PUBLIC-PRIVATE PARTNERSHIPS TOOLKITS

How to develop

SUSTAINABLE IRRIGATION PROJECTS

with private sector participation

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foreword

As the impact of climate change on food production for both developed and emerging economies shapes a new set of demands worldwide, there is a need to look at how water resources and irrigation can be optimized to meet the requirements of coming generations. This handbook explores one possible route: the use of public private partnerships (PPPs). PPPs have the potential to facilitate an expanded role for the private sector in irrigation, mobilize expertise in the sector, and ensure medium- to long- term sustainability. This handbook compiles some of the most useful international experiences in irrigation PPPs while offering suggestions to practitioners on strategies and approaches to better harness public and private resources.

It is worth noting that the irrigation sector has not changed its basic developmental paradigm for over 60 years. This model relies on public funding for capital investment combined with public management and supply of water resources to farmers at highly subsidized rates. Yet the last few decades have witnessed a significant decline in investment in irrigation projects in the developing world. One reason may be that the traditional public model does not serve either governments or citizens as it was first intended to. I believe strongly that we should consider combining public and private enterprise and expertise to better face changes that are inevitable.

Governments, public authorities, and others interested in designing and tendering sustainable PPPs in the irrigation sector will benefit from this handbook. It has been designed first and foremost as a practical guide, including a checklist at the conclusion of each chapter so that project managers can track progress on necessary tasks related to policy and implementation of PPPs. It's important to point out that this guide was written by experts with significant experience in irrigation PPPs around the world, and because they are familiar with different agricultural and geopolitical scenarios, they lay out likely obstacles alongside pragmatic solutions.

Climate change, constraints on water resources, the looming food security crisis, and accelerating urbanization compel us to come up with original solutions to challenges faced by people across the globe. When it comes to irrigation PPPs, "business as usual" is no longer an option. This toolkit is the first step toward implementing policies and practices that can strengthen the irrigation sector for generations to come.

Laurence Carter

acknowledgements

The Toolkit was co-authored by Cledan Mandri-Perrott and Jyoti Bisbey with support from Elena Timusheva, Philipp Vaubel, Zao Wei and Cambridge Economic Policy Associates (CEPA). This work benefitted from comments provided by peer reviewers from the World Bank Group, including Aldo Baietti, Jacob Burke, Richard Colback, Victoria Delmon, Neeraj Gupta, IJsbrand de Jong, Erwin de Nys, Francois Onimus, Johannes Jansen and Arturo Villanueva. The authors acknowledge their constructive comments and recommendations, along with the detailed examples they provided and the global perspective they shared, all of which helped improve the Toolkit. Arnaud Cauchois from Asian Development Bank contributed to the case study "Muhuri" from Bangladesh. We are grateful for this partnership. This Toolkit would not have been possible without insightful guidance and managerial support from Laurence Carter and Clive Harris. Peter Honey copy edited the Toolkit and Delphine Divan audited the Options Assessment Tool. The authors would like to acknowledge the financial contribution and development support from the Public-Private Infrastructure Advisory Facility (PPIAF), specifically François Bergere, Amsale Bumbaugh and Lauren Wilson. In addition, the authors are grateful for editing, design and outreach to Alison Buckholtz, Jeanine Delay, and Nadine Shamounki Ghannam, and to TM Design Inc. for designing the Toolkit.

Funding for this publication was provided by PPIAF. PPIAF, a multi-donor trust fund housed in the World Bank Group, provides technical assistance to governments in developing countries. PPIAF's main goal is to create enabling environments through high-impact partnerships that facilitate private investment in infrastructure. For more information, visit www.ppiaf.org

LIST OF abbreviations

ADB	Asian Development Bank
AMP	Asset Management Planning
BMDA	Barind Multi-purpose Development Authority
BMDES	Brazilian National Bank for Economic and Social Development
BOO	Build Own Operate
BOT	Build Operate Transfer
CSS	Compagnie Sucriere Senegalaise
CODEVASF	Development Company of the Sao Francisco River Valley
DBO	Design Build Operate
DINC	Nilo Coelho Irrigation District (initials relate to the Portuguese title)
ECA	Europe & Central Asia region
EIS	Environmental Impact Statements
EMP	Environmental Management Plans
EPC	Engineering Procurement Construction
EPLAUA	Environmental Protection and Land Use Authority & Land Administration (Ethiopia)
EoI	Expression of Interest
ESIA	Economic and Social Impact Assessment
ETB	Ethiopian Birr (currency)
FAO	Food and Agriculture Organization
GMWA	Goulburn-Murray Water Authority, Australia
GYGA	Global Yield Gap and Productivity Atlas
Ha	Hectares
HY	Holding-YNNA
IBRD	International Bank for Reconciliation and Development
IDA	International Development Association
IDSP	Irrigation Development & Support Project, Zambia
IFI	International Financial Institution
IFPRI	International Food Policy Research Institute
IMO	Irrigation Management Operator
IRR	Internal Rate of Return
IMTA	Mexican Institute of Water Technology

InfraCo	Project company for irrigation infrastructure project in Chiansi, Zambia
ITFC	Integrated Tamale Fruit Company (Ghana)
IWMI	International Water Management Institute
IWUA	Irrigation Water Users Association (var. of WUA in Megech-Seraba, Ethiopia)
LAC	Latin America and the Caribbean region
MAL	Ministry of Agriculture & Livestock, Zambia
MoF	Ministry of Finance
MoWE	Ministry of Water & Energy (Ethiopia)
MWRRA	Morocco Water Resources Regulatory Authority
MENA	Middle East and North Africa region
O&M	Operation and Maintenance
OMM	Operation, Maintenance, and Management
ONA	Omnium Nord Africain
PASDEP	Plan for Accelerated and Sustained Development to End Poverty, MoF, Ethiopia
PGF	Partnership Guarantor Fund
PPIAF	Public-Private Infrastructure Advisory Facility
PIU	Project Implementation Unit
PPP	Public-Private Partnership
PSD	Public Service Delegation
PSP	Private Sector Participation
RAP	Resettlement Action Plans
RFP	Request for Proposal
RFPQ	Request for Pre-Qualification
SEA	South and East Asia region
SERCO	An international service company
SPV	Special Purpose Vehicle
SSA	Sub-Saharan Africa region
VfM	Value for Money
WEINCO	Dutch-owned service provider company in ITFC project, Ghana
WSC	Water Supply Corporation
WUA	Water-Use Association
WUC	Water-User Charge

NOTE: All dollar ($) amounts are U.S. dollars unless otherwise indicated.

GLOSSARY OF definitions

Ability to pay. It is a maximum amount a representative farmer can be expected to be able to contribute toward financing the costs of specific plan to develop operate, maintain and/or rehabilitate irrigation infrastructure under assumed or forecasted technology, policy and market conditions.[1]

Agricultural Value Chain. A "value chain" in agriculture identifies the set of actors and activities that bring a basic agricultural product from production in the field to final consumption, where at each stage value is added to the product. Value can be added vertically through the linkages or steps between cultivation and final consumption or horizontally through the network of independent, though interdependent business organizations and can involve processing, packaging, storage, transport and distribution.[2]

Bankability. A measure of a project's suitability for commercial financing that typically includes factors related to the service charges that can be levied by the irrigation service provider on users of the irrigation service and whether project risk allocation protects the irrigation service provider sufficiently.

Bid Bond: A written guarantee provided by the private party to the procuring authority. The bid bond is intended to ensure that if selected, the bidder will proceed with the contract. It is also known as a "bid submission guarantee". The bid bond is generally returned to the successful bidder on effectiveness of the relevant contract or on financial close.

Build-Own-Operate (BOO). PPP Contracts in which the private company is responsible for constructing the assets. The private company is then responsible for owning, operating and maintaining the assets during the life of the contract. BOO contracts are similar to BOT contracts except that the assets developed by the private sector as part of its contractual responsibilities are not transferred to the government.

Build-Own-Transfer (BOT). PPP Contracts in which the private company is responsible for constructing the assets. The private company is then responsible for owning, operating and maintaining the assets during the life of the contract, but at the end of the contract period the assets are transferred back to government.

Commercial viability. The commercial viability of a PPP project defines the extent to which it has the potential to offer a private firm a sufficient financial return to enable it to recover any capital and operational costs as well as a suitable financial return on any investment given the opportunity cost involved.

1 Bjornlund, H. (2010) Incentives and Instruments for Sustainable irrigation. WIT Press, 216 pages: Boston, MA.

2 FAO. (2005). Addressing Marketing and Processing Constraints that Inhibit Agrifood Exports: A Guide for Policy Analysts and Planners, FAO Agricultural Services Bulletin 60, Rome.

Commercial viability. The commercial viability of a PPP project defines the extent to which it has the potential to offer a private firm a sufficient financial return to enable it to recover any capital and operational costs as well as a suitable financial return on any investment given the opportunity cost involved.

Competitive procurement. A competitive bidding procedure in the PPP context begins with the government's description of its requirements and an invitation to the private firms to indicate their interest in the contract and their professional capacity to fulfil it. The government (i.e., contracting authority) then identifies potential suppliers and invites them to submit bids.[3]

Concession. A grant of economic rights of a public asset in an administrative law jurisdiction to a private party by the government, including the legal title to possess the site of the land. It may also refer to a PPP contract that is generally reserved for contracts where the majority of revenue comes from users.

Construction risk. Risk involved in constructing and as appropriate rehabilitate the bulk irrigation assets of the scheme.

Contracting authority. Synonymous with "government," either national, regional or local, in the context of PPP irrigation projects described in this handbook. The public counterparty to a PPP (most often a signatory to the contract). Contracting authorities may have some or all of the roles and responsibilities set out below:

- Formulating sector policy
- Procuring assets
- Regulating contracts
- Monitoring and evaluating project performance
- Operation of selected assets
- Ownership of the assets

The role and responsibilities assigned to authorities may differ depending on individually specific mandates or charters.

Demand risk. Risk of in insufficient user volumes compared to base case assumptions.[4]

Design-build-finance-operate-transfer (DBFOT). PPP Contracts in which the responsibility for design and financing is explicitly transferred the private company. The private company is also responsible for constructing, operating and maintaining the assets during the life of the contract, but at the end of the contract period the assets are transferred back to government

Design-Build-Operate (DBO). Contracts in which the private sector designs, builds and operates the assets to meet certain agreed outputs, while the public sector typically owns and finances the construction of the assets.

3 UNDP. Accessed on 30/7/2014 at: http://pppue.undp.2margraf.com/en/16_2.htm

4 European Investment Bank (2015) The EPEC PPP Guide

Developer. In most cases, the private sector partner in a PPP contract. See *Private Partner*.

Divestiture. Form of private sector participation whereby the government sells all publically owned irrigation assets to the private sector. In this situation, the private firm takes on indefinite ownership and responsibility for all aspects of the scheme including construction, rehabilitation, operations and maintenance.

Due diligence. A process of examining and analyzing every aspect of a project (financial, technical, legal, market, and so on) to fully understand its risks, cash flows, and overall sustainability.

Expression of Interest (EOI). First stage of the competitive procurement procedure which enables the government to gauge the level of interest in the project from private companies.

Financial close. The point in time when all financial arrangements become contractually binding and thus the private firm is, subject to satisfaction of any outstanding conditions, ready to draw on the funding available for the project.

"First-demand" bonds. A means of protection against non-performance of a contractual obligation by the private partner. These bonds are callable without the government having to show that the private partner has defaulted

Force majeure. An event beyond the control of any project party that significantly (and often adversely) affects a project. Examples of force majeure events include natural disasters or political unrest, shortage of water due to a natural disaster etc.

Free-riding. In the context of an irrigation scheme refers to a situation in which individual farmers seek to benefit from the irrigation services without contributing to the costs of providing such services.

Gearing. The relative proportion of debt to equity in the capital structure of a project company. Highly geared companies have a greater amount of debt relative to the portion of equity that is provided by the sponsor of the project company. See also definition for *leverage*.

Grantor. In most cases, the public sector, or government partner in a PPP. See also *Contracting Authority*.

Greenfield irrigation scheme. Such schemes refer to the development of irrigation infrastructure on a new site where there is no need to rehabilitate or modernize existing structures.

Guarantee. One party's agreement to endure the consequences of risks otherwise born by some other party, typically involving a commitment to provide a minimum amount of remuneration, in the event that revenues are insufficient.

Hydrology/ scarcity risk. The risk that the source of the water supply on which the irrigation scheme will rely will not be sufficient to provide the contracted service, for instance due to drought or flood damage, or allocation of water to other users.

Irrigation and drainage services. Better delivery of water to, and drainage of water from, arable land, including better timing, quantity, quality, and cost-effectiveness for the water users.[5]

Improved irrigation and drainage services. Upgrading, rehabilitation, and/or modernization of irrigation and drainage services in an area with existing irrigation and drainage services.[6]

Informal irrigation schemes. Sections of the irrigation sector, which have established themselves without public funding and official recognition, that is outside of government-initiated "formal irrigation schemes".[7]

In-kind payment. Payment made with goods and/or services, typically agricultural produce and/or labor, rather than cash.

Irrigation potential. Area of land, which is potentially irrigable.[8]

Lease/affermage contract. A lease or affermage contract is similar to a concession contract, but with government typically remaining responsible for providing the capital expenditure funding which may be partially or totally executed by the private party.[9]

Leverage. An alternative term for gearing and the degree of debt a project involves. Highly-leveraged projects involve greater amounts of debt relative to equity.

Management contract. A contractual arrangement in which a private party is paid a fee for managing a part or all of the existing irrigation assets. Such contracts do not transfer responsibility for capital investment mobilization to the private party. The fee that is payable to the private party typically consists of a fixed and variable portion, with the variable portion being linked to the achievement of pre-specified performance targets.

New irrigation and drainage services. Provision of irrigation and drainage services in an area that has not had these services before. The area is not necessarily newly cropped or newly productive land, but is newly provided with irrigation and drainage services, and may have been rain-fed before.[10]

Non-recourse or limited recourse finance. This form of financing a project is also referred to as project finance in which the lenders to the scheme can only take security (also referred to as collateral) on the basis of the project in question and have no recourse or ability to return to the project sponsors in the event that the project fails or requires more funding. In limited recourse structures sometimes project sponsors are required to provide some form of corporate guarantee that promises to mobilize more financial resources should they be needed to repay the lenders, but the notion of non-recourse implies that the project itself – and the revenues it

5 World Bank (2012) Core sector indicators and definitions. Irrigation and drainage.

6 Ibid.

7 IWMI (2006). Informal Irrigation in Urban West Africa: An Overview.

8 AQUASTAT. Accessed on 30/7/2014 at http://www.fao.org/nr/water/aquastat/data/glossary/search.html

9 World Bank (2014). Public-Private Partnerships Reference Guide2.0.

10 World Bank Group. 2012. Core Sector Indicators and Definitions: Irrigation and Drainage.

generates—are the main form of security that lenders will take. This implies that the contract itself can be used as security by the lenders and therefore the lenders have the right to substitute one or all parties to the contract subject to the prior authorization of the contracting entity, authority or government.

On-farm management. On-farm irrigation equipment owned (or sometimes leased) by the farmer (includes sprinkler irrigation, drip irrigation, treadle pumps etc.) and the associated water management practices.[11]

Operation, maintenance and management (OMM). Function of the irrigation scheme which includes the management of water allocation, general system maintenance, and possibly provision of support services (e.g. farmer training) and collecting fees from irrigation scheme users.

Operational water user association. Number of water user associations that regularly meet; collect and retain membership fees; use their resources to carry out, or have carried out, operation and maintenance works; and have a decisive voice in water allocations.[12]

Patient capital. Long-term subordinated capital invested at sub-commercial costs.

Performance-based payments. Payments conditional on a private firm fulfilling pre-determined outputs or targets.

