. Nevertheless, the success of irrigation is dependent on the revenue and net profit that would accrue from such development.

With the high population growth rate and limited arable land, it appears difficult for Lesotho to be able to produce the food requirements of its population.

Overview

From the regional perspective, in Africa as a whole large-scale irrigation, inter-basin water transfer and high-technology desert-irrigation do not appear to be viable options to solve the problem of famine and food-aid dependence because of the relatively high-cost involved that is beyond the means of most governments of the region. The record of large-scale modern irrigation has not been good especially in sub-Saharan Africa (and this is also confirmed in the country case studies) not only because of capital cost which is more than double those in other continents but because of numerous factors such as weaknesses in planning and management and maintenance constraints that have not allowed irrigation schemes to fulfil their desired objectives. It is often argued that small-scale irrigation development aimed at the bulk of food producers, including pastoralist will have the greatest impact that would lead to long-term benefits. This approach is adopted in Chad, Ethiopia and Lesotho in the country case studies and the results are yet to be seen.

One of the fundamental problems of African development is its weakness in producing enough food and in meeting the objective of establishing food-security. Poor access to markets and unreliable rainfall partly account for the problem and this has also been evidence in the country case studies. About one-third of the continent is known to be too dry for any rainfed crop production, however 93.5% of the cultivated area is under rain-fed conditions. The annual fluctuation in the output of African food and agricultural production can largely be attributed to the variability in the rainfall regime. This is amply demonstrated in the years following the drought in the mid-80s. In 1985 for example, there was a marked regional recovery of about 10% in food production (Table 3). This was followed by a further increase in 1986. From Table 3, it is observed that although both the agricultural production and food production indices increased in absolute terms by more than 30%, the corresponding per capita indices did not change significantly over the decade. As stated earlier after the recovery in 1986 of per capita food (agricultural) production due to good rains after the drought years up to 1985, there was a steady decline on per capita basis of both indices falling back to the levels of 1983 by the year 1993.

Another indicator of this trend also shown in table 3 is reflected in the agricultural trade figures. Of particular importance is the Trade Gap which is the net of agricultural imports over the exports. This gap decreased by nearly 75% during the good rainy years of 1986/87 and gradually climbed back to a peak of more than US$7 billion by 1992 which showed the onset of another drought in most drought prone parts of Africa. A general correlation is indicated between good rainfall year(s) and an increase in Africa's Agricultural exports and a simultaneous increase relation with Agricultural Imports which logically leads to the reduction in the Trade Gap. The case study of Chad, Ethiopia, Ghana and Lesotho also confirms this statistical deduction.

Table 3 PRODUCTION INDICES (AFRICA)

SOURCE: SOFA, 1994, State of Food and Agriculture, Rome, Italy

year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Agriculture*	101.42	102.34	110.95	115.88	115.44	122.4	126.47	127.88	133.78	130.72	134.97
Products +	92.97	91.12	95.96	97.31	94.13	96.9	97.21	95.43	96.93	91.96	92.2
Food *	101.49	102.36	111.10	116.32	115.95	123.43	127.4	128.96	135.25	132.39	136.67
Products +	93.04	91.14	96.09	97.68	94.55	97.72	97.93	96.24	98	93.14	93.36
Agriculture(a) Products	15142	15754	15025	13752	13016	14693	16313	16007	14975	1773	1693
Trade(b) Million US$	10368	11467	10818	12556	12011	11763	12386	12190	11218	10713	10774

* the figures on the rows marked with an asterix indicates the relevant index without considering changes in population.
the figures in the rows marked + show a per capita indication of the index.

(a) represents imports of agricultural products

(b) represents exports of agricultural products

Food production in Africa has been declining steadily for the past two and a half decades on per capita basis and dependence on food imports has consequently been growing. This situation prevailed in 1987, 1988 and 1989. Going back to 1975/79 we can see that Africa produced 83% of her cereal requirements and imported 8 million tons. It is, however, estimated that by the year 2000 the net import will have risen to 49 million tons and Africa will only be producing 56 per cent of the cereal she needs. At the same time food imports as well as food-aid keep on growing resulting in unhealthy dependence for these basic items of food. The contribution of irrigation to cereal production is significant since 53 per cent of the land area under irrigation in Africa is devoted to cereal production viz. rice, wheat, maize, barely, millet and sorghum. The regional distribution of land under irrigated farming in Africa remains low. Since the drought this figure has been about 14.2 million hectares, with most of this area in Egypt, Sudan and Morocco. A large portion of the irrigated area is classified as modern and a small part comprises of traditional small-scale projects.

For developing countries of Africa, a major portion of the needed increase in food production is expected to come from existing irrigated and rainfed lands through increasing yield per unit area and yield per unit of water consumed. FAO's International Action Programme on Water and Sustainable Agricultural Development puts emphasis on increasing water use efficiency through modernization and improvement of existing irrigation schemes, rehabilitation of waterlogged and salinised irrigated lands. It recommends the promotion of small-scale water programmes for purpose of expanding supplementary irrigation, and water harvesting and soil moisture conservation are recommended to increase the available water for rainfed arable lands. It is also suggested to continue expansion or irrigation at a rate that can be justified in terms of meeting the goals of food security, increased farm income, improved rural development and conservation of the natural resource base. FAO suggests that the scale of new irrigation development should be appropriate to it being sustainable with focus on medium - and small-scale developments while large-scale developments must be considered as components of multi-purpose projects. All developments are to be subject to meet the stipulation of an environmental impact assessment (EIA) at the planning stage before being pursued. Community involvement, particularly of women is considered a necessary condition during all phases of development. This suggestion of FAO is being pursued to varying degree by Chad, Ethiopia, Ghana and Lesotho.

It is obvious that food shortage is a major crisis and the region remains a net importer of cereals. It is also recognized that to save the situation a wide range of policy measures will have to be adopted in the areas of production inputs, price incentives, credit facilities, assured markets, transportation and extension services including the control of water to make it available for irrigation in the dry season. Major policy measures are required to institute better utilization and improvement in management of water resources and the establishment of low-cost irrigation schemes. The development of national capacity and capabilities with a view to enhancing the quality of management will be very crucial.

One of the reasons why water resources development in Africa did not progress well is essentially attributed to the low priority accorded to the sector. In addition, even where water development activities were being undertaken, a comprehensive multi-purpose integrated development approach was not adopted. Consequently, disjointed planning which did not take into account complementary activities has given cause to past failures. Emphasis was often given to hydropower development at the expense of other water development sectors. In fact, the 1988 ECA organised interregional meeting on river and lake basin development notes that river basin planning has invariably been the prerogative of most energy and irrigation agencies and as such did not encompass other aspects of economic and social dimensions to realize sustainability. Africa's future development orientation should be based on integrated and multi-purpose strategy. This puts the adoption of a comprehensive approach with a balanced mix of policy measures including water management, as well as legal and institutional frameworks to serve the sectoral and national development objectives.

2.9 Population Pressure

The issue of population is one of the critical factors in the nexus of population, environment and food security. Its impact on the environment and in the development of water resources is very critical in the context of the African continent as a whole and in sub-Saharan Africa in particular. In the five country case studies, it is noted that there is high population growth rate of about 3 percent and high fertility with population doubling time of about 20 to 25 years; and uncontrolled urbanization. This situation perpetuates environmental degradation and undermines the natural resources base like water quality and quantity, soil fertility and fragmentation of agricultural lands. At the same time it poses higher demand for food and social services like water supply and sanitation, health, education and infrastructures for communication, dams and electricity etc. With the state of economic stagnation in some of the countries and the rate of growth which falls below the population growth rate, the situation would exacerbate the effort of supplying the population with drinking water and sanitation as well as other services and attaining the objective of food security.

The regional situation also shows the same picture. The population of Africa (with growth rate of 2.6 percent), which was 160 million is expected to reach 867 million by the year 2000. As the demand of this population for basic needs is increasing at a faster rate than the development pace, the countries of the region will not be able to cope with the demand. Further, in the struggle for survival, the population could deplete the natural resources and degrade the environment. One of the major challenges therefore, is controlling the population growth, which most countries of the region including those in the case studies are launching.

2.10 Water and Human Settlements

Providing water supply in human settlements involves tapping the most suitable source of water, ensuring that the water is fit for domestic consumption and supplying it in adequate quantities. Quality standards for water supply are principally concerned with ensuring that water does not contain any matter, either chemical or biological, which could affect its safety or acceptability.

In undertaking water development projects, the first step is that all water sources should be assessed, so that the most suitable and acceptable source can be selected. Different sources of water require different degrees of treatment which have marked bearing on on the cost of installation. The choices of source and technology used determine the sustainability of water supply systems. The case study of Ethiopia points out that in remote rural areas boreholes equipped with motorized pumps have resulted in failure as these did not afford simplified operation and finance opportunities. In another situation, the case study of Ethiopia makes reference to two successful spring-based gravity water supply systems which did not require treatment. In one of these systems, women were owners of the system and in both cases community participation was very high. These systems supplied water to communities lying along their destined routes of over 100 kilometres of pipeline. Each of the systems supplied water to about 60,000 people and relieved 8000-9000 women each from the drudgery of fetching water. Both systems are quoted as best practice and have sustained over 10 years.

Urbanization heightens the relationship between available water quantity and water quality. Cities are faced with mounting cost of water shortages, water treatment, well deepening and development of new sources. Particularly cities in Africa, face a dilemma: they do not only have limited means with which to expand the water, and maintain the quality but they also need to expand water supply services to meet the ever increasing needs of industry and to support growing population with varying distribution of population and settlement patterns in rural and urban settings. The five country case studies provide an indication of the magnitude of the problem of providing social services like water and sanitation, health, education and other infrastructures due to both the population concentration/high urbanization and the dispersed nature of community settlements. The following is a brief summary of the situation in each of the countries included in the case studies:

Chad

Chad has an area of 1,284,000 km^2 and is the fifth largest country in Africa. The total population (1996) was 6.9 million and density varied from a high* of 52.4 to a low* of 0.1 persons/km^2. The density varies according to climatic and other condition being higher in the Sudanese zone and low in the Sahelian zone. With economic development growth rate which is far below the population growth rate in Chad, most people at best depend on pools, wells and boreholes for domestic water supply and sanitation is literally absent in rural areas.

Egypt

In Egypt intensive development is concentrated in the Nile valley and delta and the total population of 60 million (1996) is settled with highest concentration in those developed areas. The density of population varies from as high as 15,000 to as low as 0.4 persons/km^2. The most populated regions are the urban governorates, especially the capital Cairo. About 11.5 percent of the population is concentrated in Cairo; 7.1 percent live in coastal governorates; 43.5 percent in the Delta governorates, 36.5 percent in Upper Governorates and the rest of the population is distributed among the remaining areas of the country. The rate of urbanization is increasing in Egypt and there has been rural/urban influx. The percent of population living in the urban areas compared to those living in rural areas has increased from 33 percent in 1947 to 43

percent in 1966. The number of villages in Egypt is about 4,625 in addition to 22,704 hamlets which are administratively affiliated to the main villages. This situation of population settlement patterns added to high and increasing population growth undermines the capacity to provide adequate water and sanitation; as well as other social services to all the population within a short planning horizon.

To curb this situation, Egypt has adopted a demographic policy of redistribution of population and making full use of unexploited vast areas and natural wealth by concentrating on New Towns and reconstructing and expanding infrastructures. It is creating new job opportunities in the development package of the Sinai Peninsula and the Southern Valley which have advantages in easing up the congested cities and in speeding up development in general. Egypt is also giving greater attention to development of rural areas.

