

Nineteenth Congress  
Beijing 2005

**MODERNIZING PUBLIC IRRIGATION  
INSTITUTIONS : THE TOP PRIORITY FOR THE  
FUTURE OF SUSTAINABLE IRRIGATION**

Salah Darghouth\*

**ABSTRACT**

Agricultural water has helped meet fast-rising demand for food and has contributed to the growth of agricultural profitability and poverty reduction as well as to regional development and environmental protection. However, after several decades of publicly funded surface irrigation, and more recently of privately developed groundwater irrigation, opportunities to harness new resources for agriculture are fewer and more expensive. Investment is increasingly focused on rehabilitating and improving existing systems. However, water productivity remains generally low and returns to public investment have been generally disappointing, especially in large-scale irrigation (LSI). New solutions are needed, based on new management options and widely available technologies. How to meet ever rising demand for food, while at the same time increasing farmer incomes, reducing poverty, and protecting the environment—all from an increasingly constrained water resource base—is the main challenge facing agricultural water management (AWM).

Governments have taken up the expansion of LSI, but performance has been suboptimal. Despite strong investment and management input from governments, the supply driven approaches and LSI infrastructure that were to

---

\* Senior Water Advisor for Agriculture and Rural Development, The World Bank, and Chairman of the International Network for Participatory Irrigation Network (INPIM)

fuel growth have often resulted in bureaucratic institutions, lacking the structure and incentives for efficient management, and in inflexible water delivery systems incapable of responding to farmer needs.

The roles of the various stakeholders are, however, changing. The role of government in AWM has begun to change, with tentative moves toward an enlarged role for users. There has been some decentralization, and the participatory irrigation management (PIM) movement has caught on in more than 50 countries. Several governments initiated some modernization programs of their irrigation institutions, but only few have been successful. Most successes have occurred in the developed world (e.g., Australia, France, United States, New Zealand), and little has been achieved in the developing countries. The restructuring of the Mali Office du Niger remains a successful exception. Investment by farmers and other private parties is substantial, but it has been concentrated in small-scale irrigation and private groundwater irrigation. Some initiatives have been taken in public-private partnership (PPP) for large-scale irrigation, but they remain very timid.

In large-scale irrigation, the objective is to improve farming profitability sustainably through improved service delivery at the least public cost. The bureaucratic institutional design and the inflexible water delivery systems that characterize much LSI make response to changing markets and profit opportunities difficult. Further improvements in profitability have to be done through integrated system modernization, namely by turning both the institutional structure and the irrigation delivery system around to focus on delivering sustainable, efficient, and demand-responsive water delivery service.

The institutional changes to create demand-responsive water delivery service typically include a reduction in the role of governments in management and financing, decentralization, agency accountability, and scheme financial accountability. Efficiency improvements should be introduced to reduce costs and expand the revenue base. Water user associations have proved effective in several modernization programs, and user participation should be included at each step of the decision making process. Scaling-up to water boards or user federations should be encouraged. Irrigation management transfer should be undertaken when the conditions are right and should be a carefully designed and implemented medium- to long-term process. A possible complement is to promote and develop public private partnerships. The main purpose of such PPP arrangements should be to bring in a “professional third party” that can be the catalyst for improved management and the genesis of a corporate culture. This third party does not necessarily have to be purely private sector. Depending on each case, it could be a farmer, public or private sector body, or the combination of any of them. In addition, it is recommended that PPP should be considered primarily for the operation, maintenance, and management (OMM) functions of irrigation and drainage.

Women are stakeholders in agricultural water management—and a poverty target group—yet they are widely disregarded in policy and programs. Women should be systematically involved in agricultural water management projects, and economic and social analysis and mechanisms for their participation and inclusion should be adapted to increase the effectiveness of women's participation.

Established water rights—especially tradable rights—should improve water productivity and promote investment. However, on large schemes where water volumes are difficult to measure and service delivery weak, attribution of legal rights is hard, and development of firm entitlements, often at the group level, should form part of modernization programs. Some countries—Jordan, for example—have started to introduce formal groundwater rights by developing over time a flexible legal framework of entitlement and transfer, with capacity building. Other countries have started by formalizing traditional informal water markets.

### PERFORMANCE OF THE PUBLIC IRRIGATION SCHEMES HAS BEEN GENERALLY POOR

Performance of irrigated agriculture in the publicly managed schemes that serve about half of the irrigated areas (Table 1) in the developing countries, has been generally well below technical and economic potential.