Performance bonds. A performance bond is an amount of money lodged with a neutral third party, such as a bank or financial institution, which the Government may claim in the event the private partner breaches pre-specified obligations detailed in the PPP contract.

Post-bid negotiation. Stage in the competitive procurement process, in which the government and the winning bidder enter into additional dialogue which enables them to agree upon the final contract

PPP[13]. A long-term contractual arrangement between a public entity or authority and a private entity for providing a public asset or service in which the private party bears significant risk and management responsibility.

PPP contract. This is the document (or collection of documents) that governs the relationships between the various parties involved directly and indirectly with the provision of services under the contract, defining the allocation of responsibilities and rights, and which provides mechanisms that can be used to enable the parties to deal with unforeseen changes to meet the ultimate objectives of the contract.

PPP contract manager. In the context of irrigation schemes, this term refers generally to the public entity within a defined government institution, which represents the public interests set out in the PPP contract and is the main point of contact within the government on all matters relating to the PPP project.

11 Ibid.

12 World Bank. 2012. Core Sector Indicators and Definitions: Irrigation and Drainage.

13 World Bank Group, 2016

PPP project steering group. Part of the management team overlooking the completion of the competitive procurement process. This would include representatives from the key government agencies that are relevant to the project and individuals with the necessary technical expertise to review and evaluate the bids.

Private partner. The counter party of the contracting authority in the PPP contract. A private entity which has been granted the contract to construct and operate a government asset, and which is usually created under the form of a Special Purpose Vehicle or SPV (see Special Purpose Vehicle). It may also refer to the shareholder members of the SPV, however these are more accurately defined as "equity investors" or "shareholders".

Project definition. Refers to the early stage concept design work that examines various alternatives for the PPP and is carried out before the full feasibility phase to define the service need, identify desired outputs as well as the possible project partners.

Project feasibility analysis. Refers to a series of feasibility or appraisal criteria against which the project is tested to assess its suitability as a PPP and which includes the notion of sustainability both in terms of the scheme itself, its benefits to the ultimate users and its bankability. Such feasibility analysis is typically undertaken once the business case has been made for the proposed project to proceed as a PPP and the project has been designed to a preliminary level.

Project structuring. Process to ensure that the proposed project involves an appropriate mix of public and private participation in the project; i.e. that there is an efficient transfer of risk between the key stakeholders involved, which is then formalized in the PPP contract.

Public service delegation (PSD) contracts. Contracts in which the private firm is paid according to its operational performance and where the private sector usually has to collect fees directly from the end user (farmers, in the case of irrigation projects) and is not paid directly by a single party, which is typically the public sector client. Alternatively PPP deals can be structured to include payments directly from the government to the private firm, which may augment existing collections by such private firms.

Request for Proposals (RFP). Second stage of the competitive procurement process, involving submission of technical and financial proposals.

Service contracts. Arrangements in which a private sector firm is contracted to carry out a support service for the irrigation scheme, such as issuing the bills to the farmers using the irrigation services. These are different to management contracts, which usually include a more comprehensive set of activities, and are generally agreed for a longer time period.

Special Purpose Vehicle (SPV). Specific company formed for the purpose of the PPP project by the private firm taking on the financing responsibilities associated with the scheme.

Sustainability of an irrigation scheme. This refers to the long-term abilities of all parties to the contract (i.e., the public authority which has granted the PPP, the private firm(s) that provide the services, and the beneficiaries of the services) to benefit in a sustained way from the project. For the private sector in particular this implies being able to operate and maintain the scheme profitability[14]. Revenue from water user fees (both connection fees and consumption fees) is sufficient to enable the recovery of operations and maintenance (O&M) and any capital investment. Sustainability is thus linked to a viable agricultural value chain, as the level of fees that farmers will be able to pay will ultimately be dependent on the increased income that they will achieve as a result of the irrigation services.

Tariff. Monetary compensation due per amount of water made available by the relevant irrigation service provider. Generally the price per unit of water changes according to the monthly consumption based on a water pricing scheme.[15]

Transaction phase. This phase of a PPP arrangement is concerned with moving a project from the planning stages to implementation. Detailed work is undertaken to translate plans into tangible financial agreements and to procure the necessary goods and services.

Unsolicited bids. An unsolicited proposal refers to any proposal received by a government agency that was not requested by the government, and that usually originates within the private sector.[16]

User equity and safeguarding. The principle whereby the PPP project should favor public interest, safeguard any particularly vulnerable groups and set charging and tariff structures so as to be both affordable and equitable.

Viable business opportunity. A business opportunity that has ability to generate profit over a long-period of time and remain operational.

Viability Gap Funding (VGF). These funds use resources sourced from the national budget to provide up-front subsidies for infrastructure projects

Water conveyance. The system (including the physical primary system, associated equipment and any regulations) used to carry water from mobilization to distribution (e.g., main canals, natural river, pipelines).

Water distribution. Stage in the irrigation value-chain which involves the delivery of the water through secondary or tertiary canals or through pipelines

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14 Kedir, Y. and T. Alamirew. "Design Considerations of SSI Schemes for their Sustainability and Farmers' Management Simplicity." International Water Management Institute.

15 AQUASTAT. Accessed on 30/7/2014 at http://www.fao.org/nr/water/aquastat/data/glossary/search.html.

16 See Cledan Mandri-Perrott and Iain Menzies. 2011. "A Guide for Implementing Unsolicited Proposals for PPPs in Nigeria." Infrastructure Concession Regulatory Commission. Accessed on 30.07/2014 at: http://ppptoolkit.icrc.gov.ng/wp-content/uploads/2012/09/Guide-for-Implementing-Unsolicited-Proposals.pdf, PPIAF, 2014. "Unsolicited Proposals – An Exception to Public Initiation of Infrastructure PPPs An Analysis of Global Trends and Lessons Learned". http://www.ppiaf.org/sites/ppiaf.org/files/publication/UnsolicitedProposals_PPIAF.pdf)

Water mobilization. Initial stage in the irrigation system value chain which involves exploiting the water resource (diversion weirs, wells), storing it (dams, tanks) and managing it under a regulatory framework.

Water users. Recipients of irrigation and drainage services, i.e., the owners or, in case the land is leased, the lessees of the land provided with irrigation and drainage services.

Water-user association. Groups of water users receiving irrigation and drainage services. The associations may have different names according to local practice or national legislation.

Water-user charge. The contracted charge for beneficiaries of the water service, often expressed in cost per hectare served or cost per cubic meter used.

Water Use Efficiency. It is a measure of yield per unit water applied.

Willingness to pay. It is the largest amount of money an individual can pay for a service, or good, without being made worse of. Willingness to pay is conditioned on ability to pay.

HOW TO use this book

This is a handbook designed to guide governments, public authorities and other interested stakeholders in the process of designing and tendering sustainable Public-Private Partnership (PPP) arrangements in the irrigation sector. It takes a practical, step-by-step approach in describing what a government needs to do in preparing and implementing a PPP irrigation scheme from inception. The handbook takes account of the various stages of the irrigation value chain and how to handle private sector participation in irrigation schemes of different sizes and types. It assumes that governments have already made the underlying policy decision to embark on a PPP in irrigation, and therefore does not dwell on the rationale for undertaking a PPP.

The handbook's practical aspects are contained in four, stand-alone chapters that follow an over-arching Executive Summary and an Introduction. The chapters are deliberately numbered to coincide with the four steps that a government should take in establishing an irrigation PPP: Preparation, Structuring, Procurement Management, and Implementation. In addition, each chapter concludes with a practical Checklist to help executives keep track of the necessary tasks in each step on the way to establishing a sustainable PPP operation.

The chapters

The chapters are designed to be read as stand-alone guides, out of an understanding that institutions using the book may already have completed prior steps. Nevertheless, it would be prudent for users to acquaint themselves with the entire handbook so as to develop a holistic view of the requirements for a full PPP project. For, although the handbook is replete with PPP case studies and examples, as well as likely obstacles and pragmatic solutions, every project is unique and should be structured according to its own circumstances and conditions; there is no one-size-fits-all PPP structure. Nevertheless, the handbook is particularly useful, even unique, in providing a financial model by which users can gain a quick understanding of the revenue implications of an irrigation PPP and link these to capital needs do as to assess the viability of that undertaking.

Chapter One: Preparation is divided into two parts, A and B (each with its own concluding Checklist). Part A reviews the scope for introducing PPPs into the irrigation sector, identifying the issues that policymakers should consider from the outset in order to make the private sector's involvement feasible with a specific irrigation project. It touches briefly on the rationale for PPPs in irrigation before focusing on aspects such as feasibility and risk assessments, determining financial viability and stakeholders' roles and responsibilities. Part B discusses the irrigation as a business. It contains a variety of case studies—the first time such studies have been documented—with discussion of lessons learned, PPP types, transfer of investment functions in developing countries, competitive bidding, and third party involvement among the subjects covered.

Chapter Two: Structuring a PPP sets out the various tasks that must be completed to structure a sustainable PPP contract. It looks at establishing commercial viability, contractual structure, risk allocation, defining key performance indicators, approaches to financing, finance sourcing and related topics.

Chapter Three: Managing Procurement examines how to select a private contractor, which involves such factors as the fiscal commitments to the PPP, to what extent the process should be competitive and how that might be conducted and managed, and what issues are peculiar to PPPs in irrigation.

Chapter Four: Implementation highlights management of the contract and establishment of those management structures, monitoring, penalties and grantor's rights, use of performance bonds, enforcement of customer payments, dealing with changes to the contract, and contract expiry and asset handover.

The overall structure of the handbook is illustrated below. The handbook is supported by three annexes: Annex 1 explains how to use the Excel Options Assessment Tool, , and Annex 2 provides case studies of 29 existing or emerging irrigation PPPs.

FIGURE A.1: Handbook Structure

EXECUTIVE summary

This handbook is intended as a practical guide for governments, public authorities, and other interested stakeholders to design and tender sustainable public-private partnership (PPP) arrangements in the irrigation sector. The report should be relevant to all governments seeking to stimulate increased private sector participation (PSP) across different stages of the irrigation value chain and in irrigation schemes of different sizes and characteristics.

Governments, increasingly, are seeking to address the complex issue of targeting investments and improving the use of scarce water resources in irrigation for agriculture to achieve growth and rural development. It is noteworthy that the irrigation sector has not changed its basic developmental paradigm for over 60 years — i.e., public funding for capital investment combined with public management and supply of water resources to farmers at highly subsidized rates. But this archetype is beginning to change with the exigencies of climate change, constraints on water resources, and the need for increased agricultural yields to resolve food security. Governments are conceding that public resources are limited and they need to prioritize and achieve better value for money in their agricultural sectors. The challenge is made more compelling by the fact that water is just one of several inputs in the overall agricultural-sector value chain, and the irrigation sub-sector itself faces many challenges. One possible solution that is gaining acceptance is the concept of combining public and private expertise in order to improve sector management and delivery of irrigation services.

Over the past 60 years the increasing emphasis on irrigation has been one of the major trends in agricultural development globally. As a result of massive investments in water development schemes, irrigation today provides water to one-fifth of the world's cultivated land, from which one-third of food crops are harvested. Much of this investment has taken place in developing countries, and many of the world's poorest people are dependent on food produced on irrigated land.

There are several reasons for this decline in investment at both construction and operation phases:

Lower levels of investment in irrigation schemes. While some irrigation systems have operated successfully for long periods of time, high and increasing construction costs of the schemes, poor production performance of many irrigation systems, falling real prices of crops, and concerns about negative environmental impacts of projects, have slowed the rate of irrigation investment. This also has significantly reduced the willingness of donors and international financial institutions to invest in irrigation activities. At the same time the increasingly tight financial position of many governments, the various competing demands notably from urban development[17], has hampered their ability to raise funds for irrigation projects from local budgets.

17 The urban population of the world has grown rapidly since 1950, from 746 million to 3.9 billion in 2014. Globally, more people live in urban areas (54 percent in 2014) than in rural areas. The number of mega-cities has nearly tripled since 1990; and by 2030, 41 urban agglomerations are projected to house at least 10 million inhabitants each. Today's large cities are concentrated in the global South, and the fastest-growing agglomerations are medium sized cities and cities with 500,000 to 1 million inhabitants located in Asia and Africa (Adapted from United Nations (2014), World Urbanization Prospects: The 2014 Revision)

Lack of financing for operations and maintenance. In addition, the dramatic expansion of irrigated areas around the world has not been matched by a similar expansion in the mobilizing of financial resources for the management of irrigation systems *after* construction. Consequently, in many systems water is wasted in the upper parts and unavailable in the lower-end sections, while water deliveries are often untimely and unreliable. Pumping stations, canals, sluice gates, and metering systems, have been allowed to fall into disrepair. In general, only about 25–30 percent of water diverted into large canal systems in developing countries reaches the crops needing it.

Insufficient cost recovery. Low water user fees and poor recovery rates risk the efficient maintenance of existing water infrastructure as well as the additional investments in future water-development projects. In many developing countries irrigation user fees are extremely low. Attempts to collect them have been equally inadequate resulting in cost recovery levels that fall short of even modest targets, such as recovery of operational and maintenance costs. User fees often do not adequately cover the cost of production. Moreover, this pattern of financing creates a vicious cycle: financial difficulties cause irrigation departments to defer maintenance to the detriment of the water system, leading farmers to complain about poor service for which they have little incentive to pay. Meanwhile, the politically-rooted system of public provision and subsidized water charges separates the water economy from the influence of actual market forces.

Lack of a consistent and comprehensive irrigation policy. Finally, government efforts to improve the management of irrigation have focused mostly on building hydraulic infrastructure and on the creation of physical capital in the form of dams, aqueducts, diversion weirs, and canals, and less on institutional and implementation arrangements. However, persistent problems with the design, construction, operation, management, and use of irrigation projects have led donors and national governments to re-evaluate the emphasis on engineering and technical design in irrigation planning and management. Lack of appropriate government oversight and technical expertise to implement the projects has taken its toll over the years. The inherent issues at contractual level remain and, in the longer term, as political regimes change, the arrangements are often left in decline.

Response to the challenges

A major response to these pressures has been for governments to delegate management responsibility to other entities, notably third parties such as water user associations or private companies. However, along with the pressures to decentralize and transfer the management of irrigation systems comes a need to understand the factors that contribute to the success of irrigation schemes over the long term. Understanding how to design and manage this sub-sector optimally is necessary if market forces are to succeed in improving the performance and sustainability of irrigation systems.

Bringing private participation into this sector is complicated. It is necessary to develop a better understanding of whether and how the private sector can deliver better service. The system needs to be designed in a sustainable manner, not only from an engineering and environmental perspective, but also in terms of operations and maintenance, including linkages (if any) between production and capital investment. Appropriate institutional arrangements and contractual frameworks need to be put in place which would transfer seamlessly from one

implementation arrangement to the next. Most importantly, the right incentives need to be created for the private sector, farmers, public agencies, and others to perform together to achieve a sustainable scheme for everyone. Critical to the design of irrigation PPPs is the way construction is made, how investment is recovered throughout the life of the scheme, and the manner by which agricultural offtake is linked to the scheme. In addition, the challenge of the co-existence between agricultural businesses and subsistence farmers needs careful consideration to ensure long term viability but also to protect those most vulnerable and provide the right conditions for long term sustainability and economic development with equal opportunities for all.

