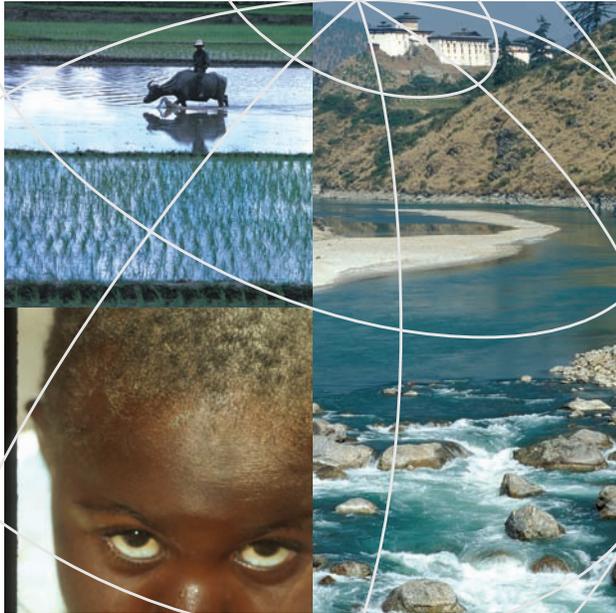


Emerging Public-Private Partnerships In Irrigation Development and Management



THE WORLD BANK GROUP



Water
Sector
Board

Public Disclosure Authorized

ACKNOWLEDGEMENTS

The report was prepared by a team led by Salah Darghouth (World Bank). The team included Henri Tardieu, Bernard Préfol, Alain Vidal, Jacques Plantey, and Sara Fernandez (consultants). The authors wish to thank Ariel Dinar, Philippe Marin, Musa Asad, Ijsbrand de Jong, Aldo Baietti, Hassan Lamrani and Julienne Roux (all from the World Bank) as well as Intizar Hussain, (INPIM), Christopher Ward and Hervé Plusquellec (consultants) for their comments and contributions.

This report describes the set of functions concerned with irrigation and drainage, and the demand and offer for private sector involvement in each of these functions. It draws on the experience of the water supply and sanitation sector to show how risks are allocated between the public client and private operator in different contracts. It also reviews emerging experiences with public private partnerships through a number of case studies, and describes some guidelines for deciding on an optimal public private arrangement.

DISCLAIMERS

The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors and should not be attributed in any manner to the World Bank, to its affiliated organizations, or to members of its Board of Executive Directors or the countries they represent. The material in this work is copyrighted. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or inclusion in any information storage and retrieval system, without the prior written permission of the World Bank. The World Bank encourages dissemination of its work and will normally grant permission promptly. For permission to photocopy or reprint, please send a request with complete information to the Copyright Clearance Center, Inc, 222 Rosewood Drive, Danvers, MA 01923, USA, fax 978-750-4470. All other queries on rights and licenses, including subsidiary rights, should be addressed to the Office of the Publisher, World Bank, 1818 H Street N.W., Washington DC, 20433, fax 202-522-2422, e-mail: pubrights@worldbank.org.

CONTACT INFORMATION

To order additional copies, please contact the Water Help Desk at whelpdesk@worldbank.org. This paper and its annexes are available online at <http://www.worldbank.org/water>.

Salah Darghouth,
Water Adviser for Agriculture and Rural Development,
World Bank: sdarghouth@worldbank.org

Emerging Public-Private Partnerships In Irrigation Development and Management

The World Bank, Washington, DC



THE WORLD BANK GROUP



Water
Sector
Board

PREFACE

The irrigation and drainage sector plays a vital role in food production and rural economies. Over the past 40 years, it has been key in meeting the fast-rising demand for food in the world. Looking forward, the strong demographic and increased income push to food demand is expected to continue in the future, and irrigated agriculture will need to continue rapidly expanding and intensifying.

However, irrigation and drainage is also facing acute challenges of water and finance scarcity. Water availability for agriculture is increasingly constrained and water use efficiency and productivity should be raised. Investments, and continued operation and maintenance of schemes, have often been based on massive public funding, placing an unbearable fiscal burden on national governments.

At the same time, the changing context for the sector offers renewed opportunities for modernization and expansion where needed most, with decentralization of responsibilities, empowerment of farmers and local stakeholders, and market-driven growth. Hence, in view of the constraints and challenges, the idea of involving private sector investors and managers in irrigation and drainage is increasingly adopted. The private sector comprises here all economic actors not directly controlled by government.

Given the long-lasting reluctance of private investors to turn into irrigation and drainage, public-private partnerships, with their promise of shared responsibility and managed risk, are a means of creating the right incentives for greater private sector involvement.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1 INTRODUCTION.....	7
I&D development	7
I&D management and PPP.....	8
2 ANALYTICAL FRAMEWORK	9
I&D system types.....	10
I&D components.....	11
I&D functions.....	12
I&D PPP analytical support diagram	14
3 LESSONS FROM PPP IN WSS	15
Types of PPP in WSS.....	15
Experience of PPP in WSS.....	18
Lessons from PPP in WSS relevant to I&D.....	19
4 EMERGING EXPERIENCE OF PPP IN I&D	20
Historical background	20
Current situation	21
The case studies illustrations	22
Main findings and PPP modeling.....	30
5 CONCLUSIONS AND RECOMMENDATIONS	37
Recommendations.....	38
REFERENCES	44

TABLE

Table 1. The 21 PPP case studies	23
Table 2. PPP contracts in the 21 case studies	27

FIGURES

Figure 1. Dominant types of I&D.....	11
Figure 2. PPP analytical support diagram.....	15
Figure 3. Types of PPP in WSS.....	17
Figure 4. International contracts awarded to the 10 world water industry leaders	18
Figure 5. The current “average” I&D management matrix	22
Figure 6. Types and contents of PPP contracts in the case studies.....	27

BOXES

Box 1. Case Study 02: Société d'Aménagement des Eaux du Delta du Sénégal (SAED), Senegal	24
Box 2. Case Study 09: China, Tieshan, Yangtze Basin Water Resources Project.....	24
Box 3. Case Study 18: Compagnie d'Aménagement des Coteaux de Gascogne (CACG), Neste, France.....	25
Box 4. Model 0: The typical pre-reform situation	32
Box 5. Model 1: First changes between well-identified partners.....	33
Box 6. Model 2: Irrigation management transfer to empowered WUAs	34
Box 7. Model 3A: Service or management contracting	35
Box 8. Model 3B: Public service delegation.....	36
Box 9: Risk-mitigating tools.....	40
APPENDIX A. PUBLIC PRIVATE PARTNERSHIPS IN IRRIGATION AND DRAINAGE: 21 CASE STUDIES	48
APPENDIX B. MATRIX FOR PUBLIC PRIVATE PARTNERSHIPS	49

ACRONYMS AND ABBREVIATIONS

AFD	Agence Française de Développement	ISO	International Organization for Standardization
AFEID	Association Française pour l'Étude des Irrigations et de Drainage (French Association for Irrigation and Drainage Studies)	IWMI	International Water Management Institute
AGR	Administration du Génie Rural	JVA	Jordan Valley Authority
AIC	Association d'Intérêt Collectif (Water or Irrigation Water Association), Tunisia	KfW	Kerdtanstalt für Wiederaufbau (German Bank for International Development Financing)
APC	Arable and permanent crop	m ³	Cubic meters
APL	Adjustable Program Loans	Mha	Million hectares
ARD	Agriculture and Rural Department, World Bank	MC	Meter cube (cubic meter)
ASA	Association Syndicale Autorisée (French Irrigator Association)	MENA	Middle East and North Africa
AUEA	Agricultural Water User Association, Morocco	MFI	Multilateral financial institutions
BOO	Build-operate-own	MIGA	Multilateral Investment Guarantee Agency
BOT	Build-operate-transfer	Mm	Millimeter
BRL	Compagnie d'Aménagement du Bas-Rhone et du Languedoc	NAFTA	North America Free Trade Agreement
CACG	Compagnie d'Aménagement des Coteaux de Gascogne (Development Company for southwestern France)	NGO	Nongovernmental organization
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement, France	OBA	Output-based aid
CRDA	Commissariat Régional de Développement Agricole (Regional Office for Agricultural Development), Tunisia	O&M	Operation and maintenance
CSS	Compagnie Sucrière du Sénégal (Sugar Company of Senegal)	OMM	Operation, maintenance, and management
DAM	Division Autonome de Maintenance (Autonomous Maintenance Division)	OPEC	Organization of the Petroleum Exporting Countries
DAT	Dépôts à Terme, investment accounts with the Crédit Agricole du Sénégal	ORMVA	Office Régional de Mise en Valeur Agricole (Regional Office for Agricultural Development), Morocco
DBO	Design-build-operate	PAGI	Programme d'Amélioration de la Grande Irrigation, Morocco
DSI	Devlet Su Isleri, Göktepe	PIM	Participatory irrigation management
FAO	Food and Agriculture Organization, United Nations	PMU	Project Management Unit
FAUR	Fédération d'Associations d'Usagers des Réseaux (Federation of Water User Associations), Madagascar	PPP	Public-private partnership
FCFA	CFA Franc	PSD	Public service delegation
FMG	Malagasy Franc	PTP	Professional third party
GA	Governmental Agency	RGE	Responsable Gestion de l'Eau, a staff member of the IDSP
GAP	Güneydogu Anadolu Projesi Turkey (Southeastern Anatolia Project)	ROT	Rehabilitate-operate-transfer
GDP	Gross domestic product	SA	Societe Anonyme
GIE	Groupement d'Intérêt Economique	SAED	Société nationale pour l'Aménagement et l'Exploitation des terres du Delta et du Fleuve Sénégal (Agency for the Development of the Delta and the Valleys of the Senegal River), Senegal
GIS	Geographical Information System	SAR	Société d'Aménagement Régional (Regional Development Corporation)
ha	Hectare, hectares	SCADA	Supervisory control and data acquisition
I&D	Irrigation and drainage	SCP	Compagnie du Canal de Provence (Development Company of the Provence Canal), France
ICID	International Commission on Irrigation and Drainage	SEM	Société d'Economie Mixte
IDSP	I&D service provider	SIDD	Self-financing irrigation and drainage district
IFPRI	International Food Policy Research Institute	SIL	Sector investment loan
IFC	International Finance Corporation	SIM	Sector investment and maintenance loan
IFI	International Financial Institution	SME	Small and medium enterprise
IMT	Irrigation management transfer	SOMALAC	Societe Malgache du Lac Alaotie
IMTA	Instituto Mexicano de Tecnología del Agua (Mexican Institute on Water Technology)	UP	Uttar Pradesh, India
		WAJ	Water Authority of Jordan
		WRMSP	Water resource management service provider
		WSC	Water supply corporation
		WSS	Water and sanitation sector
		WTO	World Trade Organization
		WUA	Water user association
		WUF	Water user federation

EXECUTIVE SUMMARY

As part of its program to analyze key issues related to water for food, the World Bank has prepared a series of background papers: reengaging in Agricultural Water Management, water pricing and cost recovery, and public-private partnership (PPP) in irrigation and drainage (I&D), the subject of this background paper. The objective of this paper is to identify the possible role and opportunities for the private sector to participate with governments and farmers in developing and managing I&D infrastructure. The paper is based on a desk study of reports and on a series of case studies of selected projects.

Background

Over the last 50 years, irrigated agriculture has been vital to meeting fast-rising food demand and has been key to poverty reduction. In the coming years the strong demographic demand for food is expected to continue, and intensified irrigated agriculture will have to provide close to 60 percent of the extra food. However, in recent years, the pace of irrigation expansion has been slowing, there has been less improvement in productivity, and water availability for irrigation is increasingly constrained. Governments have long led the expansion of large-scale irrigation, but performance has been suboptimal, and reforms that have been introduced have proved slow to improve efficiency and water service.

Faced with this challenge, the I&D sector has been wrestling with three deep-seated problems: low water use efficiency, a high reliance on government financing, and poor standards of management and maintenance. Much of the search for improved investment and institutional models in I&D has been driven by the need to resolve these three problems.

One solution that has been tested over the last two decades has been PIM involving water user associations (WUAs) in the financing and management of schemes. This solution had its logical culmination in irrigation management transfer, the handover of responsibility for scheme operation and maintenance (O&M) to farmers and their organizations. This solution promised to relieve governments of both the fiscal burden and the responsibility for asset management and maintenance and to improve efficiency by empowering farmers. PIM has made impressive strides. However, efficiency has risen only marginally, and there are many schemes where O&M is beyond farmers' capacity—for example, the management of headworks and major distribution systems. In addition, major I&D investments are often simply beyond the financial capacity of farmers.

In light of these challenges, the idea of involving private sector investors and managers in publicly managed I&D schemes was debated. PPP may be one way of bringing in efficient management skills and fresh funds and of relieving government of the fiscal and administrative burdens.

Analytical framework

For a better understanding of PPP opportunities and risks in the I&D sector, an analytical framework has been designed, comprising four sets of functions through which the components of an I&D system are put into practice:

- The investment functions, including the decision to invest, project financing, design, and implementation

- The governance functions of regulation and control, including water allocation and monitoring, and supervision of irrigation management
- The operation, maintenance, and management functions (OMM), including management of water allocation, water service, and system maintenance
- The agricultural production function, in which water is combined with other factors to create value

Although I&D systems throughout the world are diverse, the most common type throughout the world is the large, collective, and publicly managed system, representing an estimated 50 percent of all I&D. As these systems have proved the most problematic in terms of raising efficiency, the analysis in the report focuses on the scope for PPP to contribute within these large systems.

Lessons from PPP in the water and sanitation sector

As experience with PPP in I&D is scant, a review was carried out of the experience of PPP in a parallel sector—water supply and sanitation (WSS)—where PPP has been practiced with some success for two decades. The two sectors are sufficiently similar for lessons to be drawn.

A public-private partnership arrangement is, by definition, a contract between a public client and a private service provider. All the many different types of PPP contracts used in the water and sanitation sector fall into two major categories, depending on whether payment for the service is tied to operational results.

- If the private service provider is paid a fee by the public client that is not tied to operational results, the PPP contract is termed a public contract. A public contract can be either partial (a service contract for the provision of a specific service) or comprehensive (a management contract).
- If the private service provider is paid according to operational results, the PPP contract is termed a public service delegation (PSD). Under this heading come the five arrangements known as lease, affermage, concession, build-operate-transfer (BOT), and divestiture. A characteristic of PSD is that the service provider normally collects fees from the end user and not from the government.

The crux of the distinction between these two categories of contract is really how risks are allocated between the public client and private operator. In a public contract, the private operator bills the public client and gets paid, at least theoretically, regardless of operational results or whether the service fees are collected, thus leaving most of the risk with the public client. In a public service delegation, the private operator is responsible for operational results and typically bills the end users, thus assuming the major risks of collecting service fees from a large number of clients.

Experience in the water and sanitation sector has shown that the private sector can help mobilize financing, implement investment programs, and improve performance of service delivery. Under PPP, governance functions typically remain with government, although there is some scope for contracting out. OMM functions have proved the easiest functions to contract out. Regarding investment, the private sector is essentially risk averse and, faced with relatively high levels of risk, is reluctant to commit investment capital unless government assumes much of the risk. Also, although efficiency and service delivery have certainly improved with the advent of the private service provider, charges have usually gone up at the same time, and there have been social

problems over the common need to downsize staff. Overall, the WSS experience shows that PPP may not relieve government's investment burden much but is useful to establish the principle of financial autonomy and to raise professional standards by introducing improved management.

Emerging experience with PPP in I&D

In I&D, PPP is a more recent business, and early innovation has been driven mainly by government initiatives to curb recurrent operation subsidies and scale back government involvement rather than by private sector interest. The PPP arrangements so far show that investment and OMM are the key functions for private sector involvement. Most PPPs include OMM functions (90 percent), either alone or together with private participation in investment. The most favored arrangement appears to be public service delegation (four-fifths of the sample) rather than public contracts. However, the levels of risk—country risks, commercial risks, and water-specific risks—are higher than in WSS, and this has very much constrained development. PSD arrangements are more sensitive to commercial risk than public contracts, as the service provider is required to take the risk of collecting fees from farmers. Finally, regarding client benefits in the PPPs studied, the general result is improved but more expensive water service because of decreased government subsidies not fully compensated by efficiency gains.

Conclusions and recommendations

The key conclusion of the analysis is that the objective is improved efficiency—a more timely and inexpensive water service responsive to farmers' needs. It is important to design the most appropriate institutional setup. Given that the private sector is demonstrably efficient in many of the functions in I&D, it is likely that in many cases a PPP arrangement would in fact be optimal. However, a range of third-party service providers can be considered, either public (for example, a reformed and financially autonomous government agency) or private (for example, a private I&D service provider looking for business, a non-governmental organization (NGO) specialized in irrigation management, or a WUA turning into a private corporation).

