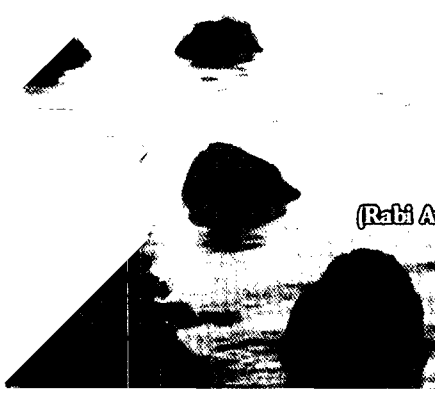
ISLAMIC DEVELOPMENT BANK

MANAGING WATER RESOURCE AND ENHANCING COOPERATION IN IDB MEMBER COUNTRIES

Occasional Paper No. 11



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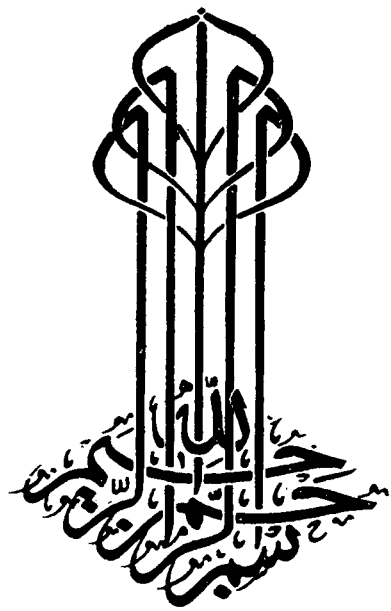
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ISLAMIC DEVELOPMENT BANK

Managing Water Resource and Enhancing Cooperation in IDB Member Countries

by

Dr. Shawki Barghouti

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ECONOMIC POLICY AND STRATEGIC PLANNING DEPARTMENT

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PREFACE

The global concern over water is reflected in the United nations Millennium Development Goals (MDGs), adopted in 2000, whereby 189 countries pledged to halve the proportion of people without sustainable access to safe drinking water by 2015. Since then, the developing countries, including IDB member countries, are seeking new plans and new strategies to counteract the looming global water crises.

The growing volume of water-related operations in the Bank's portfolio, which historically account for around 20 percent of IDB total commitments in project finance and technical assistance operations, clearly reflects the Bank's growing recognition of the importance of this sector to the development of member countries. The recently approved IDB Group Strategic Framework suggests, albeit implicitly, a renewed focus on the water sector. The Strategic Framework has also identified the promotion of cooperation amongst member countries, as a strategic objective. Although trade in goods and services is expected to be the main instrument for promoting stronger ties amongst member countries, the management of trans-boundary natural resources, especially water, provides further incentives for regional cooperation

In view of the importance of water related-issues in promoting cooperation between member countries, the IDB Board of Executive Directors endorsed the proposal for preparing an occasional paper on 'Managing Water Resources and Enhancing Cooperation in IDB Member Countries'. Accordingly, Dr. Shawki Bargouti of the World Bank, was invited by the Islamic Development Bank, as an external expert, to prepare the paper according to detailed terms of reference and outlines prepared by the Bank. Dr. Abdel-Hameed Bashir of the IDB was designated as the coordinator of the occasional paper, and the EPSP Department as the technical forum for reviewing the document. The views expressed in the paper are those of the author and do not necessarily represent the views of the IDB, its Management, Board of Executive Directors, or Member Countries.

The paper analyzes the major water issues in IDB member countries and highlights current and future challenges facing different sub-regions. The paper also proposes actions for cooperation and improved water management based on best practices conducted by different countries. Indeed, IDB member countries present a great diversity with regard to their physical and natural resources endowments, and their water conditions also vary with time and space.

The IDB hopes that the paper would be found useful by those interested in the subject, especially policymakers, donor agencies, specialized institutions, academics, students and officials of the water agencies in the member countries. We also hope that ideas discussed in the paper will generate interest for future research in this important area.

LIST OF ACRONYMS AND ABBREVIATIONS

ARWR	-	Actual renewal water resources
BOT	-	Build-Operate-Transfer
CAC	-	Central Asia and the Caucasus
CGIAR	-	Consultative Group for International Agricultural Development.
FAO	-	Food and Agriculture Organization of the United Nations
GCC	-	Gulf Cooperative Council
IDB	-	Islamic Development Bank
ICBA	-	International Center for Biosaline Agriculture
IFPRI	-	International Food Policy Research Institute
IRR	-	Internal rate of return
IRWR	-	Internal renewable water resources
IWRM	-	Integrated Water Resources Management
KISR	-	Kuwait Institute for Scientific research
MDG	-	Millennium Development Goals
MENA	-	Middle East and North Africa
MSF	-	Multi-stage flash- desalination method
NEPAD	-	New partnership for Africa's development
NGOs	-	Non Governmental Organizations
SSA	-	Sub Saharan Africa
SEA	-	South and East Asia
UNESCO	-	United Nations Education, Social and Cultural Organization
UNEP	-	United Nations Environmental Protection
UNDP	-	United Nations development Program
WSS	-	Water Supply and Sanitation
WANA	-	West Asia and North Africa

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Disclaimer:

The views expressed in this paper are solely the responsibility of the author and do not represent the views of any institution or expert whose work was cited in this paper".

Managing water resource and
Enhancing Cooperation in IDB Member Countries:

Executive Summary

1. **Poverty reduction and sustainable investment**: The main challenge in all IDB member countries is to sustain and expand achievements already made in the water sector. Investment in the sector has expanded the delivery of water supply to millions of poor households, and expanded irrigation to benefit millions of small farmers and improved the assets of poor cultivators in marginal areas. Small towns and villages in many IDB member countries, especially in Africa and South Asia have taken the lead in developing local water resources and improving the delivery services to their communities. Governments have supported local actions and provided financial and institutional assistance to these communities. The challenge ahead is to develop and sustain the water sector through new organizational structure capable of addressing emerging needs to protect water quality, its eco system and the environment.

2. More than 500 million people in IDB member countries, mainly rural households and poor communities in Sub Saharan Africa and South Asia, are still without adequate water services. Governments have to double their efforts to meet the millennium development goal to halve, by 2015, the proportion of people without sustainable access to safe drinking water. Many challenges may delay achieving this objective, including tight public financial and budgetary allocation to the water sector, and over extended institutions with limited capacities and resources. Investment in the water sector in IDB member countries in Sub Saharan Africa has been relatively modest. Much of the investment has been in expanding water supply to urban households. More investment is needed to expand this service to the larger segment of the population still living in rural areas.

3. Countries in West Asia and North Africa, and South and East Asia have allocated substantial resources for the development and management of water for irrigation, and have realized significant economic growth and poverty reduction. The economic benefits of expanding irrigation have been shared by millions of small and poor farmers in most IDB member countries except in Sub Saharan Africa where investment in irrigation has been slow and inadequately financed. Expansion of irrigation has slowed down in recent years in all IDB member countries. Additional investment is needed to ensure that benefits can be obtained from increasing water use efficiency. Further investment is needed to modernize existing irrigation production and delivery systems. Irrigation is by far the largest user of water in IDB member countries, consuming about 80% of the annual consumption of water resources. But these achievements could be at risk because of the increasing complexity in managing water resources.

4. Several IDB member countries may have adequate water supply per capita, at least for the short run. Malaysia. Indonesia, Bangladesh, Turkey, and Albania, do not face

immediate water shortages. They are following a thoughtful approach for managing this resource which would allow them to avoid damage to the environment, ensure equity of water services and distribution to all households, especially the poor, and increase the efficient utilization of water in irrigation for poverty reduction and rural development.

5. **Managing water scarcity in West Asia and North Africa (WANA):** Available renewable water resources per capita in the WANA region is among the lowest in the world. This challenge will intensify with expansion of economic growth and the burgeoning population in the region. The severity of water shortages is forcing several countries in the region to augment water resources through expensive investment in tapping less favorable water systems and non conventional water sources. These sources include seawater desalination and waste water treatment, and tapping deep water aquifers. Most Countries have been tapping deep groundwater aquifers to meet the growing demand for water. Members of the Gulf Cooperative Council have been investing in substantial plans to increase seawater desalination. The annual cost of seawater desalination in several IDB member countries is estimated at $ 3-4 billion. Recent reports predict that investment in seawater desalination in IDB member countries is likely to be between $15 to16 billion in the next decade. The bulk of this water is allocated to cities and towns, while groundwater is allocated to agriculture. These countries are encouraged to adopt stringent management of groundwater resources, reduce allocation to the agricultural sector, and address water pricing as a tool to better manage water conservation and allocation among competing sectors.

6. **Droughts and scarce water resources in Sub Saharan Africa and Central Asia:** Frequent droughts increase risk, and aggravate the already vulnerable water resources in several of IDB member countries. Water resources in Sub Saharan Africa and Central Asia are coming under further pressure because of climate change and frequent droughts. Most IDB member countries suffer from variable precipitation, and large areas in these countries are arid or semi arid or desert. Average rainfall in these countries exhibits a large variability as measured by the average departures of about 20-40 percent from the long term annual mean. The variation in the flows of major rivers: The Nile, The Niger, the Senegal, The Jordan, The Syr and Amu Darya are around 3:1 and can reach 10:1 subject to the variability of seasonal rainfall. Flow variations have a dramatic influence on local production systems, on millions of farmers and their crops and livestock, on pastoralists and fishermen, and on wildlife and the ecosystems. The impact of repeated droughts on IDB member countries in West and Central Asia, and in Sub Saharan Africa has been receiving increasing attention by development agencies to support affected communities to better deal with interrupted water flow, damaged irrigation systems, and the substantial harm caused to local communities. Member countries which built reservoirs, large water storage facilities, and water tanks have been successful in mitigating the serious impact of the droughts. Member countries in SSA need assistance in building such facilities.

7. **International cooperation and joint development among IDB member countries**: Many countries are withdrawing more water than that annually renewed within their national boundaries. Several countries are dependent on renewable water from rivers which originate outside their borders and are fed by water drained from watersheds in other countries. Water security in many IDB member countries depends on international cooperation, and could be at risk in times of conflict. Immediate action is needed to articulate water policies and to guide rules and regulations designed to conserve water, improve its management, and sustain its resources.

8. IDB can lead a crucial process of international cooperation among its member countries to address emerging issues in joint management of shared water resources. Because the bulk of surface water running in IDB member countries is shared by many communities, IDB should advise these countries to take the lead in establishing joint development projects to better manage transboundary river basins in these countries. This cooperative effort should be supported by international treaties monitored by competent institutions, and information sharing systems and joint water development project. A strong political commitment from all riparian countries facilitated by IDB can provide technical and economic platform to strengthen cooperation among riparian countries. With the occurrence of droughts in IDB member countries as a fact of life, with serious impact on water flow ion shared rivers, a major challenge facing IDB ant its member countries is to develop cooperative early warning system for drought management, share hydrological and weather data and information, improve water security, and invest in building reservoirs and community water tanks. The challenge is to help these communities sustain their economic activities without being uprooted in search for water for themselves and their livestock.

9. IDB should encourage governments at the highest level to establish national and international cooperation for water allocation. They should strengthen legal agreements and cooperation among water users to go beyond sharing water resources to design joint development and management corporations. Governments could facilitate, at the macro-level, international commissions for river basin planning and management. At the local level, governments could facilitate strong partnership with water users and the active participation of communities representing the beneficiaries in this process.

10. **Integrated policy framework and capacity building:** IDB member countries are restructuring public water agencies and related water policies. The organizational structure of many public water agencies has traditionally been heavily dominated by experts in water infrastructure. Many of these experts believe that most water problems can be solved though more infrastructure. Public water agencies should attract a balanced skill mix of experts in different specializations needed for designing strategic national water plans and updating and monitoring national and regional policies for sustaining use of water resources.

11. **Demand management and water allocation:** The water policies of many IDB member countries have allowed unrestricted use of this precious resource, and have caused

weak financial viability of urban and rural water supply and irrigation. Prevailing low prices and high subsidies on capital investments and on operations and maintenance have allowed for weak demand management and should be reevaluated. The present budgetary burden is not conducive to raising substantial financial resources needed to meet the growing demands. A key motive for reforming water pricing policies is the intensifying competition among domestic, industrial, and irrigation and environmental uses, especially in arid and semi-arid regions. Policy makers may face risks when raising water prices, because they may adversely affect the poor, or reduce the potential for increasing food production. These concerns should be carefully reviewed, and appropriate policy framework be articulated to guide this process. Pricing policies prevailing in many IDB member countries are likely to encourage more waste in water allocations, and could delay the necessary reforms urgently needed to increase water efficiency and availability to millions who have been deprived because of poorly targeted investment in the water sector.

12. The pressure to reallocate water among competing water users and sectors is likely to intensify in the coming decades in most IDB member countries. Some countries are searching for a reasonable solution to reducing the allocation of fresh water to agriculture. They are faced with urgent demands from the growing population in both urban and rural communities, some of which have serious political, economic, and social dimensions. The pressure to satisfy the urgent demands may result in hurried reallocation decisions with little attention to the long term implications on the society in both social and economic terms. Public agencies are being pressured to improve the delivery of safe and clean water to the burgeoning rural and urban population. A more aggressive water allocation policy, based on the concept of integrated water resources management, could be coordinated with land use policies to regulate unwanted growth in already crowded urban centers. Special incentive in water allocation could be used to encourage local industries and housing schemes to move to targeted poor regions, where they can create jobs and economic opportunities. Instead, several governments are still investing in large water conveyance projects to bring additional water to the growing cities.

13. The growth in population in the coming two decades, some 90 percent of which will occur in urban areas, will increase the political pressure to meet this demand especially for domestic and industrial use. The challenges for water supply and sanitation will be to respond to the backlog of demands, especially in rural areas and poor communities, while meeting the needs of growing population with rising incomes. To adequately address these challenges, these countries need to articulate new water policies, invest more in the water sector, and develop new approaches for better water management and allocation.

Chapter One

Introduction

1. Objectives of the paper:

The water sector in many IDB member countries is facing complex challenges. Most donors, regional development banks, and international organizations have recognized the crucial role of water in advancing national development and poverty reduction. IDB has recognized the importance of water in national economic growth, and has, since its inception, allocated about 20% of its financing and technical assistance to this sector in its member countries. Over the last three decades, IDB has provided more than $1.9 billion for 220 projects costing more than $ 10 billion. About 60% of this investment went to supporting projects designed to improve water supply and sanitation, 35% went to irrigation and drainage, and the remaining 5% to hydropower. Other development agencies have been supporting investment in the water sector because of its important contribution to economic growth and improvement of the quality of life. Several issues are affecting the efficiency of investment and performance of this sector, and its contribution to the national economy.

The global concern over water is also reflected in the United nations Millennium Development Goals (MDGs), adopted in 2000, whereby 189 countries pledged to halve the proportion of people without sustainable access to safe drinking water by 2015. Since then, the developing countries, including IDB member countries, are seeking new plans and new strategies to counteract the looming global water crises.

This study starts reviews the water situation in IDB member countries with a special focus on salient regional issues. The main challenging issue in most IDB region is increasing water scarcity. Most countries in the Middle East and North Africa (MENA), Sub Saharan Africa (SSA), and Central Asian Republics are facing variable water supplies because of declining resources and repeated droughts. Addressing this challenge is rather serious especially in meeting the millennium development goals in expanding water supply and sanitation to millions of poor households, and on sustaining economic growth and poverty reduction, and efficient management of natural resources. This paper is an attempt to highlight the impact of water services on a number of MDGs, especially poverty reduction, health, environmental sustainability, education, and gender equity.

More specifically, the main objectives are to:

- Bring into focus the major water issues facing IDB member countries, and their implications on the socio-economic development of these countries.

- Highlight the current state of affairs in relation to member countries responses to this challenge.

- Prescribe curative measures, especially where collective action is desirable, while identifying the role of IDB and its partners could play in this context. In particular, the paper would emphasize the need for enhancing cooperation in the management of shared (transboundary) water resources, and integrated water resources management (IWRM), including demand management.

This study attempts to identify challenging issues and assess their impact on the performance of the water sector on poverty reduction and economic growth in IDB member countries. The study reviews the water situation in IDB member countries and presents current and future challenges facing the main geographical regions. Some of these issues are common to most regions, but variations exist in terms of impact and priority actions. The study proposes actions for improved water management based on best practices conducted by different countries. IDB member countries presents a great diversity with regards to their physical and natural resources endowments, their water conditions also vary with time and space. Given the constrains in time, and limited availability of detailed country level water reports, this study would attempt to group the countries by regions and where possible, present overarching water issues affecting the sector. It will review regional or selected country level experiences in addressing these issues.

The study attempts to clarify the differentiated aspects of the multi dimensionality of the water sector in economic development and its contribution to the protection of the environment, and to conflict resolution among water users. The study highlights factors affecting the role of water as an important driver of social development, because improved water services to millions of households, especially the poor, could result in improving the quality of life and protecting health and hygiene.

Chapter 2 looks at the current situation of the water sector in most IDB regions and highlights prevailing issues and indicators in the water sector in general with selective reference to IDB regions where possible. This chapter also reviews the IDB portfolio in the water sector and assesses its strategic contribution. Chapter 3 looks at achievements in delivering water supply and sanitation, and Chapter 4 reviews issues affecting the performance of irrigation in IDB member countries. Both chapters assess the impact of these achievements on poverty reduction. Chapter 5 focuses on water scarcity which is facing many IDB member countries, and describes the development of non conventional sources of water in IDB member countries and the need for more cooperative approach and equitable utilization of this precious resource among various users. The paper discusses the implication of scarcity on managing frequent droughts in IDB member countries in this chapter. Chapter 6 presents alternative approaches to enhancing cooperation among riparian countries along international river basins mainly in The West Asia, North Africa, and Sub Saharan Africa. This approach would require new

paradigm for international cooperation. IDB can lead as a facilitator well equipped to set agenda for cooperation in joint management of international river basins, improving water use efficiency, and facilitate exchange of data, policy and strategic planning needed to meet emerging challenges in combating repeated droughts and increasing water scarcity.

Chapter 7 presents risks facing the sector especially the financial stability and related pricing policies and the impact of these policies on the efficient use of water for irrigation and implication on water quality, the environment. The chapter elaborates on the need for a balanced exploitation of water and the long term requirements for sustainable resource management. Chapter 8 presents the case that to efficiently manage these risks; fresh approaches are required to institutional services and restructuring of public water agencies. Central to this approach is decentralization, financial autonomy, support for research and technology development, and building partnership with water users and the private sector. Chapter 9 proposes strategies for future actions and international cooperation among IDB and other multilateral development banks (MDBs) and other donors to sustain this sector.

2. Framework of analysis:

The study is based on existing sources of information and reports from the international and national studies of the water sector. It relies on studies conducted largely by the World Bank and other organizations. The study benefited from several regional studies conducted on water and irrigation, and relied on thematic reports presented at workshops and seminars on water in Sub Saharan Africa, the Middle East and North Africa. The study suffers from major limitations. First it relies on secondary data from restricted sources. Data on water issues are mostly global, and country and regional data are only available where investment in the water sector has been significant. This study is short on country level analysis because of the paucity of national water data and public expenditure reviews and country evaluation reports. It attempts to analyze generic regional issues and their impact on the sector. The study assumes that several major issues affecting the water sector are universal in nature, and do not fall within specific regional boundaries. The study will attempt to present these issues, and where possible, explore what has been done to address them and lessons learned.

Because investment in the water sector has received significant support from international development and investment agencies especially the World Bank, the study relies on data available from these agencies; some are more reliable than others. The study attempts to identify best country level practices in managing water resources and would present them as a tool for sharing of information and to facilitate cooperation among IDB member countries in dealing with this important sector.

Chapter Two

Water Issues and Indicators in IDB member countries

1. Emerging issues:

Among alternative investment options to advance the process of national development, and to improve the livelihood of the poor in IDB member countries, the water sector is the most important dimension with a significant impact on the quality of life[1]. Water is used for drinking, cooking and sanitation, and is essential for agriculture and food production. It is instrumental for managing risks against climatic variability and associated frequent droughts in Sub Sahara Africa (SSA), the Middle East and North Africa (MENA), in Central Asia and Caucasus (CAC), and South and East Asia (SEA). Water plays a crucial role in protecting and attaining a balanced ecosystem much needed for sustained management of natural resources and the environment. Water is also a source of energy and power generation, and waterways could be further utilized for increased shipping and transport.[2]

The regional water problems in IDB member countries are rather universal, but vary in intensity and impact. For example, the 21 member countries in Sub Saharan Africa share common problems in water scarcity, poor investment in irrigation, and limited coverage in water supply and sanitation. The priority challenge in this region is to extend basic water services to the millions of households, especially in the rural areas. The five member countries in North Africa have expanded water supply to most citizens, and allocated substantial investment in irrigation. In most countries, there is no room for expansion of irrigation, and most water resources have already been committed. The priority issues are more related to efficient management and equitable allocation of water resources through responsive water policies and pricing.

Most of the 15 countries in West Asia and the countries in Central Asia are facing increasing water scarcity which is likely to impose new restrictions on the sector. Controlling allocation to irrigation and pricing policies are essential to reducing waste and damage to the resources

[1] There are about 48 references to the contribution of water to life in the Koran, (Al Quraan Al Kareem). For example, "In the water which God sends down from the sky, and with which He revives the earth after its death, dispersing over it all manner of beasts", Al Baqarah, 164). "And we made from water every living thing" (Al Anbiya' 30). "He sends down water from the sky which fills the riverbeds to overflowing, so that the torrent bears a swelling foam that mounts up to the surface", (Al Ra'ad, 16). "The earth is barren and lifeless, But when We pour down the rain on it, it is stirred, and it puts forth every kind of beautiful growth in pairs"(Al Hajj, 5)

[2] In discussing salient issues in the main regions of IDB member countries, the paper will rely on an IDB report "Water for Living", a note on Bank's involvement in the sector. The use of this note will be selective, and highlighted where needed. It will point to the importance of each issue to the respective IDB region. Limited data may preclude adequate quantification of the impact of such issues on the performance of the sector. Data on these issues have been distilled from various documents written on the water sector by international experts, donor agencies, and occasional reports on water in IDB main regions.

base. Member countries in Europe and South and East Asia do not face immediate water shortages. The main challenge in these countries is to improve the performance of existing investment in the water sector, especially in irrigation, achieve universal coverage in water supply and sanitation, and address emerging issues in water quality and risks to the environment.

Several organizations have also recognized the importance of this sector in their effort in reducing poverty and enhancing the environment. As an issue of global importance, donors and several United Nations Agencies including UNDP, UNEP, FAO, UNESCO, and the international and regional development banks and several bilateral donors supported international initiatives to monitor and protect the water sector such as the World Water Commission, the World Water Council, and the Global water Partnership[3].

The main water policies and strategies being promoted by the international and bilateral development agencies and several national programs have focused on the following issues: Options for comprehensive management of water as an integrated ecological resource; policies, rules and regulations to protect the public good dimension of water especially as resources are declining in both quantity and quality; the institutional framework for efficient implementation and monitoring of these policies and regulations; the economic role of water in increasing agricultural productivity and food security; the impact on the poor; managing water supplies, demands, and allocations among various users within an integrated and participatory approach; water pricing , financing and water rights; and river basin planning and international cooperation. This paper will address a selection of these issues and their implications on the performance of the sector in IDB member countries.

2- Water and poverty reduction:

Investment in the water sector has received high priority in most development countries. Donors and multilateral development banks (MDBs) have allocated substantial resources to develop the water sector. As will be seen later in this chapter, lending to operations in this sector constitutes about 20% of overall IDB portfolio. The driver for this investment is the crucial contribution of water development to poverty reduction. Water supply services contribute directly to income generation, to health and education, and to improving the quality of life. Consensus is growing worldwide that water and water services are essential because they touch on almost all the millennium development goals (MDGs). Several studies will be cited in this paper which confirm that investment in water infrastructure, to protect against droughts and floods, produce renewable energy, and provide water supply to cities and rural

[3]Many international agencies and bilateral donors are increasing focus on the water sector and have established specialized departments to monitor evolving issues. They also support activities designed to increase the exchange of information and facilitate communications among concerned experts. The growth of international activities related to this sector has significantly increased since the Earth Summit held in Rio de Janeiro in 1992.

mixed, because intervention in the water sector is a complex process. Some countries face difficulties in articulating clear water policies. One reason is the lack of clear development objectives of the water sector. As mentioned earlier, the water sector can serve several development goals, and they need to be carefully articulated, prioritized, and accompanied by realistic action plans to achieve them. Not all of these objectives are equal. Many countries face difficulties in setting priorities among these objectives. Priority setting should also be supported by reliable performance indicators to measure the results of the new policy framework. Many countries have been reforming the sector, but have not yet articulated field tested indicators needed to assess the impact of the newly recommended policies on the performance of the water sector within national and local setting.

These indicators can be measured at the policy and institutional level. This task is carried out by reviewing reforms and changes in the policy framework. Legal indicators include actions, rules and regulation approved and enacted, and measures taken to enhance the capacity of institutions created to manage various dimensions of the water sector.

Others indicators relate to the social impact on affected people including improved delivery of drinking water and associated improvements in quality of life, and health and hygiene benefits. These indicators measure the extent to which water services have been extended to all segments of the population, especially the poor. Other social indicators could be the extent of ownership and participation among the users, (also included in some cases indicators related to the impact on those directly affected by the construction of new facilities such as dams and canals, and the adequacy of compensation for resettlements and relocation of affected communities).

The performance of the sector could also be measured by direct economic and financial indicators. These factors could be assessed by measuring the increase in revenue from costumers, by the rising rate of cost recovery, and the appreciation in the value of productivity of water in agriculture, and the type and extent of the participation of the private sector. Other indicators may be designed to assess the impact of the new policies on protecting the environment, reducing pollution, and restoring natural habitat and biodiversity to areas affected by the construction of water project.

The above attributes could form an assessment framework and define actions needed to improve the performance of this important sector. The new investment paradigm has largely emerged in the 1990s when the United Nations organized a special international conference on water in Dublin. The outcome was adopted during the Earth Summit held in Rio de Janeiro in 1992. Box 1 summarizes the Dublin Principles which have guided investment in the water sector in many IDB member countries.

Box 1: Water on the Global Development Agenda: The "Dublin Principles"

Main issues related to the water sector were articulated during the Rio Earth Summit in 1992 and forged global consensus to adopt the Dublin Principles. These principles were stated during the United Nations sponsored "International Conference on Water and the Environment" held in Dublin in 1991. The consensus stated that modern water resources management should be based on three fundamental principles:

First is the ecological principle, which argues that independent management of water by different water using sectors is not appropriate, that the river basin should be the unit of analysis, that land and water should be managed together, and that much greater attention needs to be paid to the environment. Second is the institutional principle, which argues that water resources management is best done when all stakeholders participate, including the state, the private sector, and civil society; that women need to be included; and the resource management should respect the principle of subsidiary, with actions taken at the lowest level. Third is the investment principle, which argues that water is scarce resource and that greater use needs to be made of incentives and economic principles in improving allocation and enhancing quality.

5- New water resources: scarce, expensive, and unconventional:

For all IDB member countries, new water resources are expensive to exploit. Many countries are exploiting deep water aquifers, at high pumping and transport cost, and others are expanding investment in desalination of seawater. The pressure to reallocate water among different users is likely to intensify in the next decade. Since irrigated agriculture is the main user of these scarce resources, pressure is mounting in several countries in the Middle East, North Africa, and South Asia, to adjust water allocation to agriculture. The justification is to meet the growing demands of the increasing population, satisfy the expanding urban centers, and supply new industries with water. In addition, more water would have to be allocated to address serious impact on the environment and ecology which have been caused by investments in previous years which ignored allocation of water for environmental protection.

Some countries are searching for a reasonable solution to reducing the allocation of fresh water to agriculture. They are faced with urgent demands from the growing population in both urban and rural communities. Serious political, economic, and social dimensions are shaping the debate on water allocation. The pressure to satisfy the immediate demands may result in hurried reallocation decisions with little attention to the long term implications on the society in both social and economic terms.

Parallel to this pressure would be the increasing demands for expanding sanitation and additional treatments of wastewater. But the existing systems of urban water supply and sanitation in many countries already fail to provide adequate services, and the problems posed by urban pollution are likely to grow.

Urbanization and industrialization will also increase the demand for energy and hydropower. These developments pose a great challenge for governments in their effort to better manage water resources to meet the MDGs in the next decade. The challenges for water supply and sanitation will be to respond to the backlog of demands while meeting the needs of growing population with rising incomes. To adequately address these challenges, these countries need to articulate new water policies, invest more in the water sector and develop new approaches for better water management and allocation.

Public agencies are being pressured to improve the delivery of safe and clean water to the burgeoning rural and urban population. The growth in population in the coming two decades, some 90 percent of which will occur in urban areas, will increase the political pressure to meet these demands especially for domestic and industrial use.

Most suitable and accessible fresh water sources have already been developed. The cost of building new dams and storage reservoirs continues to increase rapidly. The mounting opposition from environmentalists and non government organizations has virtually prevented many governments and international development agencies from financing new dams or reservoirs. The rising cost of new dams combined with increased deteriorations and sedimentation of existing reservoirs, net water storage is stagnant or declining in many countries. Governments do not have the resources to invest in building new water storage facilities. Instead, governments have allowed for expanded exploitation of ground water resources to meet the growing demands for water, especially in the burgeoning urban centers and crowded cities in IDB member countries. Overdrafting of groundwater resources has intensified in several river basins in IDB countries. The declining water tables make extraction cost too high.

A recent study by the Asian Development Bank estimated the average tariff charged by water utilities in 38 large Asia cities rose 88 percent between 1993 and 1997. In Amman, Jordan, the average incremental cost from groundwater sources was about $0.41 per cubic meter during the 1980s, but with shortages of groundwater in the 1990s the city began to rely on surface water pumped from a site 40 kilometers away at an average incremental cost of $1.33 per cubic meter (Rosegrant 2002). Several studies in Sub Saharan Africa also confirm this trend. An analysis of incremental cost based on a sample of previous and new water supply projects by the World Bank in SSA indicates that the unit cost of water supply would almost double and some cases increase by three times under new water development projects. In this study, the average incremental cost of new water project in Senegal increased from 0.60 to about $1.80 per cubic meter. The study listed the reasons for the cost increases as more distant sources have been developed, more complex source work and treatment plans were constructed, and lack of flexibility in allocation of lower cost water from other users. (The World Bank, 1995).

Similar trends have been reported about the cost of new irrigation systems in several IDB member countries. Real cost of Indonesian irrigation more than doubled from 1970 to 1990;

and in Pakistan they more than doubled between 1980 and 1990. In Africa, irrigation construction costs are even higher than in Asia because of numerous physical and technical constraints. The average investment cost of medium or large scale irrigation with full water control was estimated to be $ 8,300 per hectare in 1992 dollars. The average cost of irrigation systems in Sub-Saharan Africa increased to $18,300 per hectare if the typically high indirect costs of social infrastructure, including roads, houses, electricity grids, and public services facilities, are included. (Rosegrant 2002). The reasons for the high costs include the possible construction of storage work to regulate river flow, severe climate variability requiring high irrigation duties and expensive flood control, schemes built in remote locations requiring high transportation cost and basic infrastructure, insufficient local engineering expertise to design and supervise construction works, and the work is likely to be carried out through small contracts because big contractors usually prefer bulk contracts for big schemes and avoid competing for scattered small schemes where risk could be high and profit margin low.