PPPs in irrigation are still evolving

There are few examples of PPPs in irrigation in the developing world, and where they do exist results are mixed and success limited. Given the complexity and nascent track record of PPPs in irrigation, concessional financing in one form or another has been the primary modus operandi to enable private sector involvement. This fact underlines the recognition that - in most cases - a measure of public support is needed to make the schemes sustainable. This is because typically the required level of investment is far greater than what can reasonably be recovered through user fees alone.[18] The following table lists selected cases and their main characteristics:

TABLE A.1: Case Studies and their Main Characteristics

Underlying features (Financial Close date for I&D PPP)	Megech-Seraba Ethiopia (2012)	Chiansi Zambia (2014)	Guerdane Morocco (2004)	Olmos Peru (2010)	Southeast Anatolia, Turkey (2001)	Muhuri Bangladesh (2016)	Eastern Uttar Pradesh India (1985)
Project Costs	$47 million	$2.5 million (pilot) + $32 million	$85 million	$527m		$58.0m	
Farming activity	Subsistence	Subsistence	Cash-crops	Mixed	Cotton	Mixed	Mixed
Size and scope	4,040 ha	300-2,600 ha	Up to 10,000 ha	43,500 ha	100,000 ha	17,000 ha	2,400,000 ha
PPP model	Operate & Maintain	Build Operate Transfer	Design Build Operate	Concession	Management	Management & Lease	Management
Scope of Private contract	Irrigation only	Irrigation only	Irrigation only	Both Irrigation and Agriculture	Irrigation only	Both Irrigation and Agriculture	Irrigation only

18 Under PPP schemes the revenue that the project generates is used to service debt for construction, pay O&M and ensure a reasonable return on investment to the private party. Strictly speaking user charges are set to meet all these factors within the prescribed contract period. Given that contract periods cannot be too long given the uncertainty this generates to the private party (it would be unreasonable to expect a private party to recover its money over too greater a period of time), user fees end up being quite high. This results in affordability challenges which force authorities to set such fees to a "reasonable" level. In many instances in the irrigation sector, such affordability constraints together with the reality of not being able to have too long a contract period, mean that project revenues need to be augmented by public funds. The forms in which the public sector can support are discussed in later chapters but may include capital grants or revenue payments amongst others.

Conclusion: Is there a role for the private sector in delivery of water in irrigation?

As this incipient market evolves, the need to create the necessary linkages between the private and public sectors is becoming increasingly apparent. Regardless of the level of private sector involvement—whether in the construction, financing, agricultural production, or all phases—it is evident that some form of active public sector collaboration is needed to help projects succeed. This revolves around the fact that irrigation PPPs need a "market" to encourage investment in assets which have a long-term life, yet provide the necessary incentives to both public and private parties to ensure sustainability. Innovation is needed in structuring projects and applying imaginative and pragmatic mechanisms, whether in contract design, financing structures, or procurement process.

A number of other factors, too, will determine success. It is important to recognize that the novelty of private participation in the sector, insufficiency of long-term capital markets, and the balancing of subsistence farming's needs with those of agri-business in some emerging economies will strongly influence the design and type of PPP structure that is to be developed. Accordingly, strategies and projects must be adapted to new market conditions; these should include an early focus on viability of the proposed scheme, a clear delineation of roles between the construction of assets, their maintenance, and operation, and the production of agricultural goods. Flexibility in bidding to allow financial close and, most importantly, rethinking the manner of government support—both financial and regulatory—will be key to foster the development of PPPs in irrigation

introduction

Background to the irrigation sector

The use of irrigation in the agricultural sector, when combined appropriately with other inputs, has been key to increasing the productivity of agricultural production around the world—a vital factor in helping governments to manage the growing demand for food caused by demographic pressures and changing dietary habits. For instance, when used in conjunction with high-quality inputs, irrigation can raise cereal production to 7,500 kg per hectare, compared to around 2,000 kg per ha under rain-fed conditions.[19]

Upward demographic pressures are expected to continue to about 2050 when the world population is expected to level out at about 9 billion, from 7.2 billion currently. Moreover, as people become wealthier their dietary habits change to include more meat, fruit, and vegetables and less staple food items. The challenge for the irrigation sector is how to grow more food in the face of a range of environmental concerns such as water shortages, poor water quality, soil-land degradation, climate uncertainty, land take for commercial and other developments, as well as political interests. Agricultural commodity prices have shown a sustained upward trend since 2008 with several sharp peaks, and many countries are increasingly vulnerable. There is thus a renewed need for investment to develop new irrigation schemes and improve performance of existing schemes. The Food and Agricultural Organization (FAO), the International Food Policy Research Institute (IFPRI), and International Water Management Institute (IWMI) together estimate that irrigation will need to provide at least half the required increase in food production to meet demand over the next 30 years.

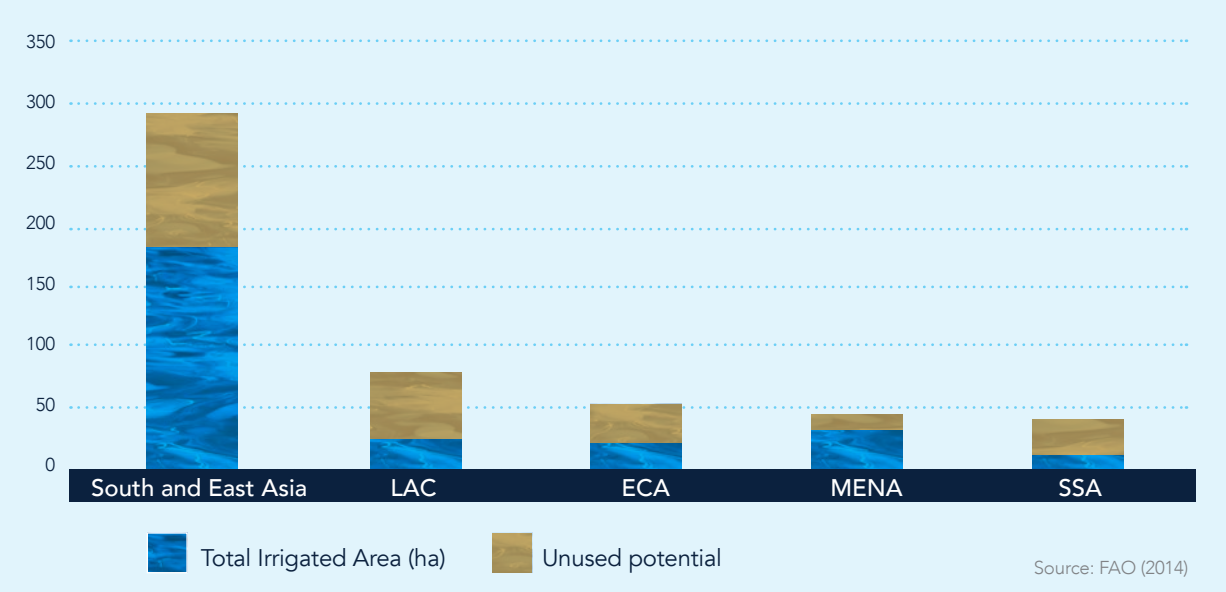
However, despite the continued importance of irrigation, the pace of expansion in the coverage of irrigation schemes has slowed in recent years. The FAO estimates that the growth of irrigation development was around 2 percent per annum in the 1960s and 1970s, but fell back to around 1 percent in the 1990s. In addition, there is a question about where the funds for investment in irrigation schemes will come from. Commitments from development partners have decreased significantly, to around $2 billion from the peak of $2.5-$3 billion in the mid-1980s, and government resources are often constrained. As a result, there is growing interest in finding ways for the private sector to play in helping to raise investment in irrigation.

19 Food and Agricultural Organization (FAO), "Improving Irrigated Production".

Coverage of irrigation schemes around the world

Statistics suggest that of the total global potential of about 500 million ha irrigable land, roughly 230 million ha is currently under irrigation,[20] covering some 20 percent of all cultivated land.[21] Figure A.2 illustrates the overall level of agricultural land under irrigation as a share of the total irrigation potential across the developing regions.[22]

FIGURE A.2: Total Area Irrigated out of Total Irrigation Potential (hectares millions)



As the Figure above shows, the South-East Asian (SEA) region accounts for most of the world's irrigated area. It is also worth noting that in regions such as Europe and Central Asia (ECA), Latin America and Caribbean (LAC), and Sub-Saharan Africa (SSA), significant amounts of land that could be irrigated are currently undeveloped.

The World Bank 2007 report summarizes the most common types of irrigation schemes present across different regions. An adaptation of this summary is presented in a table on the next page, indicating that publically managed, large-scale schemes are most prominent in the world's developing regions, in particular SSA, SEA, Middle East and North Africa (MENA), and ECA. Many of the publically managed schemes in these regions were initially developed to support the production of subsistence food crops rather than for commercial reasons. However, in recent years there has been rapid growth, especially in SEA, in small individual schemes. Collective, large-scale public schemes no longer predominate in this region, although they remain an important provider of irrigation water.

20 FAO (2014): http://www.fao.org/nr/water/aquastat/data/query/index.html

21 IWMI (2007). "Reinventing Irrigation", in *Water for Food, Water for Life*.

22 There is limited availability of data on the irrigation potential of the developed regions, including North America, Western Europe, and Australia.

TABLE A.2: Main Types of Irrigation Schemes Across Various Regions*

Criteria	Sub-criteria	WE	NA	AUS	ECA	SSA	SEA	MENA	LAC
Irrigation system	Individual								
	Collective								
Scale of system	Small/ medium								
	Large								
Public/private management	Private								
	Public								

Key - Level of frequency: Low Medium High

Source: World Bank (2007)

** WE = Western Europe, NA = North America, and AUS = Australia. See text for remaining regional acronyms.*

What makes a PPP scheme sustainable?

For a PPP scheme in irrigation to be sustainable, it would need to generate sufficient revenues over time from either water use fees or subsidies to enable the private firm to recover any capital investments, as well O&M costs. As the handbook shows, sustainability is linked to a viable agricultural value chain, as the level of charges that farmers will be able to pay will ultimately depend on the increased income that they will achieve from the irrigation services. Long-term sustainability of a project depends on several factors, ranging from balanced bid and contract design to allocating risks fairly between the government and its private partner(s), to gaining commitment from the various stakeholders to improved service delivery. It is also critical to ensure sustained change so as to facilitate delivery of long-term benefits for a long time after the transaction has been completed.[23]

How and why this handbook was developed?

This discussion draws on published research by organizations such as the World Bank Group, the Public-Private Infrastructure Advisory Facility (PPIAF), the International Water Management Institute (IWMI), the Asian Development Bank (ADB), Food and Agricultural Organization (FAO) and a variety of individual authors. However, although it draws extensively on some of these reports, this handbook is original in presentation.

23 Cledan Mandri-Perrott, X. 2005. "Six Guiding Principles to Achieve Sustainable PPP Arrangements". Institute of Public-Private Partnerships, Washington DC.

The value-add of this report is in its systematic, project-based focus on how to prepare, structure, and implement a PPP project specific to irrigation. The handbook is not confined to any geographical region, but seeks to highlight common solutions to downstream issues normally encountered when setting up and conducting financial and legal due diligence for any irrigation PPP project. It is exclusively focused on PPPs in irrigation worldwide, while the reports and references listed in the Reference chapter are mostly focused on (i) the irrigation sector in general with emphasis on technical aspects relating to a specific country, (ii) water supply & sanitation in general, or (iii) upstream issues only that attract the private sector to irrigation schemes with limited geographical coverage.

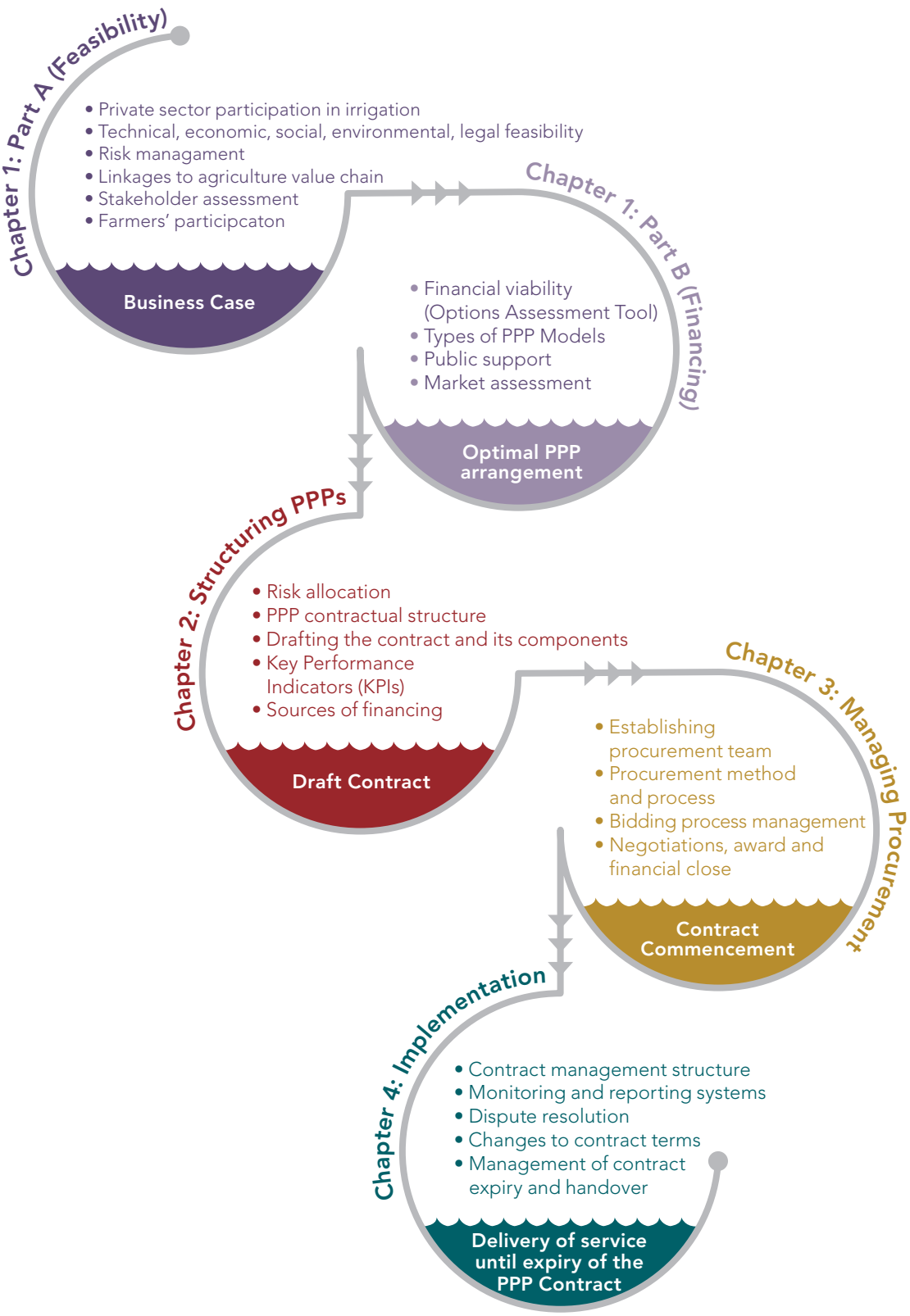
While this book (and each of its four process-related chapters) is designed to be stand alone, readers will benefit by reading it in conjunction with four studies in particular:

- "Approaches to Private Participation in Water Services: a Toolkit." 2006. Funded by the PPIAF, this report outlines PPP models, the planning process for introducing private participation, setting of standards, and common risks in water-sector partnerships. This paper (also funded by the PPIAF) includes some of the same processes in its focus on the emerging irrigation PPP sector.
- "Emerging PPPs in Irrigation Development and Management." 2007. This PPIAF discussion paper classifies irrigation schemes and maps case studies that are included in Chapter One of this handbook.
- "Public-Private Partnerships Certification Guide", 2016 for the "CP3P"[24]. This is a comprehensive reference manual on a good PPP practice exhaustive in scope, coverage, application and detail. The Guide is organized around the stages of a PPP project and is supported by case studies and examples around the world.
- "PPP Reference Guide, Version 2.0." 2014. This is a PPIAF report that examines the details of a PPP project cycle, from the basics of PPPs, establishing PPP frameworks, and implementing PPP projects. While the Reference Guide provides in-depth knowledge about PPPs in general, this handbook applies that knowledge specifically to irrigation-sector PPPs.