Given that the problems of irrigation are concentrated in the critical OMM functions and that private service providers can usually provide these functions most efficiently, OMM would be the logical primary "target" for new PPP projects. Based on experience, public service delegation arrangements appear to be preferred by both sides because of their longer-term nature, comprehensive coverage, and transparent treatment of risks.

From these conclusions derive the following three recommendations:

The first recommendation is to *improve efficiency by bringing in third-party service providers through PPP*. The multiple functions of an I&D system require high standards of management and professional skill. In some cases and for some functions, the needed management capacity and level of skills may best be provided by private sector service providers, and PPP arrangements may be the best way of improving standards. The scope for involvement of a third-party service provider under PPP varies by function:

- In the investment functions, governments typically have to source most of the financing themselves and also assume much of the risk, so that the involvement of a private provider may not relieve the financing burden very much. The gains are in efficiency of design, contracting, and execution, and more generally from the management expertise of the private sector, where cost control and cost efficiency are central to financial sustainability.

- By their nature, governance functions belong to the public sector, although some of these functions could be the object of outsourcing service contracts—for example, water monitoring.
- The OMM functions are relatively easy to contract out in I&D, either through public contracts or through public service delegation. It is in OMM that third-party service providers can have the greatest impact in improving performance, raising standards across all functions, and creating institutional capacity.

The second recommendation is to *address risks in PPP in ways most likely to attract the third-party service provider*. Risks are a major constraint to the development of PPP arrangements. Effectively, the high level of risk translates into investor reluctance and potentially higher costs. If the public sector wants to work with private service providers, it must recognize the special nature of these risks and develop packages to mitigate them. Some risks can be mitigated by contractual provisions, but others are inherent in PPP and require guarantees of different kinds to attract private investors.

The principal risks involved are the following:

- The strong political and social issues related to water, food, and agricultural production make for high country risks. Devaluation and export market risk are also important. Mitigation tools include government risk guarantees, involvement of international financial institutions, matching currencies, and third-party partial risk guarantees.
- Commercial risks—especially the risk of not being able to recover user fees from farmers—are high in most schemes. There is also the business risk if the farm fails. Among the recommended protections against commercial risks are tariff indexation and resets, a grace or transition period at the start of the contract, government risk guarantees, and financial third-party partial risk guarantees.
- Water-specific risks are high in all countries where water is scarce or the climate variable and where agricultural water competes with other uses. Recommended protections against water-specific risks are tariff indexation and resets, government risk guarantees, and termination payments.

The third recommendation is that *the World Bank promotes and develops PPP in I&D*. The range of available instruments is broad—from technical assistance and policy advice, adjustment loans and credits, and standard investment approaches to new products such as output-based aid and guarantees. Because achieving the conditions for sustained progress often takes years, long-term Bank involvement will be needed in policy dialogue, technical assistance, and capacity building for governments, WUAs, and private operators.

With the public sector, the Bank should support reform programs working toward new investment and institutional models, beginning the policy dialogue, creating consensus for policy reforms, and providing resources to build technical, managerial, and oversight capacity. Lending operations, perhaps beginning with pilot projects, should follow once the reform program has been proven.

Work with the private sector and WUAs should be the core of Bank support in the move toward PPP. The Bank should provide sustained support to reforms where private sector (or professional third-party) participation and financing are introduced as a means of increasing the efficiency and performance of water service. PPP should be developed jointly with client countries to ensure that transactions are based on realistic investment and service targets and that risks and responsibilities are allocated appropriately between parties. Thus, the Bank could play the role of an “honest

broker” supporting the elaboration of the partnership between the government and the professional third party. Both existing and innovative ways should be explored to leverage private sector investment and expand access. Technical assistance should be provided where needed to help governments select from among private participation options. The Bank could also support a range of initiatives to promote the development of small-scale providers and WUAs.

Typical investments could include the following:

- Technical assistance and financing of consultancies to prepare feasibility studies for PPP arrangements
- Support to government and WUAs in negotiation and finalization of PPP arrangements
- Pilot projects to test innovative PPP arrangements
- Financing for projects involving PPP, in collaboration with government, the International Finance Corporation (IFC), other IFIs and the private sector
- Underwriting of partial guarantees to improve the terms on which finance is accessed on capital markets
- Underwriting of noncommercial risk guarantees (with IFC and the Multilateral Investment Guarantee Agency [MIGA]) on management contracts

1 INTRODUCTION

As part of its program to analyze key issues related to water for food, the World Bank has prepared a series of background papers: reengaging in Agricultural Water Management, water pricing and cost recovery, and public-private partnership (PPP) in irrigation and drainage (I&D), the subject of this background paper.

The objective of this paper is to identify the possible role and opportunities for the private sector to participate with government and farmers in developing and managing I&D infrastructure. The private sector comprises all economic actors not directly controlled by government (Svendsen 2001). The paper is based on a desk review of reports and on a series of case studies of selected projects.

Irrigation and drainage (I&D) development

Irrigated agriculture has been vital to meeting fast-rising food demand. In the last 40 years, as nutrition has improved, developing-country demand for food has gone up by more than 300 percent, much faster than population growth rates. Food production in the developing world has almost kept pace, with an enormous rise in production (up 250 percent during the same 40-year period). Crops that are mostly irrigated—such as rice, wheat, maize, and cotton—saw production increase two to four fold since the early 1960s. Increase in the production of irrigated fresh fruits and vegetables, was particularly rapid—by 400 to 600 percent, and these crops now account for over one-fifth of all developing-country agricultural exports. Two-thirds of the increase in crop production has come from yield increases, rather than from expansion of the cropped area (except in Sub-Saharan Africa). Average yields of rice and maize have more than doubled, and wheat yields have gone up by 300 percent.

Irrigation continues to expand, but now the pace is slowing. For developing countries as a whole, irrigated areas have more than doubled over the last 40 years, and by 2000 covered 234 million ha,¹ about half the land estimated by the Food and Agriculture Organization (FAO) to be potentially irrigable. However, the pace of development has now slowed quite significantly: annual rates of expansion of around 2 percent a year in the 1960s and 1970s slowed to hardly 1 percent in the 1990s. In many countries, there are now constraints to expansion, particularly social and environmental concerns. The low productivity of many existing schemes has prompted a change in investment policy away from new infrastructure and toward programs that improve the performance of existing schemes.

Water availability for irrigation is increasingly constrained. Irrigation accounts for 85 percent of water withdrawals in developing countries, and the rapid growth of the sector has been based on the availability of huge quantities of low-cost water. Now, rising demand for agricultural water faces increased domestic and industrial consumption. In many areas, there are already rising costs associated with the competition for water. For years, groundwater provided a profitable new resource, but in many basins groundwater is now being mined rapidly.

Governments have led the expansion of large-scale irrigation, but performance has been suboptimal. With strong investment and management input from governments, large-scale irrigation has contributed to rapid increases in food production, the major public policy goal. However, the supply-led

1 This represents 85 percent of the world's total irrigated area of 276 million ha in 2000.

approaches and large-scale irrigation infrastructure that were to fuel growth have resulted in bureaucratic institutions that lack the structure and incentives for efficient management and have resulted in inflexible water-delivery systems not capable of responding to farmers' needs.

Water productivity has shot up, but there is massive room for improvement. The increase in water productivity in recent years has been spectacular: over the period 1961–2003 the water needed to produce food for one person went from 6 m³ a day to less than 3 m³ a day. Over the same period, the production of rice and wheat went up by 100 percent and 160 percent, respectively, but with no increase in water use. However, in many basins, water productivity remains startlingly low, and take-up of modern technology is slow: drip technology has been adopted on less than 1 percent of irrigated lands worldwide.

The strong demographic demand for food is expected to continue. For the developing world as a whole, population is projected to increase by 50 percent from 1999 to 2030. Developing countries' food self-sufficiency ratio is expected to decline from 91 percent to 86 percent, and their food trade balance is expected to turn sharply negative (US\$50 billion annually by 2030). Nations with fast-growing economies will be able to import an increasing share of their basic food needs, and this will stimulate investment in higher-value irrigated agriculture where markets exist. The poorer nations, particularly in Sub-Saharan Africa, are likely to focus on strategies to develop irrigated agriculture where investment costs are not too high and to improve food-crop production in subsistence agriculture environments. Agricultural water management will be an essential element in both strategies.

Intensified irrigated agriculture will provide close to 60 percent of the extra food. FAO has estimated that crop production in developing countries needs to increase at about 1.6 percent per annum over the next three decades—a demanding challenge, although only half the rate of growth recorded in the last 10 years. Projections by FAO and the International Food Policy Research Institute/International Water Management Institute (IFPRI/IWMI) are that irrigated areas must provide more than half this increased production. As water and land resources are constrained, further water productivity improvements will be essential. Water productivity improvements in large-scale irrigation are possible but will require major programs of modernization—a combination of institutional change and investment in system improvement. There is scope, too, for groundwater productivity to improve. In addition to technical choices, farmers have multiple opportunities to increase income from their production, particularly through diversification into production of higher-value irrigated crops like fruits and vegetables.

The challenge is therefore enormous. In sum, new I&D investments and higher productivity from existing assets are needed to meet rising demand, improve food security, and reduce poverty. Yet investment has been declining and productivity is rising only slowly. What new investment and institutional models could remedy this situation? This paper is intended to explore one high-potential model: PPP.

I&D management and public-private partnership (PPP)

As discussed above, the I&D sector plays a vital role in food supply and in the world economy. However, after almost 50 years of rapid growth, it is confronted with three deep-seated problems:

- Water use efficiency. Irrigation uses 70 to 80 percent of the world’s fresh water, but efficiency is low. As water scarcity grows, the water available to irrigation will be constrained further. Competition between water uses is highest in the dry seasons, when plants usually need the most water and water is usually most scarce.
- Fiscal burden. Investments to develop the I&D sector have been based on massive public funding, often justified on the basis of food security. However, new development paradigms place more emphasis on private responsibility and restrict the role of government. The public treasury has often also paid costs of operation and maintenance (O&M) for publicly managed schemes, and this has frequently led to a vicious circle of underfunding, poor service delivery, and declining productivity.
- Asset management and maintenance. Costly I&D investments are deteriorating all over the world. Some of them are in such bad shape that they are useless for production purposes. Poor maintenance is attributed to lack of funding and weak management all along the line.

Water use efficiency can be addressed by improvements in I&D management and practices. Switching from surface to localized irrigation can result in a 20 to 30 percent water saving, for example, and growing high-value-added crops can improve economic efficiency. But no easy solutions have been found for the fiscal burdens and asset management and maintenance. Even after decades of reflection and study, finding the investment and institutional models that can break the vicious circle driven by tight public funds and neglected asset management and maintenance is still a challenge. The recently issued World Bank report “Reengaging in Agricultural Water Management: Challenges and Options” (World Bank 2006) provides an in-depth review of the challenges the sector is facing and recommends solutions.

One solution that has been tested over the last two decades has been PIM involving water user associations (WUAs) in the financing and management of schemes. This solution has its logical culmination in irrigation management transfer, the handover of responsibility for scheme O&M to farmers and their organizations. This solution promised to relieve governments of both the fiscal burden and the responsibility for asset management and maintenance. PIM has made impressive strides. However, there are many schemes where O&M are beyond farmers’ capacity—for example, the management of headworks and major distribution systems. In addition, major I&D investments are often simply beyond the financial capacity of farmers.

In light of these constraints, the idea of involving private sector investors and managers in I&D was debated in the hope that private partners would bring efficient management skills, fresh funds, and relief of government responsibility. However, although the private sector has long been a major participant in irrigation, private investors have generally steered well clear of this kind of large-scale irrigation scheme, which is proving most problematic. Public-private partnership, with its promise of shared responsibility and managed risk, has been seen as a means of creating the right incentives for greater private sector involvement.

2 ANALYTICAL FRAMEWORK

For a better understanding of public-private partnership opportunities and risks in the I&D sector, an analytical framework was designed. This framework recognizes the diversity of I&D systems and analyzes systems by type, components, and function. This chapter reviews and discusses each of these in turn.

I&D system types

Far from being homogenous, irrigated areas can be categorized in a number of types according to six basic criteria:

- Is the system individual or collective?
- Is the system large or small?
- Does the system use surface water or groundwater?
- Is irrigation essential for agricultural production, or is it just a supplement to rainfall?
- Does the system produce mostly subsistence or cash crops?
- Is the system privately or publicly managed?

The combination of these six two-state variables provides a theoretical total of 64 possible types of irrigation. However, only a few of the combinations are commonly found. Examples relevant to the analysis in this paper include the following:

- Individual (individually managed), small-scale irrigation using surface water, with inadequate rainfall for cropping, privately producing subsistence crops. This example could describe, for instance, a private irrigator in the Senegal River Valley using a diesel pump to draw water from the Senegal River and apply it to his small rice plot. It could also describe a similar irrigator in India or Pakistan, disappointed by the poor quality of the government surface-irrigation service and turning instead to groundwater for irrigation.
- Collective (collectively managed), large-scale irrigation, using surface water to supplement rainfall, producing cash crops, on a publicly managed scheme. This is the situation, for example, on one of the concession schemes of CACG², producing industrial corn in southwestern France. A similar situation is found in China, where rainfall is more than 1,200 mm, cropping intensity is high, and supplementary irrigation is used for rice and cash crops.
- Individual, large-scale irrigation using groundwater and producing cash crops in a privately managed system. This description could fit a Saudi agribusiness case described below.
- Collective large-scale irrigation using surface water, with inadequate rainfall, producing food crops, in a publicly managed system. This is the most prevalent case of post-World War II irrigation development in Southeast Asia, and also in MENA (Middle East and North Africa) and Mexico before the development of WUAs. This type, accounting for more than 50 percent of the global irrigated area (Diemer 2000), is the central target of ongoing attempts to reform the I&D sector.

This first part of the analytical framework allows some predominant types of irrigation to be distinguished (Figure 1). The I&D type where PPP is most likely to be relevant would be the large collective surface water scheme where management is currently public. Thus, PPP would appear to be applicable to many of the regional situations noted in Figure 1. For example, in South and East Asia, which account for 60 percent of the total irrigated area in the world, the predominant I&D system is large collective schemes, almost equally dependent on surface and groundwater, with irrigation generally essential for agricultural production, under public management.

² Compagnie d'Aménagement des Coteaux de Gascogne (Development Company for southwestern France).

Figure 1: Dominant types of I&D

Regions	WE	NA	AUS	ECA	SSA	SEA	MNA	LAC
	Western Europe	North America	Australia	Eastern Europe and Central Asia	Sub-Saharan Africa	South and East Asia	Middle East and North Africa	Latin America and the Caribbean
Criteria								
Irrigation system								
Individual								
Collective								
Scale								
Small/ medium								
Large								
Water resource								
Surface								
Groundwater								
Irrigation Need								
Essential/ Vital								
Supplementary								
Production								
Subsistence crops								
Cash crops								
Management								
Private								
Public								

Level of frequency:  low  medium  high

Source: Authors

I&D components

The second part of the analytical framework comprises four successive components that can be distinguished in I&D from up to downstream:

- Water mobilization. This first component, corresponding to physical headworks, consists of tapping the water resource (catchment, diversion weir, borehole), sometimes storing it (dam, reservoir), and managing it (releasing it to meet users' needs in a given regulatory framework).
- Water conveyance. The second component, corresponding to the physical main system (or primary system) consists of conveying water from mobilization to distribution (main canal, natural river, or pipeline), and the accompanying equipment and management rules.
- Water distribution. The third component consists of delivering water to farmers through secondary and tertiary channels (sometimes called laterals) in accordance with existing water rights, water quotas, or other arrangements.

- On-farm water management. The final component consists of on-farm I&D, defined as the irrigation equipment directly owned and managed by the farmer for watering crops (for example, furrows, sprinklers, drip) together with the associated water management practices (for example, irrigation intervals).

What is presented above for irrigation similarly applies to drainage in reverse order, from the plot to large drainage canals, sometimes complemented by pumping plants.

I&D functions

The third and final part of the analytical framework comprises the four sets of functions through which the components of an I&D system are put into practice (also described in a matrix format in Appendix B):

- The investment functions, including the decision to invest, project financing, design, and implementation
- The governance functions of regulation and control, including water allocation and monitoring, and supervision of irrigation management
- The operation, maintenance, and management (OMM) functions, including management of water allocation, water service, and system maintenance
- The agricultural production function, in which water is combined with other factors to create value

Investment functions

The investment functions include the decision to invest, the financing of the investment, project design, and implementation of the investment, as described below.

The decision to invest. The asset owner decides whether to invest and in what type of I&D: individual or collective, large or small, and so on. In large collective I&D systems, the decision is public, based on farmers' demand explicitly or implicitly taken into account in a cost-benefit analysis where economic and social benefits usually outweigh construction and environmental costs (economic rate of return, preferably embodied in a multicriteria analysis). In private I&D systems, the decision criterion is purely financial (return on capital).