**Table 1.** Management types in irrigation

Region	Total	Public/Agency managed		Farmer / privately managed		Joint management		No data
	Million ha	Million ha	Per-cent	Million ha	Per-cent	Million ha	Per-cent	Per-cent
SSA	6.2	0.8	12.9	2.2	35.5	0.2	3.2	48.4
South Asia	73.7	31.6	42.9	32.4	44.0	0	0.0	13.2
East Asia	71.8	34.7	48.3	34.5	48.1	0.5	0.7	2.9
MENA	20.3	5.2	25.6	1.3	6.4	0	0.0	68
LAC	18.4	4.8	26.1	3.3	17.9	0	0.0	56.0
ECA	31.6	23	72.8	2.6	8.2	0.09	0.3	18.7
Developing country total	222.0	100.1	45.1	76.3	34.4	0.79	0.4	20.2

SSA - Sub-Saharan Africa; MENA - Middle East and North Africa; LAC - Latin America and the Caribbean; ECA - Europe and Central Asia

*Note:* The total acreage data in this table are different from the most recent ones provided by FAOSTAT.

*Source:* van Vuren G. and Mastenbroek A. 2000

*The performance of the large-scale irrigation (LSI) schemes has been particularly disappointing.* In most LSI schemes, water service to farmers has often been poor, and reliable and timely irrigation service delivery is the exception rather than the rule. The reasons behind these disappointments are many. However, the major causes of poor service delivery are generally located in the inter-related problems of *bureaucratic institutional setup* and *rigid technical design*, both of which generally originate in the “top-down” planned approach to irrigation. Bureaucratic institutional setups for LSI have contributed to poor service delivery in the well-known vicious circle of insufficient funding and cost recovery, inadequate operation and maintenance, and system deterioration, often forcing deferred maintenance and successive rehabilitations. Technical design has suffered from the same “top-down” approach. Indeed, many schemes were constructed with inflexible delivery patterns that are incapable of responding to changes in users’ water demand. Irrigation managers typically have paid insufficient attention to how schemes can be operated reliably, flexibly and equitably. As a result, most publicly managed schemes have achieved neither demand-responsive water service nor fiscal efficiency.

*Central bureaucracies and public sector irrigation institutions have often lacked the structure and incentives to optimize productivity.* In most developing countries, large-scale irrigation schemes have been managed by state bureaucracies and rigid formal irrigation institutions. Under such a management structure, system management has often failed to respond to the needs of users, in particular smallholders and tail-enders. Cost recovery is low, and water-use fees are not fully collected and are not allocated to proper system operation and maintenance. Irrigation institutions are often not adequately equipped to adapt to changing circumstances and expectations, and they suffer from bureaucratic incentives and institutional rigidity. All these shortcomings have resulted in poor water delivery, deteriorating systems, and poor economic and production performance, and high fiscal costs.

### **THE ROLES OF THE RESPECTIVE AWM STAKEHOLDERS ARE EVOLVING BUT MANY GOVERNMENTS ARE RESISTING THE CHANGE**

*Governments have been and remain predominant in managing large-scale irrigation.* Since the early 1990s, most development organizations have been actively advocating reforms in the irrigation sector, emphasizing a redefined role of the government, financial autonomy for irrigation agencies, and devolution of management responsibilities to water user associations (WUAs), at least at the scheme downstream levels. However, in practice, only a few developing countries have made significant progress with implementing these changes. Indeed, reform in the irrigation sector has been slow, in part because political economy considerations have been an important brake on these changes, which carry high political transaction costs. In most developing countries and

particularly in Asia, which accounts for two thirds of the developing world's irrigated area, centralized planning and top-down implementation approaches are still dominant and the prevailing model for large-scale irrigation remains a government-run and largely subsidized scheme. Despite some movement toward scheme administrative and financial management autonomy, only a few large-scale public irrigation schemes in the developing world (e.g., in China Shandong, Mali Office du Niger, and Morocco Tadla irrigation schemes) are autonomous and financially self-sustaining to cover operation and maintenance (O&M) expenditures. In most cases, institutional changes have been unsuccessful. This was the case in Madagascar, for example, where in the late 1980s, regional public sector irrigation agencies were dismantled, the schemes they were managing were hastily transferred to user responsibility, and government budget support was almost totally suppressed, except for major repairs after natural disasters (cyclones). As a result, the management of the public schemes virtually collapsed.

*The scope for farmer and other private sector involvement is, however, increasing.* Historically, private investment has been the rule in small-scale irrigation, and farmers worldwide have invested in groundwater extraction, by far the fastest growing agricultural water management activity in recent years. In India and Mexico, two thirds of groundwater development has been financed entirely by the private sector. In some countries, particularly in Latin America, private sector investment in irrigation is dominant and has improved efficiency. On some large-scale surface schemes, private contractors provide services for a fee. For example, in Shaanxi province, China, contractors operate a local irrigation system based on a multiyear contract between contractors and users.