The purpose of this handbook is to highlight the best practices noted in previous reports, selected case studies, and discussions about the irrigation sector; further refine them, and present a roadmap by which to structure a PPP irrigation scheme just about anywhere in the world (see Figure below) . The roadmap outlines the specific tasks to be undertaken during each phase of project preparation and execution. Each phase concludes with a distinctive result as shown on the next page:

24 CP3P (Certified Public-Private Partnerships Professional) is a certification program credential awarded upon successful completion of examinations on PPPs. For more information, please visit www.ppp.apmg-international.com. This is an innovation of ADB, EBRD, IADB through MIF, IsDB, PPIAF and WBG.

FIGURE A.3: Roadmap



Chapter One

PREPARATION

1

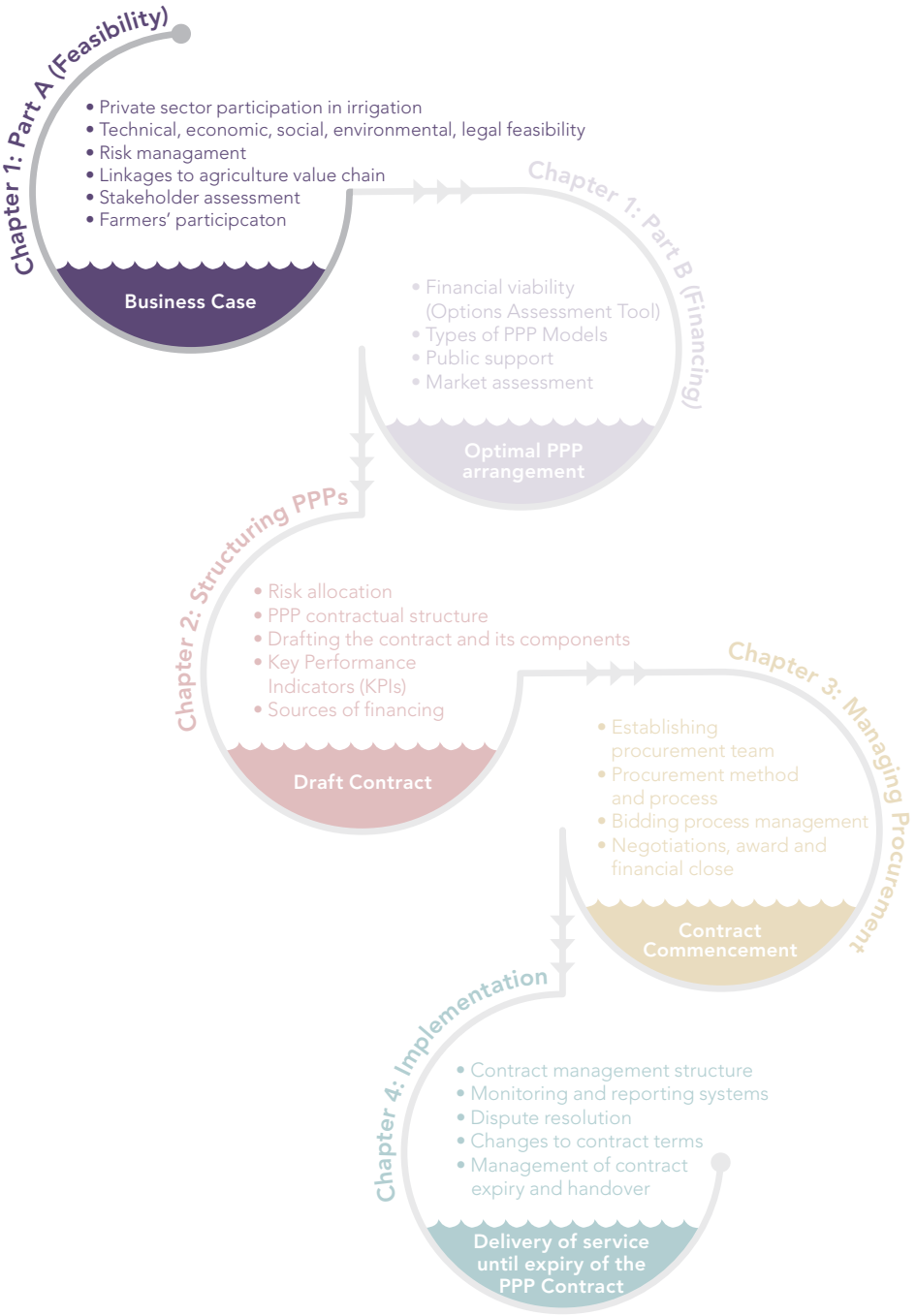
PREPARATION

Chapter 1 sets the foundation on which an irrigation scheme should be developed. Given the amount of detail in Chapter One, it has been divided into Part A and B. The Part A focuses project definition and feasibility assessment; the end product should be a clear business case demonstrating why the proposed project is a good investment decision. Part B explores whether an irrigation scheme can be a business opportunity to the private sector and examines various PPP arrangements currently functional in the market. Case studies of emerging and existing irrigation PPPs are explored in detail to support the principles of a sustainable irrigation PPP scheme throughout the Handbook.

PART A

As illustrated in Figure 1.1, the first stage of a PPP irrigation scheme preparation is centered on appraising the project to ensure a sound business case. Whether public or private, the foremost objective should be to set up a system that maintains its own viability by using techniques that allow for continual reuse. There are two broad elements to this assessment: (i) developing and assessing the feasibility of the project scope, and (ii) appraising whether the project is a good public investment decision; typically based on some form of economic viability analysis.

FIGURE 1.1: Roadmap—Feasibility Stage



1.1. involving the Private Sector in irrigation schemes

Given the experience with public schemes to date and the general lack of government funds to support additional investment, increasing consideration has been given to how PPPs can be used to help improve the provision of irrigation services to farmers.

A PPP[25] can be defined in a number of ways, but typically includes the following characteristics:

- At the core, PPPs involve a significant degree of risk sharing between the government and the private firm, such that both parties would suffer financially if the contract fails.
- All PPPs have a contractual agreement between government and a private firm in which the private party will provide or help to provide a service for a given level of time.
- The contractual agreement should define the service standards that the firm should meet.
- The private firm should generate its revenues off the back of providing the service. This revenue can be recovered directly from the government or from fees levied on users of the service (in this case the farmers using the water to irrigate their crops).
- At the end of the contract, the government should typically own the service. It may be that the government owns the infrastructure during the contract and the private firm simply operates it or that the private firm owns the infrastructure during the contract and is responsible for maintaining it. In either case, at the end of the project ownership returns to government.

25 "A long-term contractual arrangement between a public entity or authority and a private entity for providing a public asset or service in which the private party bears significant risk and management responsibility" (World Bank Group, 2016)

BOX 1.1: Development of the Megech-Seraba Irrigation Scheme in Ethiopia

In 2004, the Eastern Nile Council of Ministers took action to fast-track an irrigation and drainage project piloting the involvement of the private sector in the planning, implementation and operation of irrigation schemes in Ethiopia, with the objective of using public resources to leverage private funding. By introducing improved agricultural water management technologies to mitigate food shortage, the project was designed to reduce risks associated with investments in irrigation and facilitate increased production and productivity for farmers.

The Megech-Seraba scheme for small-scale farmers in Ethiopia was the first irrigation PPP to be funded by the International Development Association (IDA), the World Bank's arm dedicated to helping the poorest countries with concessional loans and grants. In this project, transaction advisory support was funded by both IDA credit and the Public-Private Infrastructure Advisory Facility (PPIAF), with a study commissioned to prepare an Action Plan for implementing the recommended PPP options for the development of irrigation schemes in the Megech, Ribb River, and Anger Valley. Consultations held with government officials as part of the study, indicated that the principle objective underlying the three schemes was to provide a more reliable irrigation service for smallholders, particularly compared to past approaches. The key issues identified in the sector centered on inefficient and unsustainable irrigation systems, with technical and non-technical losses of up to 75 percent or more, and inadequate O&M leading to system breakdowns and requiring significant rehabilitations.

The Ministry of Water Resources objectives included encouraging the involvement of the private sector in a) implementation or construction of medium/ large scale schemes and O&M and management phases of the schemes, b) introduce best practices, which had been lacking in the past in schemes developed for smallholder farmers and c) provide a combination of non-irrigation services to farmers such as input supply; training on crop selection and use of irrigation; and post-harvesting services including storage, processing, marketing and transportation. This is consistent with the government's Plan for Accelerated and Sustained Development to End Poverty (PASDEP), which advocates for the commercialization of agriculture and the promotion of non-farm private sector growth.

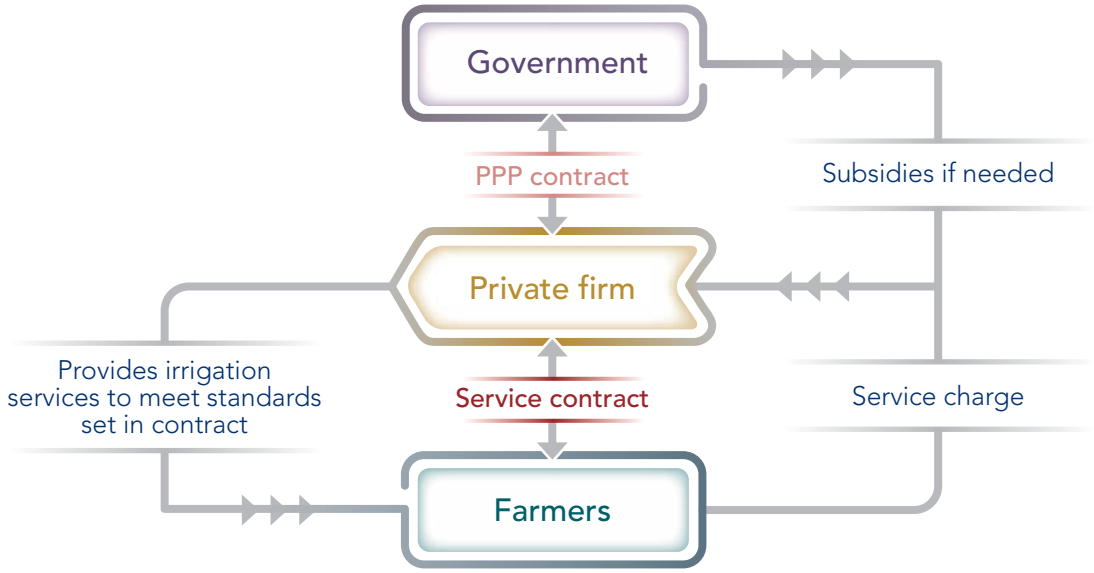
An enhanced management contract was structured developed by linking O&M to the actual improvements in farmers' livelihoods, with provisions for

1. incorporating oversight by the operator on the construction designs;
2. placing responsibility for construction supervision on the operator; and
3. remunerating the operator on a key performance indicator basis
4. building capacity and training the farmers and public officials

In April 2012, the government of Ethiopia entered into an eight-year contract with the French operator BRL Ingénierie for the O&M of the Megech-Seraba irrigation project. The operator will also be in charge of construction supervision, and establishing and building the capacity of WUAs. It is anticipated that the PPP will increase water availability to over 6,000 landholdings over a 4,040 hectare irrigated area.

The basic structure of a PPP arrangement is set out in Figure 1.2. A more detailed discussion of the various types of PPP model and the different ways in which private companies can participate in the irrigation sector is contained in Part B of Chapter One.

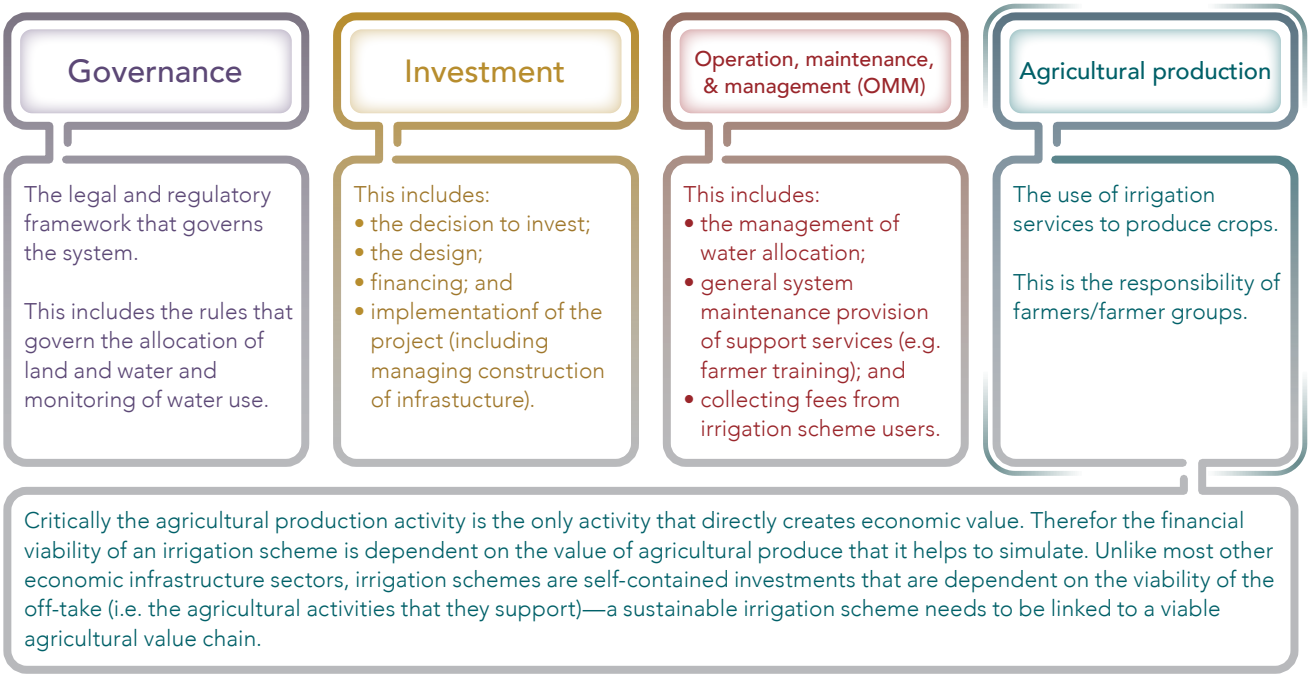
FIGURE 1.2: Basic Structure of an Irrigation PPP



1.2. Rationale for involving the private sector in public irrigation schemes

The various functions of a sustainable system, together with the activities that are carried out under each of them, are set out in Figure 1.3. Public and private sectors can be involved in one or multiple points in the irrigation value chain depending on the comparative advantage.

FIGURE 1.3: Functions of an Irrigation Scheme



The governance, investment and operation, maintenance, and management (OMM) of a scheme are all crucial to the efficient design and operation of the scheme. However, as Figure 1.3 highlights, the decision to invest in an irrigation scheme depends largely on the financial value of the agricultural produce that it helps to stimulate. Ultimately, the amount that farmers will be willing to pay for irrigation services will depend on the additional value that they can generate from their agricultural produce by using the services. Thus, an irrigation scheme has to be linked to a viable agricultural value chain to be sustainable.

For a privately owned and operated scheme, financial value of output will be the foremost consideration in deciding whether to go ahead with the investment. This contrasts with a public scheme, where the government will consider also any wider benefits that may be associated with the investment. However, even if the public scheme generates wider economic benefits, if it fails to generate enough value to enable the recovery of the upfront capital costs and O&M costs, and make a suitable return on capital, the government will have to find a source of funds to effectively subsidize the scheme (either from public funds or development partners) to ensure that it remains financially sustainable.