Also a World Bank study reported that the average unit cost to develop a hectare of irrigated agriculture has more than doubled between 1980 and 1990. More than 25 percent of irrigation systems in the world cost 3.5 times more than the average. The study also concluded that new construction projects are costlier than rehabilitation. Gravity schemes are costlier than pump schemes, and rice schemes are costlier than non-rice schemes. The study also reported that irrigating an hectare in publicly developed systems which is mainly surface irrigation is three times as expensive as irrigating an hectare in privately developed systems (mainly from groundwater) (World Bank, 1994). Other studies cited poor management as one of the reasons for rising cost of investment in water resources both for irrigation, and household water supply in rural and urban communities.

Despite the rising cost of developing new water resources, many governments still prefer expanding supply which has led to investment in infrastructure that could have been avoided or postponed. Water users in both industrial and developing countries often pay little for their publicly supplied irrigation water. They have few incentives to refrain from growing water-intensive crops or to conserve water. In some arid areas, water prices are so low that it is attractive to grow low value crops. Similarly, many towns and cities charge fees that provide no incentive to conserve water. A recent review by the World Bank of municipal water supply projects found that the price charged for water cover only about 35 percent of the average cost of supply, and charges in many irrigation systems are much less. The benefits of this cheap water go largely to the middle class and the rich. The poor usually depend on water vendors, and may pay many times more for water than the well off who usually enjoy piped water. It is therefore believed that cross-subsidies whereby the richer customers cover part of the cost of serving the poor can be achieved by incorporating a 'progressive tariff schedule', but in practice subsidies are often poorly targeted. (Rosegrant 2002).

6- The millennium development goals (MDGs) and the water sector:

Box 2 lists a summary of the MDGs, which includes a specific reference to improving water supply and sanitation[8]. An indication of the looming crises is that most member countries in Africa and several in South Asia have not delivered the basic water services to large sections of the society, especially the poor who always suffer most for lack of investment in water resources.

Box 2:
Millennium Development Goals:

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empower women
- Reduce child mortality
- Combat HIV/AIDS, malaria and other diseases
- Ensure environmental sustainability: (The Water and Sanitation Targets are (I) Integrate the principles of sustainable development into the country policies and programs and reverse the loss of environmental resources; (ii) Halve by 2015 the proportion of people without sustainable access to safe drinking water; (iii) Achieve by 2020 significant improvement in the lives of 100 million slum dwellers.
- Develop a global partnership for development.

Sources: United Nations Millennium Declaration, September 2000

For example, Table 1 provides data on the provision of piped water services to households in all IDB regions and to irrigated areas. Specific references to large countries are also listed in the table. The table confirms that significant number of poor and rural population in most IDB member countries lack access to this basic service. Most of the poor live in marginal and rural areas and have largely limited or unreliable access to water to drink or even for subsistence farming. As indicated in the table, less than 40% of the rural household in member countries in Africa and in Afghanistan, Pakistan and Bangladesh are connected to pipe water supply in 2000. The table also shows the areas under irrigation have not expanded in the last decade.

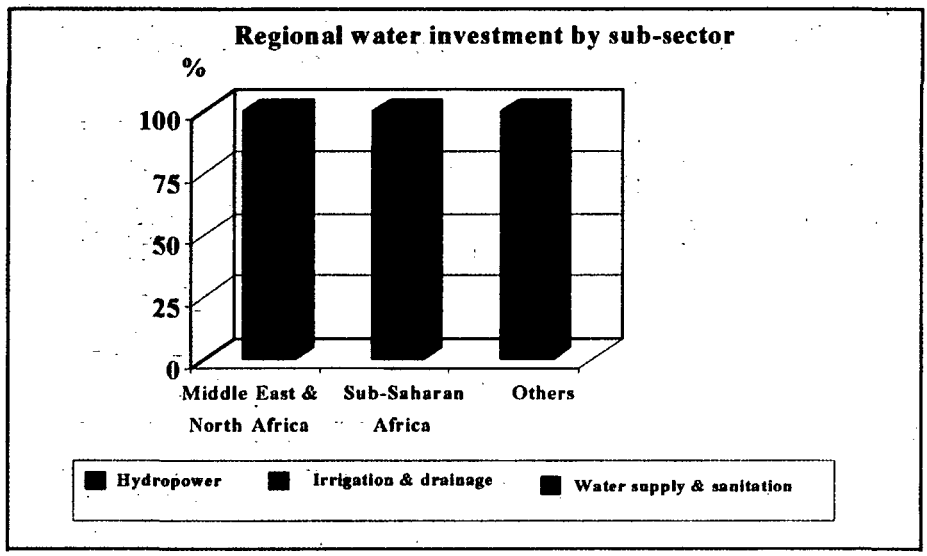
[8]Box 3 describes the important contribution of the water sector to achieving the other goals, and confirms the vital role of water in poverty reduction as targeted by the MDGs.

Table 1 Areas under irrigation and Percentage of Households with access to piped water in 2000

Country	Total Population Million	Rural Million	% with piped water	Urban Million	% with piped water	Irrigated Areas Million 000Ha
Central Asia	**54**	**31**	**78**	**23**	**97**	**10,212**
Kazakhstan	17.5	7.1	97	10,4	98	2,313
Kyrgyzstan	4.5	2.8	66	1.7	98	1,077
Uzbekistan	23.8	14.2	78	9,6	96	4,309
West SSA	**133**	**85**	**30**	**48**	**66**	**1,200**
North SSA	**133**	**104**	**17**	**39**	**29**	**2,200**
East SSA	**89**	**70**	**40**	**19**	**83**	**2,500**
Egypt	65	35	86	30	97	3,200
Turkey	61	10	70	43	92	4,500
WANA	215	85	57	130	92	12,550
Pakistan	125	81	28	43	86	17,000
Bangladesh	125	97	36	28	80	4,300
Indonesia	198	127	48	70	82	6,800
Malaysia	20	9	94	11	98	5,200
Afghanistan	20.7	16.8	11	3.9	19	3,100
Developing countries	4600	2900	30	1650	76	na
Developed countries	1300	340	89	960	97	na

Sources: World Water and Food to 2020, Mark Rosegrant, Ximing Cai, Sarah A. Cline, International Food Policy Research Institute (2002)

The table also confirms that of the more than one billion people in the world who are deprived of access to water of sufficient quantity and quality, about 500 million are in IDB member countries.(IFPRI 2000). If IDB member countries are to keep pace with meeting the Millennium Development Goals for Water Supply and Sanitation and seek to halve the proportion of people without sustainable access to safe drinking water by 2015, they have to reach at least 250 million people in the next 10 years. If they also want to sustain secure food production and to maintain a commercially viable agricultural sector, IDB member countries need to also invest in modern water saving methods and in related modern agricultural technology. If they are to successfully meet the growing needs of all water users within a socially and environmentally sustainable framework, they would need to develop



Source Freshwater Future, 2003

Environmental concerns have led, in recent years, to increasing demand for financing water pollution control projects (e.g., wastewater treatment plants), especially in the Middle East and North Africa, where treated sewage is increasingly used for irrigation purposes.

Support to Africa. In sub-Saharan Africa, the Bank's assistance has targeted primarily rural areas, where water supply and sanitation coverage is often low and agriculture is the main source of income. As a result, major water components have featured regularly in Bank-financed agricultural and rural development projects—it is estimated that over 10,000 "water points" and rural water supply schemes were financed in Sub-Saharan Africa. Furthermore, this region has received around a third (36 percent) of the Bank's investment in irrigation and drainage and, given its vast hydropower potential, more than half (60 percent) of its investment in hydropower.

Support to Central Asia. The Bank is also actively involved in Central Asia, where the water sector has attracted around a quarter (27 percent) of the Bank's overall assistance to this region. The Bank's assistance has been more or less equally divided between water supply and sanitation (55 percent) and irrigation and drainage (45 percent) projects. In water supply and sanitation, the Bank's financing has generally been used to upgrade decaying water-related infrastructure and improve the delivery of water services in both rural and urban areas. Similarly, the Bank's financing has targeted the rehabilitation of irrigation and drainage infrastructure as well as the development of new irrigation schemes.

Recent Developments. Over the years, the Bank has been giving greater attention to the social and environmental dimensions of water projects, through increased water user participation, improved water use efficiency, cost recovery and financial sustainability, and institutional and capacity building. Also, the Bank's experience has also shown that water issues need to be tackled in a comprehensive and integrated manner to ensure social welfare, environmental integrity and economic efficiency.

Some Lessons Learnt. Since its inception the Bank's Operations Evaluation Office (OEO) has filed some twenty reports on Bank-financed water-related projects. In 1997, it reviewed the Bank's experience in rural water supply in sub-Saharan Africa. Three major lessons can be safely drawn from the Bank's involvement in the water supply sector. First, Bank's involvement, more often than not, occurred late in the project cycle, leaving the Bank with little say over project design. Second, inadequate (low) user charges often threatened the financial sustainability of projects. Third, the lack of ownership, especially in the case of rural water supply projects, was a major cause for the poor operation and maintenance of physical assets.

Chapter Three

Achievements in water supply and sanitation

Associated with IDB portfolio in the water sector is gradual progress in delivering water to millions of urban and rural households in recent years. IDB member countries have increased their focus on reducing poverty by improving the efficiency and sustainability of water supply and sanitation especially to the poor communities. They invest in this sector because it contributes to improving the quality of the life of the poor. Recent data indicate that more than 80 percent of the urban population in IDB member countries (the percentage in SSA countries is smaller) have reasonable access to clean water (piped water supply). Less than forty percent of the rural population has similar services. While coverage is expanding relatively well, it can not keep pace with population growth. The implications are particularly harsh for the poor, because the unserved will most likely be in rural communities, or in the high density, often informal settlements on the edge of the city margins. Box 3 elaborates the indicators of the contribution of the water sector water to the overall MDGs listed in Box 2. Theses indicators confirm the valuable contribution of adequate water supply to reducing poverty and improving quality of life and to major social development attributes listed in the major MDGs.

1- Water supply in IDB member countries in Sub Saharan Africa:

a) Expansion of water services: As table 2 confirms, this region is facing mounting challenges in meeting the MDGs in this sector. More than 60% of the rural population in SSA is without water services, and more than 20% of the urban population suffers from similar inadequate services. Recent studies on water supply and sanitation in several countries in Africa confirm that some of IDB member countries are at the forfront of innovations in water supply and sanitation for the last twenty years.[10] This includes simple and easy to operate and maintain technologies, supported by participatory management system based on community ownership, and increasing participation of the private sector. For example, Senegal, Mali and

[10] The studies were sponsored by several donor agencies and were summarized in a draft document, "Africa Regional Action Plan for Water Supply and Sanitation". The document was discussed by donors in 2004. This chapter includes main issues and data presented in the draft document. The importance of this sector in achieving the MDG in poverty reduction has attracted several donors and associated voluntary agencies and non governmental organizations to provide services to poor communities in many countries in SSA. The challenge is to sustain these efforts, and to ensure that such grants based and voluntary work is mainstreamed and sustained in the national water plan. To address Africa's water problems, a series of continental/regional responses have been designed in recent years, notably, the African Water Vision, which was presented at the 2nd World Water Forum in The Hague in March 2000. Fulfilling the Vision, which basically aims to achieve universal coverage by 2025, will require US$20 billion of water investment annually through 2025. The Vision, supported by the MDGs and NEPAD, led to the establishment of the African Water Task Force (AWTF) and subsequently the African Ministers Council on Water (AMCOW).

Box 3:

Indicators to monitor the contribution of water services to achieving the MDGs:

Water Supply and Sanitation

Key Ingredients in MDG

Goal 1 Eradicate extreme poverty and hunger

Water is essential for improving the quality of life – for health (drinking, eating and bathing) and for economic development (manufacturing and business). Increases productive activities though reduced sick days and saved drawing time.

Goal 2 Achieve universal primary education

Access to good quality water saves time and keeps children fit so that they can attend school regularly. Sanitation and water facilities underpin a healthy school environment.

Goal 3 Promote gender equality and empower women

Saved time allows women to take better care of themselves and their families. Community water supply provides an excellent opportunity for women to break into management.

Goal 4 Reduce child mortality

Safe water for drinking and personal/household hygiene and excreta disposal reduces infant/child morbidity and mortality, improves their nutritional status and their ability to do better in school. The marginal price of improved hygiene and sanitation promotion makes them cost effective health interventions.

Goal 5 Improve maternal health

Reduces physical stress and improves health status of pregnant women, reducing miscarriages, maternal deaths, and adverse impacts on fetuses and newborns.

Goal 6 Combat HIV/AIDS, malaria, and other diseases

Prevent vector borne disease related to water sources (guinea worm, onchocerciasis, and schistosomiasis) and diseases related to excreta contaminated water and poor hygiene (cholera, typhoid, and diarrheal diseases).

Goal 7 Ensure environmental sustainability

Communities that are organized to manage their water supplies can extend their skills to better manage their local environment and water resources.

Goal 8 Develop a global partnership for development

Provides opportunities for governments, donors, private NGO/businesses to work together to achieve the MDG.

Source: Draft Action Plan for Water supply for Sub Saharan Africa, 2004

Table 2: Water Supply and Sanitation Coverage in IDB member countries in Sub-Saharan Africa

Country	Year 2000 indicators							Year 2000 to year 2015					Institutional Reforms		Priority given by	
	Population			Coverage				Population					Rural	Urban	Country	Donor
	Total	Urban	Rural	Safe Water		Sanitation		Growth		Total	MDG coverage		yes	yes	med	med
	million			Urban	Rural	Urban	Rural	Urban	Rural	(million)	Urban	Rural	no	no	high	High
Comoros	0.70	33%	67%	98%	95%	98%	98%	4.6%	1.9%	1.07	99%	98%	n/a	n/a	n/a	n/a
G Bissau	1.21	24%	76%	29%	55%	88%	34%	6.5%	0.4%	1.73	65%	78%	no	yes	n/a	n/a
Gabon	1.23	81%	19%	73%	55%	25%	4%	3.0%	-1.0%	1.76	87%	78%	no	yes	n/a	n/a
Gambia	1.31	32%	68%	80%	53%	41%	35%	3.6%	1.2%	1.78	90%	77%	no	no	n/a	n/a
Mauritania	2.67	58%	42%	34%	40%	44%	19%	4.6%	-0.3%	4.11	67%	70%	n/a	n/a	n/a	n/a
Eritrea	3.85	19%	81%	63%	42%	66%	1%	5.0%	2.0%	5.72	82%	71%	no	no	high	Med
Togo	4.63	33%	67%	85%	38%	69%	17%	4.1%	1.3%	6.58	93%	69%	no	no	n/a	n/a
Sierra Leone	4.86	37%	63%	23%	31%	23%	31%	4.3%	1.4%	7.11	62%	66%	no	no	n/a	n/a
Benin	6.10	42%	58%	74%	55%	46%	6%	4.5%	1.6%	9.45	87%	78%	yes	no	med	High
Guinea	7.43	33%	67%	72%	36%	94%	41%	3.4%	2.6%	11.30	86%	68%	no	yes	n/a	n/a
Chad	7.65	24%	76%	31%	26%	81%	13%	5.1%	2.6%	12.38	66%	63%	yes	no	high	High
Senegal	9.48	47%	53%	92%	65%	94%	49%	3.7%	1.0%	13.52	96%	83%	yes	yes	high	High
Niger	10.73	21%	79%	70%	56%	79%	5%	6.1%	2.9%	18.48	85%	78%	yes	no	n/a	n/a
Mali	11.23	30%	70%	74%	61%	93%	50%	5.2%	1.9%	17.66	87%	81%	yes	yes	high	High
Burkina	11.94	18%	82%	84%	55%	88%	16%	4.5%	2.6%	18.51	92%	78%	yes	yes	high	High
Cote d'Ivoire	14.79	46%	54%	90%	65%	78%	30%	3.2%	1.9%	21.53	95%	83%	yes	yes	high	Med
Cameroon	15.09	49%	51%	82%	42%	99%	85%	3.2%	0.5%	20.23	91%	71%	no	no	n/a	n/a
Madagascar	15.94	30%	70%	85%	31%	70%	30%	4.8%	1.8%	24.07	93%	66%	yes	yes	med	Med
Mozambique	19.68	40%	60%	86%	53%	69%	29%	2.4%	0.2%	23.53	93%	77%	yes	yes	high	High
Uganda	21.78	14%	86%	72%	46%	96%	82%	6.6%	3.4%	38.74	86%	73%	yes	yes	high	High
Sudan	29.49	36%	64%	86%	69%	87%	48%	4.5%	1.0%	42.43	93%	85%	no	no	n/a	n/a
Total	201.77	34%	66%	82%	42%	80%	40%	4.1%	1.6%	301.66	91%	71%				

Burkina Faso have substantial experience establishing such services with a high coverage rate in both rural and urban population, and in contracting the private sector to run major urban

water supply systems with satisfactory results. More needs to be done in these countries to articulate a national program for this sector.

These countries are also addressing main problems related to water supply and sanitation services such as inadequate financial resources needed to expand the services, and to efficiently operate and maintain existing facilities. They are restructuring public utilities to adequately address overstaffing, poor incentives, and weak institutional and regulatory capacity among public employees.

Box 4: Senegal case study in water supply and sanitation:

A recent country assessment of water supply and sanitation in Senegal illustrates progress achieved in delivering water services to a large segment of the population, especially the rural poor. Senegal opted to select small pipe networks which consist of one borehole, one storage facility, and a small network supplying both house connections and public stand pipes.This simple technology allowed for providing and extended urgently needed services at low cost. There are about 1100 small networks serving rural Senegal with more than 80% in good operating conditions. An estimated $ 170 million was spent to provide water to the rural sector in the last 10 years. Little was spent on sanitation. The total coverage increased from 60% in 1990, to 67% in 2001. The increased coverage served additional two million people at an average cost of about $85 per person. The cost of providing similar services to the urban population is about $103 per person. The water supply in rural areas and small towns are managed by water users associations which are encouraged to outsource the day to day management and maintenance to the private sector. The roles of women, who are always affected by the services, were given a prominent role in managing community partnership. The national public water utility has been converted into a public asset holding company. A private company has been formed to ensure regular services in the urban water supply sector. The average expansion of water services for both rural and urban areas is about 270000 persons annually.

The case for Senegal has been repeated in several African and Asian countries which are moving rapidly to extend coverage of water services to the various sectors in the society. While impressive, progress is rather slow. The pace of expansion is not keeping up with the needs of the growing population. To achieve the Millennium Development Goal in 2015, water supply should reach more than 5.5 million people in Senegal. At the current rate of implementation, more than two million people will still be without water services in the next decade.

Source: Millennium Development Goals for water and sanitation; Senegal, The World Bank, 20003

Data from SSA indicate that in the last 15 years, water supply services have just kept up with the population growth such that the proportion of persons served has remained at about 40% in rural areas. This is partly because of relatively low investment levels but also because many facilities have fallen into disrepair due to lack of spare parts and maintenance support. In urban areas most households have access to water but many of the poor pay very high rates to vendors and many others have irregular service. It's estimated that about 80% obtain reasonably good service now, but investments will need to keep pace with a rapidly growing population. To achieve the MDG in Africa, the number of people in IDB member countries served will have to double in the next 15 years, going from 150 to 300 people served, half each in rural and urban areas. This is a formidable task, in terms of investments, but more so in terms of capacity building.

Recent studies and country reports indicate that Uganda and Benin have the most mature rural water and sanitation programs. Mozambique, has been actively implementing national programs for several years. Senegal, Mali and Burkina Faso have substantial experience and relatively high coverage rates, but lack national programs.

Overall the key success factors in rural water supply and sanitation are widely supported by sector professionals and relevant government authorities, but investments are rather ad hoc, depending on individual decision makers within the countries and donor organizations, rather than national priorities.

b) Reform in the water services in SSA: Most IDB member countries in SSA have embarked on a reform process to improve the delivery of water services to their populations. Cote d'Ivoire, Senegal, Burkina Faso, Guinea, Mali, Niger, Uganda, and Mozambique have contracted private water operators to run their major urban water supply systems. Further countries must commit to the reform agenda and to meeting the goals, and must use their own money to pay for a large part of their water supply facilities. The scale of investment required to meet the MDG will require substantial funds.

Experience to date shows that the following factors must be addressed:

- Genuine government commitment to reform.
- Thorough analytical work of the water sector by government and partners.
- Consensus building between government and donors on policies, sub-sector strategies and investment programs.
- Incorporation of investment program into budget framework.
- Solid background work on procurement, financial management, monitoring/evaluation, and quality control.

Elements of the reform are summarized in boxes on progress made in Senegal and Guinea. The country case studies in Box 4 & 5 illustrate the dynamic process underway in many member countries in Africa to expand water services to the poor communities despite limited financial resources. Two cases from Senegal (Box 4), and Guinea (Box 5), demonstrate the benefits of strong participation of users, community's leaders and the private sector. Governments could expand the delivery of water supply to consumers through this partnership which is crucial to the reform agenda.

The case study from Senegal confirms that beneficiaries have demonstrated that they are willing to allocate time, energy and resources to develop their own water supplies and sanitation. But public utilities responsible for these services in most countries are moving slowly, partly because of water scarcity, and partly because shortage in political commitments to allocate public finance needed to build infrastructure:

Box 5: Village Water Supply in Guinea:

In 1979, an estimated 30 percent of Guinea's rural people had to walk over 2 kilometers to reach a water source. Improving this statistic was the challenge facing the Service National d'Aménagement des Points d'Eau (SNAPE), when it was founded in 1980the service had developed an ambitious program to provide 22,000 new water points in rural areas, including a sizeable emergency component targeted to 2,600 critically deprived villages in the driest regions. But a tight budgetary support meant that the program was falling behind schedule. IDB agreed, in 1985 to join with other agencies in helping the SNAPE to meet its schedule.

IDB focused assistance in three districts—Duinguiraye, Dabola and Faranah—that form a north-south transect in the remote and poor interior of Upper Guinea. This area has a long dry season, lasting up to 9 months. Most of the traditional wells from which people draw their water run dry by January, well before the rains begin in June. People resort to distant rivers and ponds, which are often stagnant and dirty. As the temperatures climb into the high 30s, they long for cool, clear water, close to home.

But providing village water points wouldn't merely quench thirsts and wash the dry-season dust off bodies and clothes. A survey conducted by SNAPE before the project began showed how urgently clean water was needed to improve human health. In several villages fewer than half of all children lived beyond the age of 5, a shockingly high level of mortality caused mainly by water-borne diseases.

The three partners implemented the project on time and below cost. The main cost savings were due to the devaluation of the Guinean franc, which fell sharply in 1987-88. A further factor was that water was found closer to the surface than had been expected, reducing the time required for drilling as well as its costs. And there was a lower rate of failure than had been anticipated, due to the judicious choice of drilling sites by the consultant. As a result, the project was able to install 20 percent more pumps than had been planned, while still under-spending by $2.1 million.

Nine years after the completion of the project, IDB staff returned to the three districts to find out whether the project could be rated a success. Villagers randomly interviewed agreed that the project had brought substantial benefits. All villagers now had year-round access to fresh water—a change they said had transformed their lives. The consumption of water had increased six-fold. Women especially appreciated the shorter time it now took to collect water—reduced from 1–2 hours to a few minutes. This freed up their time for other, more productive tasks, such as growing crops, tending livestock, cooking food or going to market.

Respondents also emphasized the project's health benefits. They reported reduced incidence of diarrhea, once a major killer of children. Intestinal worms and skin diseases had also become less frequent. Because women were no longer so exhausted they were more resistant to disease and so more productive in their work. They also had the time to prepare hot meals instead of cold, reducing the risk of infection from food and providing all members of the family with a healthier, more digestible diet to fuel their daily. Nine years later. Only two percent of pumps were out of order and no major breakdown or stoppage had yet been reported for the rest.

Source: IDB, Water for Living, 2002.

The other best practice is based on IDB support to rural water supply in Guinea. The lessons learned from this experience are the need for accurate technical information about suitable water points, the beneficiaries should be committed to taking responsibility for implementation and follow up including operation and maintenance. The village water supply in Guinea also confirms that, once empowered, the villagers can sustain the service long after the project funding is completed. Women in the villages were main beneficiaries from the new water services.

c) Cooperation to expand water supply in SSA[11]**:** By 2015, almost half of the population in Sub-Saharan Africa (SSA), would be living in urban center; many of them are supported by only marginal basic social services and inadequate water supplies.

The experiences of Guinea, Senegal demonstrate that the poor are willing to participate in and to pay for building and operating water services needed by their communities. They also demonstrate that small towns and cities can attract private sector to play a larger role in managing this service. Greater participation of both water users and the private sector offer an effective means to expand and sustain these services

The main challenge for IDB is to assist its member countries in Sub Saharan Africa to expand water services to all households in rural areas. This is an ambitious goal which requires strong partnership with many players. Elements of strategic partnership have been articulated through several international conferences and country studies. IDB could establish a program with national leadership, engage regional organizations in promoting and monitoring action plans and water operations, strengthen government commitment and increase the use of own resources supplemented by donors credit, coordinated donor support, and extended knowledge of best practices through regional/international consultants to help with reform, strategies, implementation, and capacity building.

While there has been considerable progress over the last fifteen years in learning the ingredients of successful water and sanitation in villages, towns and urban centers, and there is broad consensus on these factors amongst sector professionals in IDB member countries in SSA, business as usual will not achieve the Millennium Goals. More efficient use of existing IDB resources and better coordination with other donors would help. A campaign and collaborative partnership among partners will be needed to make the difference. With local leadership, governments and civil society to embrace an agreed reform agenda, IDB and interested donors can articulate agreed strategic agenda, provide technical and financial support, and assist in implementation. The strategic focus would be on self governance, resource mobilization, capacity building, and more efficient monitoring and evaluation. The

[11]The 2002 Ouagadougou Declaration on IDB Group Cooperation with Africa pledged US $2 billion in assistance to least developed African member countries over a five year period in key sectors. It has committed Bank Group support to the water sector. The declaration clearly emphasized the importance of ensuring the efficient and sustainable use of water resources for both domestic and agricultural purposes.

A major factor in the decline of these services is the absence of an efficient cost recovery system and low domestic tariffs and poor revenue collection, combined with excessive leakages, and loss rates of about 50%of unaccounted for water. The extremely low tariffs encourages consumers, households, industry, and public agencies to waste water as there is no incentive to conserve this precious resources. Low domestic tariffs and poor revenue collection, combined with the loss of subsidies has led to an unprecedented financial crisis in the sector. In addition to inadequate maintenance and depreciation levels, low tariff setting, and practices such as barter and offsets have exacerbated the financial situation of many utilities, leading to an accumulation of large debts to their suppliers, most notably electricity providers.

Encouraging experiences are reported about expanding water supply to poor communities in member countries South Asia. Poor communities are receptive to new innovations and willing to share the financial burden. Bangladesh has expanded water services to many poor communities especially in the rural areas. The wide adoption of tube wells and small pumps in Bangladesh and Pakistan has allowed for widespread coverage of water services to millions of rural households. The coverage is still low. Many communities need assistance to acquire reliable services. The role of public agencies has been rather limited due to shortage of funds. A major area of concern regarding the adoption of tube well services is the weak monitoring of water quality. This issue will be discussed in chapter six. The reliability and quality of service has deteriorated alarmingly in the past decade.

Coverage in urban areas in most cities in this region is generally higher than in rural areas, but intermittent service is common.[12] Moreover, inadequate functioning of water treatment plants and badly deteriorated distribution networks have made drinking water unsafe in many urban centers, leading to a rise in water-borne diseases such as typhoid and diarrhea. Rural water supply services are largely in a state of total disrepair. The ability to mobilize resources for the sector is severely limited as government budgets are even more constrained and the capacity of people to pay is low.

Water systems in most IDB member countries in this region already exist—with the notable exception of Afghanistan—albeit in poor condition as described above, and can only deliver services after substantial rehabilitation of facilities and reform of institutions. While rural water supplies are generally considered to be lagging behind the urban ones with respect to access indicators, both are facing crises with respect to safety, reliability, quality, and efficiency of services.

[12] The 2003 Human Settlement Report indicates that major cities in South and South East Asia suffer from high percentage of an accounted for water. The report identifies Karachi, Dhaka, and Jakarta as cities with high interruption in water supply and more than forty percent in un accounted for water.

Estimated overall cost for meeting the MDGs for water supply and sanitation in the Central Asian member countries, excluding Afghanistan, if rehabilitation is done in the short-term would be to the tune of US$4 billion. However if systems are allowed to deteriorate further, the costs of reconstructing the collapsed systems is expected to reach as much US$14 billion. The issue now is how to keep the existing systems functioning and prevent them from collapsing. The consensus amongst donors is that investment must focus on rehabilitation rather than expansion. Where feasible, focus will be on improving productivity and efficiency, coupled with policies that promote financial sustainability. Where capital investment in water supply is critical, priority will be given to restoring and extending distribution systems and improving efficiency, rather than simply rehabilitating water treatment plants.

3-Water supply in MENA countries:

Several IDB member countries in this region have, over the last few years, prepared water action plans which also highlight the importance of water in equitable economic growth and in sustained environmental management. Water resources assessment and the reform of water policies and institutions have been carried out or under way in Yemen, Jordan, Tunisia, Saudi Arabia, and Egypt. The main features endorsed by this framework are to manage national water resources as integrated system of hydrology and development, introduce decentralization as the basis of management services, and articulate rules and regulations and incentives to increase the participation of stakeholders, the private sector, and local communities in water management. Several countries have encouraged local communities to assume more responsibility, authority and control over improvements and operations of water services and to develop local water resources to meet local needs. Rural communities have also been empowered to address evolving community demands. This partnership would ensure equitable management of water for irrigation and water supply through community action in cooperation with water users and public service institutions.

It is estimated that in the year 2000, more than 31 million people in MENA region lacked access to safe water, and more than 51 million lacked access to safe sanitation. Governments tend to approach this problem through narrowly focused but simple to design and implement incremental project approach. Such procedure may allow for urgent terms of engagement for the implementing agencies, and immediate rewards for the benefiting communities. But the long term reliability and sustainability may suffer if such investment is carried out without an integrated development strategy for the water sector.

The task of achieving universal coverage of water supply and sanitation is becoming more challenging because several IDB member countries are experiencing tight financial control on public budget. The service institutions are extended beyond available technical and financial resources. They can hardly sustain efficient services to the current populations, which are growing at 2-3% annually. Most of this growth is adding pressure on already crowded and inadequately serviced cities and towns.