Financing the investment. The decision to invest is dependent on the availability of adequate funding through self-financing, bank or other loans, government subsidies, or a combination. Usually, the owner of the future assets exercises this function, although the task of putting together the financing package may require professional assistance either in the form of a limited service provision or a complete function outsourcing. Three particular aspects of I&D financing affect this function—and have been the main reasons for the predominance of public financing. First, although costs may be very low for simple individual investments (a treadle pump may be bought for \$60), many I&D projects can be very costly, depending on how much water is to be mobilized and the length of water conveyance and distribution system required. A large irrigation development can cost billions of dollars. Second, the length of the payback period is very long (15 to 25 years or more). Third, there are considerable political, economic, and social risks associated with investment in I&D for smallholders—for example, the risks associated with cost recovery by poor farmers.

Project design. Once the decision to invest has been made and funds are available, the owner of the future assets faces the task of designing the project. For individual projects, this may be an informal process. For larger projects, particularly collective projects, design is carried out in stages: feasibility study, preliminary design, detailed design, and tender documents. Most of the time, the design function is intertwined with the decision-making and financing functions, influencing or preceding the decision to invest and the search for funds. Highly technical in nature, design is often contracted out to local or international professionals, depending on the size of the project and the finance institution's procurement regulations.

Project implementation. Once decided, financed, and designed, the I&D project can be implemented, with a distinction between work execution and supervision. In most cases, the work-execution function is contracted out according to agreed procurement procedures. The project owner may or may not wish to contract out the essential sub function of work supervision. However, most owners look for professionalism and want the construction properly supervised. Therefore, this sub function will usually also be contracted out to an engineering firm.

Governance functions: regulation and control

The regulation and control functions are water resource allocation, water resource monitoring, and supervision of irrigation management. As part of governance, these functions are essentially public, although work can be contracted out.

Water resource allocation. The water allocation function includes two levels: between competing uses at the national level, and within a given sector. The allocation of water between competing uses (drinking water, industry, irrigation, environment, sports and leisure) is a public-good function that must be carried out by a public body acting to protect the nation's higher interests and strategic choices. Water resource allocation is the main component of water-demand management, and it is done at various time intervals: multiannually (overall and broad allocations based on agreed principles and set out in a long-term plan) but also yearly and, during drought, as a spot reaction to scarcity. The second level of water allocation, apportioning a scarce resource within a given sector, requires a legal framework of water rights and a regulatory function to ensure that rights are protected. This is also a public governance function and is usually carried out by a public sector authority. How to properly and equitably share water among farmers is one of the biggest challenges of irrigation management. It requires technical and economic skills to assess water demand and the available water resources. It also requires political and diplomatic skills to explain to the stakeholders how the water balance is determined and to arbitrate any conflicts.

Water resource monitoring. Closely linked to the allocation of water is the regulatory function of water monitoring. It consists of monitoring the actual delivery of water against water rights, checking all the withdrawal apparatus (hydraulic works, wells, and tubewells) and withdrawn volumes (compliance with withdrawal permits where they exist). Water monitoring becomes critical—and delicate—at times of crisis in water-short areas (for example, drawing down aquifers). It requires a legal mandate, appropriate techniques and equipment (for efficient field work), and good databases.

Supervision of irrigation management. Asset owners are responsible for ensuring that I&D schemes are well run, deliver an efficient, least-cost water service responding to farmers' needs, carry out

3 In France, this legal mandate is entrusted to the *Officiers de Police Judiciaire*

maintenance and replacement properly, fully finance services, fairly set and properly collect water service fees, and sustain the scheme financially. These supervision functions have been too often neglected in I&D. In a private corporation they would be carried out by a board of directors assisted by financial and technical audits. Where government is the owner, they may be carried out by a board that includes both government officials and farmer representatives.

Operation, maintenance, and management functions

The OMM functions entail the management of water allocation (at system level) and all OMM tasks, including customer service.

Management of water allocation. Management of water allocation service requires the following: technical ability to assess water demand and available water resources with proper tools and databases; economic understanding of how water functions as an input to farming, economic forces driving farmers' behavior (for example, the opening of new markets), and how water scarcity might be managed; and commitment to delivering the agreed water service in terms of quantity, timeliness, and quality.

Water service. The function of water service includes the following: system operations, including canal operation, hydraulic monitoring and data control, and operation of gates and hydraulic devices; delivery of the negotiated service through water distribution (for example, by bailiffs or pumping agents); and management of the service provided (negotiating service fees, billing, collecting fees, managing contracts, and customer service and relations).

System maintenance. The maintenance function comprises three activities: predefined programs (preventive maintenance); breakdown services (curative maintenance); and daily upkeep. The maintenance function is central to the sustainability of I&D systems. Maintenance works can be contracted out easily and efficiently, but it is crucial, when outsourcing this function, to do it according to a comprehensive plan with transparent assignment of responsibilities.

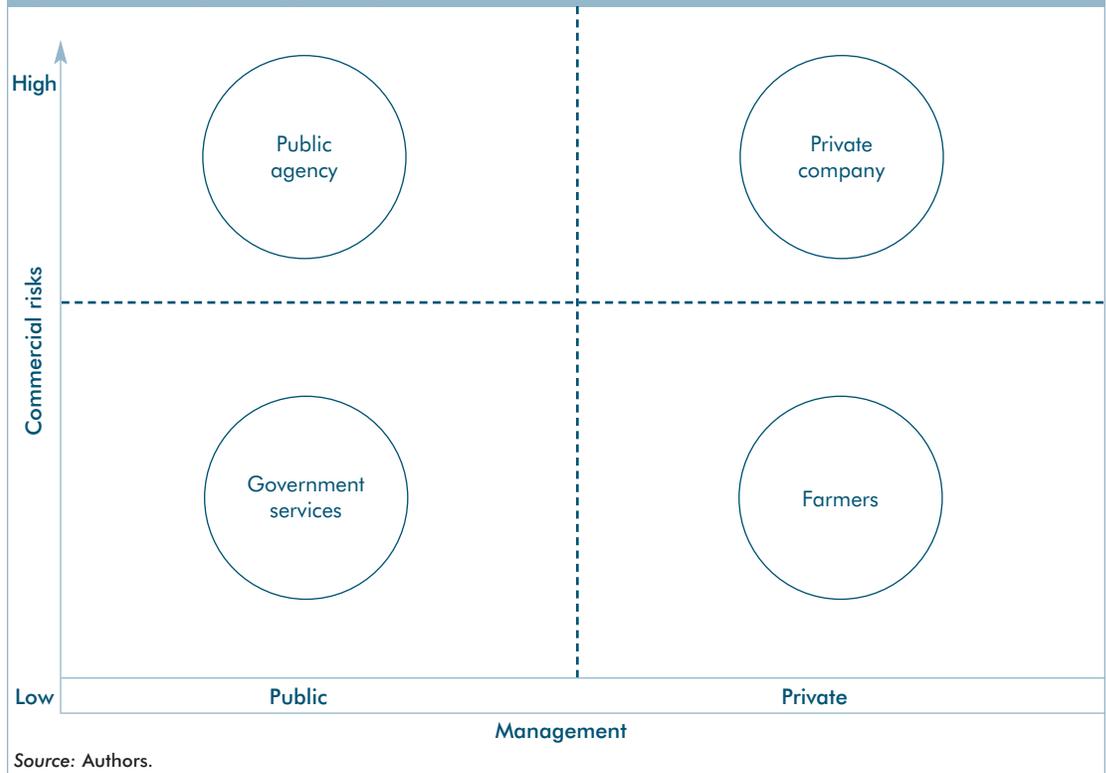
The agricultural production function

The agricultural production function is the unambiguous—and sole—responsibility of irrigators. It consists of combining land, water, capital, labor, and expertise to maximize farm income. This function is paramount: alone of all the 11 functions in the sequence, it produces economic value and its success in maximizing farm incomes both validates and is dependent on the preceding functions. The whole purpose of I&D is to provide a water service responsive to farmer needs, and all upstream functions have to be tailored to provide that service efficiently and cheaply.

I&D PPP analytical support diagram

Based on the three parts of the analytical framework discussed above—types, components, and functions—an analytical support diagram identifies and locates the various partners in PPP situations (Figure 2). The x axis represents the distribution of management responsibilities, from public to private, and the y axis represents the extent of commercial risks assumed by the service provider, from low to high. Two “threshold” lines are also plotted in the diagram. The vertical line between public administration and private management indicates the extent of the service provider's real financial autonomy and accounting mode (public or private). The horizontal red line symbolizes the service provider's most decisive risk—namely, the commercial risk of having to collect fees directly from farmers. The result is a four-box diagram in which each box has been allocated to a typical I&D actor.

Figure 2: PPP analytical support diagram



3 LESSONS FROM PPP IN WATER SUPPLY AND SANITATION

Because experience with PPP in I&D is scant, a review of the experience of PPP in a parallel sector—water and sanitation—was carried out. The two sectors are sufficiently similar for lessons to be drawn: both are water-using sectors downstream of water resource allocation functions; both have a long history of public financing and management; both are priority sectors for economic development with a presumption of a public-good aspect; both raise sensitive political economy questions of tariffs and equity; and both have in principle a number of functions suited to private sector involvement. This chapter analyzes the results of PPP in the water and sanitation sector and draws lessons relevant to the I&D sector.

Types of PPP in Water Supply and Sanitation

A public-private partnership arrangement is, by definition, a contract between a public client and a private supplier, called the operator or service provider. All the many different types of PPP contracts used in the water and sanitation sector (WSS) fall into two major categories, depending on whether payment for the service is tied to operational results.

- If the private service provider is paid a fee by the public client that is not tied to operational results, the PPP contract is termed a public contract. A public contract can be either partial (a service contract for the provision of a specific service) or comprehensive (a management contract).

- If the private service provider is paid according to operational results, the PPP contract is termed a public service delegation (PSD).⁴ Under this heading come the five arrangements known as lease, affermage, concession, build-operate-transfer (BOT), and divestiture. A characteristic of PSD is that the service provider normally collects fees from the end user and not from the government.

The crux of the distinction between these two categories of contract is really how risks are allocated between public client and private operator. In a public contract, the private operator bills the public client and gets paid, at least theoretically, regardless of operational results or whether the service fees are collected, thus leaving most of the risk with the public client. In a PSD contract, the private operator is responsible for operational results and typically bills the end users, thus assuming the major risks of collecting service fees from a large number of clients.

Public Contracts: the service contract and the management contract

Service contracts are task-specific, usually short term, sometimes renewable, and suitable for outsourcing system maintenance, meter reading, or fee collecting. The public client simply purchases a professional service outside instead of trying to perform it through its own organization.

Management contracts transfer responsibility for running a government-owned business to a private operator, typically for a period of three to five years. The simplest contracts involve paying the nonpublic operator a fixed fee for performing managerial tasks. Although the operator is not responsible for overall operational results, contracts may introduce incentives for efficiency by defining performance targets and basing the fee in part on their fulfillment. In many management contracts, except for a few top executives, personnel are employed by the public water utility, not the management contractor. In others type of contracts,⁵ the operator employs the technical staff.

Public Service Delegation: lease, affermage, concession, BOT, divestiture

Lease and affermage are both arrangements under which the operator is responsible for operating and maintaining the business but not for financing the investment. The operator has a direct incentive to improve operating efficiency and increase sales because profits depend on sales and costs. The public partner is typically responsible for financing investments and must raise funds and coordinate the investment program with the operator. Because the distinction between investment for modernization and heavy maintenance or renewal is not always clear-cut, lease and affermage arrangements often put some responsibility for investment on the operator (for example, for rehabilitation). The difference between affermage and lease lies in the rent paid by the operator to the contracting authority.

- Under a lease, the operator pays the contracting authority a fixed, contractual rent.
- Under an affermage, the rent depends on the revenues collected from customers by the operator. In this sense, the contracting authority effectively bears some of the commercial risk.

A concession gives the private operator full responsibility not only for operating and maintaining the assets but also for financing and managing investment over a long period of time (typically 25 to 30 years). However, final asset ownership rests with the government, and full use rights to all assets, including those created by the operator, revert to the government when the contract ends.

⁴ Also known in French as *gestion déléguée*.

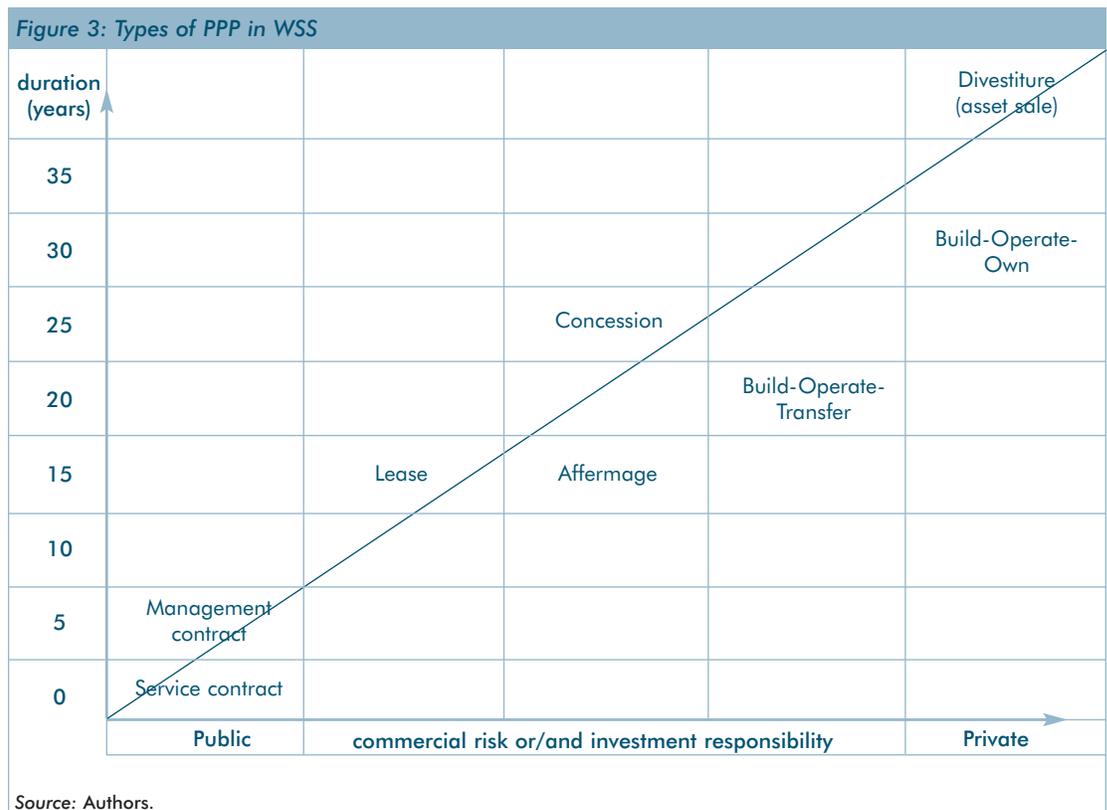
⁵ Known in French as *régies* or *régies intéressées*.

Although often associated with concessions, BOT contracts present a relatively lower level of risk for the operator because the government pays the operator a contractual amount no matter what happens in terms of water service delivery. In this sense, a BOT more closely resembles a public contract than a PSD. There are many possible variations on the BOT model.

- Under a build-operate-own (BOO) agreement, the assets remain indefinitely with the private partner.
- Under a design-build-operate (DBO) agreement, the public and private sectors share responsibility for capital investments.
- Under a rehabilitate-operate-transfer (ROT) agreement, the contract designates responsibilities for plants that need extensive overhaul.

Divestiture is another word for sale of assets to a private operator, that is, full privatization. However, although the difference between a concession and a divestiture may at first look considerable, the main rights and obligations of the contracting authority and the operator can be similar under the two arrangements. Concessions transfer the main economic rights related to ownership for such a long period of time that the operator's motivation closely resembles the legal owner's, at least in the first few years. In contrast, a divestiture may be associated with a fixed-term license, the termination of which will cause the divested assets to lose most of their value and probably to revert to the government.

Figure 3 gives an overall idea of the respective ranking of the different PPP arrangements in terms of their duration, commercial risk, and investment responsibility.