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* The terms high and low are country specific

Ethiopia

Eighty five percent of the population (60 million, 1996) are rural inhabitants. The population density varies from 3.9 persons/km^2 in scarcely populated regions to 290 persons/km^2 in Walaita Kembata. In rural settings, 88 percent of the agriculturally suitable area is in the highlands above 1500 meters contour line and this area contains about 80 percent of the human and 65 percent of the livestock population. In general, the nature of settlement in these highland areas is not only scattered but the majority of the rural people traditionally build their huts on the hill sides. Thus, the provision of services for the scattered rural people has been a formidable challenge to the government. As population increased and farms got fragmented people migrated to urban areas and induced pressure on the already weak social services.

The rural and urban population at the increase rates of 2.23 and 4.11 percent per annum respectively. The urban population projection shows a high rate of growth due to net migration of people from rural to urban areas seeking employment.

Based on the definition of the Central Statistics Authority in Ethiopia, there were 845 towns or urban centres. Some of these are small communities with nomadic pastoralist prevailing in the lowland border areas making infrastructure development difficult.

Ghana

According to the 1984 census the average population density is 51.6 persons/km^2. Regionally, there are marked variations ranging from 17 persons/km^2 to 116 persons/km^2 in Upper East Region around Kumasi and the cape coast. In Accra density exceeds 400 persons/km^2.

Ghana has over 47,800 towns and villages. Settlement sizes are generally small and scattered. According to 1984 census, there were only 189 settlements whose population was 5000 or more (the size officially classified as urban). The sheer numbers and scattered nature of settlements make provision of social services including water

supply and sanitation facilities a challenging task. In order to ensure that demand and services can be matched by the rate of economic growth, it has been decided to reduce the rate of population growth from the present 3 percent per annum to 2 percent per annum by the year 2020.

Lesotho

Urbanization in Lesotho is growing at an alarming rate and the projections are that by the year 2050 the whole lowland region will be turned into one urban village along the main road running from south to north. At this stage, it is anticipated that Lesotho would reach a state of absolute water scarcity.

Currently all land in Lesotho is owned by the Basotho nation and is held by the State as a representative of the Nation. Increasing population pressure and decreasing arable land have made land reallocation more difficult. People on their own are claiming their allocated fields as their full right possession and as such residential allocations on arable lands have mushroomed throughout the country, especially in those areas surrounding towns and alongside the main roads. Individual owners are running ahead of governments physical planning options by reallocating without proper infrastructure considerations. These unplanned settlements have consequently made impossible the provision of such services as water, electricity etc. since access roads are absent.

2.11 Regional Co-operation

Regional Co-operation is a sine-qua-non for harmonization of individual national water development programmes through cooperative arrangements between countries sharing common basins. The case studies reveal that all five countries have riparian status sharing their river/lake basins with neighbouring countries. Ethiopia and Lesotho are upper riparians.

In Ethiopia, six of the major rivers representing 73 percent of the total internal renewable surface water resources are transboundary. The government has positive altitude towards cooperating in the common development of international rivers by signing cooperative agreements with its major riparian countries. However, there is no common Basin Arrangement established as a cooperative mechanism for any of its transboundary river basins.

Lesotho has a unique position being wholly within the Orange river basin which drains into the Atlantic Ocean after flowing trough South Africa. Regionally, Lesotho has ratified the protocol on shared water course Systems in the SADC region as a mechanism toward equitable sharing of common water resources. The protocol proposes several bodies for full management of shared river basins. Several bodies to the full management of shared river basins. Numerous river basin commissions are being proposed and formulated in some of the international river basins within the SADC region. Currently regional strategies are being drafted by the Water Sector Coordination Unit for review by the SADC machinery before approval by the Council of Ministers.

The three other countries in the case study: Chad, Egypt and Ghana have lower riparian status. In Egypt,the only generative surface water source is the Nile with its watershed being totally located outside the territory of Egypt. There have been several

attempts to establish a common Basin Organization for the Nile embracing all the riparian countries. This attempt is being promoted through bilateral, multi-lateral, donor and financing institutions. At the time of revising this publication progress had been made in the launching of the Nile Basin Initiative involving all riparian countries with a secretariat to be located in Kampala, Uganda.

Ghana at present has no water rights agreements with any of its riparian neighbours. In recent times, lending agencies conditions are compelling riparian countries to negotiate on transboundary basins. This has shown some result in encouraging transboundary states to initiate dialogue.

Chad is the only country which has made some move in the establishment of common river/lake basin cooperative arrangement mechanisms. It is party to the Lake Chad Basin Commission and the Niger Basin Authority. The Lake Chad Basin Commission is making good progress despite some difficulties, while the Niger Basin Authority has faced serious difficulties which had threatened its very existence. Chad as a member of Lake Chad Basin Commission needs to look into the issue of its water requirement for the rehabilitation of its irrigation schemes.

The situation on cooperative arrangements from the regional perspective is as follows: Out of 57 transboundary river/lake basins in the African region, only a handful have some kind of cooperative arrangements having varying degree of responsibility for development of common resources. Even the existing basin institutions have been constrained by some or all of the following:

(a) Lack of full political commitment by member states backed by concrete support,
(b) technical and managerial weaknesses at the level of the secretariat of the basin authorities,
(c) inadequate funding by member States of the basin authorities,
(d) inability to mobilize external funds for pre-investment studies and for investment; and
(e) politicization of the selection of key personnel.

The preceding are the underlying problems of existing institutions. The most serious problem is the total absence of common cooperative mechanisms for the large majority of the shared basins on which the development of transboundary water resources for socio-economic development of riparian countries on an integrated and equitable basis could be addressed. As most countries of the region are riparian to one or more river basins (as also observed from the above case studies) and since about 40 per cent of the area in Africa falls within transboundary basins, the problem pervades a large portion of the continent and remains to be a serious impediment to integrated water resources Management.

The experiences and lessons learnt about river/lake basin development in Africa have been useful because almost all of the existing organizations are effecting significant changes often resulting in structural streamlining with a major shift focusing on basin planning and on identification of programmes which meet the needs of member States.

The strategy of making river/lake basins as geographical units for multi-purpose planning is fitting since they are natural entities which can be conceived as vehicles for socio-economic development for the riparian countries. It is necessary to note that the river basin units form eco-system continuum in which careful planning could embody efficiency and equity. The river basin unit can accommodate sustainable development by encompassing a range of activities that seek to maintain equilibrium of eco-systems and bio-diversity and thereby enable the optimization of resource utilization through proper and rational planning. There is need therefore, for countries sharing transboundary basins to cooperate and agree to use the river/lake basin entity as development nuclei and adopt the method of multi-purpose planning for development of resources in these basins.

3. OPTIONS FOR PROMOTING INTEGRATED WATER RESOURCES MANAGEMENT

3.1 Institutional and legal arrangements for integrated planning and management of water resources

Integrated water resources planning and management is based on the perception of considering water as an integral part of the ecosystem; being also an economic good that should be managed in a way that ensures the welfare of the society. It is a complex process that addresses a wide range of issues that are interdisciplinary, multi-sectoral, and gender sensitive. Therefore, it incorporates such aspects as:

(i) interaction between technical, ecological and social factors,
(ii) equity in associated benefits,
(iii) sustainability of the resources,
(iv) involvement of all stakeholders,
(v) interlinking process between public and private sectors,
(vi) gender issues and
(vii) institutional and capacity building.

In Africa, integrated management of water resources in a holistic and sustainable manner is crucial to bringing about socio-economic progress to the majority of the population of the region. The progress can be realized through the appropriate institutional and legal infrastructures set up for orderly administration, planning and management of water resources. Since water activities are dispersed among various institutions, they need to be harmonized. This calls for each country to review the water legislation and enhance coordinated planning by adopting a comprehensive approach with a balanced mix of policy measures in different fields incorporating water management, micro-and sectoral policy as well as legal and institutional framework.

Realizing the critical role of institutions as an option to improving the progress in the water sector activities several countries including Chad, Egypt, Ethiopia, Ghana, Lesotho and others are carrying out institutional and legal reforms to effect changes as an option for integrated management of water resources. In this respect, some countries are strengthening their water institution and others are creating new ones like central policy-making and coordinating bodies and semi-autonomous public agencies; others have reassigned or are reassigning functions among institutions and still others have reassigned ministerial responsibilities for water agencies.

The situation of the five-country ECA case studies differs considerably in terms of capabilities and limitations. Also what will work best for a country/region depends on a number of factors prevailing in that specific set-up. As a consequence the situation in the country case studies, concerning institutional arrangements is briefly reflected as follows:

Chad

Chad views the need for creating a coordination body, and for formulation of appropriate policy and water legislation to be critical areas for enhancing the integrated management and utilization of water resources. Chad acknowledges that action in this regard should be undertaken urgently.

Egypt

In Egypt a number of ministries and departments carry out various water activities but the control of water withdrawal is in the hands of one ministry which is responsible for managing the Nile water to satisfy the country's water demands in collaboration with other ministries and institutions.

The responsibility of monitoring and protection of surface water and groundwater is vested with the Ministry of Public Works and Water Resources. The Water Planning Unit under the Ministry is responsible for preparation of Water Master Plan for Egypt. It acts as a support body and provides information and ideas to top level policy and decision-making bodies and other water related ministries at the national level.

The basic principle of the Ministry is that it does not give licence for any water withdrawal that does not coincide with the plan as defined in (i) and (ii).

(i) The command areas for the main canals do not generally coincide with the boundaries of the governorates. Any unplanned withdrawal at the upper portion will directly affect downstream users and violate equity.

(ii) Similarly, groundwater basins extend over many governorates as they are hydraulically interrelated. Any withdrawal at one point/governorate will directly affect the others and violate equity.

In Egypt, regional authorities are responsible at governorate level and they will supported by various institutions/advisors. The regional governorates will establish a committee of stakeholders and a steering committee to facilitate integrated management of water resources.

The water policy of Egypt has been overhauled to include areas of national policy for sustainable socio-economic development and environmental protection. It seeks to outline desired objectives through development and preservation of water resources; rationalized and enhanced water utilization; integration of development projects; adoption of proper water management and updated legislation and introduction of modern technologies suited to prevailing social conditions. In line with the objectives of the water policy, the options include:

(i) increasing water use efficiency by recycling used water and by reducing losses,
(ii) careful development and utilization of desert groundwater,
(iii) conservation and utilization of runoff from rainfall,
(iv) modification of current cropping patterns,
(iv) improving water quality;
(v) construction and conservation projects in the Upper Nile,
(vi) improvement of water management techniques,
(vii) raising public awareness,
(viii) introducing water pricing on irrigation water,
(ix) applying cost recovery for the operation and maintenance of systems, and
(x) adopting desalination of sea water. In the area of groundwater, Egypt intends to develop and manage this resource based on economic return and on promoting conjunctive use of surface and groundwater resources.

Ethiopia

In Ethiopia, the water sector has been recently reorganized and a Ministry of Water Resources created. This Ministry is actively engaged in preparation of water resources policy as there is no formalized national water policy the country has a national water code drafted several years back but had not been enacted into law. The draft code and subsidiary regulations provided comprehensive and adequate legal frameworks covering the essential elements for appropriate water resources management.

The newly created Ministry of water resources has initiated actions to make necessary modifications on the water code to be in line with the new government policy after which it intends to submit the final version to the government for enactment into a Federal law.