A review of the various PPP arrangements, based on the case studies that have been developed in the sector (see Part B below), suggests that the main reasons cited for developing PPP schemes are to:

- **Improve quality of irrigation services.** One of the most important purposes of PPPs is to improve service efficiency and improve direct accountability for service provision. In nearly half of the case studies assessed—including Morocco's Guerdane scheme, the Compagnie Sucriere Senegalaise, and the Eastern Uttar Pradesh groundwater project in India—collectively-organized farmers have been strong advocates for PPP irrigation schemes. There objectives were improved water service quality, more-regular and abundant supplies, and also more equitable delivery for tail-enders. In these instances, the farmers realized that improving the quality of irrigation services would be of financial benefit to them, by facilitating an increase in their yields and therefore incomes. Farmers have also demanded access to technical assistance/agronomic advice from the private partners.

- **Separate governance and operation of schemes.** PPP contracts enable governments to separate OMM from the policy and regulatory functions. This often reduces political interference and encourages more effective management from private-sector experts, leading to more timely repairs and proper maintenance of irrigation assets. For instance, in Ethiopia, the Ministry of Agriculture and the Oromia Irrigation Development Agency indicated that they expected private-sector involvement to introduce best practices, thereby reducing (water) losses, estimated to be between 50-70 percent, in the irrigation systems built to serve smallholders.[26] Apart from enhancing performance, the case studies reviewed show that typically contracting out OMM to third-party service providers raises standards across all functions, and creates institutional capacity. It is interesting to note that system maintenance is found to be the most common OMM function that is outsourced to the private sector; however only a small proportion of PPPs have handed over responsibilities for water allocation management to the private partner.

26 ADB (2013)

- **Reduce fiscal constraints to fund high upfront costs.** A major purpose of PPPs is to reduce governments' fiscal and administrative burdens in the operation of existing schemes, and to attract private investment to help finance the costs (construction, rehabilitation, and modernization) of schemes.[27] This was the case in about half of the case studies reviewed. Typically, PPPs were seen as solutions to either to fill or to complement the availability of funding from the government. As shown in the agricultural value chain, collective irrigation schemes typically require high-cost, upfront investments in infrastructure to mobilize, convey, and distribute the water to farmers. These high upfront costs can include the bulk irrigation infrastructure assets as well as the support and rural infrastructure (roads, electricity, support, social services, etc.) required to enable the scheme to function and provide adequate access to markets. Particularly in developing regions, farmers lack access to the resources necessary to finance the construction of the required infrastructure.

- **Set tariffs and improving collection rates.** Public schemes have found it difficult to recover costs from farmers at a level sufficient to cover the O&M costs associated with the scheme, let alone make a return on the investment. This is due to a number of inter-related reasons, notably a difficulty in getting farmers to accept that they should pay for irrigation services, farmers' basic inability to afford the required level of tariffs, the ineffectiveness of public institutions in collecting and remitting irrigation service fees, and political unwillingness either to raise fees to a level that will cover O&M costs or enforce the collection of fees. In fact, some states in India, including Punjab, do not levy any fees on the consumers of public schemes using surface water. This has led to continued reliance on government subsidies to operate. Given the limited government funds available to cover O&M costs, these large-scale public schemes have in many cases been trapped in a cycle that has been characterized in a number of reports focused on the irrigation sector as, the "build-neglect-repair-neglect" cycle.[28]

- **Mitigate lack of asset management planning.** The limited long-term planning and availability of funds to maintain public irrigation schemes has inevitably led to a decline in the quality of performance and loss of faith among farmers. The increase in the use of informal small-scale schemes in regions such as South Asia and Sub-Saharan Africa has occurred largely because farmers have opted out of formal, publically-owned and operated schemes, and instead chosen to access small-scale irrigation technology (e.g., motorized pumps, drawing water directly from open water sources). In South Asia, millions of farmers now make use of small groundwater irrigation schemes instead of existing public surface irrigation schemes. The rapid growth of these schemes has led to concerns about excessive groundwater depletion, particularly in India.

27 For the purposes of this report, when we refer to investment costs of an irrigation scheme this could involve the costs of constructing a new irrigation scheme, rehabilitating an existing scheme (simply returning a scheme to its original design condition), or modernizing an existing scheme.

28 See, for example, FAO. 1999. "Realizing the Value of Irrigation Maintenance." Issues Paper No. 2.

BOX 1.2: Setting the Tariffs—Willingness to Pay

Even if the farmers are generating sufficient income to pay the water use charges, it does not necessarily mean that they will pay them. The experience of public irrigation schemes has shown that in a number of regions of the world government institutions have found it very difficult to both charge and collect annual tariffs from farmers.

In Ethiopia, the Megech-Seraba scheme provides an interesting example of an approach to developing farmers' willingness and ability to pay for an irrigation scheme, to a point at which it can potentially cover the O&M costs and enable some recovery of the up-front development costs. The findings of a survey of farmers in Megech revealed that farmers who already used irrigation had an average willingness-to-pay of Ethiopian Birr (ETB) 495 (an approx. annual charge per hectare of $25), compared to ETB 310 for farmers without irrigation. It was thus recommended that the tariff in the Megech-Seraba scheme be set initially at $15/ha/year (ETB 310) based on farmers' willingness to pay, with a view to increasing tariffs over a seven-year transition period toward $100/ha/year (ETB 2,000)—the cost paid by others in similar schemes in the country. Larger increases in the tariff will be implemented towards the end of the period to account for the non-linear increase in farmers' incomes, with the expectation that farmers' willingness-to-pay will increase as farmers begin to see the benefits of irrigation. The analysis indicates that the difference between the willingness-to-pay of farmers with and without access to irrigation schemes respectively can provide valuable information that can be used to develop a sustainable tariff policy.

Even if an optimal tariff is set, an operator needs to be effective in collecting water use fees. Traditional or older large irrigation systems do not have the necessary engineering infrastructure to facilitate fee collection. For instance, in Ghana the collection rates are estimated to be in range of 45-65 percent, and in Bangladesh collection rates were estimated to be in the range of just 3-10 percent.[30] For new and modernized systems, the following innovations may be considered: (i) "wiring" the irrigation system for improved flow measurement and accounting, (ii) irrigation delivery to individuals and small farmer groups by pipeline to ensure more direct "source to user" supply, (iii) and adoption of "pay as you go" irrigation meters and systems, etc. The Muhuri project will involve a pre-paid water metering system, which allows farmers' direct control of their water-usage, as water will only flow upon insertion of a farmer's smartcard into the meter. It is expected that with this more flexible and transparent system, there will be water use efficiency gains of about 30 percent, a flexible and on-demand supply of water, 100 percent cost recovery from farmers, and an increase in the numbers reached by irrigation. By eliminating cash payments, the system is also expected to eliminate exploitation and financial mismanagement by pump owners and operators.

Farmers need to be incentivized to pay for the service or penalized if they do not pay the necessary tariffs for the services. Conversely, in Peru's Olmos scheme, farmers are given a "take-or-pay" contract, meaning that if they do not take the water supply from the concessionaire, they are liable to pay a penalty. This should help ensure that the concessionaire will be able to collect the flat service tariff of $0.07/m^3 for the water which is used. With an average usage of 10,000m$^{3/}$ha/year, this could equal $26.6m each year.

1.3. Preparing a feasible irrigation scheme

Investment as part of the irrigation value chain will only be sustainable if the investment by itself is sound. Most governments should subject any proposed investment whether existing or a new irrigation scheme, to rigorous appraisal processes as any other public investment project. There are two broad elements to this assessment: (i) developing and assessing the feasibility of the project scope, and (ii) appraising whether the project is a good public investment decision; typically based on some form of economic viability analysis.

The proposed project should undergo detailed due diligence by commissioning and reviewing studies related to the legal and regulatory environment, engineering and technical aspects of the project, environmental, and social impact of the project (i.e., an economic and social impact assessment should be commissioned at this stage) and any resettlement requirements. The benefits of the project should outweigh the costs. The detailed due diligence should also outline any risks or issues relating to such things as competition, environment, labor, land, procurement process, institutional capacity and taxes. Changes to the project may result from the outcome of due diligence. The key questions for governments will be:

- **Is the proposal technically viable?** Can the project actually be implemented as planned, using proven technologies, and without unreasonable technical risks? Have these risks been identified and measured? For instance in the case of an irrigation project, technical viability will assess technical design and specification of proposed structures, adequacy of soil and hydrological surveys, topographical estimates of irrigable area.
- **Is the proposal environmentally viable?** Does the project design (forthcoming amendments) comply with national and local environmental and planning standards? Have these risks been identified and measured? For instance, in the case of an irrigation scheme, an environmental assessment will not only provide prediction, evaluation and mitigation of environmental impact of a new development, but address issues specific to irrigation and drainage projects. Specific to an irrigation project is over-exploitation of ground water and accessibility of surface water.
- **Is the proposal socially viable?** Does the project present clear social benefits for the farmers, community, and the society? Have the social risks been clearly identified, measured and a management plan proposed? In the case of an irrigation project, social evaluation will determine whether a project is socially acceptable, and what negative impacts may be associated with the project implementation.
- **Is the proposal economically beneficial to the users?** Is there a clear economic rationale for the project where the needs bring larger benefit to the farmers? For instance, in the case of an irrigation scheme, the economic valuation would examine not only the net income effect of an irrigation scheme for farmers, but also the economic benefits associated with improved livelihoods and nutrition.

29 World Bank. 2005. "Cost Recovery and Water Pricing for Irrigation and Drainage Projects."

- **Is the proposal legally possible?** Are there any legal barriers to the project? For a PPP this includes considering whether there are any legal constraints on the government's ability to enter into a PPP contract. Have these risks been identified and measured?
- **Is there sufficient institutional capacity and capability to undertake the project?** Does the granting authority need to complement the existing institutions with external technical, legal and financial advisers? Have these risks been identified and measured?

In order for a project to be sustainable, whether public or PPP, the above assessments should be conducted. Reasonable assessment of project-related risks and achieving efficiency in the use of public resources in an environmentally and socially responsible manner over the long term are critical. If each of the steps involved in project definition and feasibility assessment are followed, the end product should be a clear business case demonstrating why the proposed project is a good investment decision.

In practice, the process of completing the definition and feasibility phase can be quite expensive and time-consuming. Box 1.3 below provides an overview of the work that is still ongoing to complete the feasibility work for PPP irrigation projects in Zambia. The experience of this project highlights the importance of managing the feasibility work effectively, which in particular involves strengthening the relevant government institutions to ensure that they have the capacity to organize the complicated process of taking PPP projects through the various phases.

BOX 1.3: Assessing the feasibility of the Irrigation Development & Support Project (IDSP)

Overview

The Irrigation Development & Support Project (IDSP) is a World Bank-funded irrigation project being implemented by Zambia's Ministry of Agriculture and Livestock (MAL). The IDSP aims to increase yields per hectare and the value of various products marketed by smallholders benefitting from investments in irrigation in selected sites served by the project. The project will be implemented in the form of PPPs, with a private sector farming company or agribusiness (FarmCo) operating a hub operation. The bulk water infrastructure will be financed by the public sector, while the private sector operates the system, develops the land and in-field irrigation, and pays water user fees.

Project feasibility assessment

The IDSP is currently nearing the end of the project feasibility assessment phase of project development. Consultants have been hired to advise on the full financial, institutional and legal, socio-economic, and technical feasibility of the project.

For this work, the **financial consultants** assessed the range of financially feasible outcomes for each PPP entity at each site under the IDSP and made specific recommendations on tariff levels and other scheme financial flows. The aim of this work was to answer the following questions:

BOX 1.3: Assessing the feasibility of the Irrigation Development & Support Project (IDSP) (cont.)

- What degree of public subsidy for capital investment is required, and what is the potential for including private investment alongside this?
- What should be the level of water usage fees (and other financial flows) for each user group, taking into consideration risks faced, incentives, and affordability?
- Are the proposed investment opportunities financially feasible for investors? Is this consistent with achieving financial feasibility at the scheme level such that self-sufficiency is reached and no ongoing subsidy is required?

The outputs of this work were a full financial feasibility study and detailed multi-scenario financial feasibility model. The **legal consultants** have advised on the legal and institutional implications of the proposed PPP entities and scheme financial flows.

Meanwhile, **technical consultants** have conducted a number of topographic and soil surveys, as well as rural sociology analysis, to advice on the agronomics of the IDSP. They also have assessed the various irrigation system design options for each of the sites under the IDSP by first conceptualizing the design of an irrigation system, then performing comparative assessments to determine optimal irrigation design. With this, the consultants developed a detailed presentation of the IDSP's proposed water distribution network and conveyance systems and then estimated a bill of quantities and costs for the construction and O&M of the project.

Socio-economic consultants have been tasked with preparing and facilitating implementation of Resettlement Action Plans (RAPs) for each site and facilitating negotiation of leases on irrigable land developed under the project. They have also been tasked with carrying out Environmental and Social Impact Assessments (ESIAs), as well as preparing Environmental Impact Statements (EISs) and Environmental Management Plans (EMPs) for each of the sites.

Practical experience

The IDSP's project feasibility assessment phase has experienced time over-runs, with the process taking significantly more than the forecast one year to complete. The time over-runs can be attributed to a number of things, including:

- Procurement delays in hiring consultants to complete components of the feasibility work;
- Changes in Government architecture, including revisions to the role of the dedicated PPP Unit; and
- Large size of the IDSP project development team, which includes government officials from a handful of ministries, representatives from the World Bank, and many consultants.

A key "take-away" lesson from the IDSP has been that it is important to apply correct sequencing of consultancy contracts and to use realistic timelines. The World Bank has disbursed slightly more than $4 million in consultancy fees under the IDSP between 2010 and 2013.[31]

31 The World Bank Group. 2014. "Irrigation Development and Support Project." Contract Data: http://www.worldbank.org/projects/P102459/irrigation-development-support-project?lang=en

Further details on how to design and prepare sound irrigation schemes which are technically, environmentally, socially and legally feasible and complaint can be found in the following reports:

Legal analysis

FAO Legislative Study 100 (2009). "Creating Legal Space for Irrigation Water User Organizations: Transparency, Governance and the Law". The study serves as a drafting manual for policymakers on water users' association describing experiences of a number of countries in transition.

Economic Analysis

IWMI (2004). "Comprehensive Assessment of Socio-Economic Impacts of Agricultural Water Uses: Concepts, Approaches, and Analytical Tools". The report focused on discussions around generic framework for impact assessment of irrigation development as well as impacts on non-agricultural sectors using water from irrigation infrastructure or are impacted by irrigation development. Additionally, the report describes potential economic approaches for cost-benefit assessment of irrigation developments.

Financial analysis

FAO (2008). "Market-oriented Agricultural Infrastructure: Appraisal of Public-Private Partnerships". The study appraises and compares different models of PPP in rural infrastructure development and identifies failures in engaging the private sector successfully in investing in rural infrastructure. The study also highlights the key financial and institutional building blocks of public-private partnerships.

Technical analysis

JICA (2011). "Preparatory Study of Accra Plains Development Project". This field report presents a comprehensive technical feasibility study focused on evaluating the project potential contribution and benefit to the country's economic and agricultural development given the current present project area conditions and project planning and design.

Environmental and social impact

World Bank (Environmental and Social Impact Assessment of the Ribb and Drainage Project.[31] The report presents the findings of the environmental and social impact assessment of Megech Pump Irrigation and Drainage Project. It presents the findings and lists the potential risks during the construction and operation phases of the project and their mitigation strategies.

31 The World Bank Group. 2010. "Environmental and Social Impact Assessment (ESIA) of the Ribb and Drainage Project." http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2011/03/24/000333037_20110324055425/Rendered/PDF/603860V20BR0P01OFFICIAL0USE0ONLY191.pdf

1.4. Assessing risks

The key factor that determines the structure of an irrigation scheme is the way in which the various risks related to the project are identified, allocated, and managed. Table 1.1 below identifies common risks associated with irrigation schemes.