*Stakeholder involvement and water user associations have significantly expanded all over the world.* The most significant change in institutional arrangements in recent years has been the participatory irrigation management movement. In counterpart to the redefinition of the role of public institutions, WUAs have developed over the last decade as ways of decentralizing management and involving stakeholders responsibly. WUAs are usually established to be involved in operation and maintenance, setting and collecting fees, hiring their own personnel, and managing water rights when they exist. They have proven, in the best cases, to be efficient, accountable, and responsive—but not in every case. Still, WUAs have generally been more successful than government agencies in recovering costs through higher charges and higher collection rates. Maintenance activities by the associations have helped stop the deterioration of infrastructure but the impact of WUAs on efficiency and productivity is mixed. Overall, experience shows that when properly undertaken, participatory approaches can reduce costs to government and improve scheme management. However, these changes work best when physical and institutional improvements are coordinated (Vermillion 2004).

## **GOVERNMENTS' ROLES IN IRRIGATION MANAGEMENT SHOULD BE REDEFINED AND PUBLIC IRRIGATION AGENCIES SHOULD BE RESTRUCTURED**

The “new public management” paradigm is one in which “the public sector is a facilitator which develops and enforces rules by which private sector participants interact within market arenas” (World Bank 2005c). The role of the public sector in agricultural water management diverges from this paradigm in several ways. First, water—and environmental protection—are public goods that require public intervention in allocation and management. Second, the huge size of investments in hydraulic infrastructure is beyond the capacity of the private sector in most countries. Finally, agricultural water management is a critical activity for the overriding public policy objectives of food security and poverty reduction. Therefore, the role of the public sector in agricultural water management is likely to be broader in most countries than the strict paradigm would allow. Although, every nation has different goals, policies, and history, specific tasks in relation to agricultural water are assigned to the public sector. These tasks are discussed below.

*Governments should keep, rationalize, and strengthen their responsibilities for core public sector tasks related to agricultural water management.* Governments should generally manage and regulate the water resource allocation and governance framework, protecting land and water rights, setting the incentives and institutional structure, and ensuring integrated management of the resource for the optimal welfare of society (including basin management and holistic approaches). Governments should also be responsible for public policy formulation, for strategies for public interventions, and for programs of public investment. Governments should also finance core public goods in the irrigation and drainage sector; including related environmental protection and the management of externalities, research and technology transfer, and rural infrastructure such as farm-to-market roads within and around the irrigated areas. In addition to these core functions, governments should also carry out some “transitional” tasks in agricultural water management, basically to correct market failure. Examples of where governments should intervene in the sector are : poverty reduction, water price setting, and correction of product and financial market failures.

*Within large-scale irrigation schemes, governments should clarify their responsibilities in financing and managing the hydraulic components of the systems.* In large-scale irrigation, governments have to at least ensure the public good aspects of water resources management, equity and poverty reduction, water pricing, and mobilization of the financial resources needed. Thus, governments should in general take responsibility for the funding and execution of construction, rehabilitation, improvement and operation and maintenance of the headworks and main infrastructure (*bulk water infrastructure*). Downstream works—secondary canals and below—that directly serve users

and are on a scale that users can finance and operate (*distribution infrastructure*) should have the maximum financial contribution from users and maximum user involvement in management. Each case should be treated separately, and no blueprint should be advised.

Once these responsibilities are well defined and formalized, governments need to establish institutional structures that have *incentives* for delivering water service that responds to demand, that are fiscally efficient, and maximize water productivity. Although, there can be no blueprint, the following lessons from experience are important :

- Apply the principle of subsidiarity, i.e. decentralizing decisions and responsibility to the lowest possible level
- Create scheme financial autonomy, transparency, and accountability
- Maximize organized user involvement in decisions and financing, bringing demand-driven incentives to efficiency and a spirit of accountable ownership to farmer participation and cost sharing
- Target cost-effective service delivery and water productivity with benchmarking to track performance and build modernization programs that target the most cost-effective improvements.

Most of these principles were applied successfully in the Mali Office du Niger (Box 1)

*In moving toward new institutional structures based on revised allocations of operational and financial responsibilities between stakeholders, governments have to “manage” the political economy considerations.* Stakeholder roles and institutions are shaped in part by the political economy of each nation. Governments target multiple growth and equity objectives and are influenced by various constituencies in the weightage they assign to each objective and in the way they manage tradeoffs. Bureaucracies may be well entrenched, often with Byzantine complexities, and bureaucratic interests and incentives may conflict with efficiency goals. Existing “entitlements” to subsidies and rents may not provide incentives for efficient service or water productivity. Existing water entitlements may inhibit more equitable water allocation. The structure of established interests means that any change will create losers as well as winners, and reforms in agricultural water management typically have high political transaction costs. Clearly, there is no one way to manage change, but successful practice includes some common characteristics : the use of transparent and inclusive processes to diagnose problems and identify options for change; the role of champions in leading to the change and brokering solutions; piloting of reforms to make sure benefits outweigh costs; and building incentives, including early benefits for “winners” and support measures for “losers.”