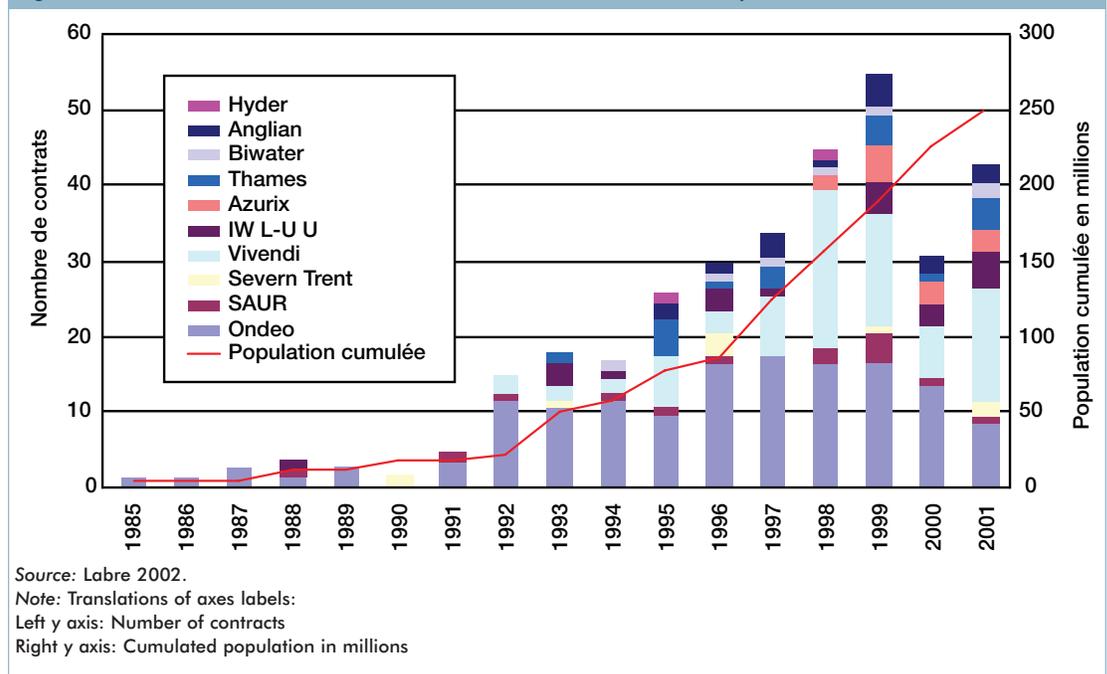
Although the categories of PPP discussed above are useful for analytic purposes, in practice, most PPP arrangements are highly case-specific and are usually hybrids of different categories. In designing PPP contracts, three issues are critical: the allocation of responsibility for risk, the responsibility for the investment function, and the extent of public subsidies for compensating or mitigating transferred risk.

Experience of PPP in Water Supply and Sanitation

The development of PPP in recent years

Public-private partnership contracts in the water and sanitation sector developed rapidly around the world in the early 1990s, derived mainly from the French historical model of PSD (*gestion déléguée*), a blend of concession and affermage created at the turn of the 20th century. Figure 4 shows the number of international PPP contracts awarded to the 10 world water industry leaders over a 17-year period, 1985–2001.

Figure 4: International contracts awarded to the 10 world water industry leaders



The initial period of slow development in the 1980s was followed by a very rapid increase in the 1990s, and then by a slowdown. The slowdown can be explained by a combination of two factors. First, most large-scale PPP contracts were of the concession type, involving heavy investment on the operator's part. These investments were made in strong international currencies, but revenues were collected in weak, local currencies. In the parts of the world where most international water contracts had been signed (Asia, Latin America), there has been considerable exchange rate instability that has jeopardized profitability. Second, and more recently, the PPP model has come under sometimes aggressive criticism, and this has probably deterred governments and private investors from launching new projects. At present, PPP provides water to 5 percent of the world's population, and private financing in WSS accounts for somewhat less than 10 percent of the sector's total investment.

Emerging issues

On the experience of recent years, four major issues have emerged on PPP in WSS:

- **Sharing of risks:** A strong incentive to PPP is the financial capacity of the private sector. Governments have turned to PPP mostly when water service quality is seriously compromised or when much of the population cannot be supplied. At such times, heavy investments are needed. However, given the level of risks involved, investors are reluctant to commit financing unless government underwrites part of the risk—for example, the critical foreign exchange risk (Camdessus 2003; World Bank 2004a).
- **Paying for good water service:** Success in the new water service usually requires a strong increase in OMM expenditures, kept dangerously low hitherto through lax service management and poor asset maintenance. To generate the resources needed to improve service levels, the private contractor must frequently choose between two unpopular measures: downsizing the (usually) overstaffed former public agency (when the contract transfers personnel), or increasing the water price (often a heavier burden to politicians), or both. Contracts have to be clear up front about how these sensitive issues are to be handled.
- **Improving professional standards:** PPP's main advantage for governments, particularly in developing countries, has been the establishment of the new autonomy needed to run water service as a business. The service provider engaged on a long-term basis can gradually but steadily introduce sound management practices but needs to be protected by continuing political commitment.
- **Making subsidies transparent:** Where governments require water services to meet social or other noncommercial objectives, cross-subsidies are often employed. However, the financial implications of this need to be transparent and the operator need to be compensated by public subsidy for any shortfall.

Lessons from PPP in WSS relevant to I&D

This section discusses whether the PPP experience in WSS is applicable to the irrigation and drainage sector.

Regarding the project financing function, the private sector is already a major investor in I&D, but there are constraints to an expanded investment role (see above). The WSS experience shows how some of these constraints could be eased, but it is silent on others. PPP in WSS has been successful in mobilizing private financing, for example, in concession and BOT contracts. Three recommendations have been made to overcome this reluctance in WSS that may have some relevance for I&D: (1) the long-term risks specific to water require guarantees and risk sharing from governments; (2) international risk management instruments should be used to handle country risks like devaluation; and (3) multilateral financial institutions should provide direct funding for sub sovereign entities and private operators (Camdessus 2003).

Project design, implementation, and supervision are functions in which the private sector has already played a significant role in I&D. The experiences in WSS confirm the value to be gained from the management expertise of the private sector, where cost control and cost efficiency are central to financial sustainability (Johnson, Svendsen, and Gonzalez 2004).

By their nature, governance functions (water allocation and monitoring, and supervision of management) belong to public governance in both WSS and I&D. However, the experience in WSS suggests that some of these functions could be the object of service contracts—for example, water monitoring.

As in WSS, OMM functions (management of water allocation, water service, and system maintenance) can be contracted out easily in I&D either through public contracts or through PSD. Every contract type used in WSS can apply to I&D. There is one exception, however, which has no real parallel in WSS: irrigation management transfer (IMT), which is essentially a PSD contract for system OMM, only with farmer organizations rather than with businesses. In some IMT arrangements, the infrastructure may also be transferred by concession.

Based on the above analysis, the following conclusions relevant to I&D can be drawn:

- PPP may not relieve the investment burden of government very much. Given the issues involved—long payback period, high level of risk, and so on—private capital is likely to be high in cost and short in supply. However, creative blends of public and private finance and guarantees may help.
- PPP could help establish the principle and practice of financial autonomy for I&D management agencies. Typically, this would entail reduction or elimination of government operating subsidies, paralleled by restructuring and downsizing of the management agency and an increase in the water service fee. In the longer run, PPP should bring some efficiency gains to offset the short-term costs, and improved water service should increase farmers' incomes. These gains could in the long run increase the financing available for OMM and investment.
- PPP could help improve professional standards by introducing improved management and a business culture. PPP can help bring transparency and accountability to I&D financing and management by the very unbundling of functions that it entails. The analysis of functions needed to prepare for and implement PPP could make clear who is responsible for financing and implementing each function, and what the expectations are. For example, PPP absolutely requires the separation of governance functions from management functions and the professional conduct of each.

4 EMERGING EXPERIENCE OF PPP IN I&D

Although experience of PPP in the I&D sector is not as extensive as in WSS, there are nonetheless a number of useful examples. To check the conclusions reached in the last chapter based on experience in the WSS sector, case studies of PPP in the I&D sector were commissioned for this report. These studies and the lessons to be drawn from them are reviewed in this chapter.

Historical background

Despite the undoubted contribution of irrigation to reducing poverty and feeding the world, most investments have fallen short of expectations, and the search for the most efficient investment and institutional models has been unceasing. The last 50 years have seen an emphasis, beginning in the 1960s, on massive investment in irrigation infrastructure, a heavy focus on large civil works (dams and main distribution networks), and funding and management chiefly by governments. This impressive push, largely due to the Green Revolution, took place mostly in Asia.

In a second phase, during the 1970s and 1980s, substantial investment was still being directed toward the construction of infrastructure, but emphasis was increasingly directed to on-farm development—extension programs and improved agricultural practices. However, these programs did little to improve overall irrigation performance, mainly because the quality of service provided by the management agencies was not addressed. During the same period, the movement toward PIM started to gather momentum. Substantial efforts were made to increase farmers’ participation in the various phases of irrigation development and management, predominantly through the organization of WUAs. By the end of the 1990s, irrigation schemes in more than 60 countries had in place some form of farmer organization, although real farmer empowerment was generally limited.

As a logical next step, programs for IMT began, driven by governments’ desire to reduce the fiscal and administrative burden and by the belief that users who are also the owners are more likely than government agencies to operate systems effectively and according to their (often changing) requirements and are also more likely to pay for operations over which they feel some measure of control. Because many transferred systems were very large indeed, split transfers was often devised whereby the irrigation agency would keep the headworks and main system, delegating responsibility for the secondary or tertiary levels to farmers. Such transfers took place in many parts of the world, sometimes successfully but in many cases with inadequate preparation and little follow-up.

Most recently, approaches to improving irrigation performance have focused less on the application of particular investment and institutional models and more on results. The question is not how PIM or IMT might best be applied but what is the mix of models that can offer the best water service. It is in this context of improving the quality of irrigation service that mechanisms for increasing the involvement of the private sector through PPP are being more closely examined.

Current situation

In line with the description of the components, functions, and actors in chapter 2, an I&D “management matrix” can be constructed. Figure 5 shows how functions are usually carried out for the “average I&D system”: the large collective scheme, using either surface or groundwater to grow subsistence or cash crops under public management.

This matrix tabulates some of the standard characteristics of the average scheme. First, public involvement tends to diminish from left to right, from upstream to downstream. However, each of the four sets of functions tends to have different levels of public and private involvement—and differing aptitude for PPP. The investment functions for this type of scheme are typically carried out mostly by the public sector, although design and implementation are sometimes “delegated” to the private sector. The regulation and control functions, the core of public governance in the water sector, normally stay under public sector responsibility, although they are all too frequently bypassed. The OMM functions, typically the responsibility of government in the past, show a recent modest tendency to “slide” from public to private. Finally, the function of agricultural production is always under farmers’ responsibility. The matrix thus points to the conclusion that private involvement is likely to be most concentrated in the investment and OMM functions.

Figure 5: The current “average” I&D management matrix

Components	Water mobilisation (headworks)		Water conveyance (main canal)		Water distribution (secondary, tertiary)	
	Public	Private	Public	Private	Public	Private
Functions assumed by						
Investment						
Decision to invest	High	Low	High	Low	High	Low
Financing the investment	High	Low	High	Low	High	Low
Project design	High	Low	High	Low	High	Low
Project implementation	Medium	Medium	Medium	Medium	Medium	Medium
Regulation and control						
Water allocation & police	High	Low	High	Low	High	Low
Maintenance audit & price regulation	High	Low	High	Low	High	Low
OMM						
Management of water allocation	High	Low	High	Low	High	Low
System maintenance	High	Low	High	Low	High	Low
System operation	High	Low	High	Low	High	Low
Water value optimization						
Agricultural production	Low	High	Low	High	Low	High
Level of frequency:	 low		 medium		 high	

Source: Authors

The case studies illustrations

A number of actual public-private partnership experiments in I&D are being conducted around the world. Although these experiences are limited, 21 cases for study were selected from every world region but one, North America (see Table 1). Detailed summaries of these studies are presented in appendix A.

Answers to five pairs of basic questions were sought in these case studies:

- How did PPP start? What was the source of demand?
- How was the demand answered? What was the supply response?
- What form did the supply response take? What type of contract was used?
- How did it succeed? What were the results?
- What were the risks? How were they borne, allocated, or mitigated?

Methodology

In the review, the analytical support diagram introduced at the outset (figure 2) was used extensively. Three of the cases presented in appendix A are discussed here as examples for illustrative purposes: SAED,⁶ Senegal; Tieshan, China; and CACG/Neste, France.

⁶ Société nationale pour l’Aménagement et l’Exploitation des terres du Delta et des vallées du fleuve Sénégal, de la Falémé et de leurs affluents (Agency for the Development of the Delta and the Valleys of the Senegal River), Senegal.

Table 1. The 21 PPP case studies

World region	Ongoing PPP arrangements	Planned PPP arrangements
<i>Regions outside the World Bank sphere</i>		
Western Europe	France (CACG/ASA) France (CACG/Neste) France (SCP)	
Australasia	Australia (Murray)	
<i>Regions in the World Bank sphere</i>		
East Europe and Central Asia	Albania (Pequin Kavaje)	
Sub-Saharan Africa	Madagascar (Alaotra) Niger (Toula) Senegal (CSS) Senegal (SAED)	
South and East Asia	China (Tieshan) India (Eastern Uttar Pradesh)	
Middle East and North Africa	Egypt (Dina Farm) Saudi Arabia (Business farms) Turkey (GAP)	Egypt (Toshka Project) Jordan (Adasiyeh Project) Mauritania (Nakhlet Project) Morocco (Guerdane Project) Morocco (ORMVA Reform Project)
Latin America and the Caribbean	Brazil (Juazeiro) Mexico (Sonora)	
Source: Authors		

In the first example, SAED (box 1), the Senegalese government transferred schemes in the Senegal River valley to user associations in the early 1990s. As part of a belated program to provide post-handover support, the public agency responsible for water management in the basin, SAED, has set up a maintenance contracting unit, which is intended to be financially autonomous.

The user associations running the transferred schemes can contract with this unit for OMM services on a paying basis. The example illustrates how, in the absence of private service suppliers, government can step in to create such a supplier with quasi-private sector characteristics.

The second example (box 2) was taken from China's new "water revolution." It is set in the Tieshan area, where the Hunan local government is conducting a thoroughgoing unbundling of I&D functions, delegating some of them either to strong water service corporations or to equally strong WUAs. This example shows how a corporation can be created within the private sector to manage upstream I&D components of water mobilization and conveyance, while WUAs can manage the downstream water distribution component.

Case Study 02: Société d'Aménagement et d'Exploitation du Delta et de la Vallée du Sénégal (SAED), Sénégal

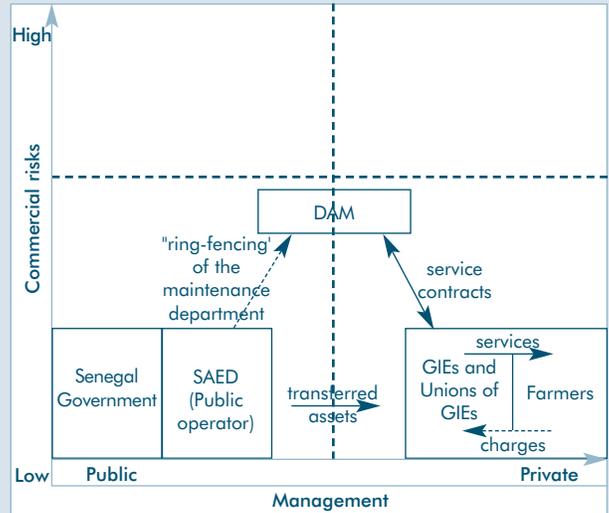
Demand: Demand from GIEs (Groupements d'Intérêt Economique), the Senegalese WUAs, empowered since the 1990 transfer of irrigation assets.

Supply response: DAM (Division Autonome de Maintenance), a SAED department created in 1998 and on the way to real financial autonomy (separate accounts).

Contract: DAM (Division Autonome de Maintenance), a SAED department created in 1998 and on the way to real financial autonomy (separate accounts).

Results: Work in progress; too soon to assess.

Source: Authors



Case Study 09: China, Tieshan, Yangtze Basin water resources project

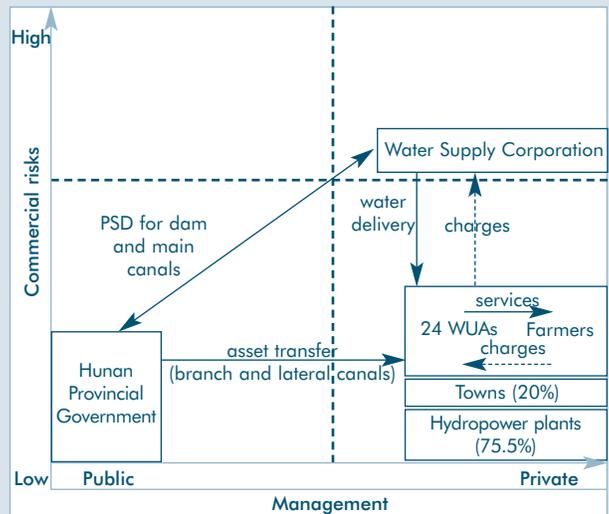
Demand: In this new project (1999– 2002) the Hunan government wanted to shed the financial and administrative burden of OMM to concentrate on regulation and control functions.