The present federal system of government vests the responsibility of water resources management of the country at two levels i.e. the Federal Government and the Regional States. At the Federal level, the Ministry of Water Resources is responsible for the preparation of policies and laws for the management and development of water resources of the country. The Ministry of Water Resources is given by proclamation, the responsibility to: "determine conditions and methods required for the optimum allocation and utilization of water resources that flows across or lies between more than one regional government among various uses and regions". This phrase underscores the government's policy of a basin wide approach to the country's water resources management and the necessary involvement of the central government in planning and allocating the water resources of the country. The Federal Ministry of Water Resources is given the responsibility to administer all international water resources and those shared by more than one regional state.

The Regions are responsible to administer the water resources that originate and remain within their regional boundaries. Development of large scale multi-purpose projects, such as irrigation, hydropower, fisheries, recreation etc., are also the responsibility of the government. Such projects whenever feasible are to be planned and executed by the central water body of the government. This body would also

provide technical support to regional water authorities in their activity on water programmes under their jurisdiction.

The Ministry of Water Resources which is constitutionally the highest federal authority for all water affairs, provides an appropriate nucleus. However, in the last few years, a number of qualified professionals have left the sector mainly to NGOs and private enterprises, and the new structure of the ministry allows for a much reduced manpower which obviously cannot cater for a centralized planning of the nation's water resources.

Institutional strengthening of the Ministry of Water Resources appropriately manned with adequate technical personnel, provided with resources and logistic support and properly empowered to effectively manage and control water resources of the country is a primary and imperative option. The need for the Ministry to be capable of attracting professionals with competitive conditions of employment is considered as a way out to enhance its human capacity. Similarly the strengthening of the regional water offices is important as some of them do not practically have even the base minimum technical staff and capability for planning and implementing water activities.

One of the options to enhance integrated management of water resources if the need for strengthening the institutions for hydrological, meteorological and hydrogeological network establishment and expansion; data and information assessment, processing and storage both in terms of quantity and quality; and for the introduction of new technologies such as computers telemetry and GIS.

Ghana

A number of reviews have taken place of all sectors of the economy and the way the natural environment is used to support and sustain social and economic development of the country. These reviews include the Economic Recovery Programme in 1983 and the Structural Adjustment Programme in 1985. In the water sector, one of the options for promoting integrated management of water resources focuses on institutions.

In this context a review by the Ministry of Works and Housing of a Water Resources Management Study shows that Ghana has enough institutions for integrating water resources management at the sectoral level, but not at the macro or national level, For this reason, the setting up of the Water Resources Commission to undertake water resources planning is expected to rectify the gap. Secondly, the Commission has been given powers to grant water rights, and Ghana has enough laws for granting water rights for controlling pollution and for protecting catchments. The present water resources management study is trying to find out the reason for not implementing the laws and to also suggest mechanisms to enable the enforcement of the regulations. According to the study, the activities of agencies involved in water resources (viz. the information, development and regulatory agencies) are not under the direction of the Water Resources Commission. The Commission will rationalize, coordinate and direct their activities so that they are better integrated into the socio-economic development process.

At present, the Ghana Water and Sewerage Corporation (GWSC) is the national agency responsible for domestic and industrial water and sewerage in both urban and

rural area. In 1993, a community Water and Sanitation Division was formed to concentrate on accelerating water and sanitation delivery in the rural areas. This Division will use the community ownership and community management approach.

In the irrigation sector, the 1980 review showed that the Irrigation Development Authority should not be responsible for the management of irrigation schemes; instead it suggested that farmers should form cooperatives and determine their own management with the authority only advising on technical aspects. The provision of credit, farm inputs, and availability of storage, processing facilities and marketing have been chosen as the best options for integrating agriculture into economic development.

In the case of drinking water for both the urban and rural areas, governments are required according to existing law, to approve tariffs so that the water supply utility can break even on its revenues and expenditures. Unfortunately tariffs approved have over protected the consumers and never been adequate (to enable the utility meet its debt and other financial obligations) with the consequent negative impact on the economy. In order to arrest the situation, a Public Utilities Regulatory Commission has been set up to ensure tariffs that are fair to the consumer and service provider are approved.

An Environmental Protection agency set up in 1974 which is transformed into an environmental Protection Agency with executive powers is the Agency dealing with environmental questions. The agency now demands the preparation, presentation and approval of Environmental Impact Assessment Statements for development projects prior to their implementation.

Lesotho

The objective is to use the available water resources of Lesotho for domestic, industrial and agricultural purposes, for generation of electricity, for recreation, tourism and environmental activities. In this regard, the water resources sector requires planning and management by one agency, which must have sufficient authority to oversee and coordinate all the agencies and parastatals involved in the sector. The option is therefore, to create a Ministry responsible for all water affairs instead of maintaining the vague status -quo whereby the Department of Water Affairs is loosely assumed as the responsible authority while other departments of the Ministry of Natural Resources are equally charged with water development activities.

In view of the inter-dependencies of water resources with industry, health, agriculture and environment it is viewed that Lesotho should have integrated water resources management policies and strategies that adequately address these concerns. For the inter-sectoral linkages mentioned above, legal framework would be required to consolidate the responsibilities of the lead agency in its coordination and management of water resources activities. It is therefore, prudent that the available water laws are reviewed to clearly reflect the policy and strategies of the water sector.

3.2 Infrastructure.

Chad

In the context of its climatic conditions, Chad views that one of the best options to utilize its surface water resources and to ensure agricultural production at reasonable cost is to embark on the construction of small dams at selected sites to conserve runoff water, and water overflowing its river banks. It is known that over 5 billion cubic meters of water are lost every year through infiltration and evaporation. In order to avoid these loses a study conducted has come up with proposals for the construction of two small dams. It is therefore, necessary to undertake the construction of the two dams across Pende River in Chad and Vina River in Cameroon (to regulate Longone). The construction of the dams besides ensuring availability of water for irrigation in Chad and Cameroon, would have multiple uses and benefits such as power generation, flood protection, improving transportation, minimizing soil erosion and making available additional water for livestock.

Egypt

The major infrastructural changes and activities required to enhance integrated management of water resources. Resources in Egypt include:

- introduction of tools to help change the method of irrigation water distribution at the farm level from levels to quantities;
- rehabilitation of the present potable water supply network and completion of its coverage;
- extension of the sewage network to cover all urban and rural area;
- supply of proper on-site equipment for industrial water treatment;
- extension of the habitable and agricultural area through new types of expansions, e.g. the South of Egypt project.

Ethiopia

The state of infrastructures in Ethiopia such as roads and telecommunications is very poor. There are very few asphalt and gravel surfaced roads; and some roads with inferior types of surfacing. There is an outdated railway line of 780km which is operating at a very low capacity.

Water resources projects so far identified in the various river basins are in remote and inaccessible areas where there are no year-round road connections to the main highways. Mostly these areas are thinly populated or uninhabited; and are infested with malaria and tsetse fly. Obviously, telecommunication services are unknown in these areas. Other infrastructures such as schools, hospitals and water supply systems do not exist.

Entrepreneurs and venturing enterprises who are interested in investment of major water resources development projects, especially irrigation projects will face problems of lack of facilities and infrastructures. In order to attract investors interests on major water resources projects, the participation of governments in improving infrastructures is critically important. Therefore, the Federal Government must take responsibility for putting in place the above mentioned economic and social infrastructures as part of its general support to irrigated agriculture and food security.

Ghana

Socio-economic development activities being promoted by water resources management, take place in towns, villages and in remote rural farms all over the country. In order that the produce of farms can be transported to markets and to ensure that farming communities get their required inputs, it becomes necessary to connect urban and rural centres by communication links. For this purpose, in Ghana, there is a programme of feeder road construction and maintenance; and rehabilitation and expansion of highways. There is also a development programme of telecommunication facilities to link all the 110 district t capitals in the country.

Lesotho

In areas where infrastructures do not exist the cost of construction of water facilities becomes expensive. In the case of drinking water supply, the cost of treatment plants and the means of conveying the treated water to consumers need capital and therefore need to have cost reflective tariffs (which must be paid by the users) to be in place. However, some users are too poor to afford the price for water. Under such circumstance, cross-subsidies between different categories of consumers should be permitted; but there should be no cross-subsidization between domestic and non-domestic consumers. The non-domestic users should pay the full cost of recovery tariff. To minimize costs, is recommended to take the option of low-cost infrastructures for water supply facilities.

3.3 Appropriate technology

The term "Appropriate Technology" is referred to technologies adopted to solve a given set of problems under a set of given conditions in a particular country/region, at present and in the foreseeable future. It may be defined as a method or technique adopted to provide a socially and environmentally acceptable standard or quality of product.

Among other things, the appropriateness of technology is essentially governed by the availability of the type and quality of a water source. The degree of sophistication or non-sophistication or its being conventional or non-conventional do not preclude a certain type of technology from being chosen. From this standpoint, desalination in the North African coastal area is appropriate as it address the specific need and problem. Similarly, water recycling is quite appropriate in the context of imminent water scarcity in several African countries.

In rural areas of Africa, integrated water management is undertaken depending on the water source, technical know how, and financial availability and affordability. The sources of water may be from rivers, springs or groundwater. The general practice in remote rural areas has been the application of labour -intensive technology in the development of water resources. Capital intensive technology is employed in the construction of large capacity ponds/dams, water galleries and treatment plants.

For better success to be achieved, there is a fundamental need to build up technological capacity within the countries in Africa to solve problems and to a void undue dependence on imported technology and raw materials. There are considerable

experiences gained in the construction of major dams like Aswan, Kariba, Kainji, Volta, Owen Falls, Manantali dam and Diama Barrage among others which have been useful to develop internal capacity. There are also many instances as in Algeria, Egypt, Sudan and Nigeria where major undertakings are accomplished by African engineers. The main difficulty however, is that the technological capacity is not distributed over the region and there are many countries in which lack of personnel and institutional weakness of basic infrastructure leave no alternative but to seek external aid to solve some of the pressing problems like provision of drinking water, irrigated agriculture and soil and water conservation activities.

In the area of development of hand pumps, the examples of Zambia, Malawi, Ethiopia and Ghana among others can be cited. Most of the hand pumps are manufactured locally, they are easy to operate and maintain and are produced at a considerably low-cost than imported hand pumps.

In Ethiopia there is a micro-dam construction project that is currently in progress that is currently in progress for water harvesting in different regions of the country. The project is focused on areas with high population density and fragile ecology. The project is intended to breaking the cycle of agrarian crises based on a strategy directed to moisture-deficient, drought-prone regions by integrating environmental rehabilitation, water harvesting and irrigated agriculture. The involvement of the beneficiary communities in all aspects of the planning and development process; the orientation in labour-intensive technology with minimal use of mechanical power and the mobilization of domestic financial resources are key features of the conceptual framework of the project that is targeted to bring about local food self-sufficiently. The project is undertaken in catchment areas of less than or equal to 25 km^2 with a micro-dam capacity of up to 2 million m^3 to irrigate 15-200 ha per micro-dam unit. The project is being considered for replication in sub-Saharan Africa and the Greater Horn.

In Ghana, since it was found that 31 percent of the borehole water contains iron far in excess of maximum permissible limits, there is a project to develop iron removal plants, using local materials, which are easy to operate by the rural population. Ghana is also implementing water and soil conservation and environmental rehabilitation programmes involving communities and employing labour-intensive technologies.