**Box 1 : Mali Office du Niger : A successful restructuring of a public irrigation agency**

As part of a major institutional restructuring program of the Office du Niger (ON), the World Bank and other development organizations jointly supported the Government of Mali's efforts to implement an ambitious reform agenda in early 1990s. The reform agenda included :

- Progressive divestiture of ON commercial activities to focus on water management and agricultural services functions
- Streamlining ON's relationship with the government through performance contracts
- Restructuring ON finances to eliminate chronic deficits
- Instituting full administrative and financial autonomy and accountability
- Improving internal management and strengthening capacity building of ON
- Rehabilitating and modernizing the irrigation networks
- Establishing new ON-farmer cooperative arrangements for operation and maintenance and cost recovery
- Improving production practices and diversifying crops
- Liberalizing rice prices and marketing
- Establishing new land tenure security systems (long-term leases)

The implementation of this program resulted in successful reorganization of the ON and restoration of its financial health, improved water fee collection from 60 to 97 percent with fees now being retained in the areas where they are collected, tripling of average paddy yields (from 1.8 to 6 tons/ha) and production, increased crop diversification, and reduction in government expenditures on subsidies to support ON and the rice sector.

Source : Author.

**USER PARTICIPATION SHOULD BE INTEGRAL PART OF ANY INSTITUTIONAL REFORM, BUT IRRIGATION MANAGEMENT TRANSFER (IMT) SHOULD BE CAREFULLY PLANNED AND IMPLEMENTED IN PHASES SO AS TO ENSURE SUCCESS AND SUSTAINABILITY**

*Key lessons have emerged on participatory irrigation management and irrigation management transfer.* More than a decade of experience shows both successes and failures in establishment of water user associations and in their functioning. The World Bank Operations Evaluation Department found that beneficiary involvement has facilitated better system operation and management and cost recovery (World Bank 2002). A more recent study, of 26 irrigation systems in six countries in Asia found that systems transferred from public to private or semi-autonomous management almost invariably perform better in terms of operation and maintenance, productivity, and irrigation charge collection

(ADB/IWMI 2004). Evaluation of participatory irrigation management has, however, provided useful insights into what not to do. Most notably, user involvement has to be correctly sequenced with upstream reform of irrigation agencies. The limits of participation have also to be recognized. In the Philippines, several groups found the operation and maintenance task too onerous, given their limited access to heavy equipment—and the tasks had to be returned to state management. (World Bank 2002). An area of inherent weakness is that water user associations effectively represent the different perspectives and interests of the involved farmers—men and women, head-end and tail-end irrigators, and commercial and subsistence producers—and a water user association does not always resolve deeply entrenched problems of inequality (Vermillion 2004).

*User participation should be included at each step of the process from the beginning.* Participation should be continued throughout the whole cycle, including : involvement in all aspects of operation and maintenance and cost recovery; “upstream” involvement in planning and in the investment cycle; “downstream” involvement in monitoring and evaluation. Women should be involved (see below), not the least because their participation has been shown to strengthen the institutional set up (Vermillion 2004).

*Water user associations need to have legal personality and water use rights.* They also need to have rights related to their own organization such as the right to require water users to pay for water service and the right to collect and use a service fee. They also need rights related to water management and the operation and maintenance function such as the right to select service providers and hire or fire personnel, and the right to determine, supervise, and execute an irrigation service plan. Finally, they need rights related to investment and improvement and the right to make legal contracts and own property (ICID 2000; Vermillion 2004).

*Irrigation management transfer should be undertaken only when the conditions are right.* Irrigation management transfer has been largely successful where farmers have water rights and farms are medium and large scale with good access to output markets (Mexico, South Africa). Where, there are large and small farmers together, or imbalances between upstream and downstream users, transfer will be difficult because the government will not be able to ensure equity. In addition, costs are likely to rise, as subsidies are eliminated. There is also some evidence that user associations may have higher cost operations than well-functioning public management. Finally, transferring a scheme out of public management requires clear allocation of financial and operation risk and liability between the parties (Vermillion 2004).

**PUBLIC-PRIVATE PARTNERSHIPS (PPP) IN IRRIGATION SHOULD BE  
CONSIDERED BUT ONLY IN THOSE CASES WHERE  
THEY CAN SUCCEED**

Faced with the challenges of maintaining high investment in irrigation and with improving operation and maintenance and cost recovery, governments have turned to new models of large-scale irrigation management. One model is discussed below—that is sharing tasks, costs, and risks with water user associations, and ultimately moving to irrigation management transfer (see below). Another model is to broaden that by moving towards public private partnerships.