Supply response: No preexisting local private service suppliers.

Contract: PSD on OMM for dam and main canals to strong autonomous water supply corporations (WSCs); branch and lateral canals transferred to strong WUAs.

Results: End of infrastructure degradation, control over asset maintenance funds by the WSC and by WUAs.

Source: Authors



Case Study 18: Compagnie d'Aménagement des Coteaux de Gascogne (CACG), Neste, France

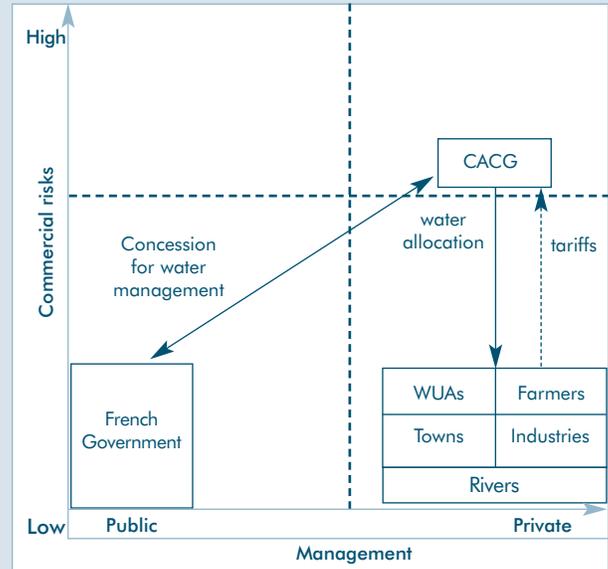
Demand: Initial demand from the government, relayed by tail-end farmers in search of equity.

Supply response: CACG had the capacity to manage the water delivery component from the headworks down and also to take on governance functions on behalf of government such as water demand management (monitoring withdrawals), control of the resource-demand balance, and crisis negotiation.

Contract: PSD on investment and OMM (concession contract) for water management over a large area in southwestern France.

Results: Control of river flows, collective management of water shortages.

Source: Authors



The third example (box 3) illustrates the management of water mobilization and conveyance and of water monitoring as performed by the French firm CACG, which is partly privately owned, partly government owned. CACG acts on behalf of the government through a concession contract.

Demand for public-private partnership

The review evaluated the demand for PPP by finding out which party initiated the process and by identifying the demand.

Origin of PPP demand. In most of the 21 case studies (appendix A), the PPP demand originated from the public side, from government (13 cases, 62 percent). In six cases (29 percent), initial demand came from collectively organized farmers (CACG/ASA,⁷ SAED, Alaotra, Nakhlet, Eastern Uttar Pradesh, GAP– Turkey Southeastern Anatolia Project). In two cases (9 percent), initial demand was shared between government and farmers (Adasiyeh, ORMVA⁸). In every case of government initiative, the aim was to shed the financial and administrative burden of operating and maintaining an I&D system. In every case of farmer initiative, farmers were looking for improvements in water service quality—a more regular and, if possible, more abundant supply and also more equitable delivery for tail-enders. In almost every example of ongoing PPP, the initial demand from either the government or the farmers was backed, endorsed, and confirmed by the other party, more or less rapidly.

Content of PPP demand. Of the I&D functions described earlier (chapter 2), actual demand was found to concern the investment and OMM functions almost exclusively, confirming the finding

⁷ Association Syndicale Autorisée (French Irrigator Association).

⁸ Office Régional de Mise en Valeur Agricole (Regional Office for Agricultural Development), Morocco.

from figure 5 that governance, a public responsibility, and agricultural production, nearly always a private function worldwide, do not really belong to the PPP sphere.

Demand for private investment. Half the case studies (10 out of 21) involved private sector participation in the investment functions, nearly always comprehensively (covering all four sub functions—decision, financing, design, and implementation) and exclusively (no real cofinancing with the public sector).

Demand for private management. The OMM functions were involved in 90 percent of the PPP case studies (19 out of 21) either by themselves (58 percent) or associated with investments (42 percent). Similarly, 80 percent of the private investment cases also included the OMM functions. Among the three OMM functions, the frequency of delegation to the private sector was 42 percent for water allocation management (8 out of 19), 89 percent for water service, and 100 percent for maintenance. Although the sample is small, these figures underline that OMM is a “niche” for PPP, especially for water service and maintenance.

PPP supply response

The second answer expected from the case studies concerns the response to demand for PPP. What existing or potential supply is there to meet demand for PPP in investment, OMM, or both together?

Investment responses. The case studies showed a broad range of investment responses, either predating the demand (proactive offer) or responding to the demand (reactive offer). The responses came from among the expected sources: national or local governments offering public subsidies, nongovernmental organizations (NGOs) offering private subsidies, banks with government backing, local or international consultants for project design, and local or international engineering firms for work supervision. The invitations to bid for public services delegation attracted investment offers from among private shareholders of prospective I&D service providers, banks without government backing, and companies specializing in project design or supervision.

OMM responses. Responses from suppliers of OMM services typically came from service offers from local firms (for service contracts), national firms (for management contracts), or international firms (for advice, technical assistance, partnership). In the case of PSD, OMM offers were of two kinds: delegation of project operation to a local private firm or “mixed enterprise” (or full PSD that included also major maintenance investments), or delegation to a local or international firm willing to share risks.

The case studies revealed some reluctance among I&D service providers, evidence that PPP in I&D is still in its early stages. They also showed that each PPP situation is unique and should be treated accordingly. This seemed particularly true of arrangements involving private participation in I&D investment, which all look like special cases. This is instructive about how such deals are put together but has little scope for exact replication.

PPP contract types

The types of contractual arrangements found in the 21 case studies are shown in table 2.

In the sample, four-fifths of contracts were under PSD arrangements. Only about half the contracts provided for investment, but all except two provided for OMM.

Service contracts (19 percent of the sample) linked local businesses typically to a WUA or a group of WUAs for service provision. The risk on either side was typically low.

Table 2. PPP contracts in the 21 case studies

	Number of contracts	Percentage of total	OMM	Investment
Service contracts	4	19%	4	0
PSD ⁹ on OMM only	7	33%	7	0
PSD on investment with OMM	8	38%	8	8
PSD on investment only	2	10%	0	2
Total PSD contracts	17	81%	15	10
Total contracts	21	100%	19 (90%)	10 (48%)

Source: Authors

PSD contracts on OMM (33 percent of the sample) were granted by governments or government agencies to private or public entities for managing schemes and for collecting water charges directly from farmers. In this sense, the PSD contracts were much riskier than the service contracts.

Figure 6: Types and contents of PPP contracts in the case studies

Cases	Service contracts				PSD on OMM							PSD on investment									
	01 - CACG-ASA	02 - SAED	03 - Alaotra	04 - Nakhlet	05 - Juazeiro	06 - Toula	07 - Pequín K.	08 - Sonora	09 - Tieshan	10 - Adasiyeh	11 - ORMVAs	12 - Eastern UP	13 - GAP	14 - CSS	15 - Dina Farm	16 - Business f.	17 - SCP	18 - CACG-Neste	19 - Murray	20 - Toshka	21 - Guerdane
I&D functions																					
Investment																					
Decision																					
Financing																					
Design																					
Construction																					
Regulation and control																					
Water allocation & police																					
Maintenance audit & price regulation																					
OMM																					
Management of water allocation																					
Maintenance																					
System operation																					
Water value optimization																					
Agricultural production																					

Source: Authors

⁹ Public service delegation, either in the form of a lease, an affermage, a concession, or BOT (if investment is involved).

Nearly half the case studies (48 percent) involved PSD contracts on investment, but each one in a specific way. Two contracts came about on the initiative of a private supplier; three were really private agribusiness ventures; and two had been granted more than 40 years ago by the French government for development purposes (*aménagement du territoire*).

Figure 6 illustrates three important findings. First, although PSD on investment looks like a common PPP arrangement, half the case studies are really special cases: either a *de facto* PSD rather than a properly prepared transfer (Eastern Uttar Pradesh and GAP), or a completely private initiative in which the public contribution is minimal in terms of I&D (CSS,¹⁰ Dina Farm, Saudi agribusinesses). Second, a PPP arrangement on investment usually includes OMM for reasons of cost recovery, whereas a PPP on OMM rarely has a financing function. Finally, as discussed above, OMM is far and away the most apt function for PPP arrangements.

Risks of PPP transactions in I&D

PPP in I&D carries two sets of risks: country risks, linked to the political and macroeconomic situation in the host country; and the standard commercial risks, namely the risks of not meeting financial targets.

Country-related risks. Country risks are not related to the I&D sector itself but to the functions of other sectors or decision levels, most often at country level or above (for example, global markets).

Political risk arises from possible changes in political decisions. For example, future governments may take a different approach to PPP, political will to enforce regulations may be weak, or certain stakeholders may be reluctant to accept the new arrangements (for example, senior management of governmental agencies or state officials, fearing loss of power or simply distrusting the private operator. In some situations, it may prove hard to change arrangements where vested interests benefit from rent or to move state officials away from bureaucratic procedures (Pequin Kavaje, Albania). A milder political risk lies in the existence of a changing socioeconomic context, where the principle of solidarity between agriculture and other uses may be endangered (SCP, France¹¹). Finally, it is important to keep in mind that an uncertain political and economic environment may affect payment behavior (Nakhlet, Mauritania).

Devaluation risk can be a serious risk in an economically weak country (GAP, Turkey; Toshka, Egypt; and others) or in a country subject to considerable annual inflation (Alaoatra, Madagascar; Juazeiro, Brazil).

Export market risk concerns almost all irrigation schemes in developing and transition countries, and its seriousness depends on the type of crops grown (for example, food staples or high-value-added crops). In the case of cereals (especially rice) or fiber crops, the risk lies in the almost total lack of protection for domestic commodities when the local market is opened up to competing imports (SAED, Senegal; Alaoatra, Madagascar; ORMVA, Morocco; Sonora, Mexico). In the case of high-value-added crops, the export market can be subject to strong fluctuations, especially for farmers without well-organized marketing arrangements (Adasiyeh, Jordan) but usually not for private business farms (Senegal's CSS; Egypt's Dina Farm; Saudi agribusinesses).

Commercial risks. Commercial risks result from uncertainties over whether participants in PPP arrangements can achieve the net financial flow on which their agreement to the partnership was

¹⁰ Compagnie Sucrière du Sénégal (Sugar Company of Senegal).

¹¹ Compagnie du Canal de Provence (Development Company of the Provence Canal), France.

based. The higher the level of risk, the less the private sector is willing to take part, and the higher costs of any eventual arrangement.

Recovery risk is too often not just a risk but a reality and is frequently the main reason for the financial difficulties characteristic of I&D schemes. How is this risk affected when a professional service provider becomes involved under a PPP arrangement? Several factors can influence recovery performance. First, as explained above, political and economic uncertainties may negatively affect payment behavior (Nakhlet, Mauritania). Second, lack of transparency and of a sense of empowerment may limit users' willingness to pay. Third, a reduction in farmers' income will inevitably affect willingness to pay—for example, if public funds allocated to the irrigation sector for modernization and rehabilitation are reduced (Juazeiro, Brazil). In most cases studied where a service provider has come in and at the same time subsidies have been eliminated, water service fees have gone up, but the increase has not immediately been compensated by an increase in farmers' income (Toula, Niger). Inevitably, willingness to pay has suffered. Various ways of managing this risk have been tried. One is to ensure that there is evidence of real progress in OMM efficiency before raising user fees (Pequin Kavaje, Albania, and CACG/Neste, France). A second is to strengthen the government's authority to enforce laws, which is often weak (Alaotra, Madagascar, or Adasiyeh, Jordan). Finally, if WUAs have a say in setting and collecting the charges and can verify that funds are used to improve the quality of water service; this may put users at ease and diminish the risk (SAED, Senegal; Tieshan, China; Sonora, Mexico).

Other financial risks include various items that may jeopardize PPP's financial sustainability. As mentioned, involving a private sector service provider and canceling subsidies at the same time entails an increase in the water service cost, and the price increase is not immediately offset by an increase in farmers' income (for example, Toula, Niger, or Guerdane, Morocco). The existence of a competing black market (CSS, Senegal), insufficient scheme size (Nakhlet, Mauritania), or the temptation for shareholders to cut expenses may seriously endanger the sustainability of a PPP. Skimping on maintenance and asset renewal to lower fees or to accelerate the payback period of investments (SCP, France) could have this effect. Last but not least, the existence of direct, sometimes hidden, subsidies (Senegal's CSS, Egypt's Dina Farm, Saudi agribusinesses) and indirect (Sonora, Mexico) or intersectoral cross-subsidies, where other competing uses such as hydropower and urban water generate most of the PPP profitability (Tieshan, China), also constitute a potential financial risk because such subsidies may not last forever.

Social risks concern the acceptability of new relationships and distribution of functions among institutions and stakeholders. In a bureaucratic culture, the social risk may arise from an attempt to have service personnel on call 24 hours a day (or at least at more user-oriented times than normal business hours) (CACG/ASA, France). Government agency personnel are usually targeted in reforms, and their reassignment to new functions constitutes a social risk if not dealt with carefully (ORMVA, Morocco). At a lower level than the political risks discussed above, a switch from a bureaucracy to a new private sector relationship may be difficult for unprepared staff at every level, not only for senior management (Guerdane, Morocco).

Farming risk is remarkably low among the cases considered, not only where high-value irrigated crops are concerned (for example, Adasiyeh, Jordan), but also in other cases. This is probably because in most I&D schemes, the cost of water service is low compared with other fixed and variable costs. A noteworthy exception is the case of GAP, Turkey, where water table drawdown forced such a high increase in the water fees on groundwater schemes that subsidies had to be introduced to protect farmers' net income. However, if water service fees were raised to

sustainability cost, many farmers would be thrown into insolvency, decreasing collections and revenue.

Water-specific risks. Finally, water-specific risks have to be considered from the service provider's point of view.

Technical risks are similar to those met in other sectors, mostly related to construction quality. Nevertheless, two points are I&D-specific. In gravity systems used in rotational and scheduled irrigation, flaws in design and operation introduce inequities and can open the way to corruption. Pressurized irrigation systems use much higher pressure and voltage than in WSS and therefore require specific personnel safety measures.

Water demand risk is the possible decrease in water demand, which may lower the service provider's income. In I&D generally speaking, this risk is higher than in WSS. Already Tunisia, an extreme case, and possibly Morocco in the near future, have smaller irrigated areas than the equipped potential, as farmers are unwilling to buy water. Competition between service provider-managed surface water (delivered at sustainability cost) and groundwater (often delivered at no more than pumping cost, independent of sustainability of the resource and sometimes subsidized) may be a significant risk for PPPs if rules are not enforced (Guerdane, Morocco). In other cases, this risk lies in farmers' inability to progress toward higher-value-added agriculture to adjust to higher water prices (ORMVA, Morocco), although improved service quality and efficiency in the distribution networks should enable the service provider to keep costs down and thus maintain water sales. Except in cases like Tieshan, China, the lack of volumetric water measurement capacity limits water service accountability.

Water supply risk is, by comparison, much higher in the I&D subsector than in WSS because irrigation usually consumes the lion's share of available water resources. Competition against other uses for water resources is increasing in most irrigation schemes. It is already a reality in water-scarce areas (Adasiyeh, Jordan) and can be particularly acute when water demand is higher than the renewable resources, an increasingly common situation in groundwater schemes. Reduction of water storage by silting in reservoirs is a serious concern in some places (Alaotra, Madagascar, and all the Mediterranean countries).

Main findings and PPP modeling

From this analytical review of the 21 case studies, some conclusions can be drawn:

First, except for two or three cases, PPP is a recent business, so lessons to be learned from experience will continue to emerge.

Second, in most cases, PPP was a government initiative to curb recurrent operation subsidies and scale back government involvement. This suggests that I&D is not an activity that immediately attracts the private sector, particularly when it involves participation in investment. Current I&D reforms may help to increase private sector interest.

Third, of the four sets of I&D functions, just two functions—investment and OMM—were the object of PPPs. Most PPPs included OMM functions (90 percent), either alone or together with private participation in investment.

Fourth, in terms of contracts, service (and management) contracts accounted for only 13 percent of the sample. By contrast, PSD contracts accounted for four-fifths of contracts. Only about half of all contracts provided for investment, but all except two provided for OMM.

Fifth, the levels of risk—country risks, commercial risks, and water-specific risks—are high, and this has very much constrained development. PSD arrangements were more sensitive to commercial risk than public contracts, as the PSD service provider is required to take the risk of collecting fees from farmers. Specific water resource supply risks need special allocation agreements with the public sector.