Table 1.1: Risks Related to Irrigation Schemes

Risk	Description
Construction	• **Design risk.** The scheme could be over- or under-designed, that could hamper its ability to achieve sustainability and reliance in terms of engineering, technology, and usability. • **Land acquisition.** The risk that the project site (or sites) will be unavailable within the required time, or in the manner or cost anticipated, or that the site will generate unanticipated liabilities due to existing encumbrances and native claims to the land. Some countries limit land ownership to locals or may not allow private ownership, while there may also be difficulties with establishing land titles, particularly in countries with significant customary land rights. Further, there may be restrictions on land use and type of irrigation, which can be implemented. • **Site risk.** Relates primarily to the risks involved in constructing the bulk irrigation assets of the scheme; primarily the ability to construct the assets required to mobilize, convey, and distribute the water for an economically feasible budget and within expected timeframes.
Water Abstraction	• **Hydrology or scarcity risk.** The risk that the source of the water supply on which the irrigation scheme will rely will not be available or sufficient to provide the contracted service—for instance due to drought or flood damage, allocation of water to other users (such as urban water utilities), or increased abstraction for irrigation upstream of the scheme. • **Enforcement of water abstraction.** The risk that regulation is weak or the public agency does not have the capacity to enforce water abstraction rights.
Demand	• **Water.** The risk that there is insufficient demand for water to sustain the business opportunity—e.g., in the case of the West Nile Delta, the government opted for a closed-conduit scheme instead of an open canal, despite the added cost, in order to reduce demand and commercial risks for the private operator. • **Agricultural offtake.** Where, despite the increase in productivity, farmers are not able to sell the agricultural produce in the markets—for instance, the government of Senegal guaranteed full tariff protection to CSS against sugar imports from the rest of the world, ensuring that the domestic sugar price in Senegal remained 10-20 percent higher than world market prices; or in Saudi Arabia where agribusinesses received a guaranteed purchase price of $1,000/ton of wheat, which was 50-120 percent higher than world prices.
Payment	• **Payment and collection risk.** The risks around the ability to charge farmers for accessing the irrigation services at the level required to recover O&M and capital costs. In developing markets, in particular, there is significant uncertainty about the ability and willingness of farmers to pay to access water. This lack of certainty about the extent to which irrigation scheme operators will be able to charge and collect fees for the provision of services is a key risk that needs to be addressed to support the implementation of a PPP. • **Counterparty risk.** This is the risk related to the government party to the PPP contract—for instance, if the granting authority (i.e., government) does not fulfill its contractual obligations, such as timely enforcement of tariff adjustments, laws, government payments such as capital grants, and availability payments.

Table 1.1: Risks Related to Irrigation Schemes (cont.)

Risk	Description
Planning	• **Integration risk.** There are several issues with this risk, depending on the scheme, based on a lack of coordination in the service. These schemes are multi-regional, or multi-jurisdictional and multi-use—e.g., water supply and sanitation services vs. irrigation water to the population in the farming vicinity. Often, the granting authority does not have the power to act over authorities in other sectors and bring all stakeholders to one table. In Brazil, for example, the granting authority, CODEVASF, is a federal agency and lacks authority over local and other sectoral stakeholders in a particular scheme. Integration risk can also be when construction of the major capital program is done by the public sector but the operations and maintenance is done by the private sector, where there may be aspects of integrating the service with the commissioning of the capital works. • **Value chain.** There is risk that the full value chain is not thoroughly planned, from irrigation to agricultural value. Unless connections are built, the irrigation scheme itself is likely to have marginal value add. • **Asset Management Planning (AMP).** Risks around the lack of long-term planning in irrigation assets include life-cycle costing and asset management. AMP is more common in water supply and sanitation services.
Cross-cutting	• **Pre-contract risk.** The risk that the procurement of the PPP project is carried out ineffectively or runs into difficulties. For instance, failure to attract sufficient bidders or the development of a poorly structured deal. • **Contract design.** Risk that the PPP contract is short term and limited in scope—e.g., the one-year contract with no performance measures between DINC (Nilo Coelho Irrigation District) and CODEVASF in Brazil's Nilo Coelho. Realistically, there is very little risk transfer in short-term contracts. • **Financial risk.** Risk that investors and/or lenders will not provide or continue to provide sufficient funding (or funding at the right terms and conditions) for the project. In addition, there is the potential that financial variables relevant to the project, such as interest rates and commodity prices, will vary significantly and harm the financial viability of the project. • **Reaching financial closure.** (see discussion on Morocco's Guerdane scheme, in Box 1.5, in Part B). • **Performance risk.** The risks around the performance of the irrigation assets and the ability of the scheme to provide water to farmers of sufficient quantity and quality at the right time. • **Force majeure.** Events that occur outside of the control of the different parties to the PPP deal that fundamentally undermine the project—for instance, natural disasters, political unrest, shortage of water, or unreliable electricity supply. • **Social risk.** Risk that land relocation and scheme construction will cause rapid social changes, such as population migration, community resistance, disobedience and antisocial behavior in the community, health deterioration, erosion of cultural heritage, and the incapacity of social services to cope with such issues.

1.5. Linkages to the agriculture value chain

While the provision of irrigation services to farmers will enable them to increase production, it is only one of a number of agricultural inputs that must be available as part of the development of a viable agricultural value chain. In addition, subsistence production aside, farmers need to have access to both post-production value addition infrastructure and storage facilities and, critically, markets in which they can sell their produce. For instance, the government of Senegal provided full tariff protection to CSS against sugar imports globally, ensuring that the domestic sugar price in Senegal remained 10-20 percent higher than work market prices, while agribusinesses in Saudi Arabia received a guaranteed purchase price of $1,000/ton of wheat, 50-120 percent higher than global prices. In Megech-Seraba, the management contractor is to provide customer relations services, including advice on water management issues, farm irrigation, and related agricultural issues.

There are a number of important factors that will impact the ability of farmers to generate sufficient revenue from their land.

- **Price risk.** The farmers are exposed to significant risks relating to the volatility of agricultural prices.
- **Other agricultural inputs.** A proportion of this increased revenue would have to be used to pay for improved inputs such as seeds, fertilizer, labor mechanization, etc.
- **Access to technical expertise.** Farmers will typically take a number of years to build up their experience in using the irrigation services effectively, and possibly require technical support and capacity building to do so. To this end, an important additional cost for sustainable irrigation schemes is the provision of technical support to the farmers where necessary. This assistance can take many forms and can include the provision of advice on farming practices, support to identify the best seeds and fertilizer for a given set of agronomic conditions, and advice on how to use the irrigation equipment. The responsibility for this activity can be taken by the private firm that is constructing and/or operating the scheme, or a specialist technical advisory firm can be employed.
- **Access to markets.** In addition, in some countries farmers might not be in a position to receive all of the additional income because they lack the necessary information on market prices and/or are exploited by traders or market intermediaries.

BOX 1.4: Bringing Sustainability to an Irrigation Scheme

Whether public or private, the foremost objective should be to set up a system that maintains its own viability by using techniques that allow for continual reuse. There are a variety of different irrigation schemes used by farmers to help increase their agricultural production. This includes schemes that cover areas in excess of 100,000 hectares that have been financed by private investors to support commercial agricultural production; large-scale schemes that are owned and operated by government to support thousands of smallholder farmers; and the proliferation of informal irrigation schemes in regions such as Sub-Saharan Africa and South Asia, where an individual farmer may have purchased some rudimentary irrigation technology, such as a pump, to extract water from a water well or pond and apply it to their crop.

In the absence of these other elements of the agricultural value chain (illustrated herewith) it would be difficult to develop an irrigation scheme that is sustainable. Ultimately, without access to markets farmers will not be able to realize the increase in income required to enable them to afford paying the tariffs for receiving irrigation services at the levels necessary to facilitate recovery of capital and O&M costs, and therefore to sustain a PPP scheme.

Role of Irrigation within the Agricultural Value Chain

1.6. Stakeholder requirements for entering into a PPP

The key factor in determining the scope to introduce a PPP into the irrigation sector is the extent to which the requirements of the key stakeholders—the private sector firm, government, and farmers or WUA—can be addressed. The public sector comprises government ministries or departments, regulatory bodies[32], granting

32 In some instances there may be more than one regulatory body for example, one that deals with abstraction of water rights, and a separate entity/regulator that overseas irrigation and agricultural activities. This will depend on the particular institutional and legal set up in a given country.

authorities; the private sector comprises commercial companies. WUAs and farmers, in the third category, are the users and potentially could participate in the scheme in various roles as well.

Fundamentally, a PPP requires:

- One or more private sector firm(s) to be willing and able to take on the responsibilities defined in the PPP contract. They will only do so if they judge that they can recover any costs incurred in providing the services and at the same time obtain a reasonable rate of return taking account of the main risks that relate to the implementation of the scheme.
- A government department or institution willing to sign off on the PPP contract with the private firm. Government will only enter into the arrangement if it is confident that the private firm can meet the requirements set out in the contract—e.g., if interests of the farmers are protected, the firm has the necessary credentials and expertise to perform the services etc. From a political perspective, government will also consider if farmers and the broader constituency support their intention to hand over responsibility for providing irrigation services to the private sector.
- Farmers and WUAs willing and able to contribute necessary service fees and are more generally willing to accept the private sector taking over responsibility for the provision of irrigation services. Farmers will only be willing or able to pay the service fees if the irrigation services (together with other improved inputs where needed) help them to increase yields and thereby incomes to a level that enables them to afford the fees and make a suitable profit. Farmers' support for government handing over responsibility for irrigation services to the private sector will be influenced by a number of factors; chiefly the extent to which they are confident that the private firm will maintain appropriate levels of service provision at reasonable cost.

The allocation of these roles and responsibilities will vary according to context, such as the priorities of the government and the capacities of the private sector and farmers. An example (Table 1.2) shows a scenario in which the government is responsible for both the regulatory system and providing the investment required to develop the scheme assets up to the farm gate, but has left the O&M and management of the schemes to the WUAs.

Table 1.2: Allocation of Responsibilities in a Hypothetical PPP Scheme

	Water mobilization	Water conveyance	Water distribution	On-farm irrigation	Agricultural production
Governance and regulatory framework					
Investment					
Operation, maintenance & management					

Public sector | Farmers/WUAs | Commercial companies

Table 1.3 below provides an analysis of the main considerations of each of the three main stakeholder groups and explains in theory how a well-designed PPP can be adjusted to ensure that each group is satisfied by the arrangements.

TABLE 1.3: Stakeholder Requirement for Entering a PPP

PRIVATE SECTOR		
Key concerns	**Dependencies**	**Scope to mitigate?**
Is it feasible to provide the services specified in the PPP service contract?	Depends on the specification of services that government wants to be provided on a given scheme.	• The specification of service requirements needs to reflect the technical realities (e.g., the enabling engineering infrastructure) as well as the physical and social environment of the existing/ proposed scheme location. • The requirements have to develop following negotiation between the government, private sector firms, and the users/farmers. • Private firms will only take on risks that they have some control over, the design of the contract/specification of services will need to take this into account.
Is it possible to obtain a reasonable rate of return from providing the services specified in the contract?	Depends on the willingness and ability of farmers to pay for the services and the capital and O&M costs that it expects to incur to provide the services. Also the extent to which farmers already pay for services.	• Government may need to provide subsidies to cover the shortfall between what farmers are willing to pay and what is required to cover costs. • Depending on the capacity and willingness of the farmers there may be need for technical and financial support from government/development partners to improve the quality of their farming practices and access to other inputs so that they can increase yields and then access markets to increase their incomes. • There may also be need for government to provide additional investment in roads/supporting infrastructure to enable farmers to access local, national and international markets.
Are the risks of relying on farmers to pay service fees too high?	Depends on the type of farmers being provided irrigation services by the scheme and the nature of the crops that they are producing.	• Government can agree to pay subsidies to provide some cover for the risks that the private firms would ordinarily face. • Potential to formalize a contractual agreement with an agribusiness that will agree to offtake a proportion of the farmer's agricultural produce for pre-defined prices. • Potential to provide technical support to the farmers to improve their farming practices.
Can government be relied upon to pay any subsidies on a consistent and timely basis?	Willingness and ability of government to pay of government	• Does the government have a track record of adhering to the terms of PPP arrangements, if not government could consider providing guarantees and/or establishing a dedicated fund that could be used to provide the necessary payments. • In addition government may need to implement reforms to improve the existing enabling environment for the implementation of sustainable PPPs (the minimum requirements are discussed in Part B of this guide).
Can I rely on government to enforce the terms of the agreed PPP service contract?	The ability of government to design, implement and enforce a sustainable arrangement.	

TABLE 1.3: Stakeholder Requirement for Entering a PPP (cont)

GOVERNMENT

Key concerns	Dependencies	Scope to mitigate?
Are there enough potential private sector firms with track record to deliver required services to the necessary standard?	Availability of private firms with a track-record/ capacity to deliver services.	• Ensure that the service requirements for the PPP are realistic and specified clearly to attract relevant private sector participants. • Develop an effective procurement process that ensures that potential private firms are aware of the opportunity and can understand what is being requested.
Will the private sector provide the services at the agreed level of quality on a sustainable basis?	Provisions specified in the service contract and the ability of government to monitor and enforce those provisions.	• Develop an appropriate enabling environment in which it is possible to define and enforce a suitable service contract. • Identify a relevant government institution that can play the role of monitoring and enforcing the terms of the contract.

FARMERS

Key concerns	Dependencies	Scope to mitigate?
Are the farmers willing and able to pay service fees at the level specified in the service contract?	Ability to generate enough income from farming activity to make it worthwhile to pay the required tariffs for accessing irrigation services. Ability of the private firms working with government to deliver the services specified in the contract.	• This is dependent on the market price that the farmers can get for their produce and the quantity of the produce that they are able to generate. The farmers might therefore need assistance to consider appropriate cropping plans and intensity (depending on whether it is feasible to do so given the agronomic conditions and whether markets and other supporting services are available) and more general support to improve the productivity of their agricultural practices. • Government may need to provide investment to support the improvement of the supportive infrastructure, e.g. roads, access to power necessary to enable the farmers served by a potential scheme to access markets, research and innovation, market information systems etc..

The main theme that runs through the concerns of each group and thus the scope to establish PPPs is whether the scheme has the potential to operate on a financially sustainable basis. We examine this issue in Part B.

1.7. Farmers' participation in the PPP contract

While there are two main parties in a PPP arrangement, the user or the farmers form an intricate part of the value chain. In most cases, farmers are the service recipients, and in some the farmers have formed WUAs to support OMM services (for more, see subchapter 1.13 of Part B). In order to attain sustainability, farmer's active involvement can generate the links which are missing between the public and private partners.

In some cases, farmers have become part of the agricultural off-take bringing certainty to the demand for irrigation services. For example, in Ghana's Integrated Tamale Fruit Company (ITFC) irrigation scheme, in order to participate, smallholders have to provide an 85kg bag of mango upfront (equivalent to around $25). From the fifth year onwards the out-grower will repay 30 percent of their sales to the ITFC until the debt is repaid. Until then, all mangoes must be sold through the ITFC, though after the debt is repaid they may switch to another buyer.

Peru's pioneering Olmos irrigation PPP scheme has implemented a "take-or-pay" policy, by which farmers acquire title to the land and the right to the irrigation services, with an obligation to pay the service fee of $0.07 per m^3 for water used to irrigate their farm. It is called a "take-or-pay" policy because if the farmers do not take the water supply from the concessionaire they are still liable to pay.

Farmers can be involved in the structuring, financing, and implementation of the schemes. For example in Egypt's West Nile Delta project. Although the irrigation scheme was stalled in 2012 and is yet to be implemented, the early preparation work involved setting up a representative advisory group of farmers—a water user council—to engage in project preparation on behalf of all the beneficiaries. During implementation, the council would monitor the relationships and potential conflicts in the farmer community in matters such as water entitlements, water use, and alternating hours of irrigation.