*Among developing countries, only in Latin America has irrigation PPP taken place extensively, but even there governments have played a “trailblazing” role. In Brazil, for example, the government has undertaken large-scale irrigation demonstration projects that have given the private sector the confidence to invest (Box 2).*

**Box 2 : Public investment leads the way for the private sector :  
Irrigation development in the Brazilian semi-arid region**

In the 1970s, the Brazilian government began to establish public irrigation schemes to settle new farmers in the semi-arid region of the country. These schemes were designed to create jobs and boost exports. They were also expected to serve as development “poles” that would create a regional dynamic, boosting economic growth and reducing income inequalities. Over three decades, the Brazilian government invested more than US\$2 billion to develop 200,000 hectares, a cumulative public investment of about US\$10,000 per hectare. A remarkable effect has been the stimulation of private investment: the development of 360,000 additional hectares of private land for irrigation was “motivated by the new cropping alternatives, technologies and productive processes validated in the pioneering public schemes”. Irrigated agricultural production in the area is now worth US\$2 billion annually, including US\$170 million a year in fresh fruit exports.

A study of the process drew a powerful lesson: that it can take a long time for large-scale irrigation to show positive results—in this case about 10 to 15 years. There is thus a role for the public sector to undertake demonstration schemes, because the private sector is unlikely to invest with such a long payback period unless the model is shown to be profitable.

*Source : World Bank 2004a*

*Beyond Latin America, PPP in irrigation has made some modest beginning in providing management services and, to a lesser extent, in investment partnerships. A study of 21 cases (World Bank 2004e) found that PPP demand has mostly been a government initiative with service providers more reactive than proactive (e.g. Tieshan, China or Maniçoba, Brazil). Most PPP contracts have covered operation and maintenance functions, either alone or in accompaniment with private participation in investment. Most contracts were public service delegation contracts. Early results show that water service delivery has improved, that the performance of both government and user*

associations has benefited from interaction with a “professional third party” bringing a business-like approach, and that cost recovery has improved despite the fact that water tariffs have gone up as the government subsidy was reduced.

*Three lessons from experience in the water supply sector are significant for the irrigation sector.* First, PPP helps water service become autonomous and enables it to embark on long-term management improvement. Thus, PPP’s main positive impact is the introduction of improved management and a corporate culture. A second lesson is that the arrival of a private operator generally spells the reduction of subsidies and entails increased water charges. These increases could have the beneficial effect of driving conversion to high value-added crops in place of the staple crops that still predominate in irrigated agriculture. On the negative side, a private operator raising charges could create a bad public image and make government and civil servants reluctant to embark on reform. A third lesson is that efficiency gains can be obtained, but they may be offset by the higher cost of private capital and management inputs.

*Where PPP is considered, risks should be identified carefully and addressed properly.* Although, numerous risk-mitigating tools exist, PPP risks remain significantly higher in irrigation than in water supply and sanitation, due to the specifics of the sector. Governments should seek expert advice to develop contracts that handle risk efficiently and equitably, especially in relation to the following :

- *Country risks.* The main country risks stem from the strong political and social issues connected with water, food, and agricultural production.
- *Policy risks.* Large-scale irrigation development is often required to meet nonmarket policy objectives such as food security, poverty reduction, or job creation, and product markets may be distorted and unlikely to yield commercial returns
- *Water scarcity and water demand risks.* The growing water insecurity and more frequent “water shocks,” some of them associated with climate change (droughts, flood), intensify the perception of risk. In addition, water is a strategic commodity, controlled by sovereign governments, that may be diverted to other uses
- *Financial risks.* Exposures are long, and many projects cannot pay sufficient financial returns.
- *Commercial risk.* Setting water charges at sustainable levels and ensuring their full collection have proved difficult almost everywhere.
- *Environmental risks.* Irrigation PPP projects should be systematically subjected to environment impact assessments.

*Large-scale irrigation projects with high-value crops and commercial farming may provide opportunities for public private partnerships*, such as the recently awarded build-transfer-operate (BTO) investment contract in Guerdane, Morocco (Box 3). Lessons from this promising project were that the advisory role played by the World Bank's International Finance Corporation (IFC) was a key incentive to investors, even though, there was no IFC financing. Second, commercial tariffs would have exceeded affordability and the farmers' willingness to pay, and public sector cost sharing was essential to the deal. However—and this is the third lesson—the public sector contribution could not be pitched too high in order to maintain incentives for water saving. Fourth, the competitive bidding process resulted in major savings. Finally, careful design is essential, and includes setting realistic prequalification criteria for bidders.