In Lesotho, the innovative soil and water conservation and agro-forestry programme is intended to prevent the chronic problem of soil erosion and environmental degradation. The project applies labour intensive technology which is integrated into the normal farming operation to yield long-range sustainable improvement in agricultural productivity. The project was also intended to promote an innovative agricultural extension system based on clients demand. It was designed to provide agro-forestry research capability and establish a monitoring system within the government for coordinating its soil and water conservation policies and programmes.

The five country case studies show the following views on technology as an option for integrated water resources management.

Chad

In Chad the need for continuing research activities in the water sector especially on water pumps and well casings for different conditions of groundwater exploitation

considering affordability and using locally available materials is viewed as a technological option that should be sustained.

Egypt

To address the issues impending integrated water management, Egypt is the only country among those selected for the case study that extensively uses advanced technological tools and instruments.

1. Several state-of-art models are used for planning and management of water resources, including:

   (i) A control model for the High Aswan Dam, interactive regulation of water demand and supply based on an analysis of satellite rainfall data were the Nile Basin;
   (ii) A water quality management Decision Support System (DSS) for spotting water quality bottlenecks and for analyzing the option for water quality;
   (iii) A model to describe agricultural, municipal and industrial demands, calculating crop-water demands, simulating water distribution in branching canals and drainage networks, taking capacity limits into consideration and estimating the impacts of water shortage, increased salinity and water logging on crop yields and gross revenues;
   (iv) An agro-economic model to determine optional cropping patterns and economic impacts of various water management options;
   (v) A geographic information system (GIS) and remote sensing facilities to develop base maps and data basis for water networks that can be linked to hydraulic and hydrologic models.

2. A national water monitoring system (telemetry) and a national water quality network that provide real-time data which is essential for the operation and management of water supply and use systems.

3. Various types of maps including hydrogeologic maps, groundwater vulnerability maps, land use maps etc.

4. Groundwater potential atlas that is updated periodically.

5. A licensing system to control over-exploitation of groundwater.

Ethiopia

One of the major problems in rural water supply in Ethiopia is the question of sustainability due to inappropriate choice of technology like the installation of boreholes with electrical pumps which often become inoperational since the beneficiaries neither have the technical know-how nor the financial capability to make repairs on the systems. From this standpoint, the preference is to go for simpler and more sustainable technologies like spring development and hand-dug wells fitted with hand pumps. These technologies offer beneficiary participation both during implementation and operation stages and consequently enhance sustainability of systems.

In the area of irrigation, Ethiopia is undertaking construction of micro-dams for conservation of supplementing water for small-scale irrigation development. The construction of micro-dams and irrigation canals are for the most part labour-intensive affording participation by beneficiaries. In addition, such projects are implemented by mobilizing domestic resources and using local materials, These activities are being given emphasis in many parts of Ethiopia and there is a plan to replicate the project in sub-Saharan African countries. The technology is considered as an option to improve crop production for local food self-sufficiency.

Ghana

Ghana's new strategy adopted for rural water supply and sanitation is to go beyond the hard technology of the type of system to be installed (viz. borehole with a hand pump, mechanized borehole, package plant or conventional treatment plant). As affordability for communities to contribute to projects and ease of technologies to enable maintenance and operation of facilities to be performed by communities are critical elements for success and sustainability of rural water supply projects; the strategy opted by Ghana is to fully involve the beneficiary communities at all stages of project development i.e. from inception to implementation. This strategy affords the communities to choose the technology they can pay for and maintain the strategy also embraces coupling hygiene education is also being coupled to the technology choice so that communities will appreciate the relation between potable water, sanitation and health.

Presently, the general technological option is the choice of boreholes or hand dug wells fitted with hand pumps for communities below 2000. For large communities of 5,000-15,000 the choice is mechanized boreholes powered with diesel generator, solar energy or connected to the national electrical grid.

In the area of irrigation, there are three classification i.e. small scale projects less than 200 ha, medium scale projects 201-500 ha, and large scale projects with greater than 500ha. The best option for irrigation is to use surface water instead of groundwater. For such projects, water is withdrawn by low lift pumps and distributed by pipes or canals; and, wherever feasible gravity advantage is taken of distribution by canals and pipes. In all cases farmer participation in irrigation projects from the conception to the implementation is considered an essential aspect of the development strategy.

Lesotho

Lesotho's view is that the choice of appropriate technology should be seen in the light of the cost of water development projects.

Overview

The five country case studies show that each country has its own approach of technological options to solve its specific set of problems. However, common desire expressed by all the countries is for technologies to be simple for installation, operation and maintenance so that services could be sustainable. Another important factor related to technology is the question of affordability. In view of this countries apparently opt for technologies that are simple, have least cost, are easy to maintain,

could preferably be produced locally, have easy access for spare parts and conducive for beneficiary participation. This trend is clearly visible from the experiences of rural water supplies in Ethiopia and Ghana who are moving away from drilled boreholes fitted with diesel or electrical pumps to that of hand-dug wells fitted with hand pumps.

In terms of irrigated agriculture, most of the countries tend to encourage small-scale irrigation by constructing water harvesting schemes for additional cropping. These schemes are intended to be low-cost, labour intensive and community-based projects.

One of the difficulties encountered by most countries in the area of technology is to the maintenance of imported equipment especially the need for continuous import of spare parts. In this respect, it is noted that action would be needed for:

a) greater standardization of equipment among possible suppliers, and
b) promotion of manufacture of spare parts leading in due course to the manufacture of an increasing number and types of equipment in the countries of the region.

There is also a need to establish linkages among research centres and centres of excellence, and the promotion of inter-country technical assistance programmes within Africa and the countries of the South in the context of TCDC. This venture will serve the purpose of enhancing the capacities of countries planning, design, operation and maintenance of water development projects.

3.4 Private sector participation (psp)

An efficient allocation of water needs to prevent possible abuses and monopolistic practices. Thus, water policies, institutions, laws and regulations should promote a sustainable and economically efficient and socially equitable use of water. Moreover, as water becomes scarce, legal title to water needs to be established in order to facilitate private investment. These consolidated concepts are the directions towards which several African countries are moving in the current democratization process. The five country case studies of Chad, Egypt, Ethiopia, Ghana and Lesotho show that all of them are making efforts to promote PSP albeit at varying paces.

In general, public water schemes have been found to have lower productivity than those developed by individual users' or users groups. The recovery of operation and maintenance costs is not only a financial issue but also an economic one also since the problem lies in the efficient provision of the service. It is therefore, unlikely that the cost recovery objective will be reached without a formal and effective participation of users in management of the project; and experiences in southern Africa have demonstrated the positive influence of this participation (FAO, 1996). Pilot projects have shown that much can be achieved when management responsibilities are properly shared with, or transferred to farmers and in fact, some of the most successful water projects in Africa are the result of private initiatives. The private sector participation in water resources management and development range from the individual family to small NGO projects and up to large-scale corporate investors. This private sector initiative has been translated into a successful and increased performance of water resources management especially in irrigation schemes.

Water users' associations engage in contracts with private agents who manage the entire scheme or who provide most of the essential services to water users. These managing agents are set free from the stranglehold of normal government procedures and thus, are able to apply private sector procedures in the provision of efficient, cost-effective and timely services to farmers. Thus, this service -oriented approach to management, in the context of sound economics and adequate profitability, has helped to ensure the maintenance and efficiency of water development projects with the capacity both to serve the market and to adjust to change. Besides successes in water management, the private sector participation is also essential as a source of finance and technical expertise. The needed capital can be generated from domestic savings and with the new more liberal attitude towards the private sector, it is also possible to devise means to use public finance to promote private sector initiatives (FAO, 1996).

Governments have the responsibility to provide the basic infrastructure that will not be built by the private sector, such as roads, dams, social service facilities and others and then let private initiatives take over to develop the remaining of the system. However, the private sector will do so only if it believes that the investments are profitable and secure. The creation of this friendly environment requires only the necessary political will and investments in infrastructure to transform the above experiences into more general policies and practices and this can be achieved by introducing sound macroeconomic policies to promote investments and profitability of water resources development projects and to accompany these policies with a high-quality technical support. Furthermore, for a more efficient working of these privately managed schemes, governments must retain some control especially with regards to policy issues and must be able to monitor the performance of the private agents so that they respect their contractual obligations. Some form of government control is also required to ensure public safety, environmental protection, water rights of others, and so forth. In this perspective, the case study provides information on the steps that are being taken as follows:

In Ghana for example, under the current development plan "Vision 2020", the Government, (which has until 1985 had been involved in the production and distribution of various goods and services), has changed its policy and is now ready to withdraw from those activities and allow the private sector to take over economic development activities and become the engine of growth. The government has decided correspondingly to create an enabling environment for the private sector to function efficiently. In this context, in rural water supply and agriculture sector, the supply-driven approach is replaced with demand-driven approach. This approach has led to government redefining its role at various levels of administration. Accordingly, government will henceforth essentially focus on policy making and monitoring activities.

With deregulation in place, any agency or person can now apply and obtain a water right from the Water Resources Commission in Ghana, to abstract, treat, transmit and distribute water for sale if they find this to be a profitable venture. The private sector is expected to play a significant role in the development of urban water supply sector. In fact, even utilities like transport services, security services, construction and consulting services can now be contracted out to the private sector. Entrepreneurs are also being considered for development of hydropower and Lake Transport.

Lesotho subscribes to the view that privatization is a vehicle for integrated water resources management and is an option towards enhancing cost recovery in the water sector, especially in urban water supply.

In Egypt, the present policy of the government is to change its role from full responsibility to partnership and facilitator. It is considered that this policy will increase the magnitude of private projects by about 15 percent in the next five years. The present policy of Egypt is being implemented in the planning of projects for development of the South Egypt Project.

The economic policy of the present government of Ethiopia accords a pivotal role to the private sector in the water resources field. Consultants and contractors can now participate in planning, design and implementation of projects. Consultants have vast opportunities to participate in the study, design and supervision of irrigation and hydropower development projects.

Overview

Some important concerns with privatization relate to the thorny problem that tariffs would go up very high to meet the profit expectations of private investors. Hitherto, tariff have been depressed and consumers have been under the impression that water supply is either fee or must be subsidized. This is revealed in the country study of Ghana and holds true for rural areas of several African countries.

Another issue is that although, it is important to let private entrepreneurs take over the provision of goods and services, it is at the same time necessary to ensure that they have adequate financial and human resources including the capacity to carry out their contractual obligations.

In the context of national capacity building, most national consultants in African countries have limited human and financial capabilities, their participation is limited to minor irrigation and other water development projects. There is also the absence of adequate number of local companies that are acceptable to external financing agencies to take up large projects. This leads to a state of monopoly by huge foreign companies and transnational that drain the limited capital of the countries which are in transition economy. Consequently, this situation could perpetually continue to undermine the countries whose internal capacities both at the public and private sector are too weak to complete at international bids. Innovative solutions are needed in the long term to resolve this situation. Local and foreign partnerships could be a good beginning.

3.5 Community Participation (with emphasis on gender)

In Africa, particularly in sub-Saharan Africa, there is a decreasing rate in the execution of new water supply and irrigation projects. The problem is further compounded by the failure of existing schemes because of lack of proper operation and maintenance. Consequently, communities falling in the low-income bracket, particularly those dwelling in peripheral or urban fringe areas and the rural segment of the population, have to stay without proper service facilities of drinking water and sanitation and often revert to unhygienic and polluted sources. It is noted that this situation is also dominantly visible in the country case study.

In rural areas of Africa, carrying water from distances exceeding 5 kilometres, day-in and day-out for years and a lifetime represents the order of the day for many women and children. It is therefore, a matter of great concern to all to improve conditions in the rural setting. A momentum of a continuing effort through community involvement especially women and public participation could be seen as a way to assist in salvaging this situation.