Finally, regarding client benefits in the PPPs studied, the general result is improved water service but at a higher price induced by decreased government subsidies not fully compensated by any efficiency gains. The added cost to farmers may be absorbed by higher farm income made possible by improved water service, and higher costs may in fact push farmers to improve their irrigation practices (from surface to drip irrigation) and adjust their cropping patterns (from food to cash crops, and from cash to high-value-added crops). The case studies, however, give no evidence on the success of this process of intensification or on whether farmers were able to manage the increased risk of higher-value cropping.

Possible PPP models in I&D

Drawing on the case studies, a series of models of successive stages of the PPP process for I&D has been prepared. The models move along a continuum of reducing government involvement and increasing participation by user associations and private sector service providers. Although there are many types of I&D (see chapter 2), the models have been based on the large public systems that represent half of the irrigated area and that represent the most serious problems. The analysis looks at successive models from the point of view of both government and of the farmers.

The five models are as follows:

- Model 0. The typical situation before reform
- Model 1. Initial adjustment between partners (ring-fenced government agency, creation of WUAs)
- Model 2. Irrigation management transfer to empowered WUAs
- Model 3A. Outsourcing through service or management contracts
- Model 3B. Public service delegation (lease or concession)

The models are presented using the PPP analytical support diagram in boxes 4 through 8.

Model 0: The typical prereform situation (continued)

The government—an irrigation ministry or department—has built the I&D system with public funds, mostly from bilateral or international donors and mostly in the form of grants or soft loans. Farmers were given small plots (1 ha maximum per family), and cropping patterns were recommended or compulsory to simplify water delivery planning and operation.

Government employees manage the system, following technical handbooks that have little to do with actual water needs.

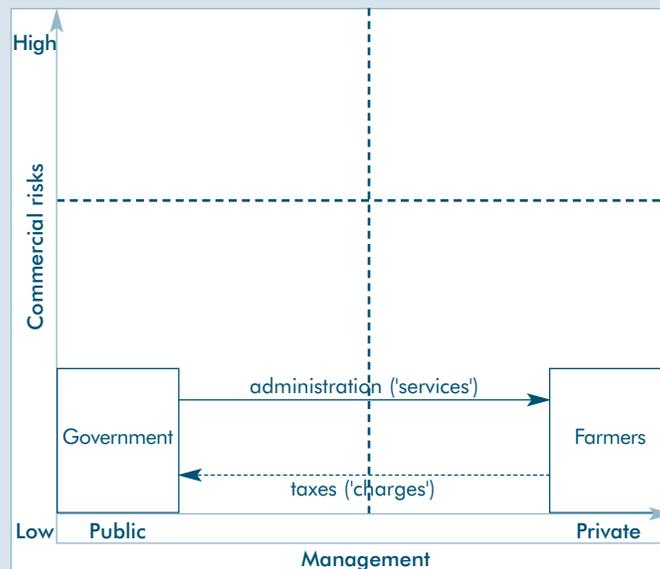
Farmers are asked to participate in meeting some OMM costs of the system. Water service fees are usually based on irrigated area (ha) and sometimes based on duration of access to water (hours). Fees are essentially a flat rate unrelated to the quality of water service.

Water fees are far from covering the cost of water service. There may be no real knowledge of the actual cost of water service, and the collection rate is poor, with no incentives to improve it. Government budget transfers to make up the shortfall are inadequate and erratic. Tight money prevents adequate daily upkeep, much less the constitution of a long-term maintenance fund for heavy repairs.

Results are degradation of assets, decreasing water service quality, and deteriorating agricultural production. Breaches in equity also occur, because the more powerful farmers can arrange to get more water—often through corruption.

Farmers' economic performance does not encourage payment of water service fees.

Examples: Eastern Europe and Central Asia before 1990; ORMVAs in Morocco before the Programme d'Amélioration de la Grande Irrigation (PAGI); Mexico before water reform; France (Neste system) before the 1990 concession.



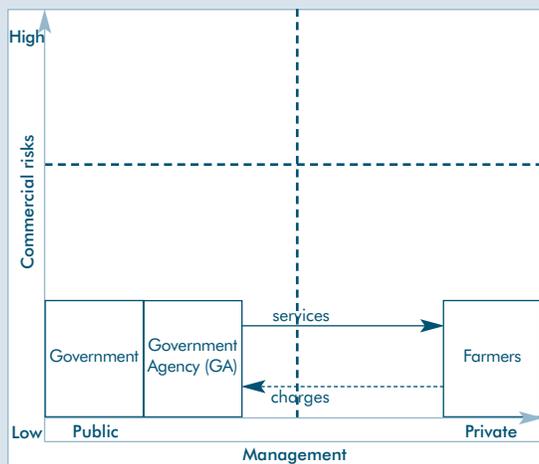
Model 1: First changes between well-identified partners

In this minimal but decisive change, both partners better identify themselves.

The government wishes to separate its role in irrigation management (OMM function) from its public responsibilities (policy making and governance) by creating a management agency. However inefficient the resulting body may be, it is nevertheless distinct from the government and identifiable. This is a first step toward accountability.

For the farmers, the creation of WUAs raises their awareness of their own collective strength. The WUAs help farmers share problems and solutions and prepare them for further quasi-corporate behavior.

On the government side: hiving off



Under budget constraints or a policy shift toward less government involvement in the economy, the government decides to hive off part of its own services to form a governmental irrigation management agency. Sometimes it goes so far as to create a separate entity, although typically this has little, if any, financial autonomy.

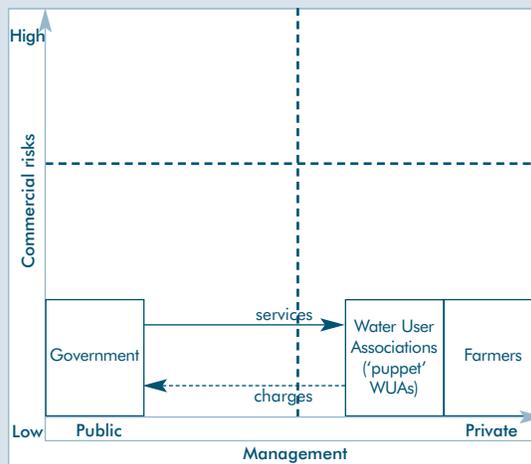
Collective agricultural and irrigation equipment is sometimes turned over to farmers.

At first, things seem to improve. The governmental agency genuinely wishes to provide farmers with quality services, including nonwater services like agricultural extension. Farmers are happy to see someone in charge.

The improvement does not last long. If civil servants initially feel more inclined to improve the quality of water service, the lack of dedicated management and proper incentives brings them back to their previous routine.

Farmers complain: "We're back to square one!"

On the farmers' side: creation of WUAs



WUAs are set up based, theoretically, on social reality and economic willingness, stemming from farmers' initiative and positioning themselves as partners to the public agency.

However, WUAs are in many cases creatures of the government or the governmental agency, which, under pressure from bilateral and multilateral donors, push for reform without believing in it and with little enthusiasm from farmers.

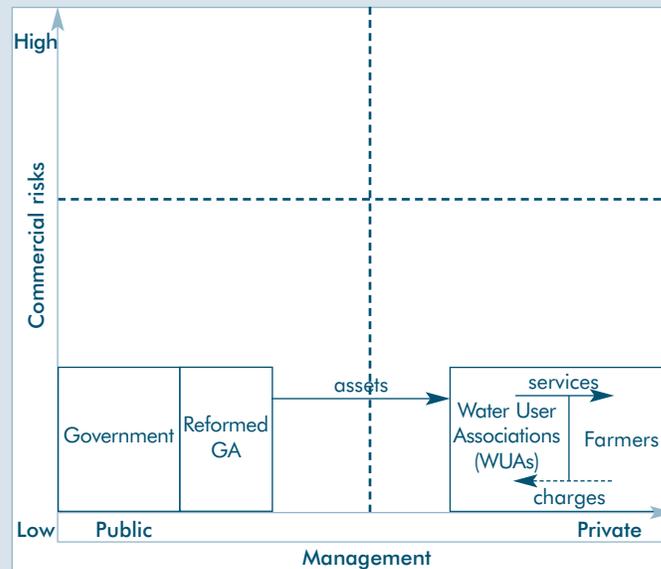
The main purpose of these "puppet" WUAs is to collect water fees at a higher rate than before so that asset maintenance can be improved.

However, some WUAs have several thousand members, and their lack of social reality and cohesion does not make for success.

Examples: Puppet or shadow WUAs and governmental agencies could be found in Morocco (agricultural water user associations [AUEAs] and ORMVAs) or in Tunisia (Associations d'Intérêt Collectif [AICs] and Commissariats Régionaux de Développement Agricole [CRDAs]) before ongoing reform.

Model 2: Irrigation management transfer to empowered WUAs

This is a widely promoted next step following the creation of an irrigation agency and WUAs: transferring public assets to farmer groups with a parallel reduction in public financial assistance. It is a mutual move, in which the government's initiative to divest is met by farmers' willingness to take over and by WUAs' quasi-corporate behavior.



The I&D infrastructure (mostly tertiary, sometimes secondary, rarely primary) is transferred to WUAs through concession contracts, usually together with the corresponding water rights.

Having transferred the better part of its activity (OMM), the governmental agency has itself to adapt to its smaller, higher-level role of headworks management and capacity building for WUAs. The crucial issue here is the much-needed downsizing, reallocation, and retraining of personnel, which typically is problematic, considering their age, lack of enthusiasm, and increasingly irrelevant experience. Two examples of partial reallocation can be found in Turkey (retraining for other functions or other I&D systems) and Tunisia (from CRDAs to AICs).

WUAs take care of the transferred assets, collect water fees to cover their maintenance and operation costs, and manage water efficiently and equitably.

Such empowered WUAs become real service providers for their members, going as far as hiring personnel (for example, bailiffs). Good examples can be found in Mexico and California and also in the French ASAs (Associations Syndicales Autorisées) and Dutch water boards. Two conditions contributed to this initial success:

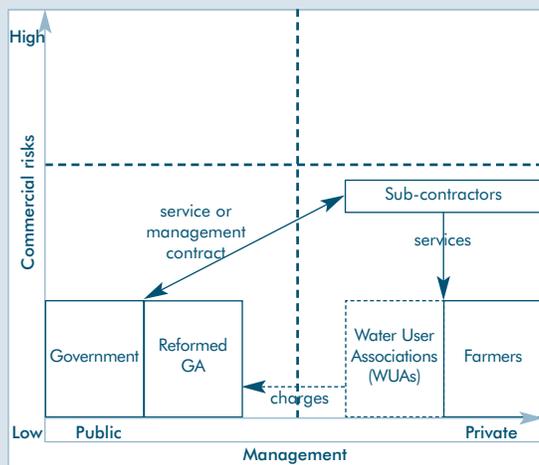
Financial support for asset rehabilitation, if not done before transfer. For example, Mexican WUAs received subsidies of 50 to 70 percent. *Technical support* in OMM, for example, the support given by the Instituto Mexicano de Tecnología del Agua (IMTA) to Mexican WUAs and CACG support to some French ASAs.

However, this works only for a little while. WUAs do not have the capacity to manage all the complex OMM tasks assigned to them. For long-term, sustainable success, WUAs need to find professional support.

Model 3A: Service or management contracting

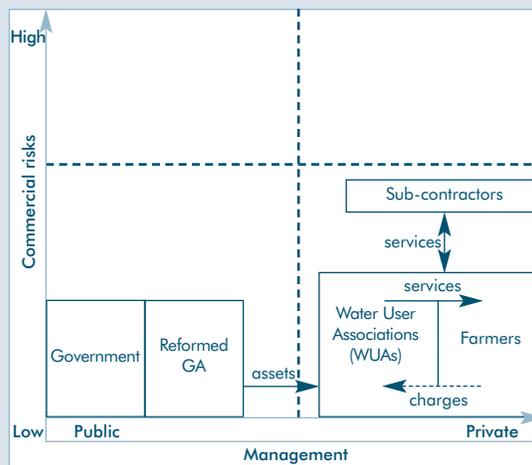
At this stage of reform, WUAs have begun to feel the benefits of managing at least part of their own water service but also have experienced difficulty in fulfilling all OMM functions without support. At this point, either partner may want to bring in a professional third party by contracting out one or more I&D functions through short-term, task-specific service contracts or longer, comprehensive management contracts.

As seen by government



Viewed from the government’s side, the IMT model (model 2) is an incomplete reform because public agencies are still managing a major part of the system, public money is still being spent—with doubts about its efficiency—and there is concern that WUAs are not able to manage their part adequately, so that the objectives of reform, such as disengagement of government and increased farmer income, are only partially attained.

As seen by WUAs



On the WUAs’ side, this level is hard to think of unless assets are transferred through irrigation management transfer. Empowered WUAs think in terms of outside support when confronted with life-size OMM problems that they cannot handle entirely on their own.

In either situation, many questions have to be tackled before outsourcing. Which function should be outsourced first? Should all functions that can be delegated be contracted out? What control should be exercised over subcontractors?

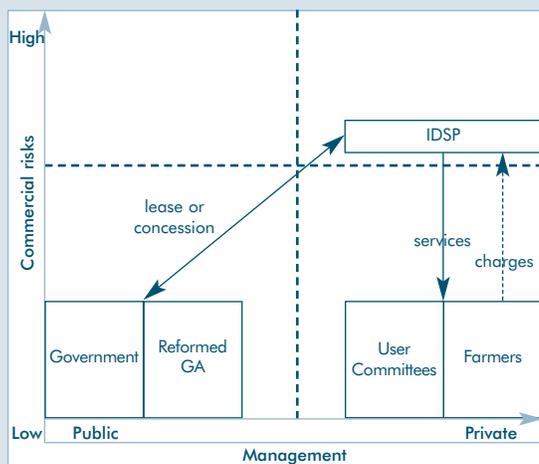
Most of the time the absence of competent local service providers acts as the critical constraint. Calling on international bidders is never easy or cheap—especially for a WUA—nor does it guarantee service quality or sustainability.

In cases of successful partial or total outsourcing, the contracting party (either the governmental agency or the WUA) should then be considered to be the accountable service provider, using outsourcing contracts for specific parts of its service provision. Model 3A will then be in sustainable equilibrium.

Model 3B: Public service delegation

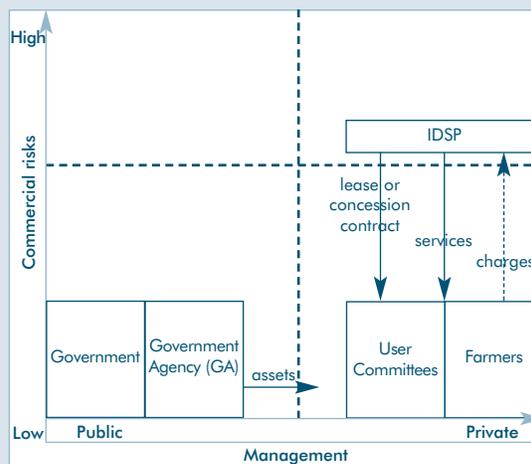
An alternative model for delivering high-quality water service is to delegate *all* the transferable I&D functions to a third party under a long-term arrangement. This PSD introduces private sector-style cost efficiency and performance management, either through a lease or *affermage* contract (when no investment is included) or a concession or a BOT contract (usually for a new investment). This outsourcing of OMM may look similar to the previous model, but there is a fundamental difference. In both graphs, the horizontal line has been crossed, showing that a third-party service provider has taken over all the commercial risks, including direct collection of water fees from farmers.

As seen by government



For the government, this option may be attractive where a private provider can take over investment and management functions retained by government, or where there are doubts about the capacity of WUAs for IMT. Thus government may choose, instead of IMT, delegation of all public service to a service provider. The WUA is then turned into a user committee.

As seen by WUAs



The empowered WUA's decision to contract out all OMM functions is often prompted by the feeling that things are "getting out of hand." Usually, however, it comes about as a result of WUA members' preference to go back to concentrating on their professional job—farming.

The choice of an I&D service provider (IDSP) is crucial. Two-stage competition is usually employed, with prequalification and then open negotiations with a short list of candidates.

In a lease contract, the existing I&D assets are let to a service provider for a long period (8 to 15 years) for a yearly rent (lump sum). Although the service provider theoretically bears no responsibility for investment, it is responsible for major maintenance and sometimes also for rehabilitation works.

In a concession contract, the service provider is fully responsible not only for the system's OMM but also, primarily, for investment. Asset ownership is not transferred, however, and full use rights to all the assets, including those created by the private partner, revert to the governmental agency or the WUA when the contract ends (in 25 to 30 years).