**Box 3 : New Initiatives in public-private partnership in large-scale irrigation in Morocco**

Morocco wished to test public-private partnership arrangements for two large irrigation schemes and invited International Finance Corporation (IFC) to look into options. One scheme, *Guerdane*, was a 10,000-ha irrigation area serving 600 citrus farmers where the groundwater was running out. The government was prepared to allocate water from the dam complex of Chakoukane-Aoulouz and to cofinance the development of the 60-mile conveyance pipe and distribution structure. In July 2004, the bid was won by a consortium led by Omnium Nord-Africain (ONA), a Moroccan industrial conglomerate, with participation of French and Austrian companies. The consortium will enter into a 30-year concession for the construction, cofinancing, and operation and management of the irrigation network. The project will cost an estimated \$85 million of which the Moroccan government will provide \$50 million, half as a loan and half as a grant. The water tariff agreed by the consortium is toward the lower limit of the present cost range of groundwater, so farmers will benefit from a cost saving.

The other scheme, *Gharb*, presented a quite different challenge—a large undeveloped public area (55,000 ha) with some traditional localized irrigation and rainfed farming in the command area of a new dam. Following new policies, the government was prepared to split development costs 50:50 with the beneficiaries or other investors, but not to shoulder the whole development cost. Could IFC come up with a formula for private participation for both development and operations? The proposal is still under study, but most likely some form of management contract will result.

Source: Author.

*But, PPP should be considered first and foremost for the operation, maintenance and management (OMM) functions of irrigation and drainage.* Most large-scale irrigation projects will continue to be unsuitable for private financing because of the risks discussed above. However, for schemes that can generate adequate cash flow, there are some areas in which private financing could be facilitated. This should be encouraged in particular on a priority basis for the OMM functions of irrigation and drainage, because this has tested and proven feasible in the above-mentioned World Bank study.

## WOMEN'S INVOLVEMENT IN IRRIGATION MANAGEMENT SHOULD BE PROACTIVELY PROMOTED AND DEVELOPED

As active participants in irrigated agriculture in most countries, women can bring their own perspective and distinct set of interests in how the water should be managed (Box 4). For example, they will have an interest in investments in low-cost drip systems that can be used for household gardens; they will be concerned about minimizing the need for night-time irrigation; and they may be effective in mobilizing the other women in the community to ensure that their husbands pay the irrigation fee on time. Culturally sensitive arrangements need to be made to include women in water user associations. Social justice and equity also point to inclusion: because women's livelihoods are affected by the way their irrigation system is managed, they should be represented in that management.

### **Box 4 : The beneficial impact of irrigation on women and girls in Bangladesh**

In Bangladesh, the increase in labor opportunities generated by irrigation has been higher for female than for male labor. Two thirds of women in landless and marginal farmer households reported a higher income through increased wage labor opportunities in irrigated production. Women reported that caring for livestock (primarily their role) became easier with irrigation because it increases water availability for bathing cows in the dry season. Incomes from animal production went up. Additionally, irrigation, by increasing access to water close to home, reduced women's general work burden because water collection is primarily an activity of women. Irrigation also changed labor relationships. Before, women often worked for rich households, receiving food in return. With irrigation, opportunities for income generation have increased such as crop processing, agricultural production, or working as agricultural laborers.

*Source:* Jordans and Zwarteveen (1999); Lipton (2004).

Entry points for increased women participation in irrigation management include the following :

- Planning and program design can use economic and social analysis tools to identify women's specific role in AWM and build-in interventions that improve the effectiveness of that role.
- Mechanisms for participation and inclusion can be adapted to increase the effectiveness of women's participation. These mechanisms might include :
  - Promoting flexible, reliable and regular water distribution arrangements for all, also including solutions for night irrigation, if needed.
  - Ensuring that women holders of water entitlements have parity—this would include women landowners who already are entitlement holders, as well as female farm decisionmakers without land titles.

- Actively inviting women to meetings, encouraging them to speak up, and creating awareness among women, their husbands, and other farmers about the need to extend membership and attendance to all.
- Agreeing on minimum quotas for female membership on WUA boards.
- Designing any labor obligations (e.g., in-kind contributions for cleaning and maintenance works) to allow women to contribute their fair share.

All these options have to be adapted to the specifics of local conditions.

### **WHILE RECOGNIZING THEIR PRACTICAL IMPLEMENTATION COMPLEXITY, WATER RIGHTS AND MARKET DEVELOPMENT PROGRAMS SHOULD BE CONSIDERED**

*Secure water entitlements and rights greatly help good agricultural water management.* Seen from the irrigation farmer's perspective, secure water access is a priority. Planning for a year's crop, or planting trees for the future, investing in irrigation equipment, or accessing credit facilities—all depend on water security. Lack of secure water entitlement leaves the farmer open to risks that are difficult to manage. Unclear water allocation can result in conflict, resource degradation, disincentives for investment, and disproportionate negative impacts on the poor who often rely on open access or communal resources. Administrative allocation has in many cases proved inefficient, especially when combined with a confusing web of administered prices and subsidies that obscure incentives (World Bank 2005). Identifying water allocations and, when possible, water rights would increase allocative efficiency and promote water-conserving technologies.