In the case studies, the experience of Chad shows that so far community participation including women has been limited and participation has essentially been in water well construction. As regards agriculture, although it is noted both men and women in Chad, participate; women' right as equal beneficiaries in land ownership as well as other aspects of interest leaves a lot to be desired. Chad perceives that the thrust of community participation in integrated management of water resources an important option.

Egypt cites a special Public Participation Programme (PPP) in El-Mansura Unit located west of Cairo which is an irrigation scheme to develop 15,000 ha using groundwater.

In Lesotho, the Department of Rural Water Supply (DRWS) is developing strategies which encourage and include village affairs participation for: production norms, technical know-how, enhancing maintenance capabilities, involvement in planning, mobilization of implementation capital and human resources. The village affairs goal is to empower villagers and particularly women to run their own affairs. In the urban areas, Lesotho encourages Authority - Customer Partnership and understanding in setting tariffs which take into account the subsidy of the very poor who cannot afford to pay. As regards to agriculture Lesotho is encouraging small-scale irrigation development through community participation. In keeping with the democratization and liberalization process, the public sector is increasingly taking the role of promoter and facilitator.

In Ethiopia and Ghana, steps are being taken to ensure community management and ownership of rural water supply projects as the option to bring about sustainability of systems. The community is charged with the responsibility for planning, operation and maintenance of their water supply systems. Both countries have taken steps for settling water and sanitation committees that will be instrumental in motivating the community to participate in planning, in the choice of technology, and in identifying members to operate and maintain facilities that are installed. Adequate representation of women will be part of the committee's constitution so that their special concerns are care of fully addressed and their interests are safeguarded. The question of awareness creation, hygiene, education, training requirements, coordination of water supply and sanitation are among the issues that will be promoted towards enhancement of community participation Ghana and Ethiopia. Encouragement of community participation on basis of demand-driven approach is in course in the area of small-scale irrigation development in these two countries with women as equal partners.

Overview.

The above shows that efforts have been made by all the countries in the case studies to involve communities in water supply and small scale irrigation. Community participation is also encouraged in soil conservation and tree planting activities. Trends

indicate that while there are some cases where programmes implemented through mass mobilization have yielded successful results, there are others where such success did not materialize, mainly because the organizers for mass mobilization had themselves limited technical and administrative capabilities while in other instances, political support was lacking.

The micro-dam project in Ethiopia and the soil conservation programme in Lesotho are good examples of water development activities where communities are heavily involved. Needless to say that the Egyptian experience on community involvement and participation in irrigation and other water development schemes is very prominent. In several countries of Africa like Kenya, Tanzania and Uganda numerous water development activities have been implemented with community involvement. All these countries are making a conscious effort to enhance the role of women in development.

Notably, meaningful involvement of the people at large requires a lot of effort in awareness creation, mass-campaign and motivation. Community participation, need not focus on material and labour contribution alone, but should also be orientated towards making the communities have the sense of ownership and responsibility. The community should feel that the water development schemes are there because they wanted them and that they are not external impositions on them. It follows that it is their own interest to attend to the proper use, operation and maintenance of the facilities. People especially women, from villages, districts and province should therefore be involved in the planning construction, operation and maintenance of water supply and sanitary installations, irrigation facilities, soil and water conservation projects as indicated in the case studies of Egypt, Ethiopia, Ghana and Lesotho. The endeavour should not remain as a mere slogan, but should develop into a national movement in which all sections of the community have a role to play. This broad-based character of community participation should be reflected in the various committees both at the national as well as regional levels.

The involvement of communities especially of women as the most concerned group at the planning stage helps in taking account of local beliefs, cultures and outlooks. Adequate respect should be accorded to the value system of the local people. These are often vital elements for the success of water and other development projects since it is only through consultation with the community concerned that the needs and aspiration could be realized and earnest involvement of communities could be guaranteed.

Involvement of women and the community at large in water supply projects and the training of grassroots-level technicians has proven successful in many African countries and has helped to reduce investment costs by about 40 to 50 per cent. In addition, experiences indicate that public participation provides the basis to promote health care and mass education programmes with respect to proper water use and storage practices and also in the areas of management, personal hygiene and human waste disposal. Internal dynamism has to be brought to the task of rural poverty alleviation. It would be a valuable venture for countries in Africa to exploit the skills and creativity of their rural communities and mobilize their participation by activating their productive potential. Self-reliance should be promoted to attain sustainable development in water activities and bring about food security.

Under the prevailing situation in Africa, where there is a remarkable shrinkage of financial resource increased beneficiary participation can be perceived as a challenge to counter the onslaught of poverty. This entails moving farther from rhetoric to practical and determined modes of operation. The perception is that community participation and most importantly women provides the dynamism that is essential to the success of integrated land and water resources development programmes and makes projects self-financing and cost effective.

There are numerous successful projects designed and implemented by various organizations. Reference may be made to IFAD income-generating production technology project specifically designed for women household heads in 1988. The project covered countries like Burundi, Cameroon, Ghana, Costa Rica, Madagascar, Mali, Senegal, Solomon Islands and Sudan. The women targeted included farmers, livestock owners and those engaged in income-generating activities like fishing.

Where participatory mechanisms at the grass-roots level exist in the form of peasants associations, cooperatives or women groups as is the case in many countries of the region, these could be used as entry points. On the other hand in countries where nucleus organizations do not exist, they can be developed by bringing together the beneficiary communities to participate in development projects. Such mobilization of people can be spurred spontaneously or initiated through trained animators.

3.6 Partnership

Primarily, the role for water resources development rests with national governments. Experience shows that in many African countries the financial, managerial and technical capability is unable to support accelerated development of integrated water resources in the multi-sectoral activities. It is noted that water activities are implemented in partnership with external support agencies including United Nations specialized agencies like FAO, WMO, UNICEF, WHO UNESCO, UNEP etc., bilateral organizations, IGOs, NGOs, the donor community and financing bodies like UNDP, WB and the ADB. The ubiquitous nature of water which identifies itself as a common denominator to most social and economic development programmes that cut across a whole range of activities makes it essential for countries to identify specific areas where partnership is most needed. The type and degree of partnership and assistance required varies from country to country. A review of the country case studies provides the following:

Chad

The need for assistance of NGOs to Chad in financial, technical and organizational aspects of integrated water resources management is viewed essential. It is acknowledged that NGOs are very close to the rural people and their impact in awareness creation of communities considered crucial.

Egypt and Lesotho

It is noted that these two countries obtain considerable benefit from bi-lateral, multi-lateral, UN agencies, WB and UNDP other partnership in the development of their water activities and programmes.

Ethiopia

According to the UNICEF/Water Resources Commission (WRC) survey of 1991/1992 there were 19 multilateral and bilateral agencies and 38 NGOs supporting water supply and sanitation programmes in Ethiopia. Projects financed constituted were 48%, 34% and 18% by multilateral/bilateral, NGOs and government respectively for rural water supply and sanitation. In 1996, the Disaster Prevention and Preparedness Commission (DPPC) reported that there were a total of about 250 NGOs of whom 80 were involved in water supply and sanitation. At the same time the Christian Relief Development Association (CRDA) survey, reported that 64 of its members were involved in water development to 150 million Birr.

The government; implemented projects supported by multilateral and bilateral agencies, while NGOs independently identified water projects (including small-scale irrigation projects in rural areas), implemented them with their own force and handed them over to communities. This entailed serious problems since neither the communities nor the governmental water organizations could keep up with the maintenance of the wide variety/unstandardized hardware. Consequently most of the systems became inoperational.

The fundamental problem was that most of the NGOs did not coordinate their activities of water development with the Ministry of Water Resources and in fact, the majority of the NGOs were not even known to the Ministry. In order to overcome this constraint, the CRDA has started a Water and Sanitation Working Committee with members of its constituent organizations to coordinate the activities among the NGOs themselves and also with government organizations.

Ghana

Ghana has enjoyed partnership with local and international organizations in the effort to manage its water resources, and to meet its socio-economic development objectives. Partnership in Ghana started in 1978 with CIDA of Canada grant to construct 2500 boreholes fitted with hand pumps followed by another similar grant in 1981 by KFW of Germany to construct 3000 boreholes fitted with hand pumps for rural water supply. Both grants assumed supply-driven approach. Since 1992, there has been considerable expansion of rural water supplies with further grant from Danida, JICA, CIDA, CfD, UNDP, UNICEF and IDA with a new demand-driven approach. Ghana has also received concessionary loan terms amounting US$240 million for 34 Urban Water Sector Rehabilitation projects from various agencies including IDA, OECD, KfW, ADB, DfID, Nordic Fund, CfD and the Austrian and Netherlands governments.

In the area of irrigation, assistance has been received from IFAD, AfDB, BADEA, IDA and JICA for rehabilitation of systems, and for studies, planning, design and financing of new projects. Other assistance received from various institutions was for hydro-power development and the Volta Lake Transport Sectors.

To meet the targets of Vision 2020, which envisages considerable rehabilitation, expansion, and construction of new systems, the leverage of partnership is an imperative option. This however, depends on funds that government can mobilize to implement the plans and to improve the financial position of agencies like GWSC and Irrigation Development Authority (IDA) by first restructuring to separate the urban

water supply from the rural, water supply, and secondly by approving adequate tariffs for GWSC, and thirdly by creating conducive environment for private sector participation. If this groundwork is not prepared, the donor community will find it difficult to invest in the programme envisaged by Vision 2020. So far the government has responded by taking positive action toward meeting the above prerequisites. However, this requires careful planning in order to avoid pitfalls experienced by Gambia and Guinea.

Overview

In the light of the reflection of the country case studies and the experiences of individual countries, it deems necessary that each country should identify the specific areas of its need for partnership. In this regard, the assessment of indigenous capacity before resorting to external support is essential, The case of Ethiopia and that of Ghana give some insight into what preparatory work has to be done to make effective use of partnership programmes. Countries need to make a cautious effort to study the impact of partnership and make an appropriate evaluation of their absorption capacity for technical and financial assistance they might be offered. The need to assess the cost-effectiveness and consequences of partnership programmes and the possibility of such programme to continue on own resources after the project implementation phase completed and partnership support withdrawn is a matter that requires careful consideration.

An important aspect of partnership should focus on transparency and accountability to the recipient government/beneficiary community. It is also vital to consider the issue of coordination of the programmes, the need for standardization of equipment, availability of spare parts and thereby sustainability of facilities, and to ascertain government supervision and authority on behalf of its people. In all partnership programmes, the choice of the beneficiary community and its involvement in the planning, designing and implementation for integrated water resources management should be ascertained and there should be a mechanism to ensure the programme reflects the needs and aspirations of the recipient government/community. All financial and administrative procedures should be observed to do away with mismanagement of resources.

3.7 Governance and Stability

Democratic government principles and political and social stability are determinant and basic requirements for any socio-economic development to take place. The United Nations System-wide Special Initiative on Africa noted that governance and stability are critical to fulfilling the political, economic and social aspirations of countries. Achieving sustainable development and growth, including that of integrated management of water resources requires an environment where decentralization of responsibilities, privatization, beneficiary-community participation and increased role of women are promoted and accountability and transparency as well as the rule of law prevail. Several African countries have recently become more sensitized and have taken a number of steps to improve the planning, development and integrated management of their water resources.