In most MENA countries, large portion of the water supply is not accounted for, and, as described by the Human Settlement Program, many cities in the MENA region are leaking buckets. The poor bear the disproportionate share of the impact of inefficient water and sanitation services. As table 1 indicates, fewer poor people (only 28% of the rural population) are connected to piped water supply. When they do have access, the installation has to be shared among many more people. The poor in most MENA cities pay high prices for water supply, generally more than those paid by more affluent households connected to the piped system.[13]

The countries in the MENA region are trying different approaches to addressing failing water and sanitation services to the poor communities. Some attempt to improve services overall, on the promise that making services work for all is necessary for making them work for the poor. Some government, especially in North Africa and in GCC countries are inviting the private sector to assist in this effort. The results are not always successful. Governments worldwide deem it their responsibility to provided, finance, regulate, and build water infrastructure. They do it for two good reasons: market failures and equity concern. The MENA region is advancing decentralization of water services to local governments, town councils, and communities. This process is in its early stage, and more is needed to strengthen ownership and accountability of services, especially to poor communities.

Another concern in the provision of water services in MENA is the increasing dependence on non conventional sources of water especially in the GCC member countries, Desalination of seawater is an expensive process with long term implication on the environment and the economy in may GCC countries. During the last three decades, the countries of the Arabian Peninsula have become increasingly dependent on desalination to meet growing water requirements. The present annual designed desalination capacity of the seven countries has reached more than three billion cubic meters, some if it includes private sector ownership for industrial or other purposes. The cost of providing water to the growing population in the region will be determined by advancement in technology and improvement in maintenance and modernization of production units, and in establishing appropriate tools for cost recovery and water recycling.

[13]The 2004 World Development Report "Making Services Work for the Poor" provides detailed analysis as to the reasons behind the inadequate services to the poor. It argues that the providers of services are generally accountable to the policy makers than the clients. The poor clients have no political voice and often have no choice among service providers.

Chapter Four

Achievements in irrigation and agricultural productivity

1. Expansion of irrigation:

Development and expansion of irrigation in the last 30 years has been concentrated in areas of high population density and high population growth in most IDB member countries. Where population density was low but population growth was high, agriculture expanded mainly by bringing new lands into cultivation. Yet this horizontal expansion was minor compared to the vertical expansion brought about by improvement in agricultural technology and irrigation. The vertical intensification, mainly in wheat and rice production, that began in the late 1960s has been called the "Green Revolution". Expansion of irrigation was instrumental in setting the green revolution in motion. Thanks to building dams and developing irrigation, the devastating impact of repeated droughts and failure of the seasonal rains have been brought under reasonable management systems. Several IDB member countries have been successful participants in this remarkable process of change. Total irrigated areas in IDB member countries have expanded over the last 30 years to about 75 million hectares), or about 20 percent of the total global irrigated land world wide (Turkey, Pakistan, Indonesia and Malaysia and Central Asia) invested heavily in horizontal expansion.

Irrigation may take many different forms from large dams and canals to small systems of shallow tube well, to pressurized small sprinkler and drip irrigation systems. There are different management systems in irrigation: large-scale farming which is common in a number of IDB member countries such Egypt, Syria, Iraq, Indonesia, Morocco, Bangladesh, Pakistan, Sudan, and Mali. Such systems are usually developed along the major river basins downstream from dams. Most large schemes have an ancient history of development. Many schemes have combination of public and private land ownership. Several large-scale, fully irrigated schemes have emerged in recent years that are privately financed, owned and operated. There are millions of small scale-irrigation, found scattered in small areas throughout the countries such as in Oman, Saudi Arabia, Tunisia, Niger, Pakistan and Indonesia and Bangladesh[14].

On the aggregate level, IDB member countries have kept pace with the annual growth of global irrigated areas of around two percent a year in the 1960s and 1970s, slowing to one percent in the 1980s. The 370 million-hectare currently under irrigation world wide, (2.5 times

[14]Among IDB member countries, Pakistan, Iraq, Egypt, Indonesia, Bangladesh, Malaysia, Sudan, Central Asia, and Turkey have developed significant large scale irrigation systems. As table 1 indicates, Pakistan has developed the largest irrigated areas among IDB member countries. About 90% of all irrigated areas in IDB member countries are located in WANA, Central Asia, South and East Asia. See Annex 2 for detailed data on irrigated areas and methods used in these regions. The remaining 10% are located in SSA.

self sufficiency, have encouraged investment in irrigated agriculture. Successful subsidies and incentive programs have resulted in large scale expansion of farming activities with substantial water requirements. The current water demand for agriculture is more than 22 billion cubic meters, provided mainly from deep aquifers. The authors present data to indicate that deep water aquifer levels are declining, pumping cost are increasing, saltwater intrusion is contaminating the aquifers and causing disturbance of the dynamic equilibrium among aquifers. These factors have led to the abandonment of farm land, decline in agricultural productivity, and increase rural migration.[17]

As water scarcity intensifies, irrigated agriculture and associated reliable food production systems are at risk, unless serious effort and investment is made to modernize irrigation and diversify agriculture. Prevailing irrigated production system in several IDB member countries in MENA would have to undergo serious adjustment process. Because most of these countries would be forces to make adjustment in the agricultural sector to cope with increasing globalization and associated liberalization of trade in agricultural commodities.

The pressure on the irrigated sector is likely to intensify to meet challenges created by water scarcity, and the declining role and contribution of the agricultural sector to the national economy. The role of agriculture in the national economy varies from less than 3 percent in the GCC countries to 29 percent in Yemen, but employs a relatively large segment of the labor forces. This adjustment process needs to be carefully planned and implemented within a comprehensive water policy, which also recognizes the importance of incentives in guiding smooth transition in agriculture, and related adjustment in traditional water rights and allocation.

Efforts are underway in several MENA countries to treat wastewater and allocate it to irrigation in exchange for fresh water diverted from this sector to meet the growing demands for urban and rural water supply. The process is complex and some countries have rushed into this exchange with little attention to possible high risks related to environmental and health hazards associated with the use of wastewater.

The issue facing the reallocation of water out of agriculture in the MENA region is mainly political, economic, and social. Most farmers have acquired the rights to the water they use to irrigate their lands over several generations. Also political leaders in some countries would like to emphasize the need for achieving high rate of food self sufficiency. Achieving this goal may be unrealistic.

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[17] Al Alawi, Jamil, and Abdulrazzak, Mohammed, 1994" Water in the Arabian Peninsula: Problems and Perspectives" provide detailed discussion on the status of water in the Peninsula, and the emerging challenge between current water supplies and the growing demands in the countries in the region.

3- Poverty reduction, irrigation systems and economic growth in South, Central, and East Asia:

Despite aggressive government policies to adopt modern irrigation technologies, less than five percent of totals irrigated areas in IDB member countries are equipped with systems designed to increase water use efficiency. Substantial irrigated areas are still served by the traditional system especially in Pakistan, Malaysia, Bangladesh, Central Asia, and Indonesia and consume more than 80% of the renewable water resources. Central Asian countries and Pakistan have some of the largest irrigation schemes in the world. In Pakistan, the Indus Basin irrigation system is the largest contiguous irrigation system in the World. Irrigation in these countries expanded at a rate of 1.5-2 percent a year in the period from 1950s to the 1980s. Area expansion has slowed down in the last decade because the development of water resources is reaching its limits. But the irrigation systems suffer from poor maintenance. Water supply has become unreliable in many areas, and tail end farmers suffer from repeated water shortages caused by decaying water infrastructure. As a result yields per hectare have dropped, and the benefits of the green revolution are diminishing. Lack of investment in drainage has caused increased water logging and salinity which in turn, cause further decline in yields, and render large tracts of land barren.[18]

Management of irrigation system is undergoing substantial changes in these countries. Water users associations are being established to better manage community level irrigation systems, and are encouraged to collect fees to recover the cost of operations and maintenance. Decentralized management structure is being introduced and water policies are receiving attention at the highest level of policy makers in the countries. Investment in irrigation has made significant contribution to poverty reduction in the regions. Irrigation increased yields of staple and commercial crops, expanded cropping areas, increased cropping intensity (average number of crops grown per year on the same plot of land), and increased the production of high value crops, which also increased employment. Irrigation also increased the stability of farming systems through the construction of better water storage facilities which helped reduce adverse consequences of repeated droughts. However, expansion of irrigation came at some costs; the most visible and politically sensitive are environmental damage, depletion of water resources, changes in the water table, increase salinity, water logging, and destruction of natural habitats (Rosegrant, 2002)

[18]For detailed analysis of the irrigation sector in Pakistan see Rashid Faruqee, 1999, "Strategic Reforms for Agricultural Growth in Pakistan". Faruqee argues that the sector suffers from rigid system design, inadequate drainage, low delivery efficiency, inequitable distribution, increased water logging and salinity, and over exploitation of groundwater in Pakistan. For detailed analysis of irrigation in Central Asia see Bucknall and others, 2003, "Irrigation in Central Asia". The analysis concluded that the impact of irrigation on poverty reduction is significant. This contribution is at risk because of the serious decay in the system. The cost of rehabilitation is beyond d the resources available to the countries. Foreign assistance is urgently needed.

Several studies conducted on the contribution of irrigation in South and East Asia confirmed the substantial benefits of this investment, and quantified the impact on poverty reduction. Some studies cautioned that irrigation may gave adverse effects on some groups, especially in the possible marginalization of the landless and the poor farmers in rainfed areas. The studies also warned that the benefits from irrigation may accrue more to large landlords, and that small farmers may be deprived from equitable market share of commodities produced under irrigation. Studies on irrigation in Malaysia and Indonesia reported significant improvement in water management which allowed for increased diversification of production systems beyond staple food to high value crops (Barghouti, 2004).

Irrigation is still essential for growth, poverty reduction and increased productivity in IDB member countries in this region. A recent study by IFPRI to examine water allocation of the Brantas River in Indonesia, analyzed a wide variety of economic, institutional, and hydrologic factors, farmers production decisions, food production, urban and industrial water demand, and resource degradation. The study also examined the potential benefits and impacts of different national-level macroeconomic policies, and the implications of alternative water management regimes. The study found out that national level crop input and output price policies have major effects on water allocation at the basin level. Public investment in irrigation accounted for 23 percent of the increase in agricultural output between 1985 and 2000, making it the single most important source of output growth. Private irrigation pumps accounted for 6 percent more growth. The study concluded that a good case exists for resuming investment in irrigation in Indonesia where public financing for irrigation has declined in recent years. Such investment should be balanced between physical infrastructure and irrigation management reform, with increasing emphasis on the latter (IFPRI, 2004).

Several studies conducted in the South and East Asia Regions agree that the impact of irrigation on poverty reduction has been significant, especially where investment in irrigation was also complemented by supportive research on modern crop varieties, adequate farm input such as improved seeds and fertilizers, and supportive local research. These benefits were quantified in the following areas: i) increase productivity. All irrigated crops produce higher yields, and irrigation allows for multiple cropping, thus increase land and labor productivity. ii) The second impact is on employment. Construction of irrigation infrastructure usually provides work opportunities to landless and rural poor households. Also improved productivity as a result of irrigation stimulates demand for additional farm labor and allows for longer seasonal employment because of increased cropping seasons. iii) The third is increase food supplies which may result in lower food prices. The experiences from Pakistan, Bangladesh, Malaysia, and Indonesia confirm that the poor befitted directly from increased the production of staples, especially rice. The share of expenditure tends to fall among rural and poor households as a result of increased food supply at lower process. iv) Another important

benefit is that irrigation increases the security of farming. While rainfed crops may fail, irrigation acts as a buffer against drought years and poor seasonal variation in rainfall.[19]

IDB member countries can increase the efficiency of existing irrigation system. Currently most of the traditional gravity irrigation systems which provide water to more than 94% of all irrigated lands in IDB member countries are based on conveyance of water in unlined canals and on running water freely over the land surface. The application efficiency of these systems is less than 50 percent and in many cases even less than 40 percent. Most of the irrigation systems in Pakistan, Bangladesh, and Indonesia suffer from low efficiency. New irrigation techniques, by which water is delivered in closed conduits and applied in small quantities at high frequency directly to the plant at a controlled rate, can improve water use efficiency. These new systems offer greatest opportunities for conservation of water. The initial cost of installing these systems is rather high (about $1000-2000 per hectare). But the long term benefits justify the expenses. Because the new water delivery technology allows for significant water saving. For example, the total water requirement for one hectare of cotton would be reduced by one half and the yields would be much higher. They also increase flexibility in agricultural diversification into high value crops, and for reducing run off, water logging, and land degradation.

4- Expansion of irrigation in IDB member countries in Sub Saharan Africa:

The Gizera and Managel in Sudan (about 1.3 million hectare of contiguous irrigation), and the Office de Niger in Mali are the largest schemes in this Region. The Gizera scheme was built in the 1920s and few years later, the Managel was built to assist Sudan utilize its agreed water share from the Blue Nile. The Office de Niger was built two decades later. Sudan added several hundred thousand hectares of irrigation based on large scale pumping for the Rahad, the New Halfa, the White Nile and the Blue Nile schemes. These schemes were among the early innovations in irrigation in developing countries. For several decades, they efficiently produced commercial and food crops and made substantial contribution to agricultural growth and development in both countries. But these schemes were allowed to deteriorate due to poor operations and maintenance, and because ad hoc management, and intervention by the government failed to modernize the water system and to motivate the farmers to take increasing responsibilities for sustainable operations of the water services[20].

[19]For detailed analysis of the impact of irrigation on poverty see the analysis provided by Rosegrant and others (2002) in World Water and Food to 2025. Also see Lipton and others, draft 2004 "The Impact of Irrigation on Poverty". Also see Faruqee (1999) on the impact of irrigated agriculture on food production and poverty reduction in Pakistan

[20]Donors have provided support for these schemes with little progress because the main focus was on rehabilitating the infrastructure. More critical is the need to restructure management, redefine the role of the public sector in managing farming activities, upgrade the facilities and modernize water delivery systems. These issues are being addressed in recent reviews conducted to of rehabilitate these schemes.

Since then African countries have financed little investment to better utilize available water resources for agriculture or water supply. Recent reports by the United Nations Food and Agriculture Organization (FAO, indicate that there are about 15 million hectares of land suitable for year around irrigation, but many African countries need assistance and substantial investment to develop these attractive resources over the next decades (FAO 2004). But to make investment in irrigation attractive, productivity and yield increases must be achieved and sustained through continued research and successful adoption and dissemination of new agricultural technology. Should public investment in agriculture, particularly in research on agricultural and water continue to decline, the aggregate food situation in IDB member countries would significantly worsen. Sub-Saharan Africa is of special concern. During the past three decades, Africa's food production has grown at the rate of 2 percent annually, whilst its population has been 3 percent. Given these alarming statistics, evidence from the gap between production and market demand for cereals in SSA is expected to double to 27 million tons in 2020. Because of widespread poverty, the gap between food production and need will be even larger. It is unlikely that the region will have the capacity to commercially import its food needs or that enough food aid will be available to bridge this gap.

Priority attention should be given to sustaining the current capacity to improve productivity of agriculture in IDB member countries in an environmentally sustainable manner, as well as to increase the capacity of poorer countries in SSA to produce food and to improve the performance of the irrigated agriculture in the region[21]. Better utilization of water for food and increasing productivity of other agricultural commodities is essential for reducing poverty in this region. Progress in alleviating poverty in Sub Saharan Africa has been relatively slow for many reasons. But a glaring factor is the poor performance of the agricultural sector which is the source of growth and income generation for poor million rural families in SSA. Agriculture in SSA is the largest sector in the national economy; hence its performance on poverty reduction in the region needs further support and assistance. The experience in South and East Asia, where poverty has continued to decline in the last two decades, points to the important role agricultural growth played in achieving this progress. South and East Asia allocated significant financial resources for investment in irrigation and were supported by the World Bank and many development agencies in building dams, irrigation schemes, and strengthen institutions which deal with the water sector.

As mentioned earlier, the experience of several IDB member countries in expanding irrigation and stabilizing productivity of agriculture through better control on water delivery systems was not always carried out in a satisfactory manner. Several investment operations did not perform well, and the rate of return was initially relatively low in the early years because of weak institutions and inadequate local capacities to implement and maintain new investment. But these countries, such as Pakistan, Bangladesh, Indonesia and Malaysia stayed the course,

[21]An important recommendation presented by Khan in "Grain Production in IDB Member Countries" is to increase investment in small scale irrigation, and devolve water management responsibilities to water users. (Khan, 2003)

improved the performance of the irrigated sector, and eventually realized significant gains as the benefits and economic returns from investing in irrigation improved. They also learned valuable lessons about the cost of poor management of water resources, because of the absence of appropriate policy framework, especially in terms of environmental damage and waste in resource allocation.

These lessons could be of a great value as IDB member countries in SSA embark on serious investment in irrigation and better water management and development. Recent irrigation development projects in Niger and Mali indicate that such lessons have been put to good results. Small scale irrigation farmers have successfully managed schemes in Mali, Niger, and Senegal. These new projects hold the promise of being sustained by the farmers. Niger is advancing tube well irrigation technology to small farmers with remarkable success in the last five years. Mali embarked on drastic reform in its public irrigation system managed by Office de Niger which serves more than 60 thousand hectares of irrigated agriculture. The reform included the establishment of secure land tenure for farmers, liberalization of pricing and marketing policies, and redefinition of the role and responsibilities of the Office de Niger as a public agency. The reform empowered the water users to take increasing responsibilities for operations and maintenance and the efficient application of water delivery at the field level. The reform also limited the role of the Office de Niger in commercial agriculture and in crop production activities. The results of this reform have transformed the region into a promising productive area with strong contribution to the local and national economy (Aw, and Diemer, 2004).

Still, concerted effort is needed to support IDB member countries in Sub Saharan Africa in their effort to improve the performance of the agricultural sector through higher and carefully designed investment in small scale irrigation. The lessons learned from Bangladesh and Pakistan in expanding the adoption of water pumps and tube well irrigation could be applied in many African countries.

5- Irrigation and food production In IDB member countries:

The more than 70 million hectares of irrigated land annually produce about $25- 30 billion worth of agricultural commodities. The expansion of irrigation is expected to slow down in most countries because most suitable lands have already been developed and most available water resources have been utilized. The growing cost of constructing new irrigation systems is likely to be too high to justify additional investment as long as world agricultural commodity prices remain relatively low. Some policy makers in several IDB member countries are challenging the high water allocation to agriculture because the declining contribution of this sector to the national GDP of many IDB member countries.

Despite the declining importance of agriculture to the national income and employment in many IDB member countries, most governments continue to subsidize water for irrigation in an effort to promote food self sufficiency. But many member countries are in fact,

increasingly reliant on world markets for their basic food supplies, especially grains. The dependency on foreign supplies of food grain in the Middle East and North Africa is more than 40%, and in Sub-Saharan Africa is close to 25%, (IFPRI 2002). For detailed analysis of the current grain production in IDB member countries, see Khan comprehensive study which confirms the increasing deficit in grain production and the widening gap between local production and national grain requirements in many IDB member countries (Khan, 2003).

Table 3. Food Produced From Irrigated land

Region	% Food produced from irrigated land
Asia	60
Pakistan	80
Indonesia	50
Central Asia	45
Malaysia	60
Bangladesh	40
Middle East &North Africa	33
Egypt	98
Iran	50
Sub-Saharan Africa	9

Source: Wallingford 1997

The dilemma in debating policies related to food self sufficiency is the conflicting requirements to better conserve the water sector, especially in countries where water scarcity is at the warning level, and at the same time, meet the growing demands for basic food commodities especially grains. Food policy issues require fundamental assessment because of the increasing globalization in agricultural trade associated with the removal of trade barriers and improve wide access to competitive markets for importing grains.[22] The allocation of substantial and precious amount of water to produce agricultural commodities that can be imported from water rich or highly subsidized regions should be carefully analyzed. The concept of food security and food self sufficiency in the current global market needs urgent assessment, because of the implications on the water sector. The trade offs between achieving food self sufficiency, and sustaining water security in several IDB member countries is an important issue which requires careful debate and policy analysis and objective assessment of national priorities. Some governments may treat the importation of grains as acquiring virtual

[22]In his extensive review of grain production in IDB member countries, Khan argues that the increased liberalization of trade in agricultural products, governments should recognize that food security cannot be increased by focusing on sufficiency without taking into account the level of productivity and production cost of grain. The regional consortia for productivity enhancement and the trade in grains between member countries should receive high priority inn the strategic plans for the Bank and governments (Khan, 2003).

water. Each ton of grain (wheat or barely) would require 2000- 3000 cubic meters of water (based on the efficiency of irrigation methods used). In his analysis of grain production in IDB member countries, Khan presents data which indicate that self sufficiency in cereal production is less than 50 percent in several countries in SSA, in most countries in West Asia, except Turkey and Iran, and in all countries of North Africa except Egypt.[23]

Table 4 illustrates the significant volume of virtual water imported as cereals in IDB member countries. West Asia and North Africa imported in 2000/2001 the equivalent of the annual flow of the Nile and double of the annual flow of the Euphrates. As the food gap is likely to increase because of population growth and increased income (which would allow for increased and diversified agricultural products including high quality small grains and livestock products.

Table 4: Value of imported cereals by IDB regions in year 2000/2001 in virtual water

Region	Cereal Imported * 000 tons	Equivalent in virtual water** Million cubic meters
West Asia	32, 368	64,736***
North Africa	26, 687	53, 374****
East and Southern Africa	1,645	3,290
West Africa	5,382	10,764
Central Asia	794	1,588
South Asia	2,625	5,250
South East Asia	9,795	19590

*Based on Table A 4 Cereal production, trade, and supply in IDB member countries, in Khan (2003). **Assume that one ton of cereal requires 2000 cubic meters of water. *** Equivalent to double the annual flow of the Euphrates, **** Equivalent to the annual flow of the Nile into Egypt.

[23]Khan presents data that Egypt and Iran each imported about 10 million tons, and Saudi Arabia close to 6.5 million tons of cereals in 2000-2001. Assuming that each ton of grain requires about 2000 cubic meters of water, each of Iran and Egypt would have imported about 20 billion cubic meters of virtual water, an amount equivalent to the annual flow of the White Nile. Similarly, Saudi Arabia would have imported about 13 billion cubic meters of virtual water, the equivalent of the flow of the Euphrates into Iraq.

This debate should assess the benefits of various policy options regarding the advantageous aspects of imported food grains. This debate would also require that countries develop long term food security based on proper management of grain stocks and storage facilities, rather than in investing in developing expensive and scarce water resources to increase food.

A recent report by the International Food Policy Research Institute (IFPRI) links global food security to efficient management of water and natural resources. IFPRI forecasts that demand for food grains and livestock products will grow fast in developing countries because of more rapid population and income growth. In the next 30 years, developing countries, according to IFPRI, will increase their total demand for food grains by 75 percent and for livestock products by 155 percent. This appears to be a substantial increase, but because of population growth, demand for food grains per persons is expected to increase by only 11 percent to 266 kilograms in 2020 and for meat by 56 percent to 26 kilograms. In Sub-Saharan Africa, however, the amount of food demand per person will show virtually no change, which is a cause for serious concern as per capita food consumption is currently low in that region (IFPRI, 2002).

Urbanization and rising incomes are associated with more diverse diets: people are eating more livestock products and fewer cereals, and they are shifting to more processed foods. Asians are eating more livestock products and shifting from eating rice to wheat. Sub-Saharan Africans are moving from eating coarse grains and roots and tubers to wheat and rice. Per capita demand for rice is likely to grow at half the rate for wheat and maize. Much of the growth in global demand for meat is driven by changes in dietary patterns and places strong pressures on the livestock industry and, indirectly, on food grain production. Demand for feed grain is growing rapidly in developing countries. (IFPRI, 1995).

In the next 25 years, the IDB member countries will be challenged to produce more food and other agricultural commodities to feed an additional 20-25 million people each year, as well as to meet increasing and changing food needs due to rising incomes and changing lifestyles. These needs will have to be met from more efficient use of land already under cultivation, as significant expansion of cultivated area is not an economically or environmentally sound option in most of these countries. Food will have to be produced where it is most needed in developing countries, not simply to increase food supplies, but also to generate incomes and employment through agriculture and economic growth.

Warning signs, however, suggest that growth in food production has begun to lag. According to IFPRI, rises in food production did not keep pace with population growth in more than 50 developing countries; many of them are IDB members, in the 1980s and early 1990s. The rate of growth of global grain production dropped from three percent in the 1970s to 1.3 percent in the 1990s, and the amount of grain produced per person has fallen in the past decade. Growth rates in yields of rice and wheat have begun to stagnate in Asia (including Indonesia, Malaysia, Pakistan, and Bangladesh, as major producers). A long-term decline in rice yields can be attributed to the combined effects of increased pest pressure, the rapid depletion of soil

micronutrients, changes in soil chemistry induced by intensive cropping, and increase reliance on low quality irrigation water.

Yield increases will be the source of most of the food production increases as cultivated area is likely to decline because of the encroachments of cities and urban centers which are being built on good agricultural lands in most of the Middle East and North Africa, and Central Asia. The lack of land use planning has allowed the conversion of large tracks of productive agricultural land for urban development. Lack of adequate policies for land use planning and urban development is causing double losses to the nations. Agriculture around several urban centers in IDB member countries is gradually disappearing as substantial areas of productive agricultural lands have been converted to urban housing and suburbs. The new urban settlements demand water which has to be diverted from agriculture.

Chapter Five

Managing water scarcity under high risk conditions

The previous sections presented progress made in developing the water sector in IDB member countries. Millions of households are being served with clean water, and millions of hectares of agricultural areas are being irrigated. The future of water projects in most IDB member countries is uncertain and investments made in irrigation and water supply are at risk. Different countries confront different problems with their water sector. Some countries have too little water, or no scope for additional supplies without massive technological and financial inputs. Others have adequate supplies, at least for the short run, but manage their reserves poorly. The common features of the water sector in IDB member countries are defined by extensive public sector investment, informal allocation and pricing procedures, and limited access by the poor communities to both clean and safe water supply, or to irrigation needed for stable agricultural production system.

Water scarcity could be caused either by inadequate infrastructure to better utilize it (reservoirs storage and water tanks), or because of poor endowment in natural resources. As mentioned earlier, at least 21 IDB member countries have reached the limit in tapping their renewable resources and are classified as countries in water stress (most countries along the Senegal, Niger, Nile, and Juba and Shebili Rivers in Africa, the Euphrates, the Jordan, and the Aral Sea basins with less than 1667 cubic meter of renewable water resources per capita), or facing water crises (less than 1000 cubic meter of renewable water resources per capita). The situation is becoming more challenging as the riparian countries along these rivers are addressing the growing challenges with little coordination or collective action. [24]

While countries in MENA and Central Asia cover 14% of the total area of the world and contains 10% of its population, their water resources are only about 2% of the total renewable water resources of the world. North-Eastern Africa and the Arabian Peninsula have very limited water resources, with less than average rainfall, and suffer severe water scarcity, with values per inhabitant varying between 200 and 700 m^3/year.

[24] Issue related to managing scarce water in the Middle East and North Africa has been the subject of several studies. The Arab Fund for Economic and Social Development in cooperation with Harvard University organized a special study of water in the Arab World. The findings of the study were edited by Peter Rogers and Peter Lydon and published in 1994 " Water in the Arab World" Detailed data on water resources in different parts of the Arab World were presented by Yahia Bakour about the Mashrek, countries, by Mohammed Jellali and Ali Jebli about the Meghreb countries. Main issues presented in these studies are presented here with additional data from recent data banks at FAO and the World Bank.

Annex 2 provides water balance sheets for IDB regions.

1- High rates of water withdrawals The Middle East and North Africa:

IDB member countries in the MENA regions have a poor endowment of water resources. Per capita fresh water availability fell from about 3,300 cubic meters in 1960 to about 1,200 cubic meters in 2000, and could fall by one-half to about 650 cubic meters as early as 2025 for all uses, agricultural, domestic and industrial. The region is also experiencing high annual population growth of more than 2.6 percent. The decline of annual water availability would have adverse effects on the local economies and the environment. Extraction of groundwater is around 160% of renewable resources in Jordan, 140% in Yemen, and 99% in Tunisia.

Table 5 Countries with Internal Renewable Water Resources (IRWR) below 500 m³/inhabitant. per year 1995

Country	Internal renewable water resources per inhabitant m³/year	Actual renewable water resources per inhabitant m³/year
Countries with IRWR < 500 and ARWR < 500:		
Kuwait	0	13
Bahrain	7	206
United Arab Emirates	79	79
Qatar	93	96
Libya	111	111
Jordan	124	161
Saudi Arabia	134	134
Yemen	283	283
Tunisia	396	463
Oman	455	455
Countries with IRWR < 500 and ARWR > 500:		
Egypt	29	926
Mauritania	176	5 013
Turkmenistan	244	17 321
Syria	477	1 791
Algeria	498	512

Sources: FAO Statistics Data Base:
http://www.fao.org/ag/agl/aglw/aquastat/regions/neast/index4.stm

Table 5 presents countries with low internal renewable water resources. Table 5 lists five countries where water withdrawal is above the internal renewable resources, and six countries

where water withdrawal is above all renewable resources. These countries are obliged to seek non conventional sources of water.

As these tables confirm, the internal renewable water resources per inhabitant in the MENA countries are among the lowest in the world. The average for the region is 1,100 m^3/inhabitant per year, as against over 7 000 m^3/year per inhabitant for the whole world. It ranges from near zero for Kuwait, which has practically no internal renewable water resources, to about 10 000 m^3/inhabitant per year for Tajikistan and Kyrgyzstan.

For 15 of IDB member countries the internal renewable water resources per inhabitant are below 500m^3/year and for 10 of them even the total actual renewable water resources are below 500m^3/year. The Gulf Cooperation Council Countries (GCC), (Kuwait, The Arab Emirates, Qatar, Bahrain, Oman, and the Kingdome of Saudi Arabia) are among the driest in MENA countries.

These countries have been mining their non renewable fossil water resources, and have invested heavily in desalination of water from the sea or from brackish ground water, an expensive investment which would have to expand in the coming years to meet the growing demands in the region. The picture is even more challenging when reviewing the scope of annual water withdrawal among IDB member countries which is, in several cases, more than the water renewed within their borders (Table 6).

Only in a few countries Turkey, Iraq, Kyrgyzstan, Tajikistan. Pakistan, Bangladesh, Malaysia, Indonesia, and Afghanistan, the internal renewable water resources per inhabitant are above 2 000 m^3/year. Three of them act as 'water towers' for the region, with large amounts of water flowing to downstream countries. They are: Turkey (the Euphrates and the Tigris rivers mainly), Kyrgyzstan and Tajikistan (the Amu Darya and the Syr Darya). Two countries, Syria and Sudan, are intermediate countries in that they depend to a large extent, around 80%, on upstream countries for their renewable water resources (mainly the Euphrates from Turkey and the Nile from Ethiopia). On the other hand they are located upstream from other countries depending on the same rivers (Iraq and Egypt respectively). Five countries depend for over 90% on other countries for their renewable water resources: Turkmenistan, Egypt and Mauritania for surface water, and Kuwait and Bahrain for groundwater. To a lesser extent, but still over 50% dependent on other countries are Somalia and Iraq. Data on withdrawal rates among countries using the Niger and Senegal rivers were not available.

The percentage of water withdrawal over internal renewable water resources is an indicator of the importance of inters country flow for some countries. Libya, Tunisia, Morocco and Algeria have almost no water flow from other countries. The rate of utilization of internal water resources is high. This situation requires strict management of the resources and proper handling of possible conflict cause by competition among the sectors of water use.