*However, water property rights over irrigation water are very difficult to establish.* In many traditional irrigation systems, mechanisms for water rights and trading have long existed. To some extent, these systems have adapted to the changing demands of the modern world (as in the traditional small and medium-scale irrigation schemes in Morocco). However, the attribution of legal rights on large-scale surface schemes is hard, especially when water volumes are uncertain and difficult to measure, and service delivery is weak. The allocation of rights to groundwater is even harder because it requires technical quantification and monitoring of the resource, and an institutional setup to regulate it. Only a few countries have succeeded in helping efficient water markets to develop. In Chile, for example, which has a legally recognized system for trading water, water markets have produced significant economic gains from trade, particularly, in transferring water between urban and agriculture uses. Some developed countries have well-functioning water trading systems, as with Murray Irrigation Limited in Australia or in parts of California.

*Also, the demanding legal, administrative, and managerial requirements make water markets a long-term prospect in most countries.* Formal water markets require a physical conveyance system, with volumetric water measurement, clear water rights, an enabling legal framework, and transparent trading rules. Institutional structures are needed to manage delivery and to provide judicial oversight and dispute resolution. Several preconditions—including a strong link between water and land rights, a prior history of informal water trading, a sound legal system, a system for registering water rights, and good governance—make water trading work. Other success factors include an independent regulatory system to allocate water rights and safeguard essential uses, and a good hydrological information base and titling system.

*In the future, water stress and structural change in the irrigation sector will drive active interest in water markets.* As scarcity pushes up the opportunity cost and as nonagricultural demand grows, water markets may be a way of easing the transition out of farming. A recent study demonstrated that farmers in Morocco who may be affected by deprotection of cereal markets can be partly compensated by creation of a water market that allows farmers to realize the shadow price of water (Tsur et al. 2004; Roe et al. 2004).

*Establishing water rights should be seen as a first step.* Peru and a number of other countries are compiling registries of water rights, and this creates incentives to investment and conservation. The development of tradable rights and markets can follow, if there is a demonstrated need and feasibility. There are two possible tracks. One track is to support the development of a formal rights-based system by developing over time a flexible legal framework of entitlement and transfer, with capacity building. An interesting finding from the Chile case is that informal markets can act as precursors, demonstrating what measures are needed for a formal market to work under local conditions. The alternative is to formalize present informal markets, as in the Jordan case. In either approach, the problems associated with individualization of water rights could be overcome by recognizing the rights of a group and strengthening the enabling and supporting environment for decentralized and community-based approaches to water rights administration.

## REFERENCES

- Bastidas, Elena. P. 1999. *Gender Issues and Women's Participation in Irrigated Agriculture: The Case of Two Private Irrigation Canals in Carchi, Ecuador*. Research Report 31. Colombo, Sri Lanka: IWMI.
- Cornish, G.A. and C. J. Perry. 2003. *Water Charging in Irrigated Agriculture. Lessons from the Field*. Report OD 150. HR Wallingford.
- CropLife International. *Water Matters for Sustainable Agriculture*. A collection of case studies.

Easter, K. William and Yang Liu. 2004. *Cost Recovery and Water Pricing for Irrigation and Drainage Projects*. Background report for the World Bank Agricultural Water Management DID.

FAO (Food and Agriculture Organization). 1999. *Transfer of irrigation management services. Guidelines*. FAO Irrigation and Drainage Paper 58.

FAO. 2002. *Why agricultural water productivity is important for the global water challenge*.

FAO. 2003. *Agriculture, Food and Water*. A contribution to the World Water Development Report.

FAO. 2003. *Unlocking the Water Potential of Agriculture*. Rome.

FAO. 2004. *Water for sustainable food production, poverty alleviation and rural development*.

ICID (International Commission on Irrigation and Drainage). 2000. *Proceedings of the 8<sup>th</sup> ICID International Drainage Workshop. "Role of Drainage and Challenges in 21<sup>st</sup> Century."* 31<sup>st</sup> Jan - 4<sup>th</sup> Feb, 2000, New Delhi, India: ICID.

IPTRID. 2003. *The Irrigation Challenge. Increasing Irrigation Contribution to Food Security through Higher Water Productivity from Canal Irrigation Systems*. Rome: IPTRID Secretariat. FAO.

IPTRID. 2003. *Supporting Capacity Development for Sustainable Agricultural Water Management*. IPTRID Partnership Programme 2003-2005. Rome: IPTRID Secretariat. FAO.

Johnson, Sam H., Mark Svendsen and Fernando Gonzalez, ed. 2004. *Institutional Reform Options in the Irrigation Sector*. Agriculture and Rural Development Discussion Paper 5. The World Bank.

Molden, David, Upali Amarasinghe, and Intizar Hussain. 2001. *Water for rural development: Background paper on water for rural development prepared for the World Bank*. Working Paper 32. Colombo, Sri Lanka: International Water Management Institute.