The following is a brief reflection from the perspective of 5 country case studies on their experience in the area of water and water-related activities

Chad

Action is in course towards encouraging private sector and community participation including the need to advance the rights and role of women. One of the major problems in Chad is the frequent and high government official mobility such that there is no continuity and no institutional memory. It is noted that with each change of Prime Minister there followed a break up of an institutional team like the high National Committee for Environment, which as a result has to date, remained in a state of inaction. It appears that if any progress is to be made stability of government and the survival of specialized National Committees despite changes in ministerial and other high government position appointments should be retained.

Egypt

Egypt has enjoyed government stability over many years. In accordance with its present policy, the government of Egypt is to change its role from full responsibility to partnership and facilitator. From this perspective, the future will see increased private sector participation and involvement of beneficiary communities. As regards decentralization at governorate level, the main responsibility is in the hands of regional authorities, supported by various institutions/advisors. Stakeholder communities and investors are encouraged to take part on development issues.

Ethiopia

Since the present government seized power in 1991, there have been indications of intent to shift to the principles of a democratic government and to liberalized the economy. The primary preoccupation of the government has been to promote peace and stability in the country. The new constitution of the Federal Democratic Republic of Ethiopia (FDRE) promulgated in December 1995, contains several basic elements of democracy and key indicators of democratic governance. These basic elements include items such as: human rights, civil liberties, the rule of law, free and fair election, combating corruption, political stability, etc.

In Ethiopia since 1991 there has been some developments in governance and in stability and if, progress continues with improvement, it will make a significant difference in harnessing the water resources potential for the improvement of the socio-economic conditions of the population.

Ghana

Since independence in 1957, Ghana has been governed under political systems which oscillated between a civilian one party dictatorship, a liberalised multi-party democracy, and military dictatorship. The last military rule lasted from 1982 to 1992. In 1992, the country returned to a multi-party democratic constitutional government, with executive, legislative and judiciary arms, which also recognized the press.

The present socio-economic development plan "Vision 2020" was prepared as a constitutional requirement where peoples' needs and aspirations are enshrined and valued, and a framework for monitoring and evaluation is established. Under the plan, the production and distribution of goods and services are left to local and foreign private

entrepreneurs. The government seeks to create an enabling environmental for all to participate in the economic development of the country within the Constitution and the laws of Ghana. Another key element is the decentralization of administration so that people will decide on projects of priority in their areas. Accordingly, the present community water and sanitation programme and small-scale irrigation projects are to be prepared at the District level with the assistance from the decentralized specialized government agencies. These district level programmes are co-ordinated at the regional level and they are consolidated as national plans.

Rural agriculture and water supply and sanitation programmes are components to change the deprived and abject poverty of the population in rural areas. These services are expected to be provided by the private sector (in the provision of goods and services) through an open and competitive bidding administered in an open and transparent manner. Supervision, monitoring and evaluation of contracts are to be done at the local level. The principle of competitive bidding is expected to be applied to regional and national projects.

In order to enable realizing the objective of improved socio-economic conditions in the rural settings of Ghana, the press is expected to educate and enhance public awareness and thereby assist the population in making informed choices and decisions. It also serves as a means of promoting understanding and national unity and stability of the country so that the environment is conducive to focus on socio-economic development. The desire is to create a harmonious situation to realize "Vision 2020" in the perspective of achieving the national aspirations. Ghana richly perceives the need to secure the understanding of citizens and their respect and compliance with the law as crucial elements for success. Capacity building for planning, supervision, monitoring and accounting at the district level is also perceived as the best and effective way of getting back good dividends on investments. In Ghana, the media is encouraged to contribute to national integration and stability besides being used as a means for mass education and awareness creation.

It appears that Ghana is on the right track in installing good governance and in bringing about political stability to promote socio-economic development in general and integrated water resources management in particular.

Lesotho

The vision of Lesotho in the water sector recognizes that policy principles and strategies must originate from the people, the water users, the stakeholders and the interested groups. It aims at discarding top-down approach and implementing bottom-up approach which is focused on involving all levels of the society; and the empowerment of community, in decision-making, planning and implementation of programmes and projects. In this context, decentralization has been introduced is the process and is in course. The central government will continue to shift its role on managing policies and strategies including inter-sectoral allocation of resources. All other activities are to be undertaken at the village, ward and district levels.

It can be seen that Lesotho is moving to democratization and the creation of a harmonious and stable environment that would encourages private sector and community participation to achieve integrated management of water resources in a sustainable manner.

Overview

As can be seen from the process in course, several countries in Africa and those selected for the country case studies are following the path of good governance and stability. They have recognized that government stability and political democratization will go a long way towards the realization of the aspired objectives of improving the quality of life and the socio-economic improvement of the majority of their rural population that currently live in abject poverty. The option of governance and stability is also seen as a way forward to enhance integrated management of water resources.

4. CONCLUSIONS AND RECOMMENDATIONS

In the countries selected for the case studies especially in Chad, Ethiopia, Ghana and Lesotho, there was a gross under-utilization or inefficient utilization of water resources. There is therefore, a strong need to harness and use the land and water resources potentials to productive use. Development should proceed on basis of sound policies and proper planning strategies that take into account the interfaces and interlinkages with the national socio-economic development perspectives. This calls for bringing together the interplay of the nexus issues of population, environment and food security with the cross-cutting elements of water resources, capacity building and gender issues. The exercise should seek to achieve cross-sectoral harmonization and reconciliation with the national development targets at the macro-economic level. With this objective in mind, the following general conclusions and recommendations are drawn:

1. The countries in the case studies (like the Africa region itself) exhibit complex patterns and striking paradoxes of climate, physiography, economy, social, cultural and political features. The countries selected are at different levels of development. Given such circumstances, it would neither be possible nor desirable to prescribe a single national water development strategy as a comprehensive model. What is obviously needed is national efforts to develop their own new approaches and strategies suited to their specific conditions.

2. Water activities are often split between a number of ministries. This fragmentation of responsibilities among sectoral ministries and administrative agencies have hindered co-ordination and impeded the attempts to integrate water management activities. This situation is observed in almost all countries albeit to varying degrees.

3. The question of maintaining equilibrium on the extent of centralization or decentralization of responsibilities is an issue to be left for local and national adaptation. In this regard, the countries in the case study recognize the need for coordination and harmonization of water activities. Some countries like Egypt, Ethiopia and Ghana are taking steps while in Lesotho; there is a future proposal to establish a new Ministry of Water. It is worth noting that about two decades ago there has been a trend towards designating some national focal point, or centre with responsibility for the management of water resources. The effort should be revived with appropriate resource allocation being provided to enable effective coordination and harmonization of water activities at the national level. Another useful instrument to assist in the implementation of multisectoral programmes in a coordinated manner which many countries are adopting as the basic planning unit is the hydrologic geographical unit or the river basin unit.

4. Water use efficiency is a subject of concern to a large majority of countries and relates to all sectors, as it sets excessive demand on the resource itself and implies increased investment in infrastructures and operational costs. This has been observed in the occurrence of excessive leakage and inefficiencies in the distribution systems of the countries in the case study and in fact in several countries in Africa. The problem is of particular significance in agriculture and more so in irrigation which has a heavy demand for water. For many countries in Africa where irrigation is increasingly gaining prominence the overall rational use of water is key to development. Demand management particularly in North African Countries (where irrigation is relatively developed even if it gives only marginal savings of water) could have profound benefits, in the large volume it releases and in avoiding costs for exploration and development of additional and new sources of water. Concerning water supply systems, the case study reports point out that significant losses due to leakages and unaccounted for water are causing serious consequences leading even to system, failures in some cases.

5. Recently, more and more countries in Africa are embarking upon irrigated agriculture. Countries in North Africa like Egypt, Algeria, Morocco have longer history of irrigation and had experiences of salinization which damage productive property of soils. These countries need to provide in their national strategy a component to combat the threat and to bring about sustainability and increase productivity potentials. For those countries like Ethiopia, Ghana, Chad and Lesotho (in the case studies) and other countries with limited experience and newly embarking on irrigated agriculture, the incorporation of drainage facilities will be a cost-effective investment. Where appropriate, irrigation development and expansion should take into consideration the possibilities of adopting necessary design and operational factors to incorporate provisions for using marginal quality of water from effluent or brackish sources into existing and future schemes.

6. Since the Great Drought of the 80s, Africa has more frequently continued to suffer from such incidence. In the country case studies, Ethiopia and Chad have gone through severe experiences of drought while the other countries have also been exposed albeit to a lesser extent. The expectations of a downward trend in rainfall has continued in many places and set in train the process of accelerated desertification and drought. The concept of "drought proofing", reflecting concern over possible climatic changes, should become an integral part of planning with increased water conservation measures and crop diversification.

7. There has been a growing concern in many countries of Africa for the control and mitigation of flood damages and associated disasters. Whereas the causes of flood may be varied, there are strong linkages between land and watershed management in upper catchments, land use policies in flood-prone areas and the costs of flood damages and of its prevention. This obviously places the subject within many national water strategies.

8. The countries in the case study like those of other Sub-Saharan African countries suffer from poor economic performance, recurrence of drought and crop failures, which led to the onset of famine and mass exodus of people. Despite the prevalence of water scarcity in the region, rainwater that is received has mostly been allowed to flow uncaptured into the seas and oceans. Countries like Ethiopia, Ghana

and Lesotho as well as other countries in the region have more recently embarked on and launched an intensive and systematic strategy of rainwater harvesting for small-scale irrigation and environmental rehabilitation by using labour intensive, low-cost technologies and mobilizing domestic resources. These activities have been very useful to meeting local food requirements and to protect and conserve the environment. This strategy responds to the needs of the rural population living in remote areas and can be accommodated within the financial means of the countries. It is therefore recommended that countries adopt and replicate successful water harvesting technologies for increasing the command areas of small-scale irrigation in parallel with the larger water development and irrigation schemes envisaged in their national development plans.

9. Closely linked to the economic difficulties which especially; Chad, Ethiopia and Lesotho in case study, and several other countries in Africa are going through is the common problem of maintaining water systems in a state, matching design criteria and meeting operational and efficiency requirements. This applies to all sectors in particular to drinking water and irrigation infrastructures. Emphasis on rehabilitation of inefficient systems, reduction in wastage and unaccounted for water, recycling and reuse of water, and improved operation and maintenance can be more cost-effective approaches than investment in new services.

10. The provision and expansion of domestic and municipal water supplies, together with hygiene education is considered to be one of the contributors to the social well being of a community. It is noted that in Africa the large majority of the rural population (i.e. 65 per cent according to the 1996 Sector Status report by WHO, UNICEF and the Collaborative council) are without water supply services, needless to say about sanitation. Consequently, about 80 per cent of all sickness are accounted to water-borne diseases. To improve this situation efforts in the water supply in both rural and urban areas should be undertaken at an accelerated pace. To be fruitful, this should be accompanied and matched by complementary services for effluent treatment and disposal particularly in the urban centres in Africa where the problem is worsening. It has been noted that the overwhelming routine and continuing discharge of industrial wastes without treatment, and the entry of fertilizers and pesticides into surface and groundwater are expanding and intensifying the problem of degraded water quality. The efforts to monitor the situation have been minimal and even the measurement of quantitative hydrological factors are inadequate. On the other hand, the health of the people, and the health of the water bodies is being jeopardize demanding a major strategy that deals with the provision of sanitation and waste disposal and for measuring and monitoring the hydrological status and quality aspects of rivers, lakes and groundwater.

11. Urgent action needs to be taken to provide adequate wastewater treatment, disposal and reuse, to complement the expansion of water supply systems.