Table 6. Countries with total water withdrawal greater than the internal renewable water resources and contribution of other sources of water to total water withdrawal

Country	Water withdrawal		Use of non-conventional water and groundwater depletion as % of total water withdrawal		
	in % of IRWR	in % of ARWR	non-conventional	groundwater depletion	total
Countries with water withdrawal above IRWR, but below ARWR:					
Egypt	3 061	95	0.4	2.5	2.9
Turkmenistan	2 280	32	-	-	-
Mauritania	408	14	0.1	-	-
Syria	206	55	2.6	12.6	15.2
Iraq	122	57	-	-	-
Countries with water withdrawal above IRWR and above ARWR:					
Kuwait	IRWR negligible	2 690	52.6	46.5	91.1
Bahrain	5 981	206	21.8	40.2	62.0
United Arab Emirates	1 405	1405	23.4	70.9	94.3
Libya	767	767	3.7	90.0	93.7
Saudi Arabia	709	709	5.5	79.7	85.2
Qatar	559	538	43.5	14.9	58.4
Jordan	145	112	5.3	17.5	22.8

IRWR: Internal renewable water resources; ARWR: Actual renewable water resources.

Sources: FAO Statistics Data Base: http://www.fao.org/ag/agl/aglw/aquastat/regions/neast/index4.stm

In Libya, annual water withdrawal is higher than the volume of renewable resources, the difference coming from non-renewable resources (fossil water). Egypt and Mauritania also withdraw more water than is produced on their territory, but benefit from transfer from other countries through the Nile and Senegal rivers respectively. Niger, Somalia, and Chad, have few internal renewable resources but benefit from important transfers. In these countries, withdrawal is still less than their internal resources, but some of it is already taken from

incoming water. Pakistan, Iran, Sudan and Afghanistan, and Bangladesh have high rates of use of their internal renewable water resources (between 48 and 63%), but benefit from important internal resources as well as from incoming water. Tunisia and Yemen also use most of their internal renewable water resources (87 and 72% respectively), but they cannot benefit from additional internal resources or incoming water. It is likely that these two countries will have to rely increasingly on alternative sources of water in the future (table 5).

2- Groundwater abstraction:

In many IDB member countries, groundwater extraction has increased exponentially with the spread of energized pumping for irrigation and to provide drinking water for the millions of rural communities which are not connected to national water carriers. In Bangladesh and Pakistan, millions of pumps have been installed to tap the shallow water table for both irrigation and water supply. Expansion of pumping technology has often resulted in dramatic declines in the water table in areas of low or zero recharge. Great improvements have been made in the methods of drilling in recent years, thanks largely to technology developed by the petroleum industry. Powerful pumps enable the users to draw large volumes of water via deep boreholes, thus affecting the water table beyond the confines of their property and depleting distant wells formerly considered to lie safely beyond the drilled zone.

Many countries recognized this problem and have introduced regulations for the groundwater sector. But the implementation of these regulations needs enforcement. Also groundwater, like surface water, is a fluid that recognizes no national boundaries. Conflict is common over groundwater use among both private owners or among sharing nations. Criteria for establishing rights and equity in sharing groundwater resources are not adequately clear or well defined in many countries. Where groundwater flows naturally from one state to another, cooperation is needed in areas such as the exchange of information and data required to better monitor and manage both water quality and quantity, and to enforce agreements reached. Especially important is the sharing of information on water recharge, and other changes in water tables in order to coordinate and adjust withdrawal rates among the riparian owners or states.

Yemen, for example, has expanded abstraction of groundwater with the widespread adoption of tube well technology to better deliver groundwater for agriculture and household use. The groundwater is being pumped at a rate approximately four times that of natural recharge. As a result, some productive valleys are experiencing drastic shortage of water and hence being abandoned. Conflict over groundwater sharing and allocation is spreading among the competing users. The overexploitation was the result of decentralized process of drilling wells without adherence to a national water plan. Such plan would have required careful monitoring and data gathering, and regulations which would guide drilling and define priority water use and allocations. The country is now preparing, with the assistance of several donors, a comprehensive water resources management plan which would provide some guidelines to regulate the process of groundwater use and allocation.

A large percentage of the over-all water supply in the Gulf Cooperation Council Countries comes from groundwater resources, mostly non-renewable in nature. (Only in Oman does renewable groundwater represent a significant portion of the water supplies used for domestic and industrial purposes). The water is derived from deep aquifers located in Saudi Arabia and Oman. The water in these aquifers is mainly fossil water which was deposited in these formations millions of years ago. The volume of water stored in these aquifers is largely undetermined, though considerable modeling has been done and more is currently being carried out by the GCC countries. These reserves contain large but unknown volumes of brackish water, and the depth of usable water exceeds 500 meters. There are no tariffs on groundwater abstraction in GCC countries, which led to the cultivation of low value crops such as grains, and high water consuming crops such as alfalfa and green forage for livestock and dairy production.[25]

The over extraction of groundwater beyond safe yield levels has resulted in the pollution of existing groundwater aquifers, due to intrusion of saline seawater and the up-coming of brackish and saline water supplies from lower aquifers. This is particularly serious in Oman, Bahrain and Qatar where major deterioration of groundwater quality has been observed and measured over the last few years. Recovery of the aquifers, even with the introduction of appropriate measures, may take generations. The responsibility of the public water agencies is to ensure that these resources are better protected and sustained for future generations. But available technical skills are limited, and the enabling policy environment is largely restricted. The expansion in and unrestricted use of non-renewable groundwater supplies in many countries (Jordan has also allowed farmers to use the groundwater from the Disi non renewable aquifer) demonstrates the impact of inadequate policies and misguided investment in this sector. The absence of a strategic national water framework to protect the non-renewable water supplies, especially for future generations, is causing many IDB countries to waste precious water resources on activities, such as cultivating low value crops, which have not received adequate economic or environmental assessment and evaluation.

The overexploitation of groundwater may cause serious problems of saline intrusion or ground subsidence. Little information is available on how to effectively manage groundwater abstraction, especially in the internationally shard aquifer such as the Nubian Sandstone Aquifer used by Chad, Egypt, Libya, and Sudan.

This situation could be addressed through carefully developed and articulated integrated water management approaches specifically designed to change the way groundwater being

[25]Main issues related to water resources in the Arab World, with a special focus on the development and use of groundwater and desalination were presented in a special study sponsored by The Arab Center for the Study of Arid Zones (ACSAD), the Kuwait Funds for Arab Economic Development, and the Arab Fund for Economic and Social Development (AFESD). The findings were presented in a special session in March 1997 and were published in Arabic in 1997 by the AFSED "Water Resources and their Use in The Arab Countries". Main issues and data present4ed in these studies have been utilized in this chapter.

abstracted and used. This requires appreciation that groundwater is part of the integrated water cycle in the country, and that it is part of the river basin which includes both surface and below groundwater flow networks. This recognition would be to harmonize water use among high priority social and economic objectives, within a framework that also takes in considerations the water needs of future generations. Efficient management of groundwater resources recognizes that some of the tapped aquifers are connected with the national hydrological network of both surface and underground, and they may also be recharged by the irrigation networks distributing surface water to the fields. As such, managing groundwater becomes an integral part of national water plans.

In Jordan, for example, the public water agency recognized the important fact that aquifers systems and sub systems are intimately connected with portions of the overall hydrological system in the country, and that the patterns of groundwater uses are usually interconnected and often sequential. The government introduced new policy framework to regulate and manage the groundwater subsector. The average annual abstraction from groundwater in all sub basins in the country is about 160% of the annual renewable average of recharge. The recently enacted national water policy is being supported with tough regulations. It prevents the issuing of new licenses for new or to renewal of existing wells; imposes full control on water drilling throughout the country; only hospitals and educational institutions would be permitted to renew their license to abstract groundwater. About 90 percent of all wells are equipped with meters to enforce new volumetric water pricing on abstracted groundwater. Also included in the new framework is new mechanism designed to regularly monitor the status of groundwater resource through observation wells, and identify and enforce actions required for water resource protection and quality control.

The new procedures clearly define the development priorities for each sub basin, set guidelines for water allocations, introduce specific policy tools to install and measure abstraction, and enforce targeted rules to prevent illegal drilling. The policy also provides support for long term research on water quality, on managing shared water aquifers, and on communication and education to the public.

3- Desalination:

The Arabian Peninsula and the GCC countries in particular have historically been faced with extreme shortages of reliable water supplies. The Gulf region is underlain by large deep aquifers which contain non renewable supplies of fossil water. This source has provided agricultural development in some parts of the Gulf, but has a finite life and quality limitations. Because of these limitations, all of the GCC countries have resorted to desalination of both sea water and brackish water to provide high quality and reliable water supplies to their citizens (Table 7).

Seawater desalination in the Arabian Peninsula has been carried out since the 1950s. The process initially used was based on distillation. The scale of operations was usually small.

Reverse Osmosis (RO) plants came on stream in the 1970s. But the technology became commercially well established in the 1980s. The case of water management in the GCC countries is interesting because of the allocation of scarce resource to agriculture to increase food self sufficiency. At the same time these countries are facing rapidly expanding demands for high quality water to support expanding population and growing industries, the governments have been providing subsidies to expand irrigated agriculture.

Table 7 Summary of Desalination & Wastewater Capacity and Production in GCC Countries, 2002

Country	Installed Capacity Mm3/year	Desalination Production Mm3/year	Treated Wastewater Production Mm3/year	Treated Wastewater Used Mm3
Bahrain	138[1]	138[1]	24	24
Kuwait	522	444	258	250
Oman	103[2]	103[2]	10[3]	9[3]
Qatar	178	158[4]	44	44
Saudi Arabia	1278[5]	1022[5]	475	n/a
UAE	952	811	227-265	205

Source: Based on data provided by GCC countries
[1] MEW gives an estimate of 115
[2] Other sources give estimates of 51 and 48 Mm^3 respectively.
[3] Muscat only
[4] The Planning Council estimates production at 132 Mm^3.
[5] Water consumption from all sources is around 2500 Mm^3
(The World Bank, From Scarcity through Reform to Security, Draft Policy paper on Water reforms in the Middle East and North Africa, presented at the third World Water Forum, Kyoto, Japan, March 2003.

The total use of desalinated water in the MENA is estimated at more than 3300 million m^3/year. At an average cost of one US dollar per cubic meter of desalinated water, the region spends more than $ 3.5 billion annually on obtaining water from these sources. In absolute terms, three countries, Saudi Arabia, the United Arab Emirates and Kuwait, are by far the largest users of desalinated water with 77% of the total for the region, with Saudi Arabia alone accounting for 41% (World Bank, 2004 e).

The private sector has been playing an important role in the desalination of water in the GCC countries at an annual current cost of about $3-4 billion annually. Until the 1960s, desalination

plants were expensive and difficult to run. By the 1970s the new Multi-Stage Flash (MSF) distillation process was developed. MSF has been the basis for seawater desalination expansion in other GCC states as well. MSF is the method most widely used on large scale and there is still room for improvement by better computer modeling, make use of low grade heat, and extend the plant's life. Because it can utilized low grade heat MSF is usually installed as part of a dual-purpose plant, along with power generation function. MSF has the advantage over reverse osmosis (RO) because it requires less specialized technical expertise and is much more robust. MSF is more suitable for seawater desalination which has 35,000 ppm (particle per million) of salt or more, while RO is more suitable for desalination of brackish water which has between 5,000 and 10,000 ppm of salt.

The economic analysis for desalination is realized around the issues of production cost and price, and affordability of drinking water. The cost can be subdivided into capital cost and production cost. Capital cost is related to capital investment, whereas production cost is composed of the variable items that make possible the running of the desalination plant. The most single cost of water desalination is energy, followed closely by capital cost. Often 20 year lifespan is assumed for capital, bud some MSF some MSF plants have been operating satisfactorily in Kuwait for as long as 26 years, because of efficient operations and maintenance.

A recent study on the cost of desalination in Saudi Arabia concluded that the production of one cubic meter is one US dollar. It has been estimated that investment of about $16 billion is needed by 2020 to meet the water demand at the current per capita production rate of 300 liters per day.. (Future Strategy for Water Resources Management in Saudi Arabia, presented at the Symposium of the Future Vision of the Saudi Economy in the year 2020, held in Riyadh, 19-23, October 2002).[26]

Many governments in GCC countries see private sector participation as the way forward for managing and operating desalination facilities. The key drivers for private sector participation are: increase access to private capital investment, increased managerial and technological capabilities, increased operating efficiency, and reduced need for subsidies. Criteria for determining the right option for the private sector participation in the provision of desalination services are whether or not capital investment are required, whether or not assets are to remain publicly owned, to what extent the governments want to keep control over the operations, and which risks the governments want to transfer to the private sector.

[26]Investment in desalination is likely to expand inn several IDB member countries. The technology is largely being developed by the private sector. More coordination is required among users to commission private research institutes to develop efficient tools to advance this technology and adapt it to the needs of small towns and communities in IDB member countries.

A set of rules and regulation need to be adopted, defining the roles and responsibilities and transparent process for award of contract to service providers. Where governments design this process, it is to be directed by a regulator, which could be independent or government body.

Table 8. Water Availability and Usage in Middle East and North Africa Countries

Country	Annual Availability				Annual Water Usage		% Use by Sector		
	Natural Renewable Resource Bm^3/year	Desalinated Water Bm^3/year	Wastewater Reuse Bm^3/year	Per Capita Renewable Availability M^3 2000	Bm^3	As a % of Total water Resources	Domestic	Industry	Agriculture
Algeria	11.50	0.07	n.a.	380	4.59	40	25	15	60
Bahrain	0.11	0.14	n.a.	214	0.25	170	26	3	71
Djibouti	0.02	0.00	n.a.	24	0.02	113	88	0	12
Egypt	61.90	00.06	5.90	1060	73.10	108	6	8	86
Iran	129.00	0.11	n.a.	2028	70.30	54	6	2	92
Iraq	80.00	0.03	n.a.	3441	42.80	48	3	5	92
Jordan	0.87	0.00	0.07	193	0.98	104	26	7	68
Kuwait	0.11	0.65	0.12	438	0.76	87	37	2	60
Lebanon	3.20	0.00	n.a	740	1.29	40	28	4	68
Libya	0.80	0.03	n.a	157	3.89	469	9	4	87
Morocco	20.00	0.02	0.07	700	16.84	84	5	-	95
Oman	1.60	0.12	0.02	687	1.22	74	9	1	93
Qatar	0.05	0.12	n.a	293	0.28		23	3	74
Saudi Arabia	2.50	2.28	0.15	162	17.00	506	9	1	90
Syria	18.70	0.00	0.26	1122	14.70	78	9	1	87
Tunisia	3.35		0.14	365	2.53	72	12	4	84
UAE	0.20	0.95	0.14	307	1.60	180	24	10	67
West Bank & Gaza	0.76	0.00	0.01	260	0.44	57	51	49	58
Yemen	2.50	0.02	0.03	145	3.20	126	5	2	93

Source: The World Bank, From Scarcity through Reform to Security, Draft Policy (*The World Bank, From Scarcity through Reform to Security, Draft Policy paper on Water reforms in the Middle East and North Africa, presented at the Third World Water Forum, Koyota, Japan, March 2003.*

A common approach for the private sector participation is the Build- Operate- Transfer (BOT) option, where the private sector party is attracted to develop, design, construct, and operate a facility, against a fixed amount per period or against a fixed amount per cubic meters

of water produced. After a predetermined period (usually between some 10-30 years), the infrastructure is handed over to the government, typically at no cost. Several cities around the world have developed this type of partnership with the private sector to provide desalination services. Under the BOT structure, the private sector has the sufficient control and guarantees to assure this financing. The economic analysis of the of the desalination services would require careful consideration of mechanisms applied for demand management, assessment of current water losses, and tariff structure.

The total quantity of reused treated wastewater in the Near East is estimated at 1200 million m^3/year. Syria, Saudi Arabia, Jordan and Egypt are the largest users of treated wastewater in absolute terms, accounting for almost 66% of all the wastewater reused in the region, with Syria alone accounting for almost 31%. Several countries in North Africa are also investing in wastewater treatment and utilization.

Considering the use of both desalinated water and treated wastewater, five countries account for almost 80% of the total for the Near East (Table 8). It is also the sub-region where the contribution of non-conventional sources of water to total water withdrawal is greatest (8%). Central Asia and SSA countries use the smallest quantity of desalinated water and treated wastewater. The contribution of non-conventional sources of water to water withdrawal is also lowest in this sub-region (0.004%). The contribution of non-conventional sources of water to total water withdrawal is over 30% in three countries Qatar, the United Arab Emirates and Bahrain (Water resources and their utilization in the Arab World, 1997).

4- Drought and associated water risks:

The limited water resources in several of IDB member countries are coming under further pressure because of frequent droughts. Most IDB member countries suffer from variable precipitation, and large areas in these countries are arid or semi arid or desert. Average rainfall in these countries exhibits a large variability as measured by the average departures of about 20-40 percent from the long term annual mean. The variation in the flows of major rivers (Nile, Niger, Senegal, Jordan, Amu Darya and is around 3:1 and can reach 10:1 subject to the variability of seasonal rainfall. These flow variations have a dramatic influence on local production systems, on millions of farmers and their crops and livestock, on pastoralists and fishermen, and on wildlife and the ecosystems. The impact of repeated droughts has been receiving increasing attention by development agencies to support affected communities to better deal with interrupted water flow, damaged irrigation systems, and the substantial harm caused to local communities.

A recent study by the World Bank on the impact of drought on the countries in Central Asia and the caucuses indicates that there is a decline in precipitation of 5 to 15% over the last 70 years. There is increase in temperature in all countries and an increase of 2 to 6 degrees Centigrade is predicted. The study predicts that water deficits and desertification processes would accelerate in Kazakhstan, Uzbekistan, and Turkmenistan. The study assessed the

impact of the drought which affected Central Asia in 2000-2001 and concluded that precipitation levels reached only 40-60% on normal, and river flows dropped by 35-40% below average levels. Irrigation water scarcity became progressively worse during the cropping seasons of 2000-2001, and almost no irrigation water was available for Karalpakstan in the north of Uzbekistan. And the decline in groundwater sources was widespread that trucking drinking water became necessary for many communities.

The study concluded that drought management in Central Asia requires substantial effort in policy reform and capacity building, and more investment in water resources management, including water storage and water tanks. New water allocation mechanism is needed to address the emergency needs of the vulnerable populations. The repeated droughts in this region has caused serious economic, social, and environmental damage such as the loss of vegetation, the loss of domestic livestock and wild life, and associated reduction in agricultural productivity. If the available estimates are reasonably accurate, the drought in Central Asia had significant effects upon the economy as a whole. Some countries lost as much as 5-6 percent of GDP as a result of the drought of the year 2000 (The World Bank, 2004 d).

Unfortunately similar trends have been reported from Sub-Saharan Africa. The frequent droughts have been associated with declining rainfall pattern since the 1940s. Climatic data and rainfall indices in several countries show that this large variability in rainfall patterns is here to stay, with major implications on water systems and irrigated agriculture.

The droughts in Sub-Saharan Africa have also disrupted the lives of millions of people, converted millions of hectares of agricultural lands into desert, a drop of several meters in ground water table levels, and decrease flow rates in all rivers. Sudan has suffered from frequent droughts in recent years. Western Sudan which is traditionally verdant with grasses and shrubs has parched beyond recognition by the droughts of the 1970s and 1980s. The grazing land was deserted, and the communities in most towns and villages migrated in search of water and grass for their livestock. The displaced communities settled temporarily in the Gezira Scheme in search of work and water, adding pressure on already extended water system.

The irrigated area in the Gezira was already drastically reduced. The schemes are irrigated from the Blue Nile which drains the rainwater of the Ethiopian highland. Ethiopia also suffered from the same drought cycle, and the water supply throughout the Nile valley was too low. All the basin countries are at risk in the years of drought. The impact of the drought knows no national boundaries, as the cases from Central Asia and the Nile Valley have demonstrated in recent years.

With the occurrence of droughts in IDB member countries as a fact of life, a major challenge facing these countries is to develop early warning systems for water management and to guide actions to mitigate the damaging effects of the drought on agriculture and water supplies.

Investment in supplementary irrigation would deliver much needed water to the affected communities and to help them sustain their economic activities without being uprooted in search for water for themselves and their livestock.

Managing drought and associated risks under conditions of increasing competition for water use among different sectors is a difficult task. Municipal and industrial water requirements are increasing sharply, while demand for water to sustain food supply continues to add pressure on already poorly managed resources. Also growing demands for energy adds more to the complexity of water management.

Chapter six

Cooperation in managing international river basins

Increasing scarcity, as presented in the previous section, is subjecting the water sector in many IDB member countries to serious adjustment problems because issues of management and allocation extend beyond local communities, but appropriate political and technical basis for collective action is not well established. The bulk of surface water running in IDB member countries is shared by many communities. As Table 9 indicates, several member countries depend on water originated outside their borders. The concept of shared international water can be expanded to include watersheds draining into international rivers, and aquifers shared by several countries. The interaction between the concrete international waterways and adjoining watersheds and groundwater can not be ignored when discussing shared river basins.

Table 9. Countries with a renewable water resources dependency ration above 50%

Country	Internal Renewable Water Resources million M^3/year	Actual Renewable Water Resources million M^3/year	Dependency ratio* %	Main source of incoming water
Kuwait	0	20	100.0	Groundwater from Saudi Arabia
Turkmenistan	1000	71000	98.6	Amu Darya river
Egypt	1800	58300	96.9	Nile river
Bahrain	4	116	96.6	Groundwater from Saudi Arabia
Mauritania	400	11400	96.5	Senegal river
Syria	7000	26260	80.3	Euphrates
Sudan	35000	88500	77.3	Nile river
Somalia	6000	15740	61.9	Shebelli, Juba rivers
Iraq	35200	75420	53.3	Euphrates, Tigris rivers

**The Dependency ratio is equal to the part of the renewable water resources which originates outside the country.*
Sources: FAO Statistics Data Base:
http://www.fao.org/ag/agl/aglw/aquastat/regions/neast/index4.stm

For example, In Africa, the number of international basins and countries that share them offer one way to measure the scale of management challenge presented by African's international rivers. There are at least 34 rivers shared by two countries, and 28 shared by three or more. The largest ten river basins – the Congo, Limpopo, Niger, Nile, Ogooue, Ojkavongo, Orange, Senegal, Volta, and Zambezi are shared by four or more African nations. The Niger River rises in the Futa Jalon Mountains in Guinea Conakry, and flows across all the Sahelian West Africa to its estuary in southeastern Nigeria.

The Nile River, the longest river in the world, depends on the flow of the White Nile from its major source in Lake Victoria in east central Africa, through Uganda and into Sudan where it meets the Blue Nile at Khartoum, which rises in the Ethiopian highlands. From the confluence of the White and the Blue Nile, the river continues to flow northwards into Egypt and on into the Mediterranean Sea. Egypt gets 97 percent of its water from the river. Sudan receives substantial amount from both the Blue Nile and the White Nile before they join near Khartoum. As the countries in the upper Nile basin continue to use more water given rising population and increasing economic growth, Egypt share could be affected.

The greatest rivers in West Asia, the Tigris and Euphrates originate scarcely 30 kilometers from each other, and wend their ways through Turkey, but the rivers are fed with tributaries in Syria and Iran. The Jordan River drains the watersheds in Syria and Lebanon, which contribute more than 60 percent of the annual flow. Syria is in mid stream on the Euphrates and the Orontes (Al Asi), but upstream on the Jordan. The Yarmouk forms part of its boundary with Jordan.

The Indus basin begins in Tibet, and flows through India and Pakistan. The conflict over water in the Indus is on going, with water tables dropping because of groundwater over pumping and basins running dry for portion of the year (Postel 2001).

1- Cooperation in joint management of river basins:

A river basin is the geographical unit determined by the watershed limits of a water system, including surface and underground water. Some of these basins are well developed at the national level. So far, much of the discussion has been on sharing resources according to a wide set of agreements and regulations designed to reduce harm to riparian countries, and to protect acquired rights for water use. Encouraging trends are emerging such as the initiatives being discussed for the Nile and the Niger Rivers which would signal increasing cooperation among riparian countries in joint management of the shared the river basin. IDB has financed joint development projects on the Senegal River, an innovative approach that IDB could advance to include the development of the entire basin. The innovation is in moving beyond the concept of sharing to joint management and could be applied to several basins shared by IDB member countries.

IDB could advise its member countries to lead this trend because a few of the transboundary river basins in these countries are effectively jointly managed. IDB could assist in facilitating an international platform for its member countries to discuss desirable formal and informal treaties. By focusing on these issues IDB may encourage member countries to strengthen political commitment, establish competent commissions and specialized institutions, and facilitate the sharing of information. IDB could also encourage these countries to raise funds to build joint waster projects along the shared river basins.

For example, the Indus Basin Treaty between India and Pakistan concluded in the early 1960s helped reduce conflict over water sharing but provided no guidelines for joint management. Almost 40 years after the agreement went into effect, problems caused by drainage and water logging in the basin are not easily managed because they require joint action by both parties.

While agreements to divide water resources among riparian countries are desirable tools to reduce possible conflict, they are not adequate for the long term sustainable management of the water resources. When the Indus water agreement was negotiated, little attention was given to the future needs of the basin. Since then, the population dependent on the water in the Indus have more than doubled, the population in the growing cities and towns have dramatically increased and the irrigation systems have expanded and caused serious changes in the hydrological cycle and salt balance in the basin.

Similar experiences reported from the Jordan River. When informal agreements allowed for the diversion of river water among the riparian countries, the total population in the river basin was about six million people and only few thousands hectares under irrigation. Now more than 20 million people live in numerous towns and urban centers demanding water from the basin, in addition to tens of thousands of hectares of irrigated agriculture which have been developed in the last 30 years. The individual concern of each of the riparian countries for water use and the limited approach to cooperative water sharing and development along the basin is causing serious challenges to the riparian countries. Especially problematic is the difficult situation each riparian is facing in its efforts to balancing water allocation to agriculture and the growing population. This situation is compounded by progressive depletion of groundwater resources. A new strategy for managing the river basin is urgently needed.

In comparison, the Danube River in Europe is jointly managed by the riparian states (more than 10) through more than 120 international treaties covering almost all aspects of water use including navigation, water transport and freight, flood control, hydropower, pollution control, treatment of waste water and effluence flow from abutting communities.[27]

[27]Worldwide, some 286 international fluvial and other fresh water treaties have been concluded. Of those two thirds concern North America and European river systems, the rest are scattered around the globe.

2-Potential areas for cooperation:

It would be desirable for IDB member countries to establish a suitable model of international cooperation and joint management among riparian states which are also IDB member countries, for example on the Nile, the Euphrates, the Tigres, the Jordan, the Yarmouk, the Orontes, the Senegal, and the Niger Rivers. IDB can take the lead and establish a specialized unit in the Bank to facilitate and motivate member countries to embark on this process of cooperation and joint development.

This cooperation is particularly urgent for member countries in Sub Saharan Africa. Many of the international river basins in Sub Saharan Africa are marginally developed. The growing population and the need for rapid economic growth in the continent would require new approaches to developing the internationally shared river basins. These essential resources need to be properly utilized and managed to meet the immediate needs, and to fulfill the aspiration of the people. Several development agencies are supporting renewed investment in major hydrological infrastructure such as dams, canals, dykes and interbasin transfer schemes, to provide water security against climatic variability in Africa and other regions in developing countries.

The Africa Water Resources Management Initiative[28] sought to strengthen the legal and institutional capacity of African countries to expand investment in water resources. This initiative is based on full stakeholders' participation and ownership. A product of this work is the Nile Basin Initiative which is led by the council of ministers of water affairs of the ten countries sharing Nile Basin[29]. The Initiative strategic action program is guided by a shared vision to develop the basin through equitable utilization of the Nile Basin water resources. The Initiative includes a basin wide program for technical assistance, and sub basin investment programs that will promote poverty alleviation, growth, and improves environmental management. (The World Bank, 2004d, and 1998). The Nile Basin Initiative (NBI) was launched in 1999. It provided an agreed basin-wide framework to fight poverty and promote economic development in the region. A draft text of cooperative framework was produced in early 2000. The immediate objective is to attain a regional cooperative framework acceptable to all Basin countries to promote Basin wide cooperation in integrated water resources

[28]The initiative has been supported by several donors including the World Bank, UNDP and other bilateral aid agencies.

[29]The ten countries sharing the Nile established a forum for a process of legal and institutional dialogue in 1997. The UNDP provided initial funding of about US$ 3.2 million to finance cooperative activities. The Nile Basin Initiative (NBI) was launched in 1999. Cooperation between Egypt and Sudan in managing the Nile water has been productive since the 1920s. Egypt supported Sudan in building Jabal Awliya Dam on the White Nile to better utilize its share of the water. In the 1959 agreement between the two countries, Sudan and Egypt agreed on seasonal sharing of the Nile water for agricultural production through which Egypt produce cotton in the spring and summer months (flood season), and Sudan grows cotton in the winter months. Egypt and Sudan cooperated in building the High Dam, and Egypt supported Sudan in building the Atbara Dam and the New Halfa irrigated schemes to help settle affected people who lost their land under Lake Nasser.

planning and management. The NBI comprised of a council of ministers of water affairs of the Nile Basin (Nile-COM), a technical Advisory Committee (Nile-TAC), and a secretariat (Nile-SEC) located in Entebbe. The basin wide shared vision program includes seven projects. Four of these are thematic in nature, addressing issues related to the environmental management, power trade, efficient water use in agriculture, and water resources planning and management. The remaining three are facilitative, supporting effort to strengthen confidence building and stakeholders' involvement, applied training, and socio-economic development and benefit-sharing. Two subsidiary action programs are being developed: The Eastern Nile currently includes Egypt, Sudan, and Ethiopia; and the Nile Equatorial Lakes Region includes the six in the southern portion of the Basin as well as the downstream riparian Sudan and Egypt. These subsidiary groups have identified joint investment opportunities which warrant further investigation and preparation. An international consortium for the cooperation on the Nile has been established to support the NBI action program.

The international river basins in North Africa, West, Central and South Asia have largely been developed and exploited. The uses of the international rivers in these regions by the respective riparian communities or states are for the most part, being carried out peacefully. But the lack of adequate cooperation and outright disputes among some riparian hinder the optimal utilization of many international water ways to the detriment of all their basin states. Effort are underway by several organizations to address these issues and replace the old divergent approaches representing conflicting interests of upstream and down stream riparian, by an approach that emphasizes international partnership for cooperative and comprehensive management, which would benefit all the riparian communities while ensuring efficient and environmentally sound uses of river basins.

The Bank, while recognizing the political nature of the process, should nonetheless encourage its member countries to develop basin-wide water resources development and protection programs for which funding can usually be used more effectively—attracting funding could be a strong incentive for inducing stronger cooperation amongst riparian states. It should use its leverage over the Coordination Group to bring in more support to regional programs such as the Nile Basin Initiative (NBI) and the Niger River Basin—by their very nature, regional water programs are capital-intensive, making it virtually impossible for the Bank to shoulder the burden alone. Other basins where IDB can take the lead are the Euphrates, the Tigris, and the Senegal rivers.