5 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Over the last 50 years, irrigated agriculture has been vital to meeting fast-rising food demand and has been key to poverty reduction. In coming years the strong demographic demand for food is expected to continue, and intensified irrigated agriculture will have to provide close to 60 percent of the extra food. However, in recent years the pace of irrigation expansion has been slowing, there has been less improvement in productivity, and water availability for irrigation is increasingly constrained. Governments have long led the expansion of large-scale irrigation, but performance has been suboptimal, and reforms that have been introduced have proved slow to improve efficiency and water service.

Faced with this challenge, the irrigation and drainage sector has been wrestling with three deep-seated problems: low water use efficiency, a high reliance on government financing, and poor standards of management and maintenance. Much of the search for improved investment and institutional models in I&D has been driven by the need to resolve these three problems.

One solution that has been tested over the last two decades has been participatory irrigation management involving WUAs in the financing and management of schemes. This solution had its logical culmination in IMT, the handover of responsibility for scheme O&M to farmers and their organizations. This solution promises to relieve governments of both the fiscal burden and the responsibility for asset management and maintenance and to improve efficiency by empowering farmers. PIM has made impressive strides. However, efficiency has risen only marginally, and there are many schemes in which O&M is beyond farmers' capacity—for example, the management of headworks and major distribution systems. In addition, major I&D investments are often simply beyond the financial capacity of farmers.

In light of these problems, the idea of involving private sector investors and managers in I&D was debated. PPP may be one way of bringing in efficient management skills and fresh funds and relieving government of fiscal and administrative burdens.

PPP has been practiced with some success in the WSS sector for two decades, and this experience has shown that the private sector can help mobilize financing, implement investment programs, and improve performance of service delivery. Under PPP, governance functions typically remain with government, although there is some scope for contracting out. OMM functions have proved the easiest functions to contract out. Regarding investment, the private sector is essentially risk averse and, faced with relatively high levels of risk, is reluctant to commit investment capital unless government assumes much of that risk. Also, although efficiency and service delivery have certainly improved, charges have usually gone up at the same time, and there have been social problems over the common need to downsize staff. Overall, the WSS experience shows that PPP may not relieve government's investment burden much but is useful to establish the principle of financial autonomy and to raise professional standards.

In I&D, PPP is a more recent business, and early innovation has been driven mainly by government initiative rather than by private sector interest. A number of PPP arrangements show that investment and OMM are the key functions for private sector involvement, and the most favored arrangement appears to have been PSD, although high levels of risk have very much constrained development. As in WSS, the experience in I&D confirms that PPP arrangements can

certainly improve service levels, but at a cost that is usually higher to farmers, especially when governments reduce budget transfers.

The key point is that the objective is improved efficiency—a more timely and less expensive water service responsive to farmers’ needs. It is important to design the most appropriate institutional setup. Given that the private sector is demonstrably efficient in many of the functions in I&D, it is likely that in many cases a PPP arrangement would in fact be optimal. However, a third-party service provider could be public (for example, a reformed and financially autonomous government agency) or private (for example, a private I&D service provider looking for business or a WUA turning into a private corporation).

Recommendations

Stemming from the analysis conducted, the main recommendations can be organized around three items:

- PPP in I&D projects should be used to bring in a third-party service provider to improve efficiency.
- In so doing, PPP in I&D projects should address risks in ways most likely to attract the third-party service provider.
- Both approaches allow wide scope for World Bank involvement in PPP in I&D projects.

Improving efficiency through PPP

Revisiting the multiple functions that characterize an I&D system, it seems clear that many of them require high standards of management and professional skill. Successive institutional models have been tried with the objective of raising efficiency, but on many schemes at least some functions still perform poorly, either because of institutional constraints and rigidities, or simply from lack of technical or financial capacity. The analysis in this report of PPP experience in WSS and I&D suggests that, in some cases and for some functions, the needed management capacity and level of skills may best be provided by private sector service providers, and PPP arrangements may be the best way to improve standards while reconciling the interests of government, farmers, and third-party service providers.

There are notable side benefits of bringing in a third party. One is that it forces government and farmers to analyze all the functions in the system, how they are to be provided and financed, and who is responsible. A second benefit is that the management rigor, cost consciousness, and high technical standards of private service providers can be expected to drive an increase in performance and skills across all functions, even where the private operator is not directly involved.

The scope for involvement of a third-party service provider under PPP varies by function:

- In the *investment function*, lessons from experience to date are that, subject to risk management, private investors are prepared to come in to PPP arrangements, and that they can assist in mobilizing financing. However, governments typically have to source most of the financing themselves and also to assume much of the risk, so that the involvement of a private provider may not relieve the financing burden very much. The gains are in efficiency of design, contracting, and execution, functions where the private sector has already played a significant role

in I&D. The experiences in WSS confirm the value to be gained from the management expertise of the private sector where cost control and cost efficiency are central to financial sustainability.

- By their nature, *governance functions* (water allocation and monitoring, supervision of irrigation management) belong to the public sector in I&D. However, the experience in WSS suggests that some of these functions could be the object of outsourcing service contracts—for example, water monitoring.
- The functions of *operating, maintaining, and managing* large public irrigation schemes seem the hardest job in I&D. The failures of many government agencies, and the difficulties met by WUAs after transfer, have been well researched and documented. However, as in WSS, the OMM functions (management of water allocation, water service, and maintenance) are relatively easy to contract out in I&D, either through public contracts or through public service delegation. It is in OMM that third-party service providers can have the greatest impact in improving performance and also in raising standards across all functions and creating institutional capacity. However, where the OMM of entire large projects is considered, there is a constraint because, compared with the very large number of potential bidders on construction projects, there is a relative dearth of qualified corporate entities in irrigation. Nonetheless, the successful experiences of the French SARs,¹² Australian companies, and professionally managed U.S. irrigation districts show that there are some promising paths.

Addressing risks

Experience in both WSS and I&D sectors shows that risks are a major constraint to the development of PPP arrangements. Effectively, the high level of risk translates into investor reluctance and potentially higher costs. If the public sector wants to work with private service providers, it must recognize the special nature of these risks and develop packages to mitigate them. Some risks can be mitigated by contractual provisions, but others are inherent in PPP as applied in the irrigation and drainage sector and will require guarantees of different kinds to attract private investors.

Country risk. Political risk, devaluation, and export market risk are the main country risks. They are not related to the I&D sector itself but to the functions of other sectors or decision levels, most often at the country level or above (for example, global markets). Recommended protections against country risks are government risk guarantees, involvement of international financial institutions, matching currencies, and third-party partial risk guarantees (see box 9). As a method of rendering the water service more autonomous, PPP itself affords some protection against political changes.

Commercial risks. Commercial risks are related to the direct income of the professional third party, either private or public: farmers' insolvency, recovery risk, social risks, and other financial risks. Recommended protections against commercial risks include tariff indexation and resets, financing of completed projects, two-part projects, a grace or transition period at commencement, government risk guarantees, and financial third-party partial risk guarantees (see box 9). When risks are simply too high, the financial risk should be limited to the working capital needed to cover the staggered collection of water charges, and no financial risk should be borne on the investment capital. Specific to I&D is the issue of setting the best payment date to improve cost recovery. Most farmers are good clients and pay their bills. A good financial deal consists of accepting the larger fraction of the payment after the harvest without tolerating excessive delays (over one year).

12 Société d'Aménagement Régional (Regional Development Corporation).

Water-specific risks. From the service provider's point of view, water-specific risks are water demand risk, water supply risk, and technical risks. Recommended tools against water-specific risks are tariff indexation and resets, government risk guarantees, and termination payments. Specific to I&D—where water is an economic input for commercial farmers and the basis of family income for subsistence farmers—is the need for continuous economic assessment of farmers' income and returns to water in order to assess demand and capacity to pay, and to set user charges at optimal levels. As for mitigating technical risks, the best tool is a state-of-the-art project design involving the service provider with specific skills in OMM of I&D projects.

Risk-mitigating tools

Experience with PPP in other sectors shows that there are tools that can mitigate risks and their impact on PPP arrangements. The following can be adapted for use in I&D:

Tariff indexation and resets. Indexation formulas attempt to anticipate changes in cost drivers that may occur over the life of the PPP and adjust tariffs automatically (and, where applicable, the service provider's remuneration) according to specified rules. In the case of long-term commitments with financial risk on investment (typical of a concession), resets are a set of processes and principles that may be used to adjust tariff and service levels in response to wide and unpredictable changes agreed on before the commencement of the PPP. Definition of these changes is a major determinant of the risk-allocation agreement. Specific to the I&D sector is the possible but controversial inclusion of agricultural product prices in the water service price indexation formula, which is a good, practical way of sharing risks and building up confidence between farmers and the service provider.

Government risk guarantees. The government may provide service providers (or their shareholders or creditors) with guarantees against certain risks. Such guarantees have the effect of transferring risk from the service provider to the government, thus making the arrangement less risky and more attractive to the private sector.

Involvement of international financial institutions. Often, even sovereign guarantee may not comfort investors. International financial institutions may use their status to comfort investors and to leverage private financing through cofinancing and guarantees. At Morocco's Guerdane, IFC did not provide financing, but its involvement created investor confidence.

Two-part projects. In many cases, large-scale irrigation projects are part of larger multifunctional water development projects, as with hydropower and irrigation development. In such cases, private sector financing may not be viable for the whole project, yet the public sector may not be willing to develop the project on its own. In these circumstances, a multipurpose project may be divided into public and private elements.

Devising appropriate financial instruments. The development phase of large-scale projects carries a high degree of risk, particularly of cost overrun and delay. A completed project is a more secure investment and could be suited to bond financing. Several Indian states have issued bonds guaranteed by government for financing large-scale irrigation.

Risk-mitigating tools (continued)

Matching currencies. Large-scale irrigation revenues are in local currency. With foreign financing, government carries the exchange risk. Financing on domestic capital markets would remove this risk.

Grace or transition period at commencement. Where information problems increase the risk, the contracting authority may wish to consider providing a transition period at the commencement of the PPP. This gives the service provider a grace period during which to collect the information needed to run the business on a commercially viable basis, without being held accountable for performance improvements. At the end of the period, the arrangement may allow key terms to be adjusted if the actual situation differs significantly from initial assumptions. This mechanism spreads the risk arising from inadequate information between the service provider, the government, and farmers.

Financial third-party partial risk guarantees. Where political and regulatory risks are high, financial third-party partial risk guarantees can be useful. For example, they may counteract political instability and diminish the possibility that future governments will renege on the PPP arrangement. A third party, such as a multilateral development bank, acts as guarantor to the service provider (or its shareholders or lenders). If the contracting governmental agency defaults on specified obligations under the PPP, the third party compensates the service provider for its resulting loss. The guarantor can attempt to manage this risk by putting pressure on the contracting governmental agency if it fails to meet its PPP obligations.

Termination payments. In the event of early termination of the PPP, termination payments compensate a private operator. They are particularly important where the service provider takes a substantial risk on the investment.

Scope for World Bank involvement

“The overarching premise of the Bank Group’s business model is to ensure efficient, affordable, and sustainable delivery of infrastructure services” (World Bank 2004a). The range of available instruments is broad, from technical assistance and policy advice, adjustment loans and credits, and standard investment approaches, to new products such as output-based aid and guarantees. In addition, there are IFC investments and guarantees from the MIGA.¹³ More important, the potential for combining products promises new opportunities, provided that the overall World Bank involvement remains consistent with a country’s poverty reduction strategy and the Country Assistance Strategy. In I&D, the Bank’s mission is further sharpened by the evident poverty reduction impact of improving irrigation water service.

Because implementing substantive reforms and achieving sustained progress often takes years, World Bank involvement will be needed over the long term, dimensioning and sequencing assistance in line with progress achieved. Fostering institutional reforms, including the development of efficient PPP arrangements, is central to the World Bank’s mission. In particular, capacity building should be an integral part of Bank interventions.

¹³ IFC finances private sector ventures in developing countries in partnership with private investors. MIGA encourages direct foreign investment in developing countries by providing foreign investors with guarantees against noncommercial risks.

Involvement with the public sector. The Bank may strengthen its activity with well-performing public institutions as well as with those that have just embarked on reform programs. Where these institutions do not perform and cannot credibly demonstrate concrete action for sustained improvements, investment lending should be deferred. Instead, policy dialogue and advisory work to create consensus for policy reforms, as well as provision of resources to build technical, managerial, and oversight capacity, should be preferred.

Although the case for PPP is growing, there is still room for continued lending to well-performing public institutions to support and facilitate the following:

- A sound policy and regulatory framework directed at the separation of service provision from policy and regulatory functions
- The establishment of an adequate governance and institutional framework for service delivery
- Financial sustainability where costs of service provision, including financing and depreciation, are covered
- Recovery of revenues from users adequate to cover O&M costs
- Training in management, experience transfer, and preparation for modernization

Assistance on investment financing can be through loans to the public institution or through credit enhancement to help the borrowing government agency access capital markets. This may be complemented by technical assistance to help governments improve the performance of entities remaining in the public sector through increased autonomy and accountability. In some cases, financing for new investment will be needed to secure the water resource, to modernize schemes for improved allocation and equity, and to extend the irrigated area.

Involvement with the private sector and professionalized WUAs. Involvement with the private sector and professionalized WUAs would be the core of Bank support in the move toward PPP. This would be achieved mostly through continuing support to reforms where private sector (or professional third-party) participation and financing are introduced as a means of increasing the efficiency and performance of water service. Technical assistance should be provided where needed to help governments select from among private participation options. Here, too, financing for new investment may be needed to secure the water resource, to modernize for improved allocation and equity, and to extend the irrigated area.

PPP should be developed jointly with client countries to ensure that transactions are based on realistic investment and service targets and that risks and responsibilities are allocated appropriately between parties. Thus, the Bank could play the role of an “honest broker” supporting the elaboration of the partnership between the government and the professional third party. Existing and innovative ways should be explored in which public sector resources can best be packaged with sector reforms to leverage private sector investment and expand access.

Innovative ways could include the following:

- Technical assistance and financing of consultancies to prepare feasibility studies for PPP arrangements
- Support to government and WUAs in negotiation and finalization of PPP arrangements
- Pilot projects to test innovative PPP arrangements

More classic ways are as follows:

- Financing for projects involving PPP, in collaboration with government, IFC, other IFIs, and the private sector
- Use of partial guarantees to improve the terms on which finance is accessed on capital markets
- Noncommercial risk guarantees (with IFC and MIGA) on management contracts

The Bank could also support a range of initiatives to promote the development of small-scale providers and professionalized WUAs. Support through existing facilities should be enhanced, for example, by opening lending windows to develop small- and medium-size local private service providers and by encouraging NGO-supported microfinance and business development entities. This type of assistance could help small WUAs or farmers become engaged in a “virtuous circle” of investing in their irrigation system and paying for its service.

Effective mechanisms, such as a government agency, should be used to channel funds if output-based subsidies are used, or a local financial intermediary should be used if credit is being provided. In the case of WUAs, the Bank might support direct interventions through matching grants or via intermediaries that provide microfinance. This may be justified even where reform efforts for the main operators are limited or nonexistent. Here, too, capacity building may be needed within the professional third parties involved.

To meet I&D funding needs, the possibility should be explored of using market-based financial intermediaries such as local (for example, municipal) development funds, bond banks, and state infrastructure revolving funds to foster professional third-party participation. As in other sectors, such as WSS, instruments may be needed to finance local, sub sovereign investment without the intermediation or guarantee of a national government.

REFERENCES AND BIBLIOGRAPHY

- AFEID. 2000. *Water for Food: The French Vision*. France. Paris: Association Française pour l'Étude des Irrigations et de Drainage.
- Aggarwal, R.M. 2000. Possibilities and Limitations to Cooperation in Small Groups: The Case of Group-Owned Wells in Southern India. *World Development* 28(8): 1481–97.
- Bandaragoda, D.J. 1999. Institutional Change and Shared Management of Water Resources in Large Canal Systems: Results of an Action Research Program in Pakistan. Research Report 36. Colombo, Sri Lanka: International Water Management Institute.
- Blokland, M., O. Braadbaart, and K. Schwartz. 2002. *Private Business, Public Ownership. Government Shareholdings in Water Companies*. Nieuwegein, Netherlands: Netherlands Ministry of Housing, Spatial Planning, and the Environment (VROM).
- Bosworth, B., G. Cornish, C. Perry, and F. Van Steenberg. 2002. *Water Charging in Irrigated Agriculture—Lessons from the Literature*. Report OD 145. Wallingford, United Kingdom: Hr Wallingford Ltd.
- Camdessus, Michel. 2003. *Financing Water for All*. Washington, D.C.: World Bank.
- Chapman, C.B., and S.C. Ward. 1997. *Project Risk Management—Processes, Techniques and Insights*. Chichester, U.K.: J. Wiley and Sons. Quoted in Grimsley and Lewis (2002).
- Cleaver, Kevin M. 2002. Foreword. In *Institutional Reform for I&D*. Technical Paper No. 524. Washington, D.C.: World Bank.
- Diemer, Geert. 2000. Technical Note. In *Review of 47 Active World Bank–Financed Large Public Irrigation Systems*. Washington, D.C.: World Bank.
- Dinar, A., and A. Keck. 1997. Private Irrigation Investment in Colombia: Effects of Violence, Macroeconomic Policy, and Environmental Conditions. *Agricultural Economics* 16: 1–15.
- Gonzalez, F.J. 2002. Benchmarking for Irrigation Systems Experiences and Possibilities. Chapter 7 in *World Bank (2002)*. Washington, D.C.: World Bank.
- Gray, P. 2001. *Private Participation in Infrastructure: A Review of the Evidence*. Washington, D.C.: World Bank, Private Provision of Public Services Group–Private Sector Advisory Services.
- Grimsley, D., and M.K. Lewis. 2002. Evaluating the Risks of Public-Private Partnerships for Infrastructure Projects. *International Journal of Project Management* 20: 107–18.
- Hallmans, B., and C. Stenberg. 1999. Introduction to BOOT. *Desalination* 123 (1999): 109–14.
- ICID. 2004. *Irrigation and Drainage Services: Some Principles and Issues Toward Sustainability*. Position Paper. New Delhi: International Commission on Irrigation and Drainage, Task Force 3.
- INPIM (International Network for Participatory Irrigation Management) . 2002. *Institutional Options for User Participation*. Sixth international seminar on PIM, April 21–26, 2002, Shen Zhen Hotel, Beijing, China.