12. Water is a commodity to be paid for. The cost of providing water services to various user sectors must be met by the beneficiaries or by the community - and usually by a mix of the two. In applying the principle of cost recovery or a degree of financial autonomy in a scheme, two important points need consideration. The first is the guaranteeing of reliability of the supply system for users to accept the principle and secondly the ability to adjust charges to meet the cost of supply. In this regard the

secondly the ability to adjust charges to meet the cost of supply. In this regard the move by Ghana, Ethiopia and Lesotho to setting appropriate tariff structure needs to be encouraged.

13. With the institutional and administrative changes that have been introduced to keep pace with water management, all countries are discovering the need to adapt their legislation to match more dynamic and more demanding circumstances. Inadequate legislation has often been a serious impediment to water development or its optimal use. of equal importance to the formulation of enabling legislation is the need to establish mechanisms to enforce its provisions. Redesign of legislation and the mechanisms for its effective application are invaluable to meet present and future water management needs. It is necessary that countries adopt a comprehensive approach with a balanced mix of policy measures in different fields, including water management sectoral and macro policy as well as legal and institutional frameworks.

14. The dearth of adequate human resources, with training, skills and experience in the scientific, technical, managerial and administrative functions required for the development, conservation and management of water resources forms a crucial constraint in the strategy proposal of countries like: Chad, Ethiopia, Ghana and Lesotho albeit to varying degrees. This is also a major constraint to several countries in the region as well. It is noted that in the early 80^s more attention was given to the development of human resources. Action is therefore, required for training in planning, project identification and preparation, project implementation, project monitoring and evaluation. A cost-effective way to train technicians on a continuous basis will be to set up training schools, which can train technicians for the various subsectors of water.

15. It is worth noting that a promising trend has been developing in all countries in the case study towards a more positive involvement of local communities in the conservation and management of their natural resources and the environment. This mobilization of popular participation, with able organizers and appropriate information support, may offer a great opportunity for sustainable management of resources. A national campaign to stimulate such action could give a strong impetus to the implementation of the strategies at the national level.

16. Increasing population growth continues to set a heavy demand on land and other natural resources and induce conflicting and competing use on water because of changing needs. So also has the environmental degradation continued its impact on sustainable socio-economic development as illustrated by the Kampala Declaration of June 1989, following the African Regional Conference on Environment and Sustainable Development and by the Rio Summit in 1992 as incorporated in Agenda 21. This is more concretely observed in the country case studies of Chad, Egypt, Ethiopia, Ghana and Lesotho. A key issue to halt and reverse the environmental degradation, is the management of natural resources at the local level by maintaining linkages and interactions between the various actors. The fundamental philosophy upholds that the planet's resources are finite and the technological tools to exploit these resources are limited at any particular time. Therefore, basically the emphasis should focus on the management of land and water as finite resources and on the co-ordination and integration of water, land-use, and population policies for sustainable development. In this regard Egypt is taking steps by establishing new settlement schemes to avert over concentration of people in the few urban centres.

17. The weaknesses in the linkages between water sector planning and national planning at the macro level and project planning at the micro level persists. The Structural Adjustment Programme (SAP) which most countries in the region are implementing is putting pressure on them to appropriately relate the water plans with National Development Plans in view of SAP's requirement to balance the internal and external accounts as evidenced in the case studies of Chad, Ethiopia and Lesotho. The essence of planning should be in the integration of sectoral plans and programmes with overall water resources management within the framework of national socio-economic objectives. This is to be accompanied by the establishment of institutional and organizational arrangements, including an appropriate form of national water resources centre to facilitate this.

18. The meteorological and hydrological services have run down badly in the past 15 to 20 years for various reasons particularly for lack of adequate funding. They are in urgent need of rehabilitation and expansion. The UNESCO/WMO National Evaluation of Water Resources Assessment activities and the UNDP/World Bank Sub-Saharan Africa Hydrological Assessment have identified actions that should be taken in each country. The improvement or, where necessary, the introduction of systematic measurement and monitoring of water quantity and quality, in both surface and groundwater sources is essential in the light or concerns regarding global atmospheric warming, and the increasing demand on the resource.

19. As a result of the debt burden and economic difficulties of the African countries and as illustrated more precisely in the five country case studies investment funds for water projects have diminished. Operation and maintenance funds have either been curtailed or removed under the Structural Adjustment Programme. The flow of external investment funds have been slowing down as a result of the difficulties of meeting debt service obligations. The problems call for:

a) the development and introduction of practical measures towards scheme autonomy and cost recovery in conjunction with greater efficiency and reliability of water supply to the various users.

b) increased attention to be given and investment funds to be made available to undertake measures to

20. As a result of recurrent droughts many countries have been living through a cycle of austerity or contingency plans to the detriment of normal programmed work. The establishment of the Emergency Relief Organizations on a more permanent basis would curb the problem of diverting resources to meet crisis conditions and would enable to act in all kinds of disasters like floods, droughts and earthquakes etc.

21. A strong emphasis should be accorded to overall planning for drought conditions and to water conservation in water scarce areas for the mitigation of flood damages.

22. The fluctuation in food and agricultural production due to meteorological variations persists. The most effective remedial measure aimed at contributing to stabilize production is the Early Warning System which is being installed in many countries. The present distribution and contribution of irrigation to food and agricultural

production has not changed, as the region is still a net importer of cereals, the one crop to which the land under irrigation is devoted. Current fund is going into rehabilitation and expansion of existing schemes. At the same time the economic viability of modern irrigation schemes is constrained by high costs of construction, operation and maintenance, and by poor production performance leading to low overall benefit of irrigation projects. Therefor a critical overall benefit of irrigation projects. Therefore, a critical review is needed of the role needed of the role irrigation should play in the national strategies for food and agricultural production having regard to climate, land and water and the nexus issues of population, food security and environment.

23. The resources of the department of community development, health and education need to be increased to enable them intensify their mass education campaigns at the local level and thereby secure the participation of local communities in the management and conservation of water resources, and to increase the awareness of the value of water among production sector users.

24. There has been in recent year a clearer perception as evidence in the country case studies to draw in private sector participation in water resources development and management. Countries should identify areas and encourage private sector investment by creating the necessary environment. The efforts initiated in the five country case studies should be encouraged and similarly those other countries of the region should also aggressively pursue such efforts.

25. The international community has been following closely and supporting activities geared to the use and development of water resources in Africa and more so to its implication on the nexus issues of population, environment and food security.

26. As regards community water supply, the International Drinking water Supply and Sanitation Decade (IDWSSD) 1981-1990, has evolved a network of External Support Agencies (ESAs) with a Collaborative Council for the purpose of stimulating action in the sector. The Council brings together multilateral and bilateral agencies, banks, Non-Governmental Organizations (NGOs) and members from developing countries. Of the water use sectors those for industrial and energy purposes are the ones that most attract external support for development from commercially-backed sources. Other development aspects like drinking water and agriculture are generally subordinated to the user sectors: A very vital area in Africa where assistance is most needed is the domain of agriculture. For this sector an International Action Programme on Water and Sustainable Agricultural Development (IAP-WASD), which proposes similar collaborative arrangements like that for drinking water, has been formulated by FAO, in co-operation with other organizations of the United Nations system, as a strategy for the implementation of the Mar del Plata Action Plan (MPAP) during the 1990s and beyond. These initiatives are in keeping with the growing concern of the poor performance of the agriculture sector during the last decades which did not measure up to expectations such that it required massive collaborative efforts to assist the developing countries.

27. The negligence of the management of water resources by the national and international community and the inadequate efforts towards the technical and managerial capacity-building for the development and conservation of water resources could partly explain the reasons for limited achievement in the realization of the MPAP, especially of its long-term objectives. In terms of the strategy, the definition of "the

allocation of and development of resources in pursuit of an objective" which has not been responded to in the past, now need to be translated into action so that the "strategy for the future may be put into effect. Several external, multi and bilateral agencies and NGOs are operating in the countries. These need to coordinate their activities with each other and with line ministries. It is noted that in some of the countries the number of NGOs operating in the water sectors is so numerous and their activities are not coordinated. There are NGOs that plan implement and hand over water schemes to communities, which in a few years become inoperational. The activities of some NGOs are not even known to the responsible government water offices. Absolute lack of accountability and transparency has been noted to prevail. Such chaotic situations should be corrected through joint arrangements between the government responsible offices and the NGOs so that partnership may attain the desired objective. Partnership programmes should also work towards standardization of equipment and to avoiding duplication of effort that result in waste of resources.

28. The establishment of a collaborative mechanism to maintain close linkages by means of strengthening the capacity for the management of water resources through the national co-ordinating bodies (National Water Resources Centres) and the corresponding regional and global arrangements and programmes in support of these efforts are central.

29. Within the United Nations system the co-ordination and co-operation being maintained by the ACC Intersecretariat group for Water Resources which has been instrumental will continue its activities. In particular, interagency efforts will be concentrated on agreed action programmes concerning water for sustainable agricultural development, water resources assessment, water quality, human resources development, and water resources management based on the outcomes of the regional assessments carried out for the formulation of the [proposed strategy into the 21st century.

Annex A-BEST PRACTICES

The term best practice has been understood as the experience which has resulted in sustainable development of water activities and which has shown indication of positive impact to economic, social and environmental concerns. Best practice is dependent on the approach, technique and technology applied to achieve a desired goal or objective. In the five countries' case study, Egypt, Ethiopia and Ghana have provided the following experiences as their best practice of water development activity.

Egypt

In Egypt, an experience of best practice is referred to irrigation improvement aiming at increasing productive lands and reducing soil and water loses and ensuring adequate farm water supply.

The project involves introducing new drainage technologies to suit new hydrologic regions in the areas reclaimed on desert fringes of the Delta and within flood plains where upward groundwater leakage occurs. The programme embraces monitoring the impact of water table fluctuations; monitoring of drains discharges and quality; and monitoring of drain performance. This is undertaken by developing and using and decision support systems for water deliveries, including sources and rates. Such systems enabled the proper reuse of drainage water in Egypt, and the efficient use of the available water resources of the country.

Ethiopia

Ethiopia has outlined various water development activities which it considers exemplary practices. A brief summary highlighting the main elements is presented as follows:

River Basin Master Plans:-

As most of Ethiopia's rivers are international, the adoption of the hydrologic/geographic entity as a basic planning unit has been found most feasible for integrated and holistic multi-purpose planning. With this perception, the government has taken steps to prepare master plans for all the river basins in the country by mobilizing its own internal financial resources and by employing consultants to carry out the master plan studies. Today, master plan studies have been prepared for about 4 major transboundary basin, and plans are underway to continue the study on the remaining river basins.

The availability of the master plan studies will put the country to determining its needs and will further enhance inter-country cooperation for the integrated development of its shared basins.

Construction of micro-dams for small-scale irrigation

In Ethiopia peasant agriculture is based on rain-fed farming. Failure of rains, which has been occurring cyclically during the last few decades, has been causing severe reduction in crop production. Consequently, famine has been triggered in rural areas of northern Ethiopia with tragic death tolls. Therefore, the government has given priority to improving the peasant agriculture which provides livelihood for 85% of the population and the small holder farmers which contribute to about 96% of the total average crop output estimated at 9 to 10 million metric tons.

Some three years back, the government launched a programme aimed at attaining self-sufficiency in food production. The strategy adopted for the programme was Agriculture Development Led Industrialization (ADLI). This strategy focuses on enhancing productivity of small holder agriculture through improved and intensified supply of inputs as well as improved technology.