1.7.1. Affordability for farmers

Setting cost-reflective fees for water can be a difficult and politicized issue, especially in emerging countries where farmers may have long viewed access to water as a free resource. Several approaches have been used to enable firms to set and collect adequate water user fees. These include:

Understanding farmers' willingness to pay. The Megech-Seraba irrigation scheme in Ethiopia has shown the importance of carrying out detailed analysis of the amount that farmers are willing to pay to receive irrigation services. Following the completion of a willingness to pay survey it was determined that it would only be viable to introduce private sector involvement if government subsidized, at least in part, the irrigation service fees. It is expected that as farmers gain the benefits from the irrigation services their willingness to pay will increase and the subsidy required by government will lessen. It is thus assumed that the proportion of the tariff paid by farmers will gradually increase proportionally.

Securing upfront payments. The Muhuri irrigation project in Bangladesh has taken on the lessons from the Barind system which makes use of a system of pre-pay coupons to reduce the collection risks around irrigation service fees from farmers. Key to this approach is the ability to control adequately the supply of water to farmers, so that they actually get the amount of water for which they have paid up-front. This was done in Guerdane and has been planned for West Delta as well.

Contract farming arrangements. In the case of the Integrated Tamale Fruit Company (ITFC) irrigation scheme in Ghana, the farmers enter into a contract with the private firm for the provision of irrigation services in exchange for a proportion of the farmers' produce. Smallholders have to provide an 85kg bag of maize upfront (equivalent to around $25). From the fifth year onwards the out-grower will repay 30 percent of their sales to the ITFC until the debt is repaid. Until then, all mangoes must be sold through the ITFC, though after the debt is repaid they may switch to another buyer. These arrangements typically work best for commercial crops where the commercial off-taker has an ongoing financial incentive to ensure that the farmers receive the irrigation services. In addition it is important to have an enabling environment within which stakeholders have some confidences that contractual provisions can be enforced adequately. The Kaleya irrigation scheme in Zambia provides a good example of this approach.

Box 1.5 below provides an additional example of this approach from India, where it has been difficult to apply water user fees to farmers.

BOX 1.5: Contract Farming of Onion and Fresh Fruit in Maharashtra

Jain Irrigation System Limited (JISL) has established an onion dehydration and fruit processing plant in Jalgaon, Maharashtra. It is a 100 percent export-oriented unit. JISL has entered into a contract farming arrangement with the farmers within a radius of 200 km of Jalgaon to buy good quality onion bulbs and fresh fruits at an assured price. JISL helps the farmers produce more and better quality produce by providing genetically superior High Yielding Varieties (HYV) planting materials, an efficient water and fertilizer management system and agronomical guidance. Farmers have to ensure optimal utilization of the available water resources. The involvement of the state government is minimal.

JISL volunteers provide first-hand knowledge of how to grow onions, technical know-how, and other extension services to the farmers, and are a pivotal link between the company and the farmers. Senior scientists of the company also visit the farms and exchange views on the latest developments. JISL has helped the local farmers to bring more than 80 percent of the onion crops under efficient micro-irrigation systems like drip irrigation and sprinklers. Farmers benefit since they receive good quality seeds at reasonable prices and the company gains from buying the fruits and vegetables from the growers and processing them at modern processing facilities to produce high quality dehydrated onion and vegetable products, aseptic fruit purees, pulps and concentrates, and exporting these throughout the world. The company has also put into place a dispute resolution mechanism which has been working well so far. The JISL experiment, which combines for-profit contract farming with focused assistance to improve water use efficiency, has proved beneficial and could potentially be replicated in other parts of India as well.

1.8. checklist

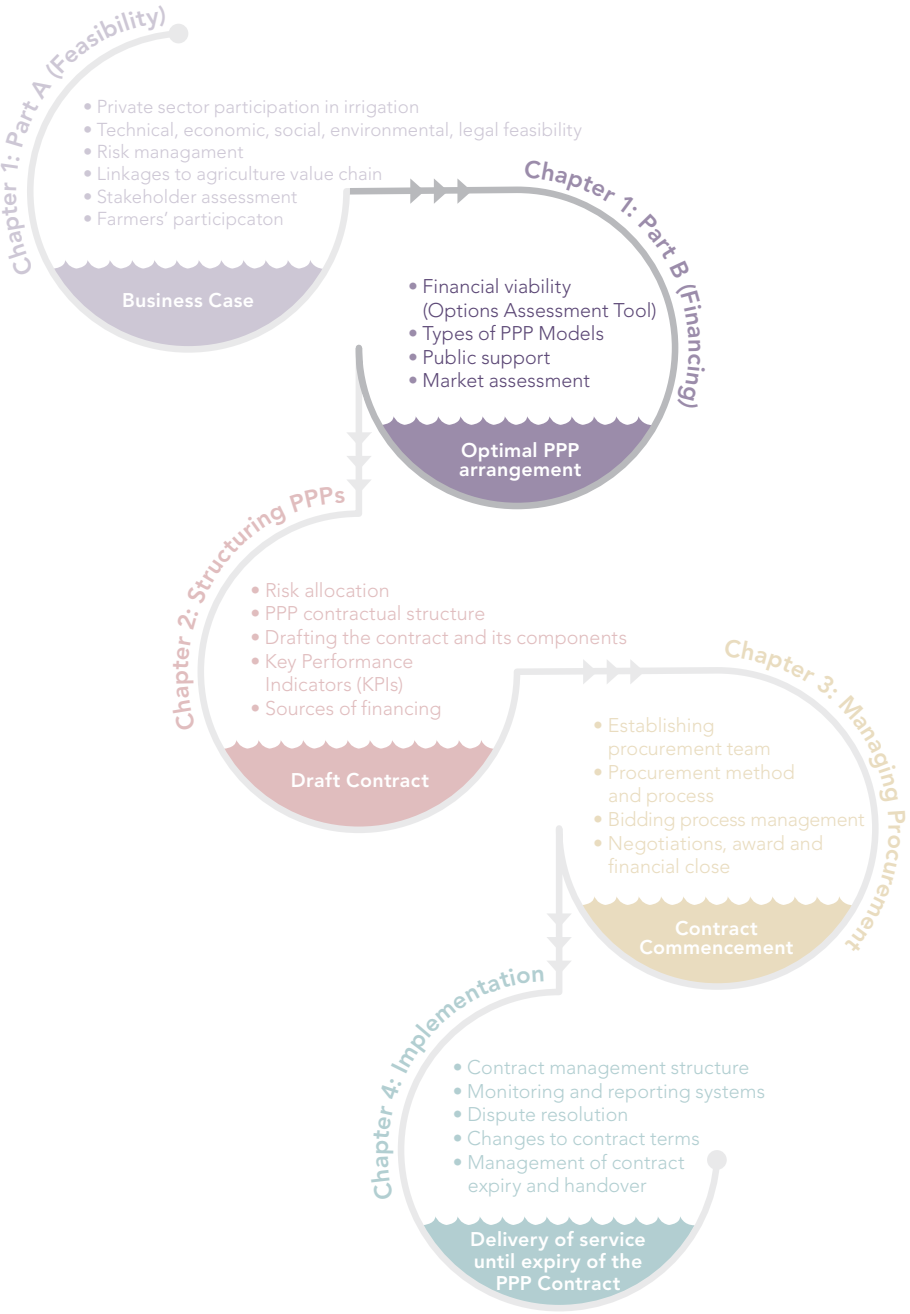
for preparing a business case scheme (Part A)

1. Clearly define the irrigation scheme rationale ☐
2. Design the irrigation scheme sustainably ☐
   a. Determine if the irrigation scheme is a part of an agricultural value chain ☐
   b. Clearly define the benefits for the farmers and other users ☐
   c. Determine the affordability of the irrigation scheme to the users (farmers, government) ☐
3. Determine the overall feasibility of the scheme ☐
   a. technical ☐
   b. economic ☐
   c. social and environmental ☐
   d. legal ☐
4. Identify the project risks ☐
5. Determine if the public sector has the capacity and resources to undertake the scheme ☐
6. Determine the rationale for private sector participation ☐
7. Carry out stakeholder assessment ☐
8. Prepare the strategic communication plan with key internal and external stakeholders ☐

1.9. Irrigation as a business opportunity

A business opportunity means that the scheme is linked to an agriculture value chain offering financial value, revenue and social benefits for the users and the private sector with the government maintaining its social and fiscal responsibility. The Chapter One Part B discusses how to further refine a business case which includes determining financial viability while testing optimal risk allocation leading to the type of PPP arrangement. Starting with a sound business case, policymakers should carry out simple analysis to determine if it is viable to bring private partner into the scheme, as shown in the Figure 1.4. below.

FIGURE 1.4: Roadmap—Financing Stage



1.10. Determining the viability of a PPP

The key requirement for a scheme to be financially self-sustaining, absent any significant government funding, is that the project needs to be able to pay water user fees at a level that enables the private firm to recover capital and O&M costs. In most cases the PPP arrangement will involve some use of public funds to support the implementation of a PPP scheme. Therefore, we have also discussed how government can assess the economic case for the use of public funds.

1.10.1. How to make a decision about a PPP using an Options Assessment Tool?

When considering the scope to introduce a PPP into the irrigation sector, policymakers should first carry out a simple analysis to determine if it is viable to bring private partner into the scheme. An "Options Assessment Tool" (see next paragraph) can be developed to determine which functions need to be carried out, how to structure the PPP so as to create opportunity of interest to both the farmers and potential private firms, and also achieve value for money for the government. For example, in Megech, Ethiopia, the financial assessment techniques helped design a scheme in which the initial funds were sufficient to cover construction of the main and secondary canals, but placed responsibility for funding of the tertiary canals to the farmers.

An Options Assessment Tool is a flexible worksheet based on MS Excel that can be used to complete a PPP options analysis. It enables the user to review the impact the potential PPP from the perspective of the key stakeholders in the scheme. If the requirements of the private firm, farmers, and government are not satisfied, the scheme will not be able to operate on a sustainable basis. Overall, the outputs of the model can help the user to identify the following:

- **Farmers**—if the farmers' level of income post-implementation of the PPP scheme is higher than pre-implementation, taking account of any required increase in water user fees.
- **Government**—if government can afford the level of expenditure required to support the implementation of the scheme on a sustainable basis.
- **Private firm**—whether the water user fees that the firm can sustainably levy on the farmers is large enough to help them recover any capital and O&M costs that they expect to face as part of the proposed PPP arrangements. The tool also estimates the returns available to the private firm, which can be used to assess if the PPP has the potential to offer the firm a high enough return given the alternative investment opportunities available.

If any one of the above conditions do not show positively, policymakers will need to vary the design of the potential PPP scheme—for instance, by changing the proposed allocation of responsibilities to the private firm and thus changing the required level of capital investment by the private firm, or increasing the level of government expenditure.

The users have the flexibility to input the main costs and revenues relevant to the scheme and the PPP arrangement under consideration. The objective of the tool is to let the user review whether, given the technical design of the scheme and the nature of PPP arrangement (e.g., a management contract implies a different allocation of costs than a concession arrangement), the proposed PPP has the potential to be a financially attractive proposition for each of the three key stakeholder groups to a potential PPP arrangement.

1.10.2. Input and output of the tool

The inputs of the tool cover all the needed variables for the calculations required to assess the viability of PPP schemes and importantly to assess the level of funding that may be mobilized by the private sector within a specific project's constraints. Understanding the revenue estimates and cost allocation under different schemes will have a large impact on the final output of the tool. The main input categories are:

- Farm characteristics variables—Farm size, farmer's plots, and number of full time employees on the commercial farm;
- Capital expenditures, and operational, maintenance, and management variables—Shared irrigation infrastructure cost, on-farm irrigation infrastructure cost, on-farm non-irrigation infrastructure cost and supporting infrastructure cost, farm overheads, water user fees, and the gross margins of the farm.
- Financing aspects variables—Financing from farmers, grant finance, available public finance for the project, which is the expected subsidy that government are willing to offer under the fiscal constraints, and the minimum required private sector return on agriculture projects
- Cost allocation variables—All the capital and O&M cost allocation percentages between commercial farms and public sectors

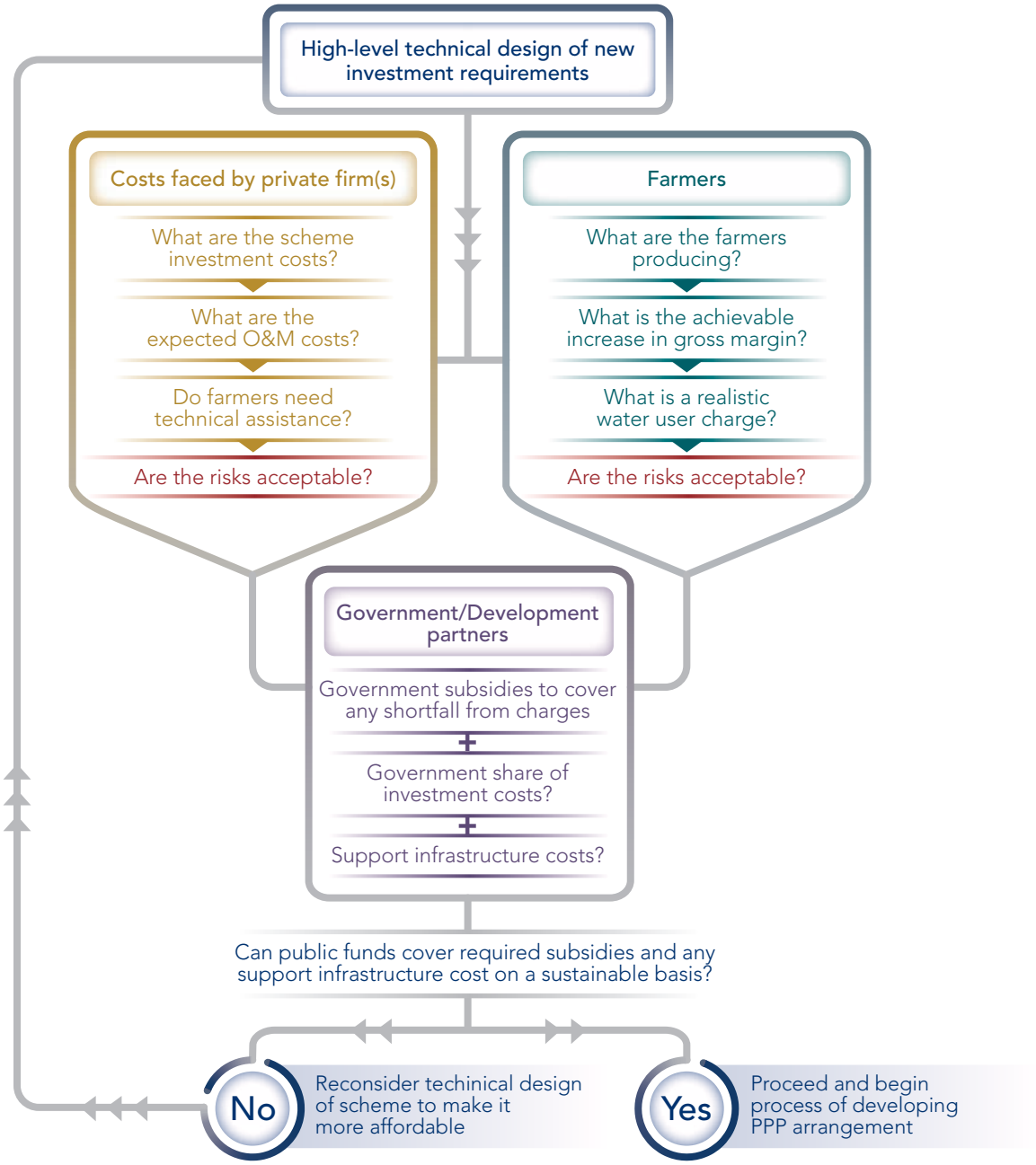
The output of the model provides users the financial variability results under different PPP schemes.