Penning de Vries, F.W.T., Acquay, H., Molden, D., Scherr, S.J., Valentin, C. and Cofie, O. 2003. *Integrated Land and Water Management for Food and Environmental Security*.

Plusquellec, Herve. 1997. *The Future of Irrigation*. Presented at the Regional Seminar on Sustainable Irrigation. Tashkent, February 20 to 25, 1997.

Plusquellec, Herve. 2002. *How Design, Management and Policy Affect the Performance of Irrigation Projects. Emerging Modernization Procedures and Design Standards*. Bangkok, Thailand: FAO.

Postel, Sandra. 1999. *Pillar of Sand*. New York, London: W.W. Norton & Company.

Priscoli, J.D., ed. 2005. "Water Institutional Reforms: Theory and Practice." *Water Policy* 7-1 (2005).

Rosegrant, Mark W. and Svendsen, Mark. 1993. *Asian food production in the 1990's. Irrigation investment and management policy*. International Food Policy Research Institute.

Rosegrant, M. W., X. Cai, and S.A Cline. 2002. *World Water and Food to 2025: Dealing with Scarcity*. Washington, D.C.: IWMI.

Schultz, Bart. 2002. *Opening Address*. 18<sup>th</sup> Congress International Commission on Irrigation and Drainage (ICID). Montreal, Canada.; 25 July, 2002.

Shah, T., B. van Koppen, D. Merrey, M. de Lange, and M. Samad. 2002. *Institutional alternatives in African smallholder irrigation: Lessons from international experience with irrigation management transfer*. Research Report 60. Colombo, Sri Lanka: IWMI.

Svendsen, Mark, Jose Trava, and Sam H. Johnson III. *Participatory Irrigation Management: Benefits and Second Generation Problems*. Lessons from an International Workshop held at Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia, 9-15 February, 1997.

United Nations. 2004. Millennium Project Hunger Task Force, “*Halving Hunger: It Can Be Done. An Action Plan for Implementing the Millennium Development Goal on Hunger*.” Draft, October, 2004.

Van Hofwegen, Paul and Mark.Svendsen. 1999. *A Vision of Water for Food and Rural Development*.

Vermillion, D.L. 2004. *Taking Action for Participatory Irrigation Management. First Draft*. Background report for the World Bank Agricultural Water Management Directions in Development report.

World Bank. 2000. A review of drainage projects supported by the World Bank from 1973 –. *Development of Land Drainage*. Water Resources Management Thematic Group. Rural Development Department.

World Bank. 2002. *Bridging Troubled Waters: Assessing the World Bank Water Resources Strategy*. Washington, D.C.: World Bank Operations Evaluation Department.

World Bank. 2003. *Sustainable Groundwater Management: Concepts and Tools*. Foster, Stephen and Karin Kemper, eds. GW-Mate Briefing Note Series.

World Bank. 2004a. *Brazil. Irrigated Agriculture in the Brazilian Semi-Arid Region: Social Impacts and Externalities*. Report No. 28785-BR.

World Bank. 2004. Johnson III, S., Svendsen, M. and Gonzalez, F. *Institutional Reform Options in Irrigation Sector*. Agriculture and Rural Development Discussion Paper 5. Washington, D.C.: Agriculture and Rural Development.

World Bank. 2004. *PPP for Irrigation and Drainage. Need for a Professional “Third Party” Between Farmers and Governments*. Background Paper for DID.

World Water Council. 2003. *Financing Water for All*. Report of the World Panel on Financing Water Infrastructure. Chaired by Michel Camdessus. Winpenny, J., ed.

## Keynote Speaker



**Salah Darghouth** is the World Bank Water Advisor for Agriculture and Rural Development. Within the Bank, he has assumed several professional, managerial and advisory services. After having worked as a Rural and then Senior and Principal Irrigation Engineer in the Europe and North Africa Region, he took over managerial responsibilities as Agricultural Division Chief in the Africa Region and Sector Manager for Rural Development, Water and Environment in the Middle

East and North Africa Region. Before joining the Bank, he was in charge of the Study and Construction and then of Operation and Maintenance and of Agricultural Development of the irrigation schemes in Tunisia. Mr. Darghouth is also the Chairman of the Board of the International Network for Participatory Irrigation Management (INPIM).

Throughout his career, Mr. Darghouth has conducted and lead an extensive number of project, economic, sectoral policy reform activities in agriculture, rural development, natural resources management, water and environment in more then thirty countries in Africa, Asia, and Europe.

Mr. Darghouth has a Master Degree equivalent in Agricultural Sciences from the Institut National Agronomique (INA), and a PhD Degree equivalent in Rural Engineering with specialization in Water Resources Management from the Ecole Nationale du Genie Rural, des Eaux et des Forets (ENGREF), Paris, France.