The attractive feature of this approach would be for IDB to convince the riparian countries sharing the water course to assess the value of the water, not in its limited scope defined by the purpose of its allocation (agriculture, water supply or energy), but in terms of system wide value for the sustainability of the shared water. The system value incorporates economic values, social benefits, environmental advantages, and the protection of the resources for future generations. The total basin wide value is likely to be more than the sum of the individual values captured by each user. The basin wide approach to water management

recognizes the need to support upstream communities to implement watershed protection programs, protect soils and reduce sedimentation, control pollution and waste discharge in joint water courses, and to share the economic benefits realized by downstream users. The shift in focus from assessing the individual user's value of water to enhancing the basin wide value of water is a complicated process (Sadoff and Gray, 2002). Special political and management efforts are needed to strengthen this approach and to develop reliable environmental, economic and social research models and field studies, to assess the trade offs of this approach for the riparian countries.

Experts from countries where such cooperation has been in place could be invited to share their experience. For example, experts from Europe working on joint management of the Danube River, or from several states in Western United State could be invited to share their experience with water experts from IDB member countries. This cooperative approach has achieved substantial results in restoring the vitality of the joint water courses for agriculture and water supplies, for tourism, for environmental protection and management, and for energy. The Colorado River, for example, is being managed by seven states to serve more than 30 million people in the United States. The management program includes banking of water underground to use in trading river water entitlements, address common concerns for the environment, and coordinate actions needed to manage resource allocation of water to agriculture. Successful cases on joint river basin management have also been reported for several rivers in Europe and Australia.

3- Existing models of cooperation:

The main requirement to achieve this desirable change is a strong political commitment from all riparian countries. IDB has a crucial role in facilitating such commitment and to provide the technical and economic platform needed to objectively assess the needs and benefits of each riparian. This role should also include strengthening the analytical tools needed to assess the costs and benefits likely to be obtained as a result of the synergy of cooperation, as compared to the cost of competition for water in terms of lost opportunities especially in years of crises such as floods, droughts and other natural disasters which may affect all or some of the riparian countries. Such events, which have no regard for national boundaries, are occurring more frequently in recent years.

IDB and its member countries can draw on international agreements already confirmed and supported by international fora. The case of 1994 international agreement adopted for the "Aral Sea Basin Plan" is a good example. Recognition by the international community of the importance of bilateral regional and multinational legal strategies has been evident in the recent conclusion of the number of treaties, protocols, and conventions on international water courses.

Such instruments include the 1992 Helsinki Convention on the Protection and Use of Transboundary Watercourses and Lakes. The 1996 Helsinki Rules of the waters in

International Rivers signaled a major shift in emphasis from water allocation to the distribution of benefits, stating, "Each basin State is entitled, within its territory, to a reasonable and equitable share in the beneficial uses of the waters of an international drainage basin." More recently, the focus on joint benefits, rather than only water sharing was supported by the World Commission on Dams in its report "Dams and Development" (2000). Other international agreements have endorsed this approach such as the 1994 Convention on the Cooperation and Protection and Sustainable Use of the Danube River; the 1995 the Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin; and the 1995 Protocol on Shared Watercourses systems in the Southern Africa Region; the 1996 Mahakali and Ganges treaties; and the adoption in 1997 by the United Nations General Assembly of the Convention on the Non-Navigational Uses of international watercourses. An understanding of the magnitude of benefits associated with cooperative management of international rivers will provide critical information for negotiating agreements and joint investments.

At the national level, cooperation among the riparian countries will pursue the benefits of cooperative management only if the proposed implementation agreements are perceived to be feasible and fair. There are, however, no clear international standards for cooperative management of international waters (Sadoff, Whittington, and Grey (2002). The conclusion of the various international instruments listed above, is a strong evidence of both, the recognition by the international community of the importance of international legal norms for enhancing cooperation and managing conflict, and the need for cooperative arrangements to resolve the quantitative and qualitative problems associated with water sharing. (The World Bank, 1998).

At the local, improving cooperation in managing international water ways can only be effective if it is complemented and accompanied by strong participation of local beneficiaries and water users at the national level. Several countries are empowering their local communities to take increasing responsibilities in managing water use and allocation at the local level, and developing alternative institutions to complement national public concern for water resources with local actions and participation. Turkey, Egypt, Pakistan, Yemen, Bangladesh. Pakistan, Niger, Mali, and Indonesia have established participatory water management systems. This experience is still young but more needs to be done to build strong partnership between institutions responsible for better management of the public good aspects of water and local institutions responsible for efficient utilization and application of water for economic and social benefits.

Chapter Seven

Managing financial and environmental risks in the water sector

The sustainability of water as a precious and scarce resource is being challenged by three important factors. The first is financial, because new water resources are increasingly expensive, existing resources are poorly managed and the demands of the growing population are urgent. The second is environmental, because of declining water quality and increased industrial, urban, and agricultural pollution. The third is institutional, because of weak regulatory and legal framework required to efficiently implement policies regarding allocation, management, and pollution of the increasing diversity of water resources. Addressing these challenges requires a cooperative approach, because these issues are complex, affect several players, and require joint actions among the riparian partners and users. No single development agency can address these issues alone, and complexities require specialized experience not always available among IDB member countries

Many development agencies including the Global Water Partnership and other international agencies are advocating that such policy be prepared within an integrated resources management framework. The blocks for building this framework should be clearly designed and articulated. For example, to reach the MDG in water supply and sanitation, IDB would work with other agencies to assist the member countries achieve the required targets by 2015. A framework for this partnership would include attention to the financial viability of the service and the sustainable management of the resources base

1- Pricing policy and financial risks:

As discussed earlier, the cost of developing new water sources is high and the efficiency of managing existing water systems is low. The approach to water pricing is affecting the performance of the sector. Water is a public good commodity needed to sustain the lives of people, their livestock and their plants, and their ecosystem. It is considered a divine gift of nature to which all citizens have inalienable right to access to meet their basic needs. Yet, water is also a utility with important economic value for agricultural production, for energy, for transport and tourism. The challenge facing the IDB and its member governments is to articulate national policies which would define the necessary interventions in the water sector and to protect those areas which are public good in nature such as the delivery of basic water supply services to all households, especially the poor. Public support is also needed to protect the environment, and to better manage national water ways and deltas. At the same time governments need to devise suitable policies and regulatory framework required to guide investment and management of water as a utility which should be conserved because it is needed to generate economic opportunities, and could cause conflict among competing water users.

The signals for appropriate water pricing policies are mixed. The economic cost of water was conceived as simply the cost of building and maintaining the infrastructure necessary to supply this resources; the water running through the system was generally not considered to have a separate economic value. Water scarcity, however, necessitates the recognition of the opportunity cost of water for particular purpose. If a certain amount of water, for example, is used to irrigate crops, the opportunity cost of this water would be the forgone benefits that could have been generated had that water been used for livestock, to produce electricity, or to meet domestic needs, whichever value is highest. Scarcity obligates policy makers when assessing options for water resource development, to look beyond the traditional capital-focused least cost approach to the broader issues of costs. The environmental, social, and economic results brought about by water projects represent real costs top society and should be incorporated into the decision making analysis of water resources management and development options.

The cost of supplying water can be estimated according to the cost of construction of capital and the expenses incurred on operation and maintenance. But this method may not present the actual and full cost of water to the society, because it does not take into account the cost of developing new and most likely expensive sources of water, or the cost to the environment, or the risks and benefit to the health and safety of the population.

Direct and indirect subsidies that lower the price of water for irrigation below real cost generally result in excessive use, and unsustainable services. Current water infrastructure in most public irrigation systems in many IDB member countries needs substantial investments for rehabilitation, modernization, and operation and maintenance. The financial unsustainability of these irrigation systems is the result of poor cost recovery, inadequate pricing of water, lack of accountability, and weak financial and management autonomy of public water institutions. Most of the public irrigation systems are performing poorly. They suffer from low irrigation efficiency, low cropping intensity, unreliable water supply, and non-completion of schemes, and are increasingly becoming a financial burden on government's budget. Pricing water for irrigation well below its economic value is prevalent in most IDB member countries..

Most governments prefer to dam new water course, tap another aquifer, build another water pipeline, or engineer another interbasin transfer. The supply side policy makers give priority to investment in new infrastructure and to developing new water resources. However, IFAD evaluated the impact of pricing on sustainable services to the poor in the in the Communal Irrigation Development Project in Indonesia (IFAD 2000) , and the World Bank carried similar evaluation (World Bank 2004 d). Both findings argue that water pricing are necessary tools for equity distribution and sustainable poverty reduction, particularly in communities facing scarce water conditions. Both institutions concluded that the poor are willing to pay when the services are reliable. IFPRI argues that new water development is not a primary to water resource challenges in the region. One needs to instead focus on water policy and

management to improve efficiency and equity of irrigation and water supply system. (IFPRI 2004).[30]

Pricing water is a complex process and requires thoughtful consideration of local conditions and the purpose for which water is used. Pricing water should be designed as a national policy with special consideration for equity and fair use and utilization. Strict monitoring of the water volumes used and imposing realistic prices in proportion to the amount taken generally cause the recipients to use the water sparingly and to practice water conservation. Most effective are policies that charge for water progressively, in increasing proportion to the amount used. Reasonable water pricing is a mechanism for recovering the cost and to maintain the reliability of the system. Many argue that users do not pay because the delivery system is unreliable. Pricing water per unit volume requires the installation of and maintenance of metering devises, which can be easily sabotaged or by passed. Data from many cities around the world confirm that the poor pay for water sometimes twice as much as the better off residents in urban centers. Many farmers buy water from tube wells and willingly pay much higher rates than government imposed prices. IDB could facilitate objective debate on the role of pricing policies and efficient use and management of water resources in its member countries. Such debate could define the scope of services required by the poor users, and articulate the roles of partners and users in sustaining the viability of water services, especially as public financial resources are limited.

2- The environmental risks of water projects:

The quality and quantity of water running in rivers and streams are highly affected by the watersheds through which water is drained into its final course. Overgrazing, deforestation, and inappropriate agricultural practices account for most of the degradation of the watersheds and the drainage land which feed the water ways. To a large extent, these problems result from, or are exacerbated by, inadequate property rights, poverty, population pressure, inappropriate government policies, and lack of access to markets and credit, and inappropriate technology. Crop productivity losses from degradation are significant and widespread in hilly areas, dryland cropping areas, rangelands, and irrigated areas. In the absence of concerted efforts to protect non degraded soils and to restore currently degraded soils, increasing population and persisting poverty will hasten soil degradation between now and 2020.

Major areas of concern include the watersheds of Ethiopia which drains water into the Blue Nile; the Lake Victoria region which supplies the water into the White Nile; and the Lake Chad Region which drains the water into much needed streams in the semi arid West Africa.

[30] Several studies confirm that water markets, especially from tube wells are active among small farmers. Public irrigation systems, which are largely subsidized, do not always befit small farmers. Alternative water sources include purchasing water from well owners on neighboring farms. Small farmers pay for such services to the well owners. Several studies confirm that residents in poor neighborhoods in many towns in IDB member countries pay higher prices for water from private vendors than residents provided water from public services.

These watersheds have been allowed to degrade because little investment has been allocated to protect their vegetation, and regulate the flow of increasing wastewater from intensified agriculture. Indeed conditions in the Lake Victoria region are so worrisome that the Global Environment Facility (GEF) and the World Bank, and several donor agencies are helping the riparian countries to better manage the surrounding watersheds. The highland areas of East Africa, where only few ready sources of further productivity increases exist are being overexploited by the growing population in Kenya, Uganda, and Tanzania. The lake is infested with alien plants, water hyacinth, and degraded shores. The water quality and flow are seriously affected. The border zone between subhumid and semiarid areas in Africa drains into the Niger and the Senegal rivers. This zone is already being degraded and migration of poor communities is adding considerable pressure on the natural resource base in this zone.

The natural hydrological conditions in the Sengal and Niger rivers allow for the deposit rich sedimentation in the flood plains during the flood season. These areas mitigate the downstream flooding and recharge the shallow aquifers. Vegetation supports large and diverse wild life population. The development of the flood plains for intensified irrigated agriculture is causing conflict with conservationists and local communities concerned about the environment and wetlands. Soil fertility and soil erosion which cause much sedimentation in water ways and reservoirs is a particularly serious problem in Africa where a lack of replenishment of nutrients is leading to rapid deterioration of the vegetative cover and loss of top soil. The importance of better management of the watersheds has been recognized by downstream users including power companies and irrigation farmers. Sustaining the cooperation between the up stream communities requires adequate incentives be made available to them to motivate them to implement protective practices in the upper watersheds needed to protect the flow of clean and reliable water supplies down streams.

Also of concern are the deteriorating basins of the Indus, Tigris, and Euphrates where continued salinization could threaten regional water supplies and agricultural productivity. In the Indus basin, the increasing diversion of river flows has significantly changed the hydrological balance of the irrigated areas in the past century. Initially, irrigation systems were developed without any provision for drainage. Seepage from irrigation canals and water courses, and the deep percolation of this water have gradually raised the groundwater table, causing water logging and salinity. The government of Pakistan has been investing large amount to manage the rising water table, currently estimated at close to three million hectares.

Many irrigation projects in Pakistan, Indonesia, Sudan, Bangladesh, Iraq, and the countries of Central Asia lack drainage components. They have caused water logging and concentrated large quantities of salts that have severely damaged irrigated land around the world. Productivity of about 10 percent of all irrigated land has suffered from the twin menace of water logging and salinity. The salinization of fertile croplands is ruining between one million and one and a half million hectares a year. Moreover, when water is diverted upstream for irrigation and other uses, downstream areas that support sensitive water-dependent

ecosystems, including wetlands, become less able to fulfill their valuable functions, such as filtering pollutants and supporting biodiversity. Important river fisheries have been eliminated by such diversions, and important deltas have been impaired by low flows. Some development projects have displaced indigenous population and deprived poor people, particularly the rural poor, of access to water of adequate quality and quantity to sustain them and their economic activities. This suffering has occurred when traditional riverine communities have not participated in planning and implementing projects and when their needs have not been incorporated in them.

3- Managing the ecology of river basins:

The poorly managed and maintained irrigation system in Iraq, combined with misguided water management policies have caused substantial damage to marshes in the lower reaches of the Euphrates and Tigris. Water logging and salinity have affected about 60 percent of the irrigated areas in Iraq. According to some reports, the total area under irrigation shrank from about 7.5 million hectares in the early 1970s, to about 6 million in the 1980s. Despite its great agricultural potential, Iraq has in the last decade become a net importer of grains to feed its population. Therefore an imperative need has risen to replace the old piecemeal salinity-prone irrigation system. In the early 1990s, Iraq completed the construction of a regional canal (about 565 kilometers long from Mohmudiya, just south of Baghdad, to the Basra "river". The regional drainage canal is draining the reedy swamps. This large drainage system threatens to destroy an entire ecosystem as well as the way of life of the Marsh Arabs.' A water policy with a realistic strategy is urgently needed, supported by well designed operations that would alleviate the damage already caused by ignoring the ecosystem and other issues of national concern.

Another area of concern is the Aral Sea which is shared by five riparian countries. Before the 1960s, the level of the Aral Sea was relatively stable. When the Soviet assigned Central Asia the role of producing cotton, irrigation became necessary in the lower reaches of Amu and Syr Darya. Irrigated areas expanded from 4.5 million hectares in the 1960s to about 8 million in the 1980s. The intensification of irrigated agriculture has led to major water logging and salinization. These problems were caused by low irrigation efficiencies, poor canal construction, and the absence of drainage work. This problem was further aggravated by the fact that farmers in the Aral Sea basin used high level of subsidized inputs such as fertilizers and pesticides which caused damage to the quality of groundwater but the extensive withdrawal from the Amu Darya and Syr Darya have caused the traditional ecosystem of the two deltas to perish. The marshes and wetlands and their rich biodiversity which covered more than half a million hectare are giving way to sand deserts. More than 50 small lakes, covering the deltas, have dried up. The Aral Sea is drying up. Its level has dropped by 17 meters, its water surface by a half, and its volume by three quarters.

At their independence in 1991, the five newly emerging Central Asian Republics, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan, recognized the urgency for

action. At their request, UNDP, UNEP, the World Bank, The European Union, and other international agencies provided support in assisting the five countries in elaborating their ideas for long term solutions. This action culminated in the adoption by the five Central Asian Republics of a comprehensive Aral Sea Basin Program (ASBP) in January 1994. Donors have already met to help the countries implement salient features of this program which include: stabilize the environment of the Aral Sea Basin, rehabilitate the disaster zone around the sea, improve the management of the international waters of the basin, and build capacity of regional institutions to plan and manage these programs. The program is likely to cost billions of dollars and will take years to complete.

A similar case of damage to the environment as a result of over use of water for irrigation is now unfolding in the Jordan River basin. After years of diverting water to irrigate thousand of hectares in the riparian states, the flow of the Jordan River into the Dead Sea is almost insignificant. The Dead Sea is drying up. The surface area of the Dead Sea was about 1000 square kilometers. Since the diversion of the northern streams that had fed it over centuries, the level of the Dead Sea has fallen over the last three decades by some 20 meters (from 390 to 410 meters below sea level. Consequently its area has shrunk to little over 700 square kilometers. The Dead Sea will continue to shrink as long as the amount of water evaporating from it exceeds the amount flowing into it. It is estimated that the evaporation rate is about 1.6 billion cubic meters per year) (Hillel 1994). The hydrological balance in the valley has been altered. Deep saline groundwater is contaminating water wells, and farmers are facing difficulties in using brackish water for high value, but mostly saline sensitive crops.

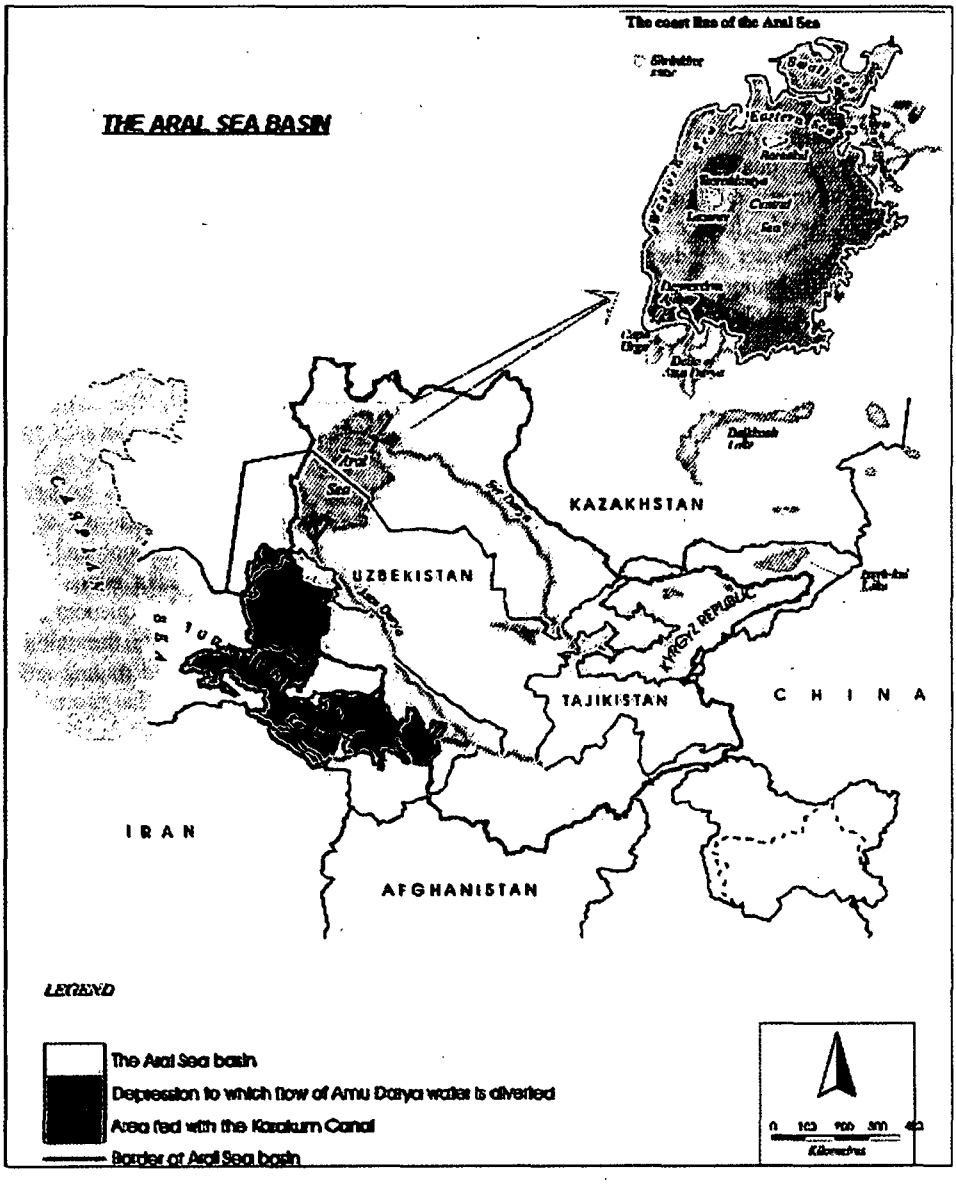
The Government of Jordan is currently mobilizing support to solve this problem through an expensive and ambitious plan to build a water carrier to draw water from the Red Sea to the Dead Sea to replenish the lost flow of the Jordan River.

4- International cooperation to manage the environment:

The cases described above illustrate the high environmental cost of developing extensive irrigation without sustainable water management. The poor management of water in agriculture has caused many agencies to question the wisdom of this investment. To avoid the repeat of these glaring failures and associated damage to the environment, IDB could coordinate with other donors to assist member countries to strengthen safeguards in all water projects. These safeguards could involve riparian countries, especially those sharing drainage watersheds and waterways. IDB could assist in building strong partnership among these countries and ensure that such investments in water projects do no cause harm to the environment that all potential risks are carefully identified and mitigation measures are in place to address possible negative side effects.

The cost of addressing these requirements have added both financial and technical burdens on water agencies and may cause further delays in attracting financing from investors or public budget to implement much needed water improvement schemes. Irrigation in particular could

be the results of these issues. However, this decline in investment in the water sector may cause more problems for future generations. The large investments already sunk in developing water and irrigation schemes have created valuable assets for IDB member countries. But these assets require upgrading and modernization, without which the benefits of this investment would gradually vanish, and indeed may cause losses to the national economy. New management tools are needed to maintain these assets, and to sustain them in high performing shape for future generations. Future generations are likely to meet harder choices to expand and develop future water resources. The old investments need new supplies of modern technology, add value to existing systems, and remedy problems created by unforeseen negative impact when these investments were planned and implemented. IDB in coordination with other donors could assist member countries in upgrading their water system, improving their management, and implementing the required safeguards.


THE ARAL SEA BASIN
The coast line of the Aral Sea
KAZAKHSTAN
UZBEKISTAN
TAJIKISTAN
KYRGYZ REPUBLIC
C H I N A
IRAN
AFGHANISTAN
LEGEND
The Aral Sea basin
Depression to which flow of Amu Darya water is diverted
Area fed with the Karakum Canal
Border of Aral Sea basin

Box 6: Managing water Quality: Bangladesh Arsenic Contamination of groundwater

Another case from Bangladesh is the mitigation plan to address arsenic contamination of ground water. Arsenic contamination is threatening to undo past achievements in the delivery of safe water supply. The arsenic-induced health crises in Bangladesh have its roots in the country's successful story in implementing the UN International Water Decade for water supply and sanitation. With the assistance of different donors and voluntary and non government agencies, Bangladesh managed to shift water supply, especially in rural areas, from surface water that was generally highly contaminated with fecal microbes, to microbiologically pure groundwater. The shift to tube well-water in Bangladesh, presently supplying 97 percent of the drinking water to the rural population, has been credited with dramatically decreasing the incidence of diarrhea and cutting in half the rate of child mortality related to water borne diseases.

Now that the unanticipated problem of arsenic contamination has surfaced, the government is determined to preserve those gains, and to build on the lessons learned during the last decade, while preparing to confront a serious problem of chemical contamination of groundwater of such magnitude. Without exception, the poor suffer most from this problem. It is estimated that about 20 million people in Bangladesh are presently exposed to dangerous amount of arsenic through groundwater. The government has approached these issues through stronger involvement of local governments and communities. The contamination crises is causing drastic institutional reforms for transforming government agencies from "providers" of services to "facilitators", assisting local government and communities help themselves. The government is searching for innovative institutional arrangements and service delivery systems that clearly define new roles and responsibilities for user communities and local government institutions; the goal is to bring them to the forefront of activities related to planning, implementation, management, and accountability for water services.

An important lesson learned from this experience is the participation of the private sector, which promoted the sale of water pumps and encouraged rural communities to invest in drilling water wells. This was a welcomed partnership in expanding water services. The private sector, however, could not assist in solving the contamination problem. It highlights the importance of the government in managing the water sector, in designing policies and legal frameworks for rules and regulations to protect the consumers, and to acknowledge that market forces alone do not always address serious issues related to the delivery of safe water to the poor communities. While acknowledging that the wide adoption of innovative water supply technology including inexpensive pumps were made possible by the active participation of the private sector and voluntary agencies, government intervention should be balanced, carefully defined, and targeting areas where public safety and health are concerned, and not to replace the dynamic role of the private sector in delivering on this service. Governments alone can not meet the growing demands for safe water supplies for millions of households.

Source: Groundwater- Legal and Policy perspective World Bank 1998

Chapter Eight

Institutional structure for allocation and decentralized management

1. Fragmentation vs. Decentralization:

Many governments have revisited their approach to water resources management, and introduced elements which allow for comprehensive management of the sector. But some countries are more committed to this holistic approach than others. Usually government activities are generally organized so that each type of water use is managed by a separate department or agency -- for example, irrigation, municipal water supply, power, and transportation -- each responsible for its own operations and independent of the others, without strong linkages among them. Issues related to the quantity and quality of water as well as health and environmental concerns are also considered separately, as are matters related to surface and groundwater. Problems of uncoordinated and fragmented decision making are numerous. Several IDB member countries are consolidating water agencies under one ministry as is the current situation in Jordan and Saudi Arabia. But other countries have to restructure their water departments.

Resolving these problems is particularly difficult in a federal government structure, where states or provinces have jurisdiction over water in their territory. In such cases, individual states may develop the same water source without considering the impact on other states. Similarly, domestic, industrial, and commercial supplies often are provided by local government units, which are not coordinated with provincial or national water departments. This detachment may lead to situations in which different agencies are developing the same water source for different uses within an interdependent system. Current planning and investment in the water sector failed to take account of the interdependencies among agencies, jurisdictions, and sub-sectors.

Many IDB member countries would benefit from conducting a critical review of the current structure of their public water agencies with the objective of restructuring them to better meet current and future challenges facing the sector. Restructuring of water agencies requires a strategic framework defining priority the functions of the public water agencies, and the priority skills needed to perform these functions. This reorganization and shift in functions should be treated more than a bureaucratic approach to manage fragmented staff and offices. Departments responsible for water planning are usually less qualified to conduct for monitoring and evaluation, enforcing rules and regulations, and conduct research on salient issue of water management and development.

There are several examples from IDB member countries where conflicting planning have affected efficient water allocation and utilization. In some countries, departments responsible

for land management promoted the need for expansion of irrigated areas in order to fulfill political and equity objectives. The expansion could happen without adequate field studies and critical consultation to ensure that there is indeed enough water to efficiently irrigate the new lands and to ensure that investment in new irrigation is economically justified. But in some cases the expansion has added pressure on already over committed water in the existing command areas. Inadequate water availability has resulted in low cropping intensity and low economic rate of return on investment in irrigation.

There are possible causes for these inefficiencies. Governments tend to base their plan to extend irrigation or to build water projects on political and social drivers rather than on well studied and sound technical and economic factors. Governments have traditionally designed water policies and investment plans, developed irrigation schemes, operated and maintained them, and allowed the users to become progressively dependent on government support. Also the heavy involvement of the public agencies in all aspect of water management from planning to operation and maintenance has stretched an already over committed and poorly resourced public services. Their performance would eventually be of low quality, or deliver services not always reliable. In many cases users are not invited to take responsibilities for designing and developing water operations which would affect their lives.

A recent report on water management in the GCC countries identified several institutional and legal constraints. Except for Saudi Arabia and Oman, where decisions regarding the water sector are coordinated by one central public agency, water management in other GCC countries is highly fragmented. This frequently results in conflicting policies, political competition among agencies, and the lack of a comprehensive and coordinated policy for the allocation, management, and use of water supplies. (World Bank, 1993, 2004 c).

The structure of many public water agencies is still heavily dominated by experts engaged in building water infrastructure, designing investment projects, and operating and maintaining such schemes. Many of these experts believe most water problems can be solved though more infrastructure. There is a need to bring a balanced structure between infrastructural development and management, and policy planning, strategic analysis. And impact assessment and modeling of various policy options.

2- Management beyond water crises:

Water issues usually attracts the concern of political leaders, both at the national and local levels, especially in times of crises, and these are many because of repeated droughts and associated water shortages and scarcity. High level public officials in the water sector are frequently engaged in water crises management, thus leaving little time to concentrate on long term strategic planning in partnership with other players form affected sectors. It would be desirable to establish specialized multidisciplinary teams of expert to handle problem solving and crises management, and devolve the responsibilities to the local levels, guided by national strategic goals. By doing so, the main function of public agencies would become mainly

focused on policy planning and monitoring strategic dimensions of implementation, especially as related to rules and regulations designed to improve and protect water resources. The case for increasing decentralization becomes stronger as IDB member countries attempt to meet the MDG in extending water supply and sanitation to millions of their citizens. Since most of the households live in scattered communities, mainly rural, the source of water is likely to be local. Most countries do not have centralized national water carries with branches to reach scattered communities. The decentralization allows for efficient response to the local needs, and to design realistic structure suitable to meet the local conditions.

Most investment programs and associated reform packages provide support for institution building and capacity enhancement. The challenge here is to articulate a comprehensive framework to manage the water sector and to engage major stakeholders, including the private sectors and consumers, into the decision making process needed to better sustain the services. Other elements of this approach include a shift in planning from only engineering and construction of new facilities to a more comprehensive planning of the economic, financial and social needs of the water sector. This shift should be supported by increasing reliance on decentralized services and management system at the local level. The decentralization process should be supported by a clear legal framework for each partner

The integrated framework should also articulate policies to guide water and power pricing and cost recovery. Power is increasingly used for pumping water from deep aquifers. Subsidy on power prices adds more distortion to the national effort to better mange water resources. Reform in water policies can not be carried out in isolation from reform in the agricultural sector, especially in commodity pricing and trade. Because governments tend to justify subsidies to irrigation on the grounds that farmers are required to sell portions of their production to government agencies at pre-determined prices. Pricing policies in water supply and agriculture in many developing countries tend to favor subsidies and to promote inefficient, inequitable and environmentally non-sustainable allocation of scarce land and water resources.