An interesting programme in food production is the Sustainable Agricultural and Environmental Rehabilitation Programme (AERP) which envisages the construction of micro-dams for water harvesting with labour-based technology to augment water supply for irrigation. The aim is to ensure production of one crop during periods of drought and allow double cropping during period of excess rain. SAERP is under implementation in Tigrai and Amhara regions of Ethiopia in the North and is also adopted in a southern region of the country. The project focuses on working at grass-roots level and has capacity building as one of its main objectives.

A detailed study has been conducted for the SAERP programme in Tigrai for construction of micro-dams to irrigate 50,000 hectares of land in 12 years. The study also confirmed the possibility of attaining 90% food self-sufficiency in Tigrai by the year 2010. Many lessons are learnt to improve upon the project and to minimize negative consequences. The project is being replicated in Eritrea and there is likelihood to extend it to other sub-Saharan African countries.

Training of Water Engineers and Technicians

The major stumbling block in development of water resources has been the lack or shortage of adequately trained professional and skilled technicians. To overcome this difficulty, Ethiopia used assistance funds from friendly countries under a special arrangement with selected and well known universities and institutions in India to train engineers with specialization in Water engineering. In addition, vast opportunities were opened for engineers to obtain scholarships for second degrees in specific fields of hydrology, hydraulics, hydrogeology, water supply etc. In the meantime a parallel course of action was undertaken by the water Resources Commission to set up its own training centre at Arbaminch in Southern Ethiopia with substantive assistance from bilateral and multilateral organizations. The institute know as "Arbaminch Water Technology Institute" started operation in September 1986 been training students for degrees, diplomas and certificates.

Thus the water sector had increased its technical main-power significantly, by mid 1991, the sector had the largest number of engineers among all government organizations.

In the area of drinking water, two water supply systems, namely, Dodola Gravity Rural Water Supply scheme and Mio-Gassera spring Development are featured as exemplary experiences in Ethiopia.

Dodota Gravity Rural Water Supply Scheme

This project is named after the district called Dodota, which is found 170 km South east of Addis Ababa. The district of Dodota had experienced recurrent drought and the problem of water supply in the area had been so severe that women had to walk 2 to 6 hours to fetch their daily water requirements. The question of water supply was considered top priority by the community; and the district water unit identified a spring which could satisfy the domestic and animal water needs of the area.

The local women's association took up the water supply project as owners, and actively set out to look for financial assistance from donor agencies.

The water supply scheme was based on water sources from springs with yields capable of satisfying the demand of the district which was estimated in 1982 to have a population of 56,000 in 1995. the project consisted of capping two springs to supply water to the population of the district by gravity. The scheme included minor distribution network with several delivery points within 250 meters of their residence. The scheme was cost effective in that there was no pumping requirement and no treatment of water was needed.

Women's association was engaged in the planning, execution, management, operation and maintenance of the scheme. Women were the main beneficiaries and community participation was high all the stages of the project cycle.

The project was implemented between 1982 and 1986. The local womens' association is responsible for running the project, and permanently employed staff for operating the scheme consisting mainly of women. Training was given to women in plumbing, accounting g and store keeping as essential component of the project, which in fact is one of the largest rural water supply scheme in Ethiopia. With the implementation of the project, about 8000 women were relieved from the drudgery of fetching water as a daily routine.

After 11 years, the scheme is well managed and operated by women who have vested interest in water supply. The project is a comprehensive scheme embracing core elements of demand-driven, community based, women centred, training oriented, public managed and owned. The Internet elements incorporated in the project have led to its success and sustenance as indicators of the project merit.

Mio-Gassera Spring Development Water Supply

This is another exemplary project called Mio-Gassera Water Supply Scheme. Mio is a place at the foot of the mountain range near Robi in Southern Ethiopia; and Gassera is a small village located 70 km from Mio on the Bale highland plains. This plain including Sheneka plain which was developed as rain-fed state farm is rainfall deficient and drought-prone area. Thus water supply had been top priority for the rural population of the area. Efforts to develop hand-dug wells had proved unsuccessful and people have been dependent on water of dubious quality. Fortunately, along the

mountain side, numerous springs with excellent water quality existed. These were located at conveniently higher elevations from the villages.

A large spring to satisfy the water demand of up to 100,000 people was identified and designs of water supply system for about 62,k000 people were prepared. The design included capping of the spring at Mio; construction of reservoir of 200 cubic meters capacity to collect night flow and to serve as pressure break; main and distribution pipelines as well as water points at villages. The total length of the pipe lines including branches was 114 km with diameters ranging between 200 mm and 65 mm. The distribution systems have diameters of 1" to 25".

The pipeline was laid over seventy kilometres to provide water to well over 60,000 people along the line from Mio spring to the last village, Gassera.

Pipeline excavation was carried out by the beneficiaries. Pipes and other construction materials were provided by UNICEF and the government. The government also provided skilled labour. The project contributed to the improvement of health by making available safe water supply.

Regionalization of Water Supply Development and Operational Maintenance

Since the change of government in 1992 and the subsequent institution of a federal system, regional governments have been formed with autonomy from the central government. In this respect, all rural water supply activities have been handed over to the regions. Budgetary allocation for these activities are made by the regional governments and priorities are set by local governments.

Because of their proximity regional an local governments are in better position to identify development priorities and evidently rural water supply activities are being more vigorously programmed and implemented by the regional water authorities. As a result, it is expected that water supply coverage of the rural population would significantly increase.

Research in Water pumps

Intensive research is being carried out in Ethiopia on hand pumps, windmills, solar power pumps and hydraulic rams.

Hand pumps programme has succeeded in producing two types of hand pumps, one named SAALLA for shallow depths of up to 10 meters and the other known as IBEX for deep wells, These pumps have been extensively tried in different social and climatic environments and have proved to work satisfactorily.

The SHALLA which is a direct action pump had been tested for endurance by the Consumers Research Laboratory in the United Kingdom and has satisfied most requirements for VLOM (Village Level Operated and Maintained) pump. The IBEX is a reciprocating pump for depths between 10 meters and 40 meters. Most of the components of the IBEX feature VLOM characteristics are used in AFRIDEV hand pump developed under sponsorship of the World Bank/UNDP Water and Sanitation Group in Nairobi. The AFRIDEV which is a successful VLOM pump has several novel designs and is commercially manufactured in many parts of the world including the Akaki Pump

Factory near Addis Ababa. The Akaki Factory has changed some of the pump's features to suit its production capacity thereby making it more expensive than the genuine imported AFRIDEV pumps.

Windmills

Six wind turbine prototypes have been designed and fabricated of the six, five have horizontal axis rotors and one has a vertical axis rotor. The wind turbine prototypes have been field tested with appropriate pumps. including a locally manufactured centrifugal pump. The field test has proved the feasibility of wind-powered pumps for domestic water supply and for irrigation in Ethiopia.

Solar and other pumps

The Pump Research Unit in collaboration with Addis Ababa University is conducting comparative studies on solar, wind, and diesel powered water pumps. The study has shown that solar pumps are promising and should be popularized in Ethiopia.

The Research Unit has designed, manufactured and tested a hydraulic ram pump and a water wheel or turbo-pump. Because of significant achievements of the Research Unit, especially in hand pump research and development, many international organizations had recognized it as one of the best in sub-Saharan Africa. However, recently it has lost most of its high calibre engineers and technicians. The Ministry of Water Resources would evidently benefit from enhanced support to that Unit.

Ghana

Best Practices in Water Resources Management

The Best practice in integrated water resources management in Ghana can be cited as the development of the Akosombo and Kpong hydro electric power stations commissioned in 1965 and 1984 respectively. The Volta River Authority set up in 1961 manages the projects.

The functions include the generation of hydroelectric power and the construction and operation of transmission system to carry the power to service the industrial and domestic needs of Ghana. The authority also has responsibility for the development of the Volta Lake which is a source of fish and means of transportation and the development and administration of Akosombo Township.

The Akosombo project consists of a rockfilled dam which has created a reservoir with a service are 8730 km^2, with a length of 400 km from south to north, and a width of 25 km. The Kpong pond is located 11 km downstream. It has a surface are of 12km^2.

The installed capacities of the two plants are 912MW and 160MW respectively. In addition, the lake is used for transportation of passengers and goods. In 1985 alone, the number of passengers carried was 54315 and a total 20590 tons of merchandise was moved. The lake has also made it possible for small lakeside irrigation projects to be installed. The Kpong reservoir incidentally provides one of the best raw water quality sources in the country. It is abstracted for treatment to augment supply of

domestic/industrial water to the Accra Team Metropolitan area. The two lakes provide sources for inland fishing. The most important fish is the Tilapia which provides employment to quite a number of people at such lake shores communities at Kpandai, Yeji, Kojokrom. Akosombo, Kpong. Fish catch in 1996 was 60,000 tonnes having increased from 52,000 tones in 1995.

The hydro-electric power generated from the 2 plants is consumed by the Volta Aluminium Company, the Electricity Corporation of Ghana and the mines. The Authority has been selling power to neighbouring Togo and Benin. The power generation cost per unit is one of the cheapest in the world. There is also interconnection between the power systems with Cote d'Ivoire so that in case of need, power could be bought and sold between the two countries.

There are now plans to move imports of Burkina Faso by road from the Team harbour in Ghana, transport them by road to Akosombo port, and tranship them by the Volta Lake to the Yeji port in northern Ghana, and thereafter by road to Burkina Faso.

The project was co-financed by the Government of Ghana, the International Bank for Reconstruction and Development. US Export-Import Bank, Canadian International Development Agency, the British Government and a number of other donor countries. So far, revenue from power sales have been able to finance operations, maintenance, replacement of equipment, pay loan on schedules and earn 2-7% return on assets to invest in other development. It has also met the energy needs for single station generation of power for the industrial estates in Accra/team, Kumasi, Sekondi-Takoradi, and the mines. It has also helped the rural electrification policy of the government. It is the one water management project that can be said to have met the economic and financial targets set for it.

Problems and constraints

Despite the many positive features of the Akosombo and Kpong projects, there have been a number of environmental problems among which may be mentioned: -

1. The resettlement of 87,000 people who were displaced by the Akosombo and Kpong dams. 33 years later, some of the people displaced do not feel they have been properly settled. Others do not think adequate compensation has been paid for the lands acquired from them. The Volta River Authority has been reviewing cases, and when found genuine redress is provided.

2. Change of flow regime of the river downstream Akosombo and Kpong. Instead of the annual flood and dry seasonal flows which favoured the development of certain specific types of fish on which fishermen made their livelihood, this has been destroyed by the regulated flows. Attempts are being made to find how the fishermen could be compensated by finding alternative fishing grounds for them.

3. Again, the change of the flow regime has affected the extent of irrigation of the tidal flow upstream from the mouth of the Volta River and the annual breaching of the sand bar that forms annually in the dry season. Considerable change in the ecology of this section of the river has taken

place. To minimize the adverse effect, the Authority has put in place a programme of dredging the sand bar in order that the fresh water/sea water interchange and its related ecology which existed before the dam was built is not completely destroyed.

4. While the creation of the dam covered some rapids and therefore helped to abate or eliminate river blindness, the construction of the spillways have created new grounds where the host for the transmission of river blindness are thriving. This problem is being tackled under the Onchocerciasis Control project of West Africa with funding from the World Bank, the Governments concerned, donor countries and implemented by the World Health Organisation.

The authority has been working with other government agencies including research institutes to tackle the above problems.

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