- IPTRID (International Programme for Technology and Research in Irrigation and Drainage). 2002. Benchmarking Irrigation and Drainage Services Provision. Chapter 8 in World Bank (2002). Washington, D.C.: World Bank.
- IPTRID. 2004. Identification et diffusion de bonnes pratiques sur les périmètres irrigués en Afrique de l'Ouest. Rapport technique final. Dissemination of Good Practices on Irrigated Schemes in West Africa. Final technical report. Rome: IPTRID Secretariat, FAO.
- Johnson, Sam, Mark Svendsen, and Fernando Gonzalez, eds. 2004. Institutional Reform Options in the Irrigation Sector. Draft report prepared for the Sixth International Seminar on Participatory Irrigation Management, Beijing, 2002. Washington, D.C.: International Network for Participatory Irrigation Management.
- Kerzner, H. 1990. Project Management, a System Approach to Planning, Scheduling and Controlling. 3d ed. New York: Van Nostrand Reinhold. Quoted in Grimsley and Lewis (2002).
- Labre, J. 2002. Revue de ENGREF 8: n.p.
- Lee, Peter S. 2000. ICID Survey on Funding of Operation, Maintenance and Management of Irrigation and Drainage Projects. New Delhi: International Commission on Irrigation and Drainage.
- Malano, H., and P. Van Hofwegen. 1999. Management of Irrigation and Drainage Systems. Delft, Netherlands: IHE.
- Malano, H., and M. Burton. 2001. Guidelines for Benchmarking Performances in the Irrigation and Drainage Sector. Rome: IPTRID Secretariat, FAO.
- Meinzen-Dick, R.S., and M. Sullins. 1994. Water Markets in Pakistan: Participation and Productivity. Washington, D.C.: International Food Policy Research Institute. Quoted in Aggarwal (2000).
- Meinzen-Dick, R.S., and R. Pradhan. 2002. Legal Pluralism in Natural Resources Management: Implications for Water Rights. World Bank Technical Paper. Chapter 5 in World Bank (2002). Washington, D.C.: World Bank.
- Merna, A., and N.J. Smith. 1996. Privately Financed Concession Contract. Vols. 1 and 2. 2d ed. Hong Kong: Asia Law and Practice. Quoted in Grimsley and Lewis (2002).
- Merrey, D.J. 1996. Institutional Design Principles for Accountability in Large Irrigation Systems. Research Report 8. Colombo, Sri Lanka: IWMI.
- Minami, I. 2002. Irrigation Management Entities in Bank-Financed Projects: An Overview. Institutional Reform for Irrigation and Drainage. Chapter 2 in World Bank (2002). Washington, D.C.: World Bank.
- Ostrom, E. 1965. Public Entrepreneurship: A Case Study in Ground Water Management. Dissertation for Degree Doctor of Philosophy in Political Science. Los Angeles: University of California.
- Ostrom, E. 1994. Neither Market nor State: Governance of Common-Pool Resources in the Twenty-First Century. IFPRI Lecture Series 2. Washington, D.C.: International Food Policy Research Institute.
- Palerm-Viqueira, J. 2001. Self-Management of Irrigation Systems, a Typology: The Mexican Case. Paper prepared for delivery at International Water History Association conference, Bergen, Norway, August

- Peirson G., and P. McBride. 1996. Public/Private Sector Infrastructure Arrangements. CPA Communiqué 73: 1–4. Quoted in Grimsley and Lewis (2002).
- Plantey, J., J. Labre, H. Tardieu, F. Le Landais, J.M. Hoffmann and T. Rieu. 2002. Combining Public and Private Involvement in the Management of Irrigation Schemes: Lessons from Experience of French Cases. Presentation at the 2002 Congress of the International Commission on Irrigation and Drainage, July 21–28, 2002, Montreal, Canada.
- Requena, S. 2002. PPP in Water for Irrigation in MNA. World Bank Draft Framework Paper for discussion. Washington, D.C.: World Bank.
- Risk, K.F. 1921. Uncertainty and Profit. Boston: Houghton Mifflin. Quoted in Grimsley and Lewis (2002).
- Rosegrant, Mark. 2002. World Water and Food to 2025. Washington, D.C.: International Food Policy Research Institute/International Water Management Institute/Food and Agriculture Organization.
- Saghir, Jamal. 2004. Diving into Implementation: Water Supply and Sanitation: Paper prepared for Water Week, March 2004. Washington, D.C.: World Bank.
- Samad, M., and M.A. Dingle. 1995. Privatization and Turnover of Irrigation Schemes in Sudan: A Case Study of the White Nile Pump Schemes. IWMI Draft Final Report. Colombo, Sri Lanka: International Water Management Institute. Quoted in Vermillion (1999).
- Shah, T. 1993. Groundwater Markets and Irrigation Development: Political Economy and Practical Policy. Bombay: Oxford University Press. Quoted in Aggarwal (2000).
- Simas, J. 2002. Issues Affecting the Irrigation and Drainage Sectors in Latin America: Lessons from Mexico, Argentina, and Brazil. Chapter 9 in World Bank (2002). Washington, D.C.: World Bank.
- Smith, R.C., and I. Walter. 1990. Global Financial Services. New York: Harper Business. Quoted in Grimsley and Lewis (2002).
- Solanes, M. 2002. Provision of Profit-Oriented Irrigation Services: Institutional Issues. Chapter 4 in World Bank (2002). Washington, D.C.: World Bank.
- Svendsen, Mark. 2001. Irrigation Management Institutions in the Western United States: An Overview. Paper prepared for the World Bank. Washington, D.C.: World Bank.
- Tardieu, H., and B. Préfol. 2002. Full Costor ‘Sustainability Cost’ Pricing in Irrigated Agriculture: Charging for Water Can Be Effective, but Is It Sufficient? *Irrigation and Drainage* 51(2): 37–107.
- Thobani, M. 1998. Private Infrastructure, Public Risk. *Finance and Development* 36(1): 50–3. Quoted in Grimsley and Lewis (2002).
- Vermillion, D.L., 1999. Property Rights and Collective Action in the Devolution of Irrigation System Management. International Association for the Study of Common Property. <http://www.indiana.edu/~iascp/water.html>.
- Wolfs, M., and S. Woodroffe. 2001. Structuring and Financing International BOO/BOT Desalination Projects. *Desalination* 142 (2002): 101–6.

World Bank. 2002a. Framework Paper for PPP in Water for Irrigation in MNA. Draft, December 2002. Washington, D.C.: World Bank, Agriculture and Rural Department.

World Bank. 2002b. Yangtze Water Basin Resources Project: Supervision Report, July 25, 2002. Washington, D.C.: World Bank.

World Bank. 2002c. Institutional Reform for Irrigation and Drainage. Proceedings of a World Bank Workshop. World Bank Technical Paper No. 524. Washington, D.C.: World Bank.

World Bank. 2003a. World Bank Sector Report 2003. Washington, D.C.: World Bank.

World Bank. 2003b. Draft Sourcebook on Smallholder Irrigation—The Role of Markets and Modern Low-Cost Technologies. Washington, D.C.: World Bank.

World Bank. 2003c. Implementing the World Bank Group Infrastructure Action Plan. Joint Ministerial Committee of the Boards of Governors of the World Bank and the International Monetary Fund on the Transfer of Real Resources to Developing Countries. Washington, D.C.: World Bank, September 13, 2003.

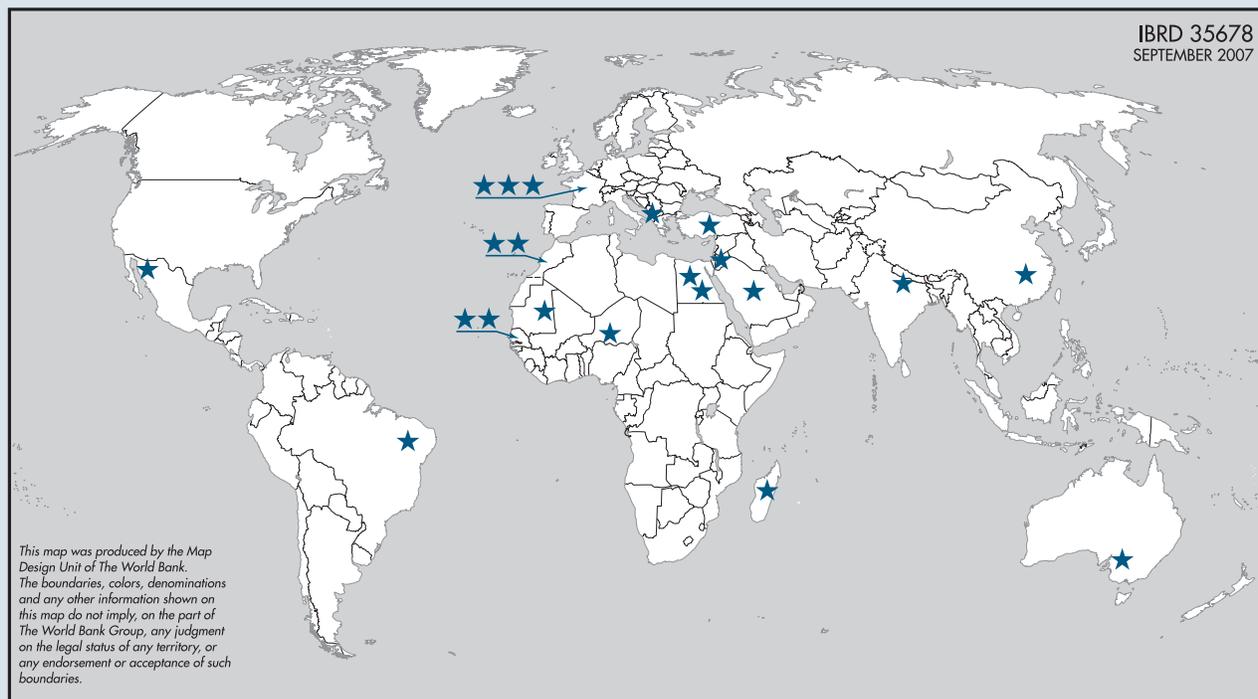
World Bank. 2004a. Infrastructure Action Plan. Washington, D.C.: World Bank.

World Bank. 2004b. Water Week. March 2004. Washington, D.C.: World Bank.

World Bank. 2006. Irrigation Management Transfer: Lessons learned from global experience and key steps for success. Washington, D.C.: World Bank. Draft, July 5, 2006.

World Water Council. 2003. Financing Water for All. Report of the World Panel on Financing Water Infrastructure chaired by M. Camdessus. Report written by J. Wimpenny. Marseille, France: World Water Council, Secretariat of the 3rd World Water Forum and Global Water Partnership.

APPENDIX A. PUBLIC PRIVATE PARTNERSHIPS IN IRRIGATION AND DRAINAGE: 21 CASE STUDIES



01—CACG/ASA, FRANCE

02—SAED, SENEGAL

03—ALAOTRA, MADAGASCAR

04—NAKHLET, MAURITANIA

05—JUAZEIRO, BRAZIL

06—TOULA, NIGER

07—PEQUIN KAVAJE, ALBANIA

08—SONORA, MEXICO

09—TIESHAN, CHINA

10—ADASIYEH, JORDAN

11—ORMVA, MOROCCO

12—EASTERN UTTAR PRADESH, INDIA

13—GAP, TURKEY

14—CSS, SENEGAL

15—DINA FARM, EGYPT

16—BUSINESS FARMS, SAUDI ARABIA

17—SCP, FRANCE

18—CACG/NESTE, FRANCE

19—MURRAY, AUSTRALIA

20—TOSKA, EGYPT

21—GUERDANE, MOROCCO

APPENDIX B. MATRIX FOR PUBLIC PRIVATE PARTNERSHIPS

I&D Functions	Key Issues	Public Sector Interests (Demand)	Private Sector Interests (Offer)
Investment			
Decision to invest	Usually a public decision Ownership of future assets Involvement of professional third party Assessment of client needs Realism in modernization Equipment standardization and maintainability	Moderate Need for professional advice Lack of adequate skills Lack of appropriate response to client needs Artificially low service prices (and even corruption) from public operators	Moderate Involvement at early project stage to secure financial sustainability of future operation, maintenance, and management (OMM) Professional skills Client-oriented approach Opening or emerging market (e.g., on-farm irrigation equipment or pumps)
Financing the investment	Ownership of future assets Need for appropriate financial engineering in high-risk and sometimes high-cost investment Irrigation and drainage (I&D)–specific risks	High, due to scarcity of public funds Need to reduce public investment while maintaining or increasing investment in I&D	Moderate, due to risks Partial or comprehensive financial engineering In-kind or in-cash farmer participation Anticipated return on investment
Project design	Project approach for collective I&D systems Highly technical, often contracted out	Usually high, for outsourcing Need for professional advice and skills	High Typically low-risk engineering activity
Project implementation	Supervision of project implementation Could be applied to heavy maintenance works	Usually high, for outsourcing Need for professional advice and skills	High Typically low-risk engineering activity
Regulation and control			
Water allocation and water police	Allocation between uses must remain with government Allocation between I&D users may be delegated to a professional third party (PTP)	Usually low Lack of experience and skills Bad records (rent seeking, corruption, and so on)	Low, due to heavy governance and political content Some very specific skills may help public agencies
Maintenance auditing and price regulation	Maintaining/increasing farmers' income Securing financial sustainability of assets Sustainable vs. full cost? Need for expertise in auditing/assessing I&D management	Usually low Lack of experience and skills	Low Auditing (large) infrastructure management may be a niche for some operators

APPENDIX B. MATRIX FOR PUBLIC PRIVATE PARTNERSHIPS (continued)

I&D Functions	Key Issues	Public Sector Interests (Demand)	Private Sector Interests (Offer)
OMM			
Water allocation management	<p>Solving conflicts (especially the tail-ender issue)</p> <p>Assessing water demand vs. water resources</p> <p>Negotiation among users</p> <p>Delegation to a PTP has to be clear to avoid dissent with public authority</p>	<p>Moderate</p> <p>Aversion to conflict solving vs. desire to “stay tuned” in case of political implications</p> <p>Need for professional skills on canal operation, sometimes absent (e.g., India)</p>	<p>Moderate, due to potential conflict situations</p> <p>Some operators (e.g., French SARs, Australian companies, U.S. irrigation districts) offer professional operation services for dams, headworks, and canals</p>
System maintenance	<p>Needed “intimacy” between operator and equipment being maintained</p> <p>Easily contracted out when similar to construction works</p>	<p>Moderate</p> <p>May be a good way to downsize overstuffed public entities and to outsource maintenance to operators with sound field competences</p>	<p>Moderate, turning to high</p> <p>Nevertheless, an emerging niche and market for local I&D service providers (IDSPs), very often SMEs employing former maintenance public officers</p>
System operation (including customer service)	<p>Negotiation of fees and services</p> <p>Customer-oriented water service management</p> <p>Optimization of water distribution and management</p> <p>Professional client servicing</p>	<p>High</p> <p>Lack of professionalism in client service</p> <p>Inability for public officers to enter into and maintain a client-provider relationship</p>	<p>High, if commercial risks (especially nonrecovery risk) are acceptable</p> <p>Strong experience and professionalism in client service</p>
Water value optimization			
Agricultural production	<p>Not considered here because not I&D-specific.</p>		



THE WORLD BANK GROUP



The World Bank
1818 H Street N.W.
Washington, D.C. 20433
USA