The water situation is usually volatile in many countries. It requires dynamic management to address changes from season to season, such as better management of drought and scarce seasonal supplies, dealing with flood and natural disasters and water quality. In addition visionary management is crucial to handle the normal planning and implementing long term operations, and at the same time articulate policies and investment plans to sustain the resource base. The overall functions should be carried out within national strategic goals for the water sector, such as strategic shifts in water allocation among sectors, introducing new pricing policies, draft new rules and regulations to address evolving situation in groundwater abstraction, design plans to clean public water ways from industrial waste and pollution. These functions are dynamic and require the regular updating of staff skills, and the recruitment of new types of expertise. It is difficult to expect that public water agencies which

remain traditional in their approach to staffing and to managing water would be able to lead this sector as it faces mounting challenges described earlier.

Most irrigation and water supply and sanitation projects financed by donors in developing countries reported management problems because of rapid turnover, overstaffing, and political appointments of senior staff. An important recommendation resulted from this experience is that services be decentralized, and investment projects be administered at the local level, with strong engagement of the beneficiaries. For this recommendation to be credible and implementable, project finances should also be decentralized. This issue received much attention when discussing water prices and cost recovery, and also when discussing the case of reforming the Office de Niger in Mali, described earlier, provides good field example for actions being taken by many countries to reform the institutional structure of public water agencies. Where pricing and cost recovery have been introduced, there is a common complain by the users that they have not seen the money invested in improving or maintaining their water system. Instead the money is usually sent to the central treasury department.

3- Financial autonomy:

There are experiences where public water agencies perform their services within a corporate structure. The agency raises its own funds and collects fees for operations and maintenance from the users. The agency is obliged to act like a corporation and strive to achieve a high level of efficiency by keeping only needed staff, and respond quickly to the users needs. Government financial support for the agency is determined by the scope of public services and duties carried out for strategic national objectives. It is essential for public agencies to succeed, that they enjoy financial autonomy with strong public participation to ensure transparency and accountability.

Among the important duties of the public agency are to deliver quality service and to set prices and collect them. Users generally do not pay if the service is poor. Studies show that poor people are also willing to pay as long as the services are reliable. This corporate model is being advocated by many development agencies to ensure that water services are efficiently delivered and its cost is adequately recovered to sustain the quality services. The financial viability of the national public water agency is a necessary but not sufficient factor to measure success. Other aspects of the performance deal with social and environmental issues such as delivering water to the poor, managing and delivering water for environmental objectives such as sustaining biodiversity and wetland habitats, and managing, testing and monitoring water safety and quality to reduce health hazards.

The overall performance of public agencies is measured by a complex set of indicators of which financial sustainability and improving cost recovery is only one dimension. Other non economic and non financial dimensions are becoming more important within the context of comprehensive water resources management which is being strongly advanced by many countries. Weakness in the non financial dimension may render the policy shallow and divert

decision makers from paying attention to the long term impact and possible negative consequences. There are main areas where the institutional capacity can be monitored and improved:

4- Water allocation and management:

The trend for water demand, as discussed earlier, is the rapidly increasing usage for household, industrial and other purposes. Community needs will double, and industrial and power requirements will multiply. Competing sectors create further demands without much effort on their side to reform and to restructure themselves to become more responsive to the changing conditions in the water sector and in the social and economic framework which guide the allocation process. Some argue that the establishment of a market approach with proper pricing mechanism for water as a utility would allow the allocation process to provide water to the most efficient users. But market failures in water services are many. The complexity of water use for social and environmental purposes requires innovative tools and guidelines to allow for equitable water allocations, including future generations. Policy planners and water practitioners tend to give priority attention to present water demands and supply, with little concern to also managing water resources as a trust for future generations. The allocation issue, especially as related to groundwater management, and investment in the construction of infrastructure that could affect the flow of rivers and deltas, should consider the long term impact on the society and the environment.

Water allocation among competing sectors is a difficult issue in many IDB member countries, because of political intervention, poor pricing policies, and weak operational capacity. Water and irrigation agencies in many countries have become progressively more outdated in both technical and management skills. Sectoral needs, including multi-sectoral planning have become urgently needed. New management framework is needed to address the increasing diversity in water resources and water quality in many countries some countries such as Jordan, Saudi Arabia, Egypt and others. These countries are using water from surface water, from groundwater, both deep aquifer and brackish water, seawater desalination and from treated wastewater. Managing and allocating such diversity of resources require new institutional framework and new skills.

Water allocation has become a highly specialized task with major implications on the health of people and the economy of many countries. For example, allocation of wastewater to agricultural crops has caused farmers to lose important markets which do not allow the importation of agricultural commodities contaminated with waste water. Meeting high food standards and food safety requirements in export markets requires close coordination between public agencies serving agriculture and water. The allocation of scarce fresh water to agriculture, even to irrigate high value crops such fruits and vegetables for both domestic and export market, while economically attractive for some producers, may have negative effect on other sectors especially the quantity and quality of water supply for the households in nearby urban and rural communities.

The management of treated wastewater is also a growing concern for many countries. Some costly mistakes have been committed in handling wastewater. Jordan for example lost the use of King Talal Dam for storing much needed fresh water from the Wadi Zarqa. The dam was converted to store treated wastewater from nearby towns and urban centers. The fresh water lost to the dam was probably more valuable than the treated water collected and stored. The decision to convert the dam was the result of poor coordination between the expansion of treatment facilities, and the utilization and disposal of treated wastewater. A more thoughtful solution could have been to evaluate the risks and benefits of other options, such as, for example, the construction of special piped networks to transfer treated wastewater to well defined areas according to agreed set of standards, rules and regulations. The country learned the difficult and expensive lessons of managing wastewater over several years of trial and error. Such efforts should be subjected to careful research and planning, and be subjected to extensive analysis and evaluation of alternative options.

As wastewater is likely to become a major source of water in many IDB countries, their use and allocation would require special policies and action plans based on scientific framework. Such effort would go beyond the engineering design and alternative technical treatments of wastewater to cover issues related to health, environment, and users concern and priorities. Most GCC countries have invested in this sub sector and are allocating wastewater to irrigate non food crops such as fodder, and to irrigate urban parks and public gardens. The use of this water suffers from low efficiency and poor targeted objectives.

Properly designed water allocation policies also assist in long term conflict resolution over water rights. Recent rules regulating water allocations in many IDB member countries have their roots in Islamic laws which have evolved a sophisticated set of principles to regulate water management in order to minimize conflict. Accordingly, wells are protected by specifying that the digging of additional wells must be distanced apart sufficiently to avoid mutual interference. The right of upstream for water use is protected as long as it allows downstream users their basic needs (Hillel, 1994). The concept of water allocation should also be treated as a dynamic process which has to respond to changes in demography, industry, environment and economic activities. Governments traditionally approach the process of allocation as a dependent variable needed to satisfy the growing demands of powerful interest groups such as farmers and land lords in urban centers. These users usually demand the allocation of more water to protect and advance their assets. But water allocation can also be used as a powerful tool to guide the process of future planning of agriculture, urbanization and industrialization throughout the country in an effort to reduce the mounting pressure on already crowded mega cities in IDB member countries. and accelerate rural development and non farm employment in rural areas.

5- Implication of water allocation on land use planning:

A more aggressive water allocation policy could be coordinated with land use policies to regulate unwanted growth in already crowded urban centers, and to provide incentives to build

new housing projects, and encourage local industries to move to targeted, less populated and economically poor regions. The objective is to use water as an incentive to attract investors who can create jobs and economic opportunities in these regions. Instead, several governments are investing in large water conveyance projects to bring additional water to the already crowded cities. This vicious circle deprives the distant population from much needed water, and creates incentives for more people to migrate to large towns where water is delivered, and where better social and economic activities are available. The unplanned growth in most urban centers in IDB member countries has been made possible by providing more water for new expansion of suburbs, many of them could be of marginal living quality.

Policy makers concerned with urban water supply and sanitation could be encouraged to use the increasing water scarcity as a tool for better management of unchecked urban population growth. By using water allocation as a powerful tool to direct and define city planning, policy makers would turn the concept of delivering water services from being a dependent sector expected to serve other demanding sectors, to an independent and powerful player in the development process in many IDB member countries. Traditionally, managing water allocation has been considered by policy planners as a subservient sector at the service of the growing urban and industrial needs. Time has come to reverse the process, employ the water sector to define the priorities and guide the urban and industrial development process. Historically communities settled close to the water resources, such as springs and water streams. Modern technology has allowed for expansion of communities away from these resources.

It is also common to observe in many IDB member countries the ad hoc nature of land use and city planning which makes water delivery services more expensive. The current pattern followed by many IDB countries to build and expand urban centers, and to extend irrigation by constructing long water conveyance projects may have reached the limit of economic and environmental sustainability. In addition, lack of proper land use planning encouraged land lords to sell highly productive agricultural lands for urban development. There are many cities in IDB member countries which have been expanding at the expense of surrounding agricultural lands. Policy makers could insist that urban growth should be encouraged to expand only in marginal or in poor rural areas rather than to expand around existing mega cities. The current expansion has been achieved at the expense of nearby agricultural communities. This growth is largely fueled by migrants from poor areas in search of employment and better social services such as schools and drinking water supplies. Many countries are concerned about the increasing encroachments of cities on agricultural lands, and to compensate for this loss they propose the development of irrigated agriculture on marginal lands- a more expensive alternative than keeping irrigated agriculture where it can excel economically and biologically.

Water is becoming more precious and scarce. New thinking and strategic approaches should guide a new way to manage the water sector as a determinant factor in the national

development plans. Urban development and expansion, and agricultural growth should be encouraged only if they are built next to available and sufficient sources of water. The shift in strategy in using water allocations as an instrument for realistic long term urban, industrial, and agricultural planning could be achieved with strong partnership with public agencies responsible for land management and registration.

Using water allocation as a tool to guide equitable development can be accomplished by supporting large investment in developing rural water resources and to encourage small business and industry to expand in rural areas, using targeted incentives, and restrict allocations of subsidized water to crowded urban centers. This shift, if acceptable by policy makers, is likely to be a long term process which requires the engagement of both the political leadership and the macro economic planners in the country. Allocating water resources to guide long term national urban, industrial and agricultural development plans is too important a function to be left to the urban or water experts alone.

6- Institutional cooperation and partnership:

The participation of the beneficiaries has been found to increase ownership, improve performance, and establish sustainable environment for project impacts. Projects which empowered the communities to take increasing responsibility in the design and implementation were found to be more effective in addressing local needs. The beneficiaries also made important contribution to improving the services delivered by public agencies. In the case of water, empowering the beneficiaries could result in more efficient delivery, reduced tension and conflict over water use, and higher rate of recovery for services rendered. The new models of enhancing community ownership and empowerment allows the establishment of reliable partners who can share the responsibilities for delivering, operating and maintaining water services, and reduce the burden on already extended and poorly resourced public water agencies. But partnership in water projects should be carefully guided, because other dimensions of water services, such as drainage, waste treatment, and protection of the public goods such as the environment would require strong support from the national public agencies.

Public water agencies need to be selective in the responsibilities they assume for water resources. The principle is that nothing should be done at a higher level of government that can be done satisfactory at the district or community level. Water agencies need to position itself along the continuum of services which include responsibilities to delivering public good services, allowing for strong community ownership through the full engagement of water users and the beneficiaries and their supporters in the informal sector and non-government organizations, and with the private sector. The objective is to enhance opportunities to expand services and to sustain the efficient management of water resources.

a) Water users and grass roots management: Experience gained from implementing several water projects in IDB member countries and elsewhere indicates that

efficient water services could be achieved with increasing the financial autonomy of the water agencies. As reported earlier, the success of rural water supplies in Senegal and Bangladesh was largely caused by strong participation at the grass root. Operation and maintenance of rural water supply, and also of irrigation systems do not improve if they are dependent on a central water agency, which most of the time is dependent on budget allocation unrelated to fee collections and, often, to performance. The financial decentralization of the water agencies in Morocco, Tunisia, and to some extent in Egypt, Indonesia, Niger and Mali, has provided a practical model for institutional change and restructuring of public irrigation authorities. This model is based on reorganizing the irrigation agency into commercial water-service units that are public with consumers strongly involved in management. It was also observed from these projects that when their budgets depended on the collection of water charges, the agencies took interest in what the payers wanted done and how the payers evaluated the agencies work. Often financial autonomy means assigning both the collection of fees and responsibility for operation and maintenance to users' group.

The results of these projects also confirmed that the participation of users in planning, managing, maintaining, and operating water facilities brings many benefits. This participation increases the likelihood that these operations will be well maintained and contributes to community cohesion and empowerment in ways that can spread to other development activities. This approach justifies the need to consistently promote the organization and strengthening of water user associations as a means to enhance participation and effectiveness in water management. In addition, governments benefit directly. Financial and management burdens on government that result from administering water allocation can be reduced through user participation in both urban and rural areas. Depending on the social context and local conditions, such participation can progressively increase in intensity over the project cycle, from consultation at the design stage to the actual operation and management of some parts of the system. In projects in Pakistan, Bangladesh, Niger, Mali and Senegal, users not only participate in establishing rural water and sanitation systems but also operate and manage them.

In irrigation and rural water supply projects, user's participation helps promote sustainability by ensuring that design choices and operational practices are consistent with local farming requirements and capacity. Such projects are more likely to be valued and maintained by the local population than projects without these elements. Governments realized that by involving strong water user associations in project management and fee collection at the local level, they can use the capacity of community members to exert social pressure on their neighbors to pay. Equally, because association-managed systems have a consumer orientation, they are likely to provide better services and improve willingness to pay. There are early signs of significant progress in using water user associations, especially in small- and medium-size systems to manage and operate and also allocate water among users. Governments can play an important role in fostering user participation by providing technical training for water user associations

and community or institutional organizers. Local Non-Government Organizations (NGOs) can also help organize and train water users.

There is growing support to build and manage water projects through community participation and empowerment. Many development and funding agencies provide funds to strengthen and empower local communities to take full responsibilities for development of water resources in their locations. Several successful projects have indicated that empowering local communities and establishing users group is necessary but not sufficient for successful implementation and sustainability of the investment. A recent review of the this experience indicates that while desirable, local participation and users engagement should be supported by a clearly defined national strategy which defines the role of these groups and how they could complement and be integrated into the larger national plan for water resources management. The sustainability of these groups is also at risk, because their functions were financed by projects largely supported by outside agencies. Also noted that that strong technical assistance is needed to strengthen both the organizational skills of the users, and improve their technical capacities to manage and operate their schemes.

The Niger private irrigation promotion project which started in 1977 demonstrates the successful partnership with water users association. The Niger association for promotion of private irrigation grow from a small group of farmers to include more than 13, 500 small farmers. The association provided training, extension, and technical assistance to member farmers in designing irrigation schemes and selection of appropriate water technology where needed. The association promoted the adoption of treadle pumps and promoted modern pumping and on farm water delivery system. Farmers paid the full cost. Areas under cultivation increased by about 63 percent, and yields of cultivated high value crops increase between 27-32 percent. The project made significant contribution to the irrigation sector in Niger. Such partnership confirmed that, properly designed, small irrigation in Africa can succeed, and that community ownership of such initiative is essential to its success.

b) The informal sector: None government organizations (NGOs) and civil society are active players in the delivery of water supply and sanitation, especially to the poor. They can lead and advise actions at community level. Water agencies in some developing countries are doing their jobs better by increasing the involvement of the informal sector in the preparation and implementation of water projects. An increasing number of NGOs are involved in the early stages of water projects (identification and design). They provide crucial background information on social and environmental conditions during the early stage of strategic and project planning. In Egypt, Bangladesh, Pakistan, Mali, and Niger, local NGOs have been participating in water projects and ensured that the views of people who will be directly affected by projects are taken into account. These NGOs work with local communities to prioritize and develop action plans, organize users' groups and involve them in the design and management of water and natural resource development activities.

c) The private sector: During the next ten years, the financial requirements for investment in irrigation, hydropower, and water supply and sanitation in IDB member countries are likely to reach several billion dollars. The public sector has been the primary source of investment capital for the water sector. The future investment needs require that the share of the private sector to substantially increase. The move toward greater reliance on financially autonomous entities, private firms, and water user's organizations should open up new sources of private capital. Some of the autonomous entities and holders of operator contracts, once they prove to be financially viable, will be able to borrow from local and international capital markets. Water user associations would be able to obtain some investment funds from their members.

The legal hurdle facing the private sector when investing in water would be mainly in securing water rights. Appropriate legal and institutional reforms in the water sector must provide secure water rights vested in individual water users or group of water users. In some countries these rights should be tradable, which further increases the incentives for efficient water use and the increasing participation of the private sector. Such reform can empower water users, provide investment incentives, and increase flexibility in managing and allocating water.

Until recently, private sector participation in the water supply sector was limited. In the GCC countries the private sector owns some desalination plans, and in administering the production of electricity and desalinated water. However, in the past few years the private sector has increased investment in the water sector where water rights and legal framework have been established for trading in water.

Various innovative forms of investment have emerged. The most common form consists of concessions secured through competitive bidding. Typically, facilities are leased to the private operation, who contributes investment capital and who operates and maintains the facilities for a period of twenty to thirty years. Such arrangements are common in Cote d' Ivoire, Niger, Senegal, Jordan. France, Guinea, Portugal, and Spain and have been recently adopted in other countries. Many countries in Eastern Europe and Latin America are contemplating similar approaches. Early in Chile's reform of water service delivery, the public water company in Santiago began using private contractors to read meters, maintain pipes, and handle billing. This shift raised staff productivity to the highest level among water and sanitation companies in Latin America.

For sewerage systems, even in countries with a long history of private sector participation as, for example, in France, concession contracts are relatively rare. The predominant form of private involvement in sewerage systems is public investment coupled with a private management contract typically for ten years. In irrigation, private sector participation has had notable successes in the sale, operation, and maintenance of tube wells, especially in Bangladesh, India, and Pakistan.

While new sources of funding is necessary for expanding and sustaining the delivery of water services to the millions of people in IDB countries, the role of the private sector is likely to be limited, (World Bank 2004 d). The private sector showed strong interest in investing the water sector in the 1990s and targeted low risk markets in East Asia and Latin America, and was largely. But this interest has declined since the later part of the 1990s. Worldwide only about 5 percent of water services are provided by the private sector. The argument promoted by some water experts about the need for private sector engagement is that it delivers efficient services, and it can raise additional funds from commercial financial institutions.

The engagement of the private sector requires drastic reforms in pricing water, in water rights and water markets. There are crucial areas where partnership with the private sector can be encouraged including the desalination of sea water and brackish groundwater, in wastewater management and treatment, and in joint construction of multipurpose water projects involving energy and power generation. It is argued that partnership with the private sector to operate and managing water supplies and water delivery system should be handled with full transparency and objectivity. The experience of several countries which contracted commercial water agencies to manage their city water supplies and reduce waste and unaccounted for water which was usually used by costumers, some of them poor, did not reduce the financial burden on the public budget. There is a notable decline in the engagement of the private sector in this service.

Selling water to costumers in many urban cities and their slums is not an attractive commercial venture for the private sector. This sector could become engaged if capital investment is financed and subsidized by public funds. Some countries like Jordan, Tunisia and Lebanon, and the GCC countries are reforming their rules and regulations to allow for stronger partnership with the private sector within a framework which serves public good purposes, and within clearly defined roles and responsibilities. Such reform is strongly desirable as different water resources, such as saline seawater, wastewater treatment and utilization, abstraction from deep groundwater aquifer would require partnership with the private sector to assist in developing and managing this complex process.

7. Research and development:

The complexity of water management and allocations requires an aggressive approach to long term planning based on strong research and scientific tools for developing, delivering, and managing water resources. There is an important role for research on the design and modeling of supply and demand and other expected changes in the society. Several academic and research institutions have developed useful models to study the water requirements under alternative options of water planning, population growth, changes in water use and quality, and other economic and social changes likely to take place in the society over several years. Also field research and modeling has been adapted to study the future water capabilities of river basins to meet growing needs under alternative scenarios of growth and development. Research models are also needed to study salt balance in water courses and

drainage network, and to assess modern technology for desalination and disposal of salt residues in many IDB member countries on regular basis. Such tools are essential to better understand the technical, economic and environmental issues affecting the water sector, and devise proper plans to adequately manage and utilize the mix of different water resources.

The future water needs of the growing population in IDB member countries will not be solved through construction of new water projects alone. Management increases its competence and credibility if it is based on updated empirical research data and information about water issues and the technological innovations available to address. IDB member countries could do more to support investment in public research on water issues.

European countries and the United States have invested heavily in research on water development, on the improvement of water quality, on management and utilization of poor water resources, on river basin planning and development, and on technology for improving water supply and irrigation, on water and the environment, and many other water related issues.

The water sector is facing complex challenges in the years ahead, and policy makers should develop scientific frameworks to guide national plans to address these challenges. Only a few countries have invested in this type of research such as Egypt, Kuwait, and Pakistan. More is needed, especially that many small countries can not afford investment in research because of lack of resources, qualified experts are in short supply, and limited capacity to build specialized research facilities in these fields

The Consultative Group for International Agricultural Research (CGIAR) is made of 15 international research centers supported by more than 60 countries to search for technologies and scientific solution to the growing demands for food and sustainable natural resources management. Donors also advocate that the success of the CGIAR center can only be possible if it is supported by capable institutions at the national level which could test and adapt new technologies to local needs. IDB member countries should invest in their national research systems to increase and to strengthen their capabilities in studying water management and modern technology.

Water issues are becoming more complicated and can only be solved through a systemic process of scientific discovery. A desirable solution to this problem is to establish a regional water research center to serve the member countries This institution could expand the limited but important research work currently being carried by the IDB funded International Center for Bio Saline Agriculture (ICBA). Located in Dubei, (ICBA) has established strong reputation among international centers of excellence on the use of saline water for agricultural production. Additional support could be targeted to build on the foundation already established by ICBA. Such an approach would allow ICBA to expand its mandate, go beyond the concern for bio saline agriculture to cover the wide water front, and establish strong partnership with the national research institutes, such the Water Research Center in Egypt, and

the Kuwait Institute for Scientific Research (KISR), and The Water Research Institutes in Pakistan and Bangladesh, and other water institute in the countries of Central Asia and Sub-Saharan Africa. Also important is to build partnership with the private sector research programs which have produced innovations in waste water treatments and utilization, in improving water quality, in managing groundwater and monitoring its quality, and in desalination of seawater and brackish water. Such partnership would also allow for guiding investment in upgrading and modernizing existing water facilities including irrigation technology and water supply and sanitation.

Chapter Nine

Strategies for the future

Major Conclusions:

The discussion in the previous sections can be clustered in three important areas which could enhance the impact of the water sector on poverty reduction. This objective can be achieved through efficient management of water scarcity, strengthen international cooperation in managing shared water resources, and support strong partnership among institutions involved in the water sector. IDB member countries and the Bank have crucial roles in advancing a productive agenda in these areas.

1) The challenge for IDB member countries:

IDB member countries, especially those facing increasing water scarcity require support to adequately address the mounting challenges. They need to take several steps to initiate the process of sustainable management of the sector that would benefit from:

a) **Integrated water resources management**: IDB member countries need to adopt a comprehensive water planning and institution building, suitable pricing policies to sustain investment, combat water scarcity and conduct efficient drought management. International cooperation is crucial among IDB member countries to share knowledge and especially those sharing international water ways and aquifers, to implement joint water development projects...

b) Modernized water delivery system and restructured water institutions: Countries should strengthen partnership with beneficiaries and the private sector. Governments should encourage joint investment by the private sector and the community of beneficiaries to invest in modern, timely controlled, well monitored and metered water delivery services. Also important is increased in decentralization, empowering water users associations, and devolving responsibilities to manage and operate local services to the communities of beneficiaries. Reform in irrigation system in several IDB countries can be carried out only through strong coordination with the reform in the agricultural sector. The credibility of the reform can be enhanced through investment in modern irrigation technology and facilities, and agricultural production systems.

c) Reaching the rural poor: IDB member countries should recognize the important goal of reaching the poor, and expand water services to all communities, especially in the rural areas. . Priority attention should be given to extending water services to vulnerable communities and encourage local initiatives in building and managing such services.

2) Agenda for IDB:

The Bank can assist member countries to improve the impact of the water sector on poverty reduction: To achieve this objective, the Bank should generally support the formulation and implementation of policies enforcing demand management in its member countries. In doing so, it should focus on both infrastructure and institutional aspects within the framework of integrated water resources management described in the previous chapter.

a) Support demand management: The Bank should support its member countries which are poorly endowed with renewable water resources. Managing water scarcity is a long term challenge. It requires new approaches and new strategies and efficient national water management system based on strong, competent, and multi-skilled institutions, guided by clear policies, and appropriate market and price signals. The main objective should be to reduce waste and increase efficiency of water delivery and utilization. Achieving this objective requires financial resources to modernize water facilities and associated services, and capacity building to acquire needed skills. Most countries in WANA, in Sub Saharan Africa and Central and South Asia would need to address this challenge.

The Bank should encourage member countries to strengthen water demand management. As mentioned previously, the water "crisis" must be tackled on two fronts: on the ***supply*** side and on the ***demand*** side of the equation. While the importance of the supply side cannot be overstated, the effectiveness of demand management is now universally accepted, especially where water is scarce and unnecessarily wasted. Ensuring the efficient use of available supply may yield significant benefits and may often prove to be more cost-effective a solution than traditional supply management measures. Efficient demand management is often less capital-intensive and, therefore, more cost-effective, but also better adapted for dealing with "emergency" situations. Better demand management reduces waste and unaccounted for water, improves leakage control, and improve quality and reliability of water services. Key measures for promoting demand management include regulation, new technology for water delivery and agricultural production systems and measures that induce behavioral change such as financial incentives including metering and volumetric pricing, and raising public awareness.

One of the most critical demand management issues is water re-allocation, particularly from agriculture. This objective requires that effective policy guidelines be developed which would improve the performance of this sector which is by far, the largest user of water, averaging 80 percent in most IDB member countries. Such issues include increasing investments to upgrade the traditional irrigation systems through the adoption of modern water delivery technology. This technology improves productivity of water (crop per drop, or cash return per unit of water delivered), and could increase diversification and commercialization of agriculture. The process of achieving this objective should be gradual, involving the beneficiaries, and selective in converting traditional systems into high performing delivery networks.

b) Assist member countries build water storage facilities: The Bank should finance the rehabilitation and upgrading of water delivery systems—be it through a domestic or an international private operator. In the same vein, it should support more forcefully water pollution control projects (e.g., wastewater treatment plants, sewerage systems).

The development of new water resources is not optional but necessary in many member countries facing severe water (and power) shortages. These countries urgently need to increase their water storage capacity, in order to meet rising water demand, most especially during the dry season, and electricity demand.

The Bank should support dam and water storage. There is a growing consensus amongst donors on the need to restore a more balanced view on the merits of large hydraulic infrastructure projects, which developing countries have persistently been calling for.

Another area of interest for the Bank is to assist member countries to explore desirable options for cross country water transfer. (The United States constructed large conveyance system in California which extends over more than 450 km. China has been constructing inter basin water transfer over large tracks of central and western China). Similarly, can Turkey share a volume of its water with Syria and Jordan? Can Iraq deliver water to the GCC countries? Such options are likely to be expensive and would require careful studies and thorough analysis. The looming crises would suggest that such options can not be ignored and that IDB should explore alternatives for water transfer with its member countries and assist them in carrying out objective assessments of risks and benefits of these options. Such assessments could be carried out within a framework of international cooperation with the Bank can help establish among concerned member countries.

c) Support member countries exchange of information and best practices: The Bank should also promote, through regional fora, the exchange of experience and best practices in demand management amongst its member countries. The Bank should cautiously assess the sustainability of irrigation and water projects in terms of compliance with safe guards, and the availability and reliability of water supply source, both in quantity and quality and the potential impact on other water user groups.

Public investment in the water sector should consider the multidimensionality of water, and the interrelationship among the competing users, and be supported by reliable tools to measure the short and long term impact on the society. Such investment may also have drastic effects on the water resources in the country which have to be carefully considered in assessing the cost and benefits of the investment projects on current and future users of the water resources...

d) IDB can support international cooperation in the water sector:

The Bank can initiate several initiatives among member countries to support integrated river basin planning and joint water development projects: Effective water management can also be achieved when governments adopt the river basin management approach. The objective of such an approach is to protect the integrity of water system. This objective can be accomplished by recognizing the need to protect the total hydrological cycle which is usually contained within the river basin. This includes water catchments, watershed and related drainage systems. Such intervention is essential for the sustainability of shared water resources. Governments at the highest level should establish water commissions to enhance national and international cooperation for water joint water development and allocation. They should strengthen legal agreements and partnership among water users to go beyond sharing water resources to design joint development and management corporations.

Promoting cooperation amongst member countries is one of the three *Strategic Objectives* identified in the *IDB Group Strategic Framework*. The management of shared natural resources, especially water, can be a strong incentive and an effective tool for promoting regional cooperation—conversely, if mishandled, it can also become a source of contention and potential conflict. However, despite the complex issues surrounding the management of shared water resources, the Bank should strive, whenever and wherever feasible, to promote stronger regional cooperation amongst its member countries, especially if it is requested by the concerned riparian states to do so.

The Bank should also support interested governments in setting-up regional commissions or task forces, and assist concerned riparian states to assume full ownership of these initiatives. The Bank should work with other donors to provide support only to jointly-agreed programs and projects. Unfortunately, experience shows that it is not so unusual for deserving regional bodies to be basically left to their own devices. As a result, they enter into a vicious circle of unpaid dues and subsequent under-delivery, making even harder to justify the payment of dues—a case in point is the Niger Basin Authority, which despite having a very good legal framework became basically ineffective over the years due to lack of resources; this situation is now being reversed thanks to a World Bank/GEF grant awarded in 2004. There is a growing consensus amongst donors that unilateral approaches are simply unsustainable—the looming water crisis is also dictating the need for a stronger (basin-wide) cooperation for sharing water resources.

e) Assist in improving the impact of water on the environment: Investment in extensive water projects has also resulted in high environmental cost. Poor management of water in agriculture and the damage to the environment such as increasing water logging and salinity, decline in biodiversity, and polluted water ways and river deltas, has caused many agencies to question the wisdom of this investment. To avoid the repeat of these glaring failures and associated damage to the environment, The Bank should work with other donors to assist member countries build adequate safeguards in all water projects. The costs of addressing

these requirements have added financial and technical burdens on water agencies and may cause further delays in attracting investors or public financing to implement much needed water improvement schemes.

f) IDB should strengthen strategic partnership with other donors and multilateral development banks (MDBs): The Bank, in its effort to assist member countries in the areas listed above, should maintain strong partnership with major donors and international development banks engaged in the water sector. Donor agencies have established global units to monitor the water sector such as the Global Water Partnership, the World Water Council, and the World Water Forum. Because the Bank is a major player in supporting the water sector in critical regions of the world, partnership with these specialized units would allow the Bank to shape the global water agenda and build productive support for its member countries. The Bank should increase its engagement with other donors to conduct regional water studies and to prepare regional water strategies. Such participation would lead to joint financing of water projects which are, by their very nature, capital-intensive, especially water resources development schemes, and often require the pooling of donor resources. The Bank should work with member countries and interested donors to increase joint co financing of projects. Among the major and bilateral donors is the World Bank which is carrying extensive work on developing water a strategy and investment program for the Middle East and North Africa, the African Development Bank which is increasing its support to the water sector in Sub Saharan Africa, and the Asian Development Bank which is active in South and East Asia, and is expanding its water portfolio in Central Asia.

This partnership should also provide support to improve project implementation and portfolio quality. Questions are frequently asked about the efficiency of investment and impact on the ground. The Bank should coordinate with other donors to ensure that jointly financed project enjoy good quality at entry, and are well monitored and evaluated during implementation.

3) Future emphasis in IDB water portfolio:

Based on the discussion in the previous sections, The Bank can assist member countries through well targeted investment operations responsive to the main issues facing the water sector in these countries. The portfolio should be designed within strategic framework based on strong partnerships and synergies with development partners, including multilateral and bilateral donors, and is guided by the following principles:

a) Clear Focus on poverty alleviation and health improvement,
b) Water quality and quantity issues should be considered simultaneously,
c) Improving water use efficiency should be accorded a high priority,
d) Strong stakeholders' participation to ensure ownership and commitment,
e) Ensure environmental sustainability,
f) Promote integrated water resources management,
g) Support the decentralization of water services delivery,

h) Support "polluter-pays" principle (for industry and major polluters), ix) support private sector involvement, especially the domestic one,

i) Maintain a balanced approach between the economic and social dimensions of water, depending on context—user charges should cover O&M costs; support well-targeted (pro-poor) subsidies.

Priority areas where investment in the water sector is needed based on the issues discussed so far include:

1-Rural water supply and sanitation, most especially in sub-Saharan Africa—there is an urgent need to generally re-engage the water supply and sanitation sector in sub-Saharan Africa, which has been somehow neglected in the past few years. This will require a more proactive approach on the part of the Bank for translating existing needs into mature projects.
2- Small scale irrigation in Sub Saharan Africa to improve production of high value crops, and be based on strong partnership with the beneficiaries.

3-Wastewater management in urban areas, particularly in the Middle East and North Africa—this sector is less likely to attract external (and private) funding than urban water supply.

4- Rehabilitation of urban water supply systems in Central Asia and, to a lesser degree, in the Middle East and North Africa—assistance should focus on secondary towns and cities.

5- Water demand management programs, focused on improving modern irrigation system to reduce water waste and rationalize allocation of water to this sector, especially in the Middle East and North Africa.

6- Rehabilitation and modernization of irrigation and drainage systems in Central Asia and, to a lesser degree, in sub-Saharan Africa—the focus should be on improving water use efficiency and production yields rather than expanding irrigated areas.

7- Water storage facilities and multi-purpose water schemes especially in Sub Saharan Africa.

8- Feasibility studies to assess joint management of shared river basin. Priority should be given to the Senegal, Niger, Euphrates, and Tigris rivers.

9- Capacity building in integrated water resources management and public water utilities management, including demand management—this is most relevant to borrowing member countries in arid and semi-arid areas, and where improving water use efficiency is a high priority.

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Annex 1: IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
ALBANIA	1994	T.A. FOR HAS PLAIN IRRIGATION	0.188	0.273	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.323
ALBANIA	1996	KORCHA PLAIN IRRIGATION PROJECT	3.85	5.2	AGRICULTURE & AGRO-INDUSTRY	LOAN	6.5
ALBANIA	1996	RURAL WATER SUPPLY PROJECT	4.8	6.99	PUBLIC UTILITIES	LOAN	8.9
ALBANIA	1999	RURAL INFRASTRUCTURE PROJECT	4.889	6.816	AGRICULTURE & AGRO-INDUSTRY	LOAN	8.196
ALBANIA	2000	UPGRADING WATER SUPPLY AND SEWERAGE SYSTEM	4.99	6.586	PUBLIC UTILITIES	LOAN	8.148
ALGERIA	1985	AIN DALIA WATER SUPPLY	8	8	PUBLIC UTILITIES	LOAN	86.32
ALGERIA	1985	AIN DALIA WATER SUPPLY	11.75	11.75	PUBLIC UTILITIES	I.SALE	86.32
ALGERIA	1988	GRAIN CARRIER PROJECT	11.5	15	TRANSPORT & COMMUNICATION	I.SALE	15
ALGERIA	1990	HABRA IRRIGATION SCHEME	0.048	0.054	AGRICULTURE & AGRO-INDUSTRY	T.A.	
ALGERIA	1993	F.S OF 12 DAMS	0.767	0.977	AGRICULTURE & AGRO-INDUSTRY	T.A.	3.148
ALGERIA	1994	WATER SUPPLY PROJECT IN THE NORTH WESTERN PARTS OF ALGERIA	13.5	18.2	PUBLIC UTILITIES	I.SALE	62.7
ALGERIA	1994	WATER SUPPLY PROJECT IN NORTH EASTERN PARTS OF ALGERIA	6.67	9	PUBLIC UTILITIES	I.SALE	25.8
ALGERIA	1995	ZERIZER AGRICULTURAL IRRIGATIO N PROJECT	7.45	11.17	AGRICULTURE & AGRO-INDUSTRY	I.SALE	23.71
ALGERIA	2001	THE BENI HAROUN WATER SUPPLY (PHASE I)	26.56	34	PUBLIC UTILITIES	ISTISNA A	576.29
ALGERIA	2002	OUED R'HIGH OASIS IRRIGATION (PHASE-II) PROJECT	25.6	32.07	AGRICULTURE & AGRO-INDUSTRY	ISTISNA A	50.025
ALGERIA	2002	FLOOD RELIEF PROJECT	6.72	8.39	PUBLIC UTILITIES	LOAN	16.04
ALGERIA	2003	CONSTANTINE AND MILA WATER SUPPLY PROJECT.	34.5	47.63	PUBLIC UTILITIES	ISTISNA A	145.97

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
ALGERIA	2005	THE BENI HAROUN WATER SUPPLY (PHASE-I) (ADDL. FINANCING)	10.18	15.47	PUBLIC UTILITIES	ISTISNA A	52.94
AZERBAIJAN	1992	F.S. OF SAMUR APSHERON IRRIGATION CANAL	0.2	0.28	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.28
AZERBAIJAN	1994	MAIN MILL-MUGHAN DRAINAGE CANAL PROJECT	7	9.8	AGRICULTURE & AGRO-INDUSTRY	LOAN	17
AZERBAIJAN	1998	KHANRC CANAL PROJECT	7	9.42	AGRICULTURE & AGRO-INDUSTRY	LOAN	12.13
AZERBAIJAN	1999	INTEGRATED RURAL DEVELOPEMENT PROJECT	7	9.565	AGRICULTURE & AGRO-INDUSTRY	LOAN	11.332
AZERBAIJAN	2001	KHANARC CANAL (PHASE II)	7	9.432	PUBLIC UTILITIES	LOAN	12.43
AZERBAIJAN	2004	SAMUR ABSHERON IRRIGATION VELVELICHAY-TAKHTAKORPU CANAL	7	10.1	AGRICULTURE & AGRO-INDUSTRY	LOAN	42.6
BANGLADESH	1984	TEESTA BARRAGE FOR AGRICULTURAL DEVELOPMENT	9.62	10	AGRICULTURE & AGRO-INDUSTRY	LOAN	246.79
BANGLADESH	1997	GREATER KHULNA DISTRICT POVERTY ALLEVIATION PROJECT	3.47	5	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	6
BANGLADESH	1997	RAJBARI & GOPALGANJ RURAL ELECTRIFICATION	7	10	PUBLIC UTILITIES	LOAN	18.37
BANGLADESH	1997	WATER SUPPLY FACILITIES IN THE COASTAL BELT AREA	7	10.15	PUBLIC UTILITIES	LOAN	11.96
BANGLADESH	2000	INTEG. AREA DEV. IN GOPALGANI, MADARIPUR, SHARIATPUR & PIROJPUR	7	9.576	AGRICULTURE & AGRO-INDUSTRY	LOAN	12.343
BANGLADESH	2001	BARISAL, PATUAKHALI, JHALAKATI & BARGUNA DIST. SMALL HOLDERS	5.702	7.413	AGRICULTURE & AGRO-INDUSTRY	LOAN	13.331
BANGLADESH	2001	BARISAL, PATUAKHALI, JHALAKATI & BARGUNA DIST. SMALL HOLDERS	1.267	1.647	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	13.331
BANGLADESH	2003	WATER SUPPLY FACILITIES IN COASTAL BELT-PHASE-II	6.132	8.617	PUBLIC UTILITIES	LOAN	10.162
BENIN	1984	IRRIGATION OF NIGER RIVER VALL	0.47	0.538	AGRICULTURE & AGRO-	T.A.	0.5801

IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005 (amounts are in millions)

COUNTRY	YEARS	PROJECT NAME	APPROVED AMT. ID	APPROVED AMT. US	MAIN SECTOR	MODE	TOTAL COST US$
		EY.			INDUSTRY		
BENIN	1985	GROUND WATER RESOURCE SURVEY	1.367	1.293	PUBLIC UTILITIES	T.A.	1.35
BENIN	1990	MICRO-HYDRO-ELECTRIC STATION	0.14	0.185	PUBLIC UTILITIES	T.A.	0.206
BENIN	1991	ADDITIONAL STUDY FOR NIGER VALLEY IRRIGATION PROJECT	0.05	0.065	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.076
BENIN	1993	VILLAGE WATER SUPPLY IN THE PROVINCE OF ATACORA	2.9	3.77	PUBLIC UTILITIES	LOAN (LDMC PROG)	4.434
BENIN	1997	CONSTRUCTION OF SMALL WATER RETENTION DAMS	0.242	0.339	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.412
BENIN	1998	SMALL SCALE IRRIGATION DEVELOPMENT PROJECT	5.18	7.26	AGRICULTURE & AGRO-INDUSTRY	LOAN	11.23
BENIN	1998	SMALL SCALE IRRIGATION DEVELOPMENT PROJECT	1.31	1.83	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	11.23
BENIN	1998	MASTER PLAN ON THE INTEGRATED DEV. OF THE NOMADIC ZONES	0.25	0.332	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.391
BENIN	2000	F.S. FOR THE ATLANTIC INTEGRATED RURAL DEVELOPMENT	0.295	0.396	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.458
BURKINA FASO	1981	VILLAGE WATER SUPPLY	4.69	5.265	PUBLIC UTILITIES	LOAN	5.66
BURKINA FASO	1984	KOMPIENGA HYDRO-ELECTRIC DAM	5.2	5.265	PUBLIC UTILITIES	LOAN	91.235
BURKINA FASO	1986	SOUROU VALLEY AGRICULTURAL DEV ELOPMENT	0.35	0.409	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.4587
BURKINA FASO	1991	SOUROU VALLEY DEVELOPMENT PROJECT	4.23	5.5	AGRICULTURE & AGRO-INDUSTRY	LOAN	27.5
BURKINA FASO	1991	RURAL WATER POINTS PROJECT	4.2	5.185	PUBLIC UTILITIES	LOAN	5.9
BURKINA FASO	*1993*	*EXTENSION OF THE LILIGOURI* DAM	*0.915*	*1.19*	*AGRICULTURE & AGRO-INDUSTRY*	LOAN (LDMC PROG)	1.42
BURKINA FASO	1994	DEVELOPMENT OF 610 HA ON DEBE	0.326	0.44	AGRICULTURE & AGRO-	T.A.	0.5

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
		PLAIN			INDUSTRY		
BURKINA FASO	1996	AGRICULTURAL DEVELOPMENT DOWNSTREAM OF SMALL DAMS	2.12	2.98	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	19.55
BURKINA FASO	1996	AGRICULTURAL DEVELOPMENT DOWNSTREAM OF SMALL DAMS	4.68	6.59	AGRICULTURE & AGRO-INDUSTRY	LOAN	19.55
BURKINA FASO	1997	OUAGADOUGOU WATER SUPPLY	6.82	9.55	PUBLIC UTILITIES	LOAN	231.3
BURKINA FASO	1998	INTEGRATED RURAL DEVELOPMENT OF DEBE PLAIN	6.26	8.76	AGRICULTURE & AGRO-INDUSTRY	LOAN	11.35
BURKINA FASO	1998	INTEGRATED RURAL DEVELOPMENT OF DEBE PLAIN	0.71	1	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	11.35
BURKINA FASO	1998	FS AND DD OF THE HYDRO-AGRI. DEV. PROJECT OF DOUROU	0.442	0.62	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.705
BURKINA FASO	1998	FEASIBILITY STUDY AND PRELIMI INARY DESIGN OF SAMANDENI DAM	0.57	0.763	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.869
BURKINA FASO	1999	BAGRE IRRIGATION DEVELOPMENT	6.9	9.2	AGRICULTURE & AGRO-INDUSTRY	LOAN	37.2
BURKINA FASO	1999	F.S.ON SMALL SCALE IRRIGATION F	0.185	0.247	AGRICULTURE & AGRO-	T.A.	0.295
BURKINA FASO	2001	RURAL WATER POINTS PROJECT (CILSS) IN KENEDOUGOU PROVINCE	1.95	2.54	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	2.9
BURKINA FASO	2005	D.E.D. OF SAMENDENI DAM AND HYDRO-AGRICULTURE DEVELOPMENT	1.223	1.754	AGRICULTURE & AGRO-INDUSTRY	T.A.	2
CAMEROON	1976	SONG-LOULOU HYDRO ELECTRIC POWER	6	7	PUBLIC UTILITIES	LOAN	219.12
CAMEROON	1983	VILLAGE WATER SUPPLY IN NORTHERN REGION	4.8	5	PUBLIC UTILITIES	LOAN	5.87
CAMEROON	1996	CREATION OF 400 PRODUCTIVE BOREHOLES IN 7 PROVINCES	5.8	8.13	PUBLIC UTILITIES	LOAN	9.7
CAMEROON	1997	MOKOLO-MORA WATER SUPPLY	7.14	10	PUBLIC UTILITIES	LOAN	13.42

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
CAMEROON	1998	FS ON THE DEVELOPMENT OF SMALL SCALE IRRIGATION IN NORTH REG.	0.245	0.34	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.4
CHAD	1978	MAMDI POLDER IRRIGATION	5	6.06	AGRICULTURE & AGRO-INDUSTRY	LOAN	37.3902
CHAD	1986	F.S. OF THE INTEGRATED LAND DE VELOPMENT IN LAKE FITRI	0.131	0.14	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.14
CHAD	1986	STUDY OF LAND DEVELOPMENT IN S ALAMAT REGION	0.11	0.118	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.118
CHAD	1988	WATER POINTS PROJECT IN BET AND SALAMAT	3.28	4.19	PUBLIC UTILITIES	LOAN	4.656
CHAD	1991	MASTER PLAN RURAL DEVELOPMENT OF BORKOU - ENNEDI-TIBESTI	0.32	0.411	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.477
CHAD	1994	F.S FOR SUPPLY OF WATER FOR FAYA LARAGEAU CITY	0.289	0.39	PUBLIC UTILITIES	T.A.	0.451
CHAD	1999	B.E.T. INTEGRATED RURAL DEV.	2.5	3.33	AGRICULTURE & AGRO-	LOAN	3.8
CHAD	1999	FAYA-LARGEAU WATER SUPPLY	2.4	3.32	PUBLIC UTILITIES	LOAN	3.77
CHAD	2001	SALAMAT CILSS WATER POINTS	1.782	2.32	PUBLIC UTILITIES	LOAN	2.604
CHAD	2005	C.B. TO CHAD ELECTRICITY AND WATER COMPANY (STEE)	0.405	0.279	PUBLIC UTILITIES	T.A.	0.455
COMOROS ISLAND	2002	RURAL WATER SUPPLY IN GRANDE COMORE, MOHELI & ANJOUAN	4.3	5.52	PUBLIC UTILITIES	LOAN	6.1813
COTE D'IVOIRE	2002	RURAL WATER SUPPLY PROJECT IN FROMAGER AND SAVANNAH REGIONS	6.31	8.2	AGRICULTURE & AGRO-INDUSTRY	LOAN	9.32
DJIBOUTI	1983	HYDRO AGRICULTURAL LAND DEVELOPMENT IN FOUR REGIONS	1.92	2	AGRICULTURE & AGRO-INDUSTRY	LOAN	2.5
EGYPT	1990	SUB-SURFACE DRAINAGE	3.83	5	AGRICULTURE & AGRO-INDUSTRY	LOAN	22
EGYPT	1990	SUB-SURFACE DRAINAGE	4.598	6	AGRICULTURE & AGRO-INDUSTRY	I.SALE	22
EGYPT	1991	IRRIGATION PUMPING STATION REPLACEMENT PROJECT	11.85	15.4	AGRICULTURE & AGRO-INDUSTRY	I.SALE	26.26

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
EGYPT	1996	PUMPING STATIONS REPLACEMENT PROJECT -II	20	27.976	AGRICULTURE & AGRO-INDUSTRY	LEASING	35.324
EGYPT	1998	STUDY OF WATER SUPPLY FOR RURAL POPULATION IN SINAI	0.168	0.225	PUBLIC UTILITIES	T.A.	0.76
EGYPT	2003	F.S. FOR THE IRRIGATION OF WEST NILE DELTA PROJECT.	0.298	0.411	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.752
GAMBIA	1980	STUDY ON URBAN WATER SUPPLY OF GREATER BANJUL	0.135	0.18	PUBLIC UTILITIES	T.A.	0.2
GAMBIA	1989	GROUND WATER RESOURCES SURVEY	0.53	0.715	PUBLIC UTILITIES	T.A.	1.49
GAMBIA	2001	GENJUR RURAL WATER SUPPLY	1.105	1.414	PUBLIC UTILITIES	LOAN	1.614
GAMBIA	2003	KOTU RING RURAL WATER SUPPLY SYSTEM	7	9.72	PUBLIC UTILITIES	LOAN	10.97
GAMBIA	2004	C.B. TO THE NATIONAL WATER AND ELECTRICITY COMPANY (NAWEC)	0.26	0.364	PUBLIC UTILITIES	T.A.	0.436
GUINEA	1985	WATER POINTS (PHASE I)	6.2	6.4	PUBLIC UTILITIES	LOAN	7.038
GUINEA	1988	FORECARIAH LAND DEVELOPMENT PROJECT	0.318	0.425	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.5
GUINEA	1988	WATER SUPPLY TO SEVEN TOWNS	1.3	1.7	PUBLIC UTILITIES	T.A.	1.7
GUINEA	1990	WATER POINTS PROJECTS (430 BOREHOLES)	4	4.9	PUBLIC UTILITIES	LOAN	5.6
GUINEA	1991	KOLENTE AGRICULTURAL DEVELOPMENT PROJECT	3.44	4.47	AGRICULTURE & AGRO-INDUSTRY	LOAN	14
GUINEA	1993	LAND DEVELOPMENT PROJECT IN KAKOSSA DISTRICT	0.554	0.72	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.797
GUINEA	1993	WATER POINTS PROJECT IN THE FRAMEWORK OF LDMCS SPECIAL	0.992	1.29	PUBLIC UTILITIES	LOAN (LDMC PROG)	1.6
GUINEA	1994	INTEGRATED RURAL DEVELOPMENT PROJECT IN TELIMELE REGION	0.296	0.399	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.482
GUINEA	1995	RURAL DEVELOPMENT PROJECT IN MIDDLE GUINEA	3.88	5.05	AGRICULTURE & AGRO-INDUSTRY	LOAN	10.49

IDB WATER PROJECTS SINCE INCEPTION - UPTO 13/02/2005 (amounts are in millions)

COUNTRY	YEARS	PROJECT NAME	APPROVED AMT. ID	APPROVED AMT. US	MAIN SECTOR	MODE	TOTAL COST US$
GUINEA	1996	CREATION OF 360 PRODUCTIVE BOREHOLES WITH HAND PUMPS	3.9	5.51	PUBLIC UTILITIES	LOAN (LDMC PROG)	6.55
GUINEA	1997	DUBREKA INTEGRATED RURAL DEVELOPMENT PROJECT	5.01	7.01	AGRICULTURE & AGRO-INDUSTRY	LOAN	11.48
GUINEA	1997	DUBREKA INTEGRATED RURAL DEVELOPMENT PROJECT	1.93	2.7	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	11.48
GUINEA	1997	DUBREKA INTEGRATED RURAL	0.3	0.42	AGRICULTURE & AGRO-I	T.A.	11.48
GUINEA	1998	FOUTA DJALLON INTEGRATED RURAL DEVELOPMENT PROJECT	5.66	7.93	AGRICULTURE & AGRO-INDUSTRY	LOAN	11.23
GUINEA	1998	FOUTA DJALLON INTEGRATED RURAL DEVELOPMENT PROJECT	1.11	1.55	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	11.23
GUINEA	2001	INTEGRATED RURAL DEVELOPMENT PROJ. IN WESTERN UPPER GUINEA	6.33	8.66	AGRICULTURE & AGRO-INDUSTRY	LOAN	11.54
GUINEA	2001	INTEGRATED RURAL DEVELOPMENT PROJ. IN WESTERN UPPER GUINEA	0.67	0.92	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	11.54
GUINEA	2001	MICRO & SMALL ENTERPRISE FINANCING	0.994	1.29	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	1.45
GUINEA	2003	RURAL DEVELOPMENT IN KAKOSSA	5.89	8.01	AGRICULTURE & AGRO-INDUSTRY	LOAN	11.5
GUINEA	2003	RURAL DEVELOPMENT IN KAKOSSA	1.1	1.49	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	11.5
GUINEA BISSAU	1985	GAMBIEL VALLEY AGRICULTURAL PR OJECT	0.46	0.465	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.465
INDONESIA	1978	SOUTH EAST SULAWESI TRANSMIGRATION	8	10	AGRICULTURE & AGRO-INDUSTRY	LOAN	81.7
INDONESIA	1991	SOUTH TAPANULI INTEGRATED RURAL DEVELOPMENT PROJECT	3.75	5.184	AGRICULTURE & AGRO-INDUSTRY	LOAN	30
INDONESIA	1995	MALOSO IRRIGATION PROJECT	8.88	13.615	AGRICULTURE & AGRO-	I.SALE	44.346

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
					INDUSTRY		
INDONESIA	1995	RURAL DIESEL-ELECTRIC GENERATORS	14.16	21.08	PUBLIC UTILITIES	LEASING	40
INDONESIA	1998	MALOSO IRRIGATION PROJECT (PHASE II)	10.37	14.104	AGRICULTURE & AGRO-INDUSTRY	ISTISNAA	24.653
INDONESIA	1998	MALOSO IRRIGATION PROJECT (PHASE II)	3.64	5	AGRICULTURE & AGRO-INDUSTRY	LOAN	24.653
INDONESIA	2000	DOMPU INTEGRATED AREA DEVELOPMENT PROJECT	7	9.407	AGRICULTURE & AGRO-INDUSTRY	LOAN	11.051
INDONESIA	2001	IMPROV. OF LAND AND IRRIGATION SYSTEM AT FARM LEVEL	6.454	8.519	AGRICULTURE & AGRO-INDUSTRY	LOAN	10.064
IRAN	1999	JAGHIN DAM AND IRRIGATION NETWORK	20	27	AGRICULTURE & AGRO-INDUSTRY	ISTISNAA	80.1
IRAN	2000	WATER SUPPLY TO QESHM ISLAND AND BANDAR ABBAS	30.2	40.5	PUBLIC UTILITIES	ISTISNAA	84.5
IRAN	2002	POST FLOOD ASSISTANCE FOR GOLESTAN WATER RESOURCES	11.15	14.5	AGRICULTURE & AGRO-INDUSTRY	ISTISNAA	28.189
IRAN	2002	SHAHID MADANI DAM & IRRIGATION NETWORK (PHASE-I)	17.9	23.81	AGRICULTURE & AGRO-INDUSTRY	ISTISNAA	69.63
IRAN	2002	SHAHID MADANI DAM & IRRIGATION NETWORK (PHASE-I)	1.65	2.2	AGRICULTURE & AGRO-INDUSTRY	I.SALE	69.63
IRAN	2003	IDAGHMOOSH DAM AND IRRIGATION NETWORK PROJECT.	26.23	38.882	AGRICULTURE & AGRO-INDUSTRY	ISTISNAA	109.5059
IRAN	2004	DASHT-E-ABBAS IRRIGATION	31	39.217	AGRICULTURE & AGRO-INDUSTRY	ISTISNAA	137.2549
IRAN	2004	GLEVARD DAM & NEKA IRRIGATION	32.045	46.529	AGRICULTURE & AGRO-INDUSTRY	ISTISNAA	130.2828
JORDAN	1982	ZARQA-RUSAIFA WATER SUPPLY AND SEWERAGE, PHASE 1	7	7.8	PUBLIC UTILITIES	LOAN	99.305
JORDAN	1986	ZARGA RIVER BASIN PROJECT	5	5.4	AGRICULTURE & AGRO-INDUSTRY	LOAN	89.2
JORDAN	1994	F.S. FOR DEEP GROUND WATER AQUIFER OF WADI ARABA	0.2	0.28	PUBLIC UTILITIES	T.A.	1.45
JORDAN	1998	THE SOUTHERN GHORS AND	18.5	25	PUBLIC UTILITIES	I.SALE	257.269

	UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
		EASTERN SHORES OF THE DEAD SEA					
KAZAKHSTAN	2003	RURAL WATER SUPPLY TO KARAGANDA OBLAST	7	9.451	PUBLIC UTILITIES	LOAN	11.314
KUWAIT	1997	STUDY OF THE DEVELOPMENT OF SALT TOLERANT PLANT	0.3	0.414	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.673
KUWAIT	1997	STUDY OF TREATMENT &STORAGE OF TREATED WASTEWATER IN AQUIFERS	0.3	0.414	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.729
LEBANON	1999	YAMMOUNAH AND OUYOUN ORGHOSH WATER SUPPLY AND DISTRIBUTION	14.736	19.516	PUBLIC UTILITIES	ISTISNA A	21.416
LEBANON	1999	AKKAR WATER SUPPLY	15.32	19.92	PUBLIC UTILITIES	ISTISNA A	32.51
LEBANON	2000	TAIBEH WATER TREATMENT AND PUMPING PLANT	9.14	12.16	PUBLIC UTILITIES	ISTISNA A	14.8
MALAYSIA	1979	BINTULU DEEP WATER PORT.	6.445	8.378	TRANSPORT & COMMUNICATION	LOAN	235.6
MALDIVES	1993	VILLINGIL WATER SUPPLY PROJECT	1.497	2.051	PUBLIC UTILITIES	LOAN	3.55
MALI	1981	OMVS MANANTALI DAM	6.651	7.39	AGRICULTURE & AGRO-INDUSTRY	LOAN	679.97
MALI	1981	INTEGRATED RURAL DEVELOPMENT I N LAKE AREA	0.552	0.65	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.82
MALI	1982	WATER POINTS (LIPTAKO GOURMA REGION)	4.86	5.35	PUBLIC UTILITIES	LOAN	26.682
MALI	1989	GOUBO PLAIN DEVELOPMENT (LAKE AREA).	2.33	3	AGRICULTURE & AGRO-INDUSTRY	LOAN	7.5
MALI	1990	HAMADJA PLAIN IRRIGATION PROJECT.	2.76	3.45	AGRICULTURE & AGRO-INDUSTRY	LOAN	9.73
MALI	1994	FEASIBILITY STUDY OF SMALL DAMS IN THE REGION OF KANGABA	0.147	0.191	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.2258
MALI	1995	F.S.AND DETAILED DESIGN OF THE KONA-KORIENTZE-TONKA IRD PROJ.	0.2	0.297	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.362

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
MALI	1995	F.S. FOR TOSSAYE DAM	0.335	0.5	PUBLIC UTILITIES	T.A.	1.8
MALI	1998	INTEGRATED RURAL DEVELOP. PROJ DOWNSTREAM MANANTALI DAM	0.93	1.29	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	26.09
MALI	1998	INTEGRATED RURAL DEVELOP. PROJ DOWNSTREAM MANANTALI DAM	3.25	4.49	AGRICULTURE & AGRO-INDUSTRY	LOAN	26.09
MALI	1999	KITA INTEGRATED RURAL DEVELOPMENT	7	9.74	AGRICULTURE & AGRO-INDUSTRY	LOAN	19.36
MALI	2000	CONSTRUCTION OF SMALL DAMS IN KANGABA REGION	0.32	0.432	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.497
MALI	2000	RECONSTRUCTION OF 400 WATER POINTS IN KAYES & KOULIKORO	1.298	1.752	PUBLIC UTILITIES	LOAN (LDMC PROG)	2.063
MALI	2002	SEGOU INTEGRATED RURAL DEVELOPMENT PROGRAM	6.15	8	AGRICULTURE & AGRO-INDUSTRY	LOAN	9.14
MALI	2003	AGRICULTURAL DEVELOP. PROJECT IN KANGABA REGION	6.528	9.009	AGRICULTURE & AGRO-INDUSTRY	LOAN	10.237
MALI	2004	D.E.D. AND ENVIROMENTAL STUDIES OF TAOUSSA DAM	1.95	2.7	AGRICULTURE & AGRO-INDUSTRY	T.A.	5.73
MAURITANIA	1980	GORGOL IRRIGATION	4.62	6	AGRICULTURE & AGRO-INDUSTRY	LOAN	83.95
MAURITANIA	1981	OMVS MANANTALI DAM	3.004	3.338	AGRICULTURE & AGRO-INDUSTRY	LOAN	679.97
MAURITANIA	1984	VILLAGE WATER POINTS	7.15	7.36	AGRICULTURE & AGRO-INDUSTRY	LOAN	7.43
MAURITANIA	1987	MAGHAMA III TECHNICAL STUDY OF HYDRO-AGRICULTURAL	0.15	0.18	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.4
MAURITANIA	1987	R'KIZ LAKE IRRIGATION PROJECT (F.S)	0.335	0.402	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.4345
MAURITANIA	1989	ENGINEERING DESIGN FOR MAGHAMM A III IRRIGATION	0.11	0.145	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.4
MAURITANIA	1989	GROUND WATER SURVEY	0.276	0.359	PUBLIC UTILITIES	T.A.	0.437

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
MAURITANIA	1991	MAGHAMA 3 IRRIGATION PROJECT	5.4	7	AGRICULTURE & AGRO-INDUSTRY	LOAN	11.002
MAURITANIA	1991	STUDY OF WATER RESOURCES OF TIRIS ZEMOUR REGION	0.603	0.783	PUBLIC UTILITIES	T.A.	0.869
MAURITANIA	1993	EXECUTION OF R'KIZ LAKE PROJECT	6.24	8.11	AGRICULTURE & AGRO-INDUSTRY	LOAN	9.19
MAURITANIA	1993	CHINGUITTI INTEGRATED DEVELOPMENT PROJECT	0.912	1.231	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	1.2315
MAURITANIA	1996	STUDY OF NOUAKCHOTT WATER SUPPLY	0.643	0.9	PUBLIC UTILITIES	T.A.	1.514
MAURITANIA	2001	WATER RESOURCES DEVELOPMENT	6.42	8.48	PUBLIC UTILITIES	LOAN	10.32
MAURITANIA	2003	RECONSTRUCT. OF SMALL & MEDIUM SCALE IRRIGATION PERIMETER	1.85	2.425	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	6.702
MAURITANIA	2003	RECONSTRUCT. OF SMALL & MEDIUM SCALE IRRIGATION PERIMETER	2.5	3.244	AGRICULTURE & AGRO-INDUSTRY	LOAN	6.702
MAURITANIA	2003	AGRICULTURAL DEVELOPMENT OF R'KIZ EASTERN BASIN	0.198	0.265	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.315
MOROCCO	1980	TAMZAOURT DAM. (ABDEL MOUMIN DAM).	6.1	8	AGRICULTURE & AGRO-INDUSTRY	LOAN	149.6
MOROCCO	1986	ABDA PLAIN RURAL DEVELOPMENT	5.54	6.3	AGRICULTURE & AGRO-INDUSTRY	LOAN	40
MOROCCO	1987	AOULOUZ DAM PROJECT.	4.8	6	AGRICULTURE & AGRO-INDUSTRY	LOAN	140
MOROCCO	1991	AL HACHEF DAM	5.55	7.29	PUBLIC UTILITIES	LOAN	120
MOROCCO	1994	INTEGRATED RURAL DEVELOPMENT PROJECT FOR TAFILALT & DADES	5.41	7.04	AGRICULTURE & AGRO-INDUSTRY	LOAN	52.53
MOROCCO	1995	AL-AGHRAS DAM PROJECT	3.6	5	PUBLIC UTILITIES	LOAN	115.33
MOROCCO	1995	AL AGHRAS DAM PROJECT	4.4	6.1	PUBLIC UTILITIES	I.SALE	115.33
MOROCCO	1997	DCHAR EL OUED AND AIT	3.6	5	PUBLIC UTILITIES	LOAN	184.93

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
		MESSAOUD DAMS					
MOROCCO	1997	TAZA WATER SUPPLY	5	7.04	PUBLIC UTILITIES	LOAN	49.88
MOROCCO	1997	STUDY OF MASTER PLAN FOR TAZA WATER SUPPLY	0.3	0.408	PUBLIC UTILITIES	T.A.	0.72
MOROCCO	1997	TAZA WATER SUPPLY	16.4	22.94	PUBLIC UTILITIES	I.SALE	49.88
MOROCCO	1997	DCHAR EL OUED AND AIT MESSAOUD DAMS	11.8	16.4	PUBLIC UTILITIES	I.SALE	184.93
MOROCCO	2000	WATER SUPPLY PROJECT FOR THE *RURAL AREAS*	15.65	20.35	PUBLIC UTILITIES	ISTISNA A	52.77
MOROCCO	2000	WATER SUPPLY ROJECT UNDER THE DROUGHT EMERGENCY PROGRAM	5.37	6.98	PUBLIC UTILITIES	LOAN	22.2
MOROCCO	2001	STUDY OF WATER SUPPLY MASTER PLAN FOR SETTAT CITY	0.185	0.236	TRANSPORT & COMMUNICATION	T.A.	0.48
MOROCCO	2003	WATER SUPPLY MASTER PLAN STUDIES FOR RURAL LOCALITIES	0.197	0.265	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.311
MOROCCO	2003	THE EMERGENCY FLOOD RELIEF PROJECT.	21.23	29.3	PUBLIC UTILITIES	ISTISNA A	45.62
MOROCCO	2003	THE EMERGENCY FLOOD RELIEF PROJECT.	5.82	8.04	PUBLIC UTILITIES	LOAN	45.62
MOZAMBIQUE	1999	MACARRETANE WEIR	7.664	10.197	AGRICULTURE & AGRO-INDUSTRY	LOAN	11.297
NIGER	1977	BIRNI N'KONNI IRRIGATION	4.89	5.6	AGRICULTURE & AGRO-INDUSTRY	LOAN	14
NIGER	1984	F.S. FOR 2ND BRIDGE, RIVER NIGER	0.6	0.63	TRANSPORT & COMMUNICATION	T.A.	0.63
NIGER	1984	DEVELOPMENT OF WATER POINTS (LIPTAKO-GORMA REGION)	6.75	6.88	PUBLIC UTILITIES	LOAN	7.756
NIGER	1986	INTEGRATED DEVELOPMENT OF OASES	0.15	0.18	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.2008
NIGER	1986	FEASIBILITY STUDY OF THE KIRCHYA DYKE	0.15	0.182	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.217
NIGER	1987	F.S. OF MOUMOURI BASIN AGRICUL TURAL PROJECT	0.588	0.734	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.715

IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005			(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
NIGER	1997	F.S. & DET. DSGN. OF HYDRO-AGR. DEV. PROJECT OF KEHEHE	0.243	0.34	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.38
NIGER	1998	RECONSTRUCTION OF SMALL SCALE IRRIGATION PERIMETERS	3.2	4.42	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	5.02
NIGER	2001	RURAL WATER POINTS IN THE PROVINCE OF TAHOUA	1.95	2.55	PUBLIC UTILITIES	LOAN (LDMC PROG)	2.91
NIGER	2003	INTEGRATED RURAL DEVELOPMENT OF KEHEHE TABALAK	1.78	2.31	AGRICULTURE & AGRO-INDUSTRY	LOAN	4.74
NIGER	2003	INTEGRATED RURAL DEVELOPMENT OF KEHEHE TABALAK	1.25	1.62	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	4.74
NIGER	2004	D.E.D. AND ENVIROMENTAL STUDIES OF KANDADJI DAM	1.22	1.69	AGRICULTURE & AGRO-INDUSTRY	T.A.	3.625
OMAN	1985	GROUND WATER RECHARGE SCHEME.	2.054	2.185	AGRICULTURE & AGRO-INDUSTRY	LOAN	7.7
OMAN	1985	WATER DEVELOPMENT PROJECT	7.006	6.684	PUBLIC UTILITIES	I.SALE	10.924
OMAN	1988	WADI GHOUL AND WADI TANOUF GROUNDWATER RECHARGE DAMS	5.522	6.902	AGRICULTURE & AGRO-INDUSTRY	LOAN	13.691
OMAN	1988	GHUBRA POWER-DESALINATION PROJECT	10.26	14.2	PUBLIC UTILITIES	I.SALE	179
OMAN	1994	GHUBRA POWER & DESALINATION PLANT (PHASE 5)	15	21.6	PUBLIC UTILITIES	LEASING	91.14
OMAN	1999	ALMASSARAT WATER SUPPLY SCHEME	8.958	12.541	PUBLIC UTILITIES	LEASING	77.248
OMAN	1999	ALMASSARAT WATER SUPPLY SCHEME	14	19	PUBLIC UTILITIES	I.SALE	77.248
OMAN	2000	ASH'SHARQIYA WATER SUPPLY	19.24	25.969	PUBLIC UTILITIES	ISTISNA A	98.163
PAKISTAN	1985	LEFT BANK OUTFALL DRAINAGE (LBOD)	12	11.5	AGRICULTURE & AGRO-INDUSTRY	LOAN	654.8
PAKISTAN	1993	MANSEHRAH VILLAGE SUPPORT PROJECT	4	5.4	AGRICULTURE & AGRO-INDUSTRY	LOAN	24.22

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
PAKISTAN	1996	GHAZI-BAROTHA HYDRO-POWER PROJECT	24.13	35.2	PUBLIC UTILITIES	I.SALE	2,250.00
PAKISTAN	1997	BAHAWALPUR RURAL DEVELOPMENT PROJECT	4.9	7	AGRICULTURE & AGRO-INDUSTRY	LOAN	58.1
PAKISTAN	2003	CHAGAI WATER MANAGEMENT & AGRICULTURE DEVELOPMENT	5.65	7.62	AGRICULTURE & AGRO-INDUSTRY	LOAN	8.655
SENEGAL	1981	OMVS MANANTALI DAM	8.345	9.272	AGRICULTURE & AGRO-INDUSTRY	LOAN	679.97
SENEGAL	1982	F.S. ON GROUND WATER RESOURCES	1.826	1.914	PUBLIC UTILITIES	T.A.	2.576
SENEGAL	1987	ANAMBE-KAYANGA RICE PROJECT	5	5.5	AGRICULTURE & AGRO-INDUSTRY	LOAN	34.63
SENEGAL	1988	CEAO WATER POINTS PROJECT	6.9	8.9	PUBLIC UTILITIES	LOAN	9.82
SENEGAL	1996	AGRICULTURAL DEVELOPMENT	6.6	9.22	AGRICULTURE & AGRO-I	LOAN	16.01
SENEGAL	1996	EXECUTION OF 34 WATER POINTS IN KAOLACK, KOLDA & TAMBA COUNDA	4.6	6.67	PUBLIC UTILITIES	LOAN	8.11
SENEGAL	1997	MATAM RURAL DEVELOPMENT PROJECT	6.18	8.66	AGRICULTURE & AGRO-INDUSTRY	LOAN	11.95
SENEGAL	1998	FS AND DD OF A POTABLE WATER SUPPLY IN THE GOROM-LAMPSAR	0.28	0.394	PUBLIC UTILITIES	T.A.	0.472
SENEGAL	2001	F.S. & DED OF TOUBA WATER SUPPLY SYSTEM	0.39	0.507	PUBLIC UTILITIES	T.A.	0.6
SENEGAL	2002	ANAMBE BASIN HYDROAGRICULTURAL DEVELOPMENT (PHASE iii)	7	8.98	AGRICULTURE & AGRO-INDUSTRY	LOAN	10.25
SENEGAL	2002	RURAL WATER SUPPLY PROJECT	7	9.1	PUBLIC UTILITIES	LOAN	11.35
SENEGAL	2004	NDIOSMONE-PALMARIN WATER SUPPLY	7	10.24	PUBLIC UTILITIES	LOAN	35.22
SIERRA LEONE	1982	NEW WATER SOURCE INVESTIGATION (OROGU RIVER DAM)	0.453	0.5	PUBLIC UTILITIES	T.A.	0.5
SIERRA LEONE	1995	RURAL WATER SUPPLY&	0.622	0.933	PUBLIC UTILITIES	LOAN (LDMC	

UPTO 13/02/2005 millions)

COUNTRY	YEARS	PROJECT NAME	APPROVED AMT. ID	APPROVED AMT. US	MAIN SECTOR	MODE	TOTAL COST US$
		DISTRICT					
SIERRA LEONE	2003	RURAL WATER SUPPLY AND SANITATION	3.1	3.97	PUBLIC UTILITIES	LOAN (LDMC PROG)	4.41
SOMALIA	1990	BAY REGION AGRICULTURAL DEVELOPMENT PROJECT PHASE-II	2.13	2.77	AGRICULTURE & AGRO-INDUSTRY	LOAN	18.47
SUDAN	1988	SOUTH KORDOFAN AGRICULTURAL DEVELOPMENT PROJECT.	3	4.1	AGRICULTURE & AGRO-INDUSTRY	LOAN	52.31
SUDAN	1990	ATBARA AL DAMER WATER SUPPLY S YSTEM	0.2	0.275	PUBLIC UTILITIES	T.A.	0.475
SUDAN	1992	NORTHERN PROVINCE IRRIGATION	7	9.5	AGRICULTURE & AGRO-I	LOAN	32.54
SUDAN	1994	REHABILIATION OF ROSEIRES DAM PROJECT	6.4	8.66	AGRICULTURE & AGRO-INDUSTRY	LOAN	10.165
SUDAN	1995	ATBARA AND AL DAMER EMERGENCY WATER SUPPLY PROJECT	1	1.48	PUBLIC UTILITIES	LOAN (LDMC PROG)	1.63
SUDAN	1996	NORTH KORDOFAN RURAL DEVELOPMENT	6.74	9.43	AGRICULTURE & AGRO-INDUSTRY	LOAN	19.36
SUDAN	1996	ROSEIRES DAM HEIGHTENING PLAN (PHASE-1)	15	22	AGRICULTURE & AGRO-INDUSTRY	LOAN	328.58
SUDAN	1998	THE HEAVY EQUIPMENT FOR THE ROSEIRES DAM PROJECT	5.88	7.88	AGRICULTURE & AGRO-INDUSTRY	I.SALE	348.7
SUDAN	1999	RURAL DEVELOPMENT PROJECT FOR WEST DARFUR STATE	0.75	1	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	4.4
SUDAN	1999	REFURBISHMENT OF PUMPING STAT ION OF RAHAD IRRIGATION SCHEME	0.74	1	AGRICULTURE & AGRO-INDUSTRY	LOAN (LDMC PROG)	1.44
SUDAN	1999	REHABILITATION OF THE IRRIGATION INFRASTRUCTURE	6.34	8.57	AGRICULTURE & AGRO-INDUSTRY	LOAN	9.82
SUDAN	1999	KHARTOUM NEW WATER TREATMENT PLANT	11	14.575	PUBLIC UTILITIES	ISTISNAA	15.974
SUDAN	1999	F.S. & P.D OF WAD MEDANI WATER SUPPLY PROJECT	0.193	0.26	PUBLIC UTILITIES	T.A.	0.3

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
SUDAN	2003	THE DROUGHT MITIGATION PROJECT FOR GREATER DARFUR STATES	9.12	12.51	PUBLIC UTILITIES	ISTISNAA	29.37
SUDAN	2003	THE DROUGHT MITIGATION PROJECT FOR GREATER DARFUR STATES	1.72	2.36	PUBLIC UTILITIES	LOAN (LDMC PROG)	29.37
SUDAN	2003	THE DROUGHT MITIGATION PROJECTS	6.9	9.47	PUBLIC UTILITIES	LOAN	29.37
SUDAN	2005	IRRIGATION DEVELOPMENT PROJECT IN 3 REGIONS	6.7	10.01	AGRICULTURE & AGRO-INDUSTRY	LOAN	17.851
SYRIA	1980	ALEPPO WATER SUPPLY	4.923	6.4	PUBLIC UTILITIES	LOAN	141.787
SYRIA	1986	UPPER YARMOUK VALLEY IRRIGATION.	7	7	AGRICULTURE & AGRO-INDUSTRY	LEASING	25
SYRIA	1994	SINN - LATAKIA WATER TRANSMISSION PROJECT	4.36	5.67	PUBLIC UTILITIES	LEASING	42.25
SYRIA	1994	ALEPPO FOURTH WATER SUPPLY PROJECT	3.7	5	PUBLIC UTILITIES	LOAN	62
SYRIA	1994	SINN - LATAKIA WATER TRANSMISSION PROJECT	6.92	9	PUBLIC UTILITIES	LOAN	42.25
SYRIA	1994	ALLEPO FOURTH WATER SUPPLY PROJECT	9.6	13	PUBLIC UTILITIES	I.SALE	62
TAJIKISTAN	1997	ENG.DESIGN FOR IRRIGATION OF 6000HA IN DANGARA VALLEY	0.2	0.28	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.32
TAJIKISTAN	2000	F.S OF HYDRO POWER PLANTS IN RURAL AREAS	0.19	0.248	PUBLIC UTILITIES	T.A.	0.32
TAJIKISTAN	2001	DANGARA VALLEY IRRIGATION PROJECT	6.31	8.14	AGRICULTURE & AGRO-INDUSTRY	LOAN	9.1
TAJIKISTAN	2003	DUSHANBE WATER SUPPLY	7	9.3	PUBLIC UTILITIES	LOAN	10.7
TAJIKISTAN	2004	MINI HYDROPOWER PLANTS IN THE RURAL AREAS	6.623	9.178	PUBLIC UTILITIES	LOAN	11.589
TOGO	1999	RURAL WATER SUPPLY PROJECT IN THE REGION CENTRALE	6.67	9.04	PUBLIC UTILITIES	LOAN	10.3
TOGO	2000	F.S. ON THE INTEGRATED RURAL	0.3	0.405	AGRICULTURE & AGRO-	T.A.	0.465

IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005 (amounts are in millions)

COUNTRY	YEARS	PROJECT NAME	APPROVED AMT. ID	APPROVED AMT. US	MAIN SECTOR	MODE	TOTAL COST US$
TUNISIA	1979	SFAX WATER SUPPLY	4.65	6	PUBLIC UTILITIES	LOAN	97
TUNISIA	1985	INTEGRATED RURAL DEVELOPMENT	10.3	10	AGRICULTURE & AGRO-INDUSTRY	LOAN	335
TUNISIA	1989	WADI MELLAGE PROJECT	2.323	3.02	AGRICULTURE & AGRO-INDUSTRY	LOAN	240
TUNISIA	1989	WADI MELLAG PROJECT	1.77	2.3	AGRICULTURE & AGRO-INDUSTRY	I.SALE	240
TUNISIA	1991	SIDI M'HADHAB PLATEAU AGRICULTURAL DEVELOPMENT	4.36	6.1	AGRICULTURE & AGRO-INDUSTRY	LOAN	57.57
TUNISIA	1991	SIDI M'HADHAB PLATEAU AGRICULTURAL DEVELOPMENT	5	7	AGRICULTURE & AGRO-INDUSTRY	I.SALE	57.57
TUNISIA	1994	AL - KAIROUAN INTEGRATED RURAL DEVELOPMENT	3.11	4.2	AGRICULTURE & AGRO-INDUSTRY	LOAN	35.53
TUNISIA	1994	INTEGRATED RURAL DEVELOPMENT (2ND) PHASE	4	5.2	AGRICULTURE & AGRO-INDUSTRY	LOAN	320.14
TUNISIA	1994	AL KAIROUAN INTEGRATED RURAL DEVELOPMENT	4.13	5.57	AGRICULTURE & AGRO-INDUSTRY	I.SALE	35.53
TUNISIA	1994	INTEGRATED RURAL DEVELOPMENT (2ND) PHASE	4.8	6.3	AGRICULTURE & AGRO-INDUSTRY	I.SALE	320.14
TUNISIA	1997	WATER SUPPLY PROJECT FOR SAHEL MADIA SFAX	3.7	5.14	PUBLIC UTILITIES	LOAN	53.85
TUNISIA	1997	WATER SUPPLY PROJECT FOR SAHEL MAHDIA & SFAX	13.7	19.07	PUBLIC UTILITIES	I.SALE	53.85
TUNISIA	1999	REINFORCEMENT OF WATER SUPPLY SYS. FOR KAIROUAN&SAHEL REG.	12.69	17	PUBLIC UTILITIES	I.SALE	26.48
TURKEY	1995	SANLIURFA WATER SUPPLY	9.86	15.38	PUBLIC UTILITIES	LEASING	78.48
TURKEY	1996	ORDU-GIRESUN RURAL DEVELOPMENT	5.568	8.168	AGRICULTURE & AGRO-INDUSTRY	LEASING	61.556
TURKMENISTAN	1993	F.S. OF KAZANDJIK-KIZYL-ATREK IRRIGATION CANAL	0.193	0.272	AGRICULTURE & AGRO-INDUSTRY	T.A.	
TURKMENISTAN	2000	BALKAN VELAYAT WATER SUPPLY PROJECT	13.15	17.41	PUBLIC UTILITIES	ISTISNAA	31.81
UGANDA	1978	REHABILITATION OF KAMPALA WATER SUPPLY SYSTEM	4.561	5.61	PUBLIC UTILITIES	LOAN	7.61

	IDB WATER PROJECTS SINCE INCEPTION UPTO 13/02/2005		(amounts are in millions)				
			APPROVED AMT.				
COUNTRY	YEARS	PROJECT NAME	ID	US	MAIN SECTOR	MODE	TOTAL COST US$
YEMEN REP.	1980	HODEIDA WATER SUPPLY & SEWERAGE	5	6.25	PUBLIC UTILITIES	LOAN	76.15
YEMEN REP.	1980	GREATER ADEN WATER SUPPLY	4.231	5.5	PUBLIC UTILITIES	LOAN	39.2
YEMEN REP.	1981	F.S. ON KHAWLAN INTEGRATED AGRICULTURAL DEVELOPMENT	1.818	2.4	AGRICULTURE & AGRO-INDUSTRY	T.A.	3.997
YEMEN REP.	1981	F.S. ON HAJJA INTEGRATED RURAL DEVELOPMENT	0.417	0.472	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.575
YEMEN REP.	1988	EASTERN REGION AGRICULTURE DEVELOPMENT PROJECT	5.5	7.15	AGRICULTURE & AGRO-INDUSTRY	LOAN	23.5
YEMEN REP.	1989	CENTRAL HIGHLAND INTEGRATED AGRICULTURAL DEVELOPMENT PROJ.	4	5	AGRICULTURE & AGRO-INDUSTRY	LOAN	28.5
YEMEN REP.	1989	PILOT DRIP IRRIGATION PROJECT AT A MODEL COFFEE PLANTATION	0.082	0.099	AGRICULTURE & AGRO-INDUSTRY	T.A.	0.1575
YEMEN REP.	1989	STUDY OF WATER RESOURCES AND DESIGN OF WATER SUPPLY SYSTEM	0.206	0.257	PUBLIC UTILITIES	T.A.	0.2815
YEMEN REP.	2000	AL HODEIDAH WATER SUPPLY	7	9.5	PUBLIC UTILITIES	LOAN	11
REGIONAL	1989	ASSESSMENT OF WATER RESOURCES IN WESTERN ASIA REGION (ESCWA)	0.15	0.2	PUBLIC UTILITIES	T.A.	0.707
REGIONAL	2000	IMPROVEMENT OF THE NAVIGATION ALONG THE SENEGAL RIVER	0.5	0.666	TRANSPORT & COMMUNICATION	T.A.	0.7646
REGIONAL	2001	AMU NATIONAL DESERTIFICATION	0.2	0.255	AGRICULTURE & AGRO-	T.A.	0.714

Annex 2

Water resources, Water Balance, and water use in IDB member countries

The following tables were adapted from FAO data base: http://www.fao.org/ag/agl/aglw/aquastat/regions/. Areas for individual countries not included in the tables such as Pakistan and Bangladesh, Turkey. And Albania can be obtained from this site...

The survey concentrated mostly on renewable resources by regions. Distinction is made between the water resources generated from precipitation falling on the territory of the country or **internal renewable resources**, and **global renewable resources** which includes transfers from neighboring countries (mostly through rivers). In both cases, the figure represents the maximum potential water resource irrespective of development potential, such as regulation of stream flow, or extractable groundwater.

TABLE 1 - Regional distribution of water resources in Sub Saharan Africa:

TABLE 2 - Regional distribution of water withdrawals, by sector, in Sub Saharan Africa

TABLE 3 - Regional distribution of irrigation methods in Sub Saharan Africa

TABLE 4: Renewable surface water resources of the Aral Sea basin

TABLE 5 - Sub-regional distribution of the renewable water resources in West Asia and North Africa and Central Asia

TABLE 6- Sub-regional distribution of water withdrawal, by sector, in West Asia, North Africa and Central Asia

TABLE7: Water withdrawal as percentage of total internal renewable water resources (IRWR) in West Asia, North Africa, and Central Asia

TABLE 8 Sub-regional distributions of irrigation methods in West Asia, North Africa, and Central Asia

TABLE 9 - Origin of irrigation water by sub-region in West Asia, North Africa and Central Asia

TABLE 10 sub-regional distributions of the main irrigated crops (based on partial information)

TABLE 1 - Regional distribution of water resources in Sub Saharan Africa:

Region	Area	Precip.	Internal renewable resources			
	(1000 km^2)	(km^3/yr)	(km^3/yr)	(mm/yr)	% of total	% of precip.
Northern	5 753	411	50	8.7	1.2	12.2
Sudano-Sahelian	8 591	2 878	170	19.8	4.3	5.9
Gulf of Guinea	2 106	2 965	952	452.0	23.8	32.1

TABLE 2 - Regional distribution of water withdrawals, by sector, In Sub Saharan Africa:

Region	Withdrawals by sector					
	Agriculture	Communities	Industries	Total	As % of total	As % of internal resources
	$\times 10^6 m^3$/yr	$\times 10^6 m^3$/yr	$\times 10^6 m^3$/yr	$\times 10^6 m^3$/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

TABLE 3 - Regional distribution of irrigation methods in Sub Saharan Africa:

Region	Irrigation				Other cultivated wetlands/ valley bottoms	Flood recession cropping	Total		
	Full or partial control	Spate irrigation	Equipped wetlands/ valley bottoms	Total irrigation					
	'000 ha	'000 ha	'000 ha	'000 ha	'000 ha	'000 ha	'000 ha	as % of total	as % of cultivated land
Northern	5 610 (95%)	305 (5%)	- (-)	5 915 (100%)	- (-)	- (-)	5 915 (100%)	41.5	24.8
Sudano-Sahelian	2 263 (79%)	212 (7%)	9 (-)	2 484 (86%)	97 (4%)	296 (10%)	2 877 (100%)	20.2	12.1
Gulf of Guinea	307 (22%)	- (-)	163 (11%)	470 (33%)	193 (14%)	730 (53%)	1 393 (100%)	9.8	4.0

TABLE 4: Renewable surface water resources of the Aral Sea basin

Country or Zone				Amu Darya basin		Syr Darya basin		Aral Sea basin	
	km²	% of basin area	% of country area	km³ per year	% of basin	km³ per year	% of basin	km³ per year	% of basin
South-Kazakhstan	540 000	28	20	-	0.0	4.50	12.1	4.50	3.9
Turkmenistan	466 600	24	96	0.98	1.2	-	0.0	0.98	0.8
Uzbekistan	447 400	23	100	4.70	6.0	4.84	13.0	9.54	8.3
North-Afghanistan	234 800	12	36	6.18	7.9	-	0.0	6.18	5.3
Tajikistan	141 670	7	99	62.90	80.2	0.40	1.1	63.30	54.8
Kyrgyz Republic	117 500	6	59	1.93	2.5	27.25	73.4	29.18	25.2
Total	1 947 970	100		76.69	97.7	36.99	99.6	113.68	98.3
Basin *				78.46	100.0	37.14	100.0	115.60	100.0

* Time series and methods used for water resources computation for the basin as a whole and for each country may vary, which explains the difference between the total of countries and the value for the whole basin.

TABLE 5 - Sub-regional distribution of the renewable water resources in West Asia and North Africa and Central Asia:

Region	Area	Population '95	Annual precipitation		Annual internal renewable water resources			
	thousand km²	thousand inhabitants	mm	km³	mm	km³	as % of precipitation	m³ per inhabitant
Maghreb	5 777	71 544	86	495	8	48	9.8	677
North-eastern Africa	4 168	100 856	306	1 275	10	43	3.4	427
Arabian Peninsula	3 103	39 110	79	246	2	8	3.1	197
Middle East	1 512	106 635	421	637	162	245	38.4	2 294
Central Asia	3 926	243 316	304	1 195	138	541	45.3	2 226
Total Near East	18 486	561 461	208	3 848	48	885	23.0	1 577
World	134 223	5 716 407	820	110 000	298	40000	36.4	7 0
N. East as % of world	13.8	9.8		3.5		2.2		22.5

TABLE 6- Sub-regional distribution of water withdrawal, by sector, in West Asia, North Africa and Central Asia:

Region	Water withdrawal by sector							% by region (1993)	m³/year per inhabitant
	agricultural		domestic		industrial		total		
	km³ per year	% of total	km³ per year	% of total	Km³ per year	% of total	km³ per year		
Maghreb	21.1	85	2.5	10	1.2	5	24.8	4.8	363
North-eastern Africa	65.0	88	3.9	5	4.8	7	73.7	14.4	764
Arabian Peninsula	21.2	87	2.6	11	0.5	2	24.3	4.8	659
Middle East	77.7	85	7.7	8	6.0	7	91.4	17.8	907
Central Asia	282.9	95	8.3	3	7.0	2	298.2	58.2	1 302
Total Near East	467.9	91	25.0	5	19.5	4	512.4	100.0	964
World 1990	2 235.6	69	259.2	8	745.2	23	3 240.0		660
N East as % of world	20.9		9.6		2.6		15.8		146

TABLE7: Water withdrawal as percentage of total internal renewable water resources (IRWR) in West Asia, North Africa, and Central Asia:

Region	Water withdrawal	
	total km³/year	as % of IRWR
Maghreb	24.8	51
North-eastern Africa	73.7	171
Arabian Peninsula	24.3	317
Middle East	91.4	37
Central Asia	298.2	55
Total	512.4	58

TABLE 8 Sub-regional distribution of irrigation methods in West Asia, North Africa, and Central Asia:

Region	Irrigation						Flood recession cropping	Water managed area
	full or partial control	spate irrigation	equipped wetl./ivb *	Total irrigation	as % of total	as % of cultivated		
	ha	ha	ha	Ha			ha	Ha
Maghreb	2412900	305000	0	2717900	6	16	64 000	2781900
N-eastern Africa	5196674	196200	0	5392874	11	46	0	5392874
Arabian Peninsula	2139887	98320	0	2238207	5	80	0	2238207
Middle East	8801127	393	115164	8916684	19	30	0	8916684
Central Asia	27067534	1402448	0	28469982	59	75	1240552	2971034
Total Near East	45618122	2002361	115164	47735647	100	48	1304552	49040199
	93%	4%		97%			3%	100%
World NE as % of world				246408529 19.4%				

- ivb = inland valley bottom

TABLE 9 – Origin of irrigation water by sub-region in West Asia, North Africa and Central Asia:

Region	Full or partial control irrigation: area equipped in hectares						
	surface water	% of total	groundwater (renewable and fossil)	% of total	non-conventional water	% of total	total area
Maghreb	1037649	43.0	1355251	56.2	20000	0.8	2412900
North-eastern Africa	4969800	95.6	222674	4.3	4200	0.1	5196674
Arabian Peninsula	51000	2.4	2066874	96.6	22013	1.0	2139887
Middle East	7198091	81.8	1598856	18.2	4180	(-)	801127
Central Asia	17865132	66.0	9202402	34.0	0	0.0	27067534
Total	31121672	68.2	14446057	31.7	50393	0.1	45618122

Note: Figures for Algeria, Libya, Somalia and Turkmenistan have been estimated on the basis of sub-regional trends

TABLE 10: Sub-regional distribution of the main irrigated crops (based on partial information)

Region (unit: '000 ha)	wheat	other cereals *	fodder crops	vegetables **	cotton	other annual ***	permanent crops	total
Maghreb	158	507	125	573	16	179	464	2 022
	8%	25%	6%	28%	1%	9%	23%	100%
N-eastern	1077	2024	1098	409	704	858	386	6556
Africa	16%	31%	17%	6%	11%	13%	6%	100%
Arabian	916	243	323	178	13	23	326	2 022
Peninsula	45%	12%	16%	9%	1 %	1%	16%	100%
Middle	784	576	38	307	408	396	197	2706
East	29%	21 %	1 %	11 %	15%	15%	7%	100%
Central	10331	3769	1187	896	3846	846	1615	22490
Asia	46%	17%	5%	4%	17%	4%	7%	100%
Total Near	13226	7119	2771	2363	4987	2302	2988	35796
East	37%	20%	8%	7%	14%	6%	8%	100%

ISLAMIC DEVELOPMENT BANK
Postal Address: P.O.Box 5925, Jeddah - 21432
Kingdom of Saudi Arabia
Telephone: 00966-2-/ 6361400 Facsimile: 6366871
E. Mail : idbarchives@isdb.org Home Page:http:/ / www.isdb.org