- For the public sector, the model provides an estimate of the subsidy requirement for government which, depending on the country's fiscal position, the user can determine whether the implied subsidy requirement is at a level that the government could sustainably pay.
- For the private sector, the model calculates the internal rate of return for the private sector and enables the user to see if the expected return is high enough relative to the potential range of alternative investment options available in the market. For instance, as part of the decision to invest in the PPP arrangement, the private sector might consider if it could get a higher return by just operating a commercial farm without entering into a PPP arrangement.
- For farmers, the model calculates the beneficiaries that the farmers gained from the project and the cost-reflective water user fees. This water usage charge is aimed to find out how much water user fees would need to be in the absence of public sector finance. The cost-reflective water usage charge

reflects a scenario where only private sector capital is available, and thus where farmers are charged by the commercial farm on a for-profit basis for the provision of irrigation infrastructure, its operation and maintenance, and any additional support services and infrastructure.

The flow chart (Figure 1.5) below illustrates the key questions and decision points that are relevant in determining the viability of establishing a PPP arrangement. It shows the main requirements of the private firm, farmers and the government and how the technical design of the proposed PPP arrangement will need to be changed if the scheme is not a viable proposition for any of the three key stakeholders.

FIGURE 1.5: Decision Tree for the Government to Determine the Scope of the PPP



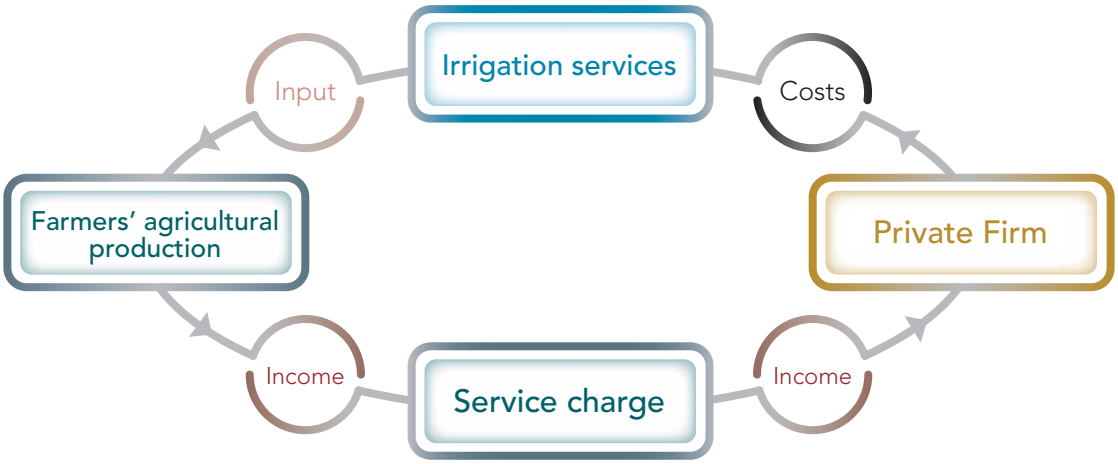
1.10.3. Is the scheme financially viable?

The question of whether an existing irrigation scheme—one that needs to be rehabilitated or modernized, or a new, greenfield irrigation scheme—could be financially viable, is central to determining whether a PPP can be implemented.

For any potential irrigation scheme development, government can decide to provide significant subsidies to make it financially viable. This is sometimes called viability gap funding—i.e., providing public support to close the revenue streams required to afford commercial financing. However, as discussed elsewhere in this handbook, the experience with large-scale irrigation schemes in developing countries shows that relying on on-going subsidies from government is not sustainable particularly if government runs into fiscal constraints. **Therefore, an important way to consider the financial sustainability of a scheme is to determine if the O&M costs and the investment costs can be recovered from the service fees that can be levied on users and/or farmers (including any upfront or connection fees, or recurrent or annual water fees, etc.)—i.e., the extent to which the scheme is potentially self-sustaining and thus presents a viable business opportunity for the private sector.** The key issue that government needs to determine upfront is whether a scheme has the potential to operate on a self-sustaining basis.

Figure 1.6 below depicts the simple relationship between farmers and the private firm that should sit at heart of any functional irrigation scheme: the firm provides irrigation services at an agreed level of quality and price; in return for that service the farmers pay an agreed service charge on a consistent and timely basis.

FIGURE 1.6: Relationship between Farmers and the Private Firm



For a scheme to be financially viable and sustainable, the following needs to hold:

- **For private firm**—Investment and O&M costs of the scheme (in addition, an acceptable rate of return compared to other potential opportunities for the firm) have to be recoverable from the service fees.
- **For farmers**—The increase in income that farmers expect to get from utilizing the irrigation services has to be greater than their expectation of the service fees that they will face for using the irrigation services.

Table 1.4 below notes the key factors that will determine if the above two requirements can be achieved.

TABLE 1.4: Summary of the Key Factors Determining the Potential Financial Viability of a Scheme

Private firm	Farmers
What are the costs involved in developing the irrigation scheme (that are part of the PPP arrangement)? These will depend on a range of technical factors related to the proposed design of the new scheme, the state of existing irrigation scheme assets (in the case of a rehabilitation or modernization), geographical considerations and the state of the surrounding infrastructure (roads, electricity, etc.).	What crops are the farmers producing, or are feasible to produce in the area served by the scheme? What is the plot size for each farmer?
What costs are borne by the private sector? Any financing costs associated with raising capital to cover upfront costs.	What is the farmers' level of productivity—i.e., yield per ha and cropping intensity, before and after receiving the irrigation services?
What are the O&M and management costs related to the scheme? In addition, any costs related to the provision of technical/agronomic assistance to the farmers should this service be included as part of the PPP arrangement.	What is the price that farmers are able to realize for their produce? These are determined by both the market price and the farmers' ability to access markets and produce according to market requirements.
The expectation of the financial capacity and willingness of the farmers to pay the service fees.	Expectation on the fees that the private firm will levy for providing the irrigation services. Costs of alternative sources of water, if these are available or feasible to develop. Expected other production costs that will be borne by farmers.

The extent to which an irrigation scheme presents a self-contained business opportunity is thus determined by the costs faced by the private firm and the water use fees that they can expect farmers to pay on a sustainable basis. What the farmers need to pay can be adapted as to which costs are passed on to them, as seen in the case studies.

1.11. Types of PPP models in irrigation

There are a variety of ways in which the private sector can be brought into a PPP arrangement, depending on levels of risk and responsibilities transferred (Table 1.5) and/or retained by the parties to the contract.

TABLE 1.5: Types of PPP Models

		Type of model	Description of contract purpose	Risk assumed by private sector	Length of contract	Capital invstment	Asset ownership
		Service contrct	Infrastructure support services such as billing	Low	1–3	Public	Public
Broad definition of PPPs		Management contract	Management of a part/ whole of the operations	Low/Medium	1–5	Public	Public
		Lease/Affermage contract	Management of operations and specific renewals	Medium	10–15	Public	Public
	Core PPPs	Build Own Transfer (BOT); Build Own Operate (BOO); Design Build Operate (DBO)	Invenstment in and operations of a specific component of the infrastructure service	High	Varies	Private	Public/Private
		Concession	Financing and operations and execution of spcific investments	High	25–30	Private	Public/Private
		Divestiture/ Privatisation	Transfer of ownership of public infrastructure to the private sector	Complete	Indefinite	Private	Private

Table 1.6 below shows how the different responsibilities associated with irrigation schemes are allocated under the various types of PPP model, defined by: the source of revenue for the private firm; the allocation of functions between the private sector and government; and the participation of the private sector in the capital expenditure of the scheme. The shaded areas represent responsibilities taken by the private sector under each model.

TABLE 1.6: Allocation of Irrigation Functions to the Private Sector in Various PPP Models

Source of revenue for private firm	Functions to be allocated between private sector and government	Participation of private sector in investment functions (capital expenditure)					
		Yes		No			
Services paid to the private operator by the final users (farmers)—Public Service Delegations (PSD)	Design	Concession arrangement		Lease/Affermage arrangement			
	Construction						
	Transfer of inftrastucture after completion of construction						
	O&M						
Services paid to the private operator by the Public Authority	Design	Build Own Transfer (BOT)	Build Own Operate (BOO)	Management contract	O&M contract	Engineering Procurement Construction (EPC)	Design Build Operate contracts (DBO)
	Construction						
	Management (staff of private operator in Public Entity)						
	O&M						
	Ownership of O&M assets						
	Transfer of inftrastucture after completion of construction						
	Ownership of infrastructure						

Source: BRL (2011) PPP Options study and awareness raising for irrigation investment in Malawi.

Case studies of recent PPP irrigation schemes indicate that most arrangements involve concession contracts. These schemes include Chiansi, ITFC, Olmos, potentially Pontal and Accra Plains as well. Only, Megech-Seraba and Muhuri are limited mainly to OMM responsibilities.

It is therefore useful to think about the responsibilities associated with different PPP structures in conjunction with the risks. In practice, when the responsibilities of the scheme are allocated to the various PPP parties, they are at the same time taking on the associated risks.

1.12. Case study analysis: Examples of PPPs in the irrigation sector

This handbook considers 29 case studies drawn from the World Bank 2007 report and other sources (listed in Tables 1.7 and 1.8). Some are ongoing and others still in planning stages. It is important to note the authors would welcome inclusion of any additional examples of PPP schemes that could be brought to our attention. These would only enhance the purpose of this handbook; so we welcome any feedback to this end. Table 1.7 below lists the various irrigation schemes that have been identified in the World Bank 2007 report.

TABLE 1.7: Current and Planned Irrigation PPPs Identified for this Handbook

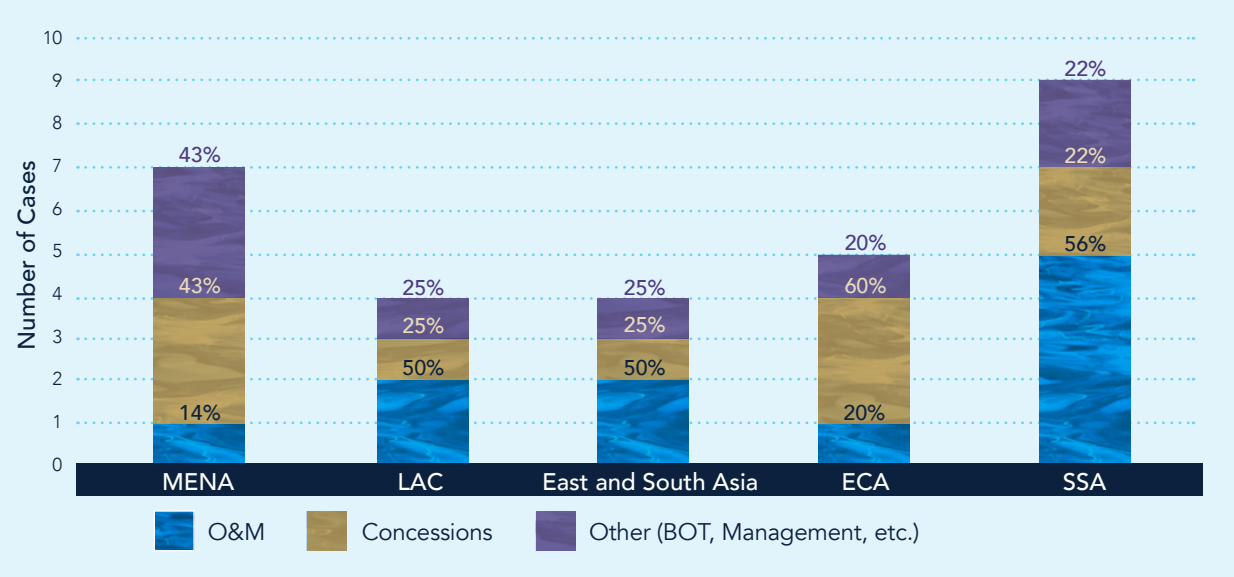
Region	Ongoing PPP arrangements	Planned PPP arrangements
Developed countries		
Western Europe	France: Coteaux de Gascogne (CACG)	
	France (CACG/ Neste)	
	France: (SCP)	
Australasia	Australia: Goulburn Murray Water Authority (GMWA)	
Developing countries		
Latin America and Caribbean (LAC)	Brazil: Maniçoba	Brazil: Pontal
	Mexico: Sonora	Peru: Olmos
East Europe & Central Asia (ECA)	Albania: Pequin Kavaje	
Sub-Saharan Africa (SSA)	Madagascar: Alaotra	Zambia: Chiansi
	Niger: Toula	Ghana: Accra Plains and Savanna Accelerated Development Authority (SADA) Zone
	Ghana: ITFC	
	Senegal: Compagnie Sucriere Senegalaise (CSS)	
	Senegal: SAED	
	Ethiopia: Megech	

Region	Ongoing PPP arrangements	Planned PPP arrangements
South and East Asia (SEA)	China: Tieshan (Yangtze Basin water resources project)	
	India: Eastern Uttar Pradesh	
	Bangladesh: Muhuri Irrigation Management Improvement Investment Programme	
Middle East and North Africa (MNA)	Morocco: Guerdane	Egypt: Toshka and West Nile Delta
	Turkey: Southeast Anatolia Project (GAP)	Jordan: Adasiyeh, Jordan Valley Authority (JVA)
	Saudi Arabia: Business farms scheme	Mauritania: Nakhlet
	Egypt: Dina farm scheme	Morocco: Offices Regionaux de Mise en Valuer Agricole (ORMVAs) reform project

Source: World Bank Group

We discuss below the reasons why each scheme was developed, and the emerging information on its implementation and impact.

FIGURE 1.7: Type of PPP Contract



Review of the 29 existing/ developing PPP irrigation schemes suggests that four basic types of PPP contractual arrangement have been used to date in the irrigation sector:

- Four of the arrangements involve only basic management contracts, in which the private firm carried out a basic service, such as collecting the water use fees or providing technical advice.
- Nine of the arrangements are structured so that the private sector is required to take responsibility for the OMM of the scheme only, under a PPP contract.

- Thirteen of the schemes involve both the investment and OMM responsibilities, under a PPP contract.
- Two of the schemes involve private sector involvement in the investment activities only.

1.12.1. Type of PPP Functions

Table 1.8 below is adapted from the World Bank (2007) report and illustrates the various functions allocated to the private sector across the different PPP projects.

TABLE 1.8: Types and Contents of PPP Contracts in the Case Studies

I&D functions	Concession Contracts												
	Chiansi, Zambia	ITFC, Ghana	Olmos,Peru	Pontal, Brazil	Accra, Ghana	CACG/ASA, France	ORMVAs, Morocco	Dina Farm, Egypt	SCP, France	CACG/NESTE, France	Murray, Australia	Toshka, Egypt	Guerdane, Morocco
Financing	■	■	■	■				■	■	■	■	■	■
Design	■	■	■	■		■		■	■	■	■	■	■
Construction	■	■	■	■				■	■	■	■	■	■
Management of water allocation			■				■		■	■	■		■
Maintenance	■		■	■	■	■	■	■	■	■	■	■	■
System Operation	■		■	■	■		■	■	■	■	■	■	■
WUA Participation							■			■		■	■
IFI Involvement	■	■	■	■	■								■

Source: World Bank 2007 Report and authors' estimation

*The Ghana Accra Plains project is still at the feasibility phase, thus the structure of the project is still not determined. However, existing information suggests that it will involve the transfer of the OMM functions only.

- **OMM:** All but two of the 29 contractual arrangements, Eastern Uttar Pradesh and GAP, involve the transfer of the OMM functions to the private sector. While more common in sub-Saharan Africa, OMM contracts are widespread all over the regions.
- **Investment:** Ninety percent of the schemes have sought to pass the investment functions on to the private sector. For instance, the irrigation component in the Olmos scheme in Peru, is being entirely funded through private investment, with 38,000 hectares of land to be auctioned to private investors, who will produce high-value crops.

O&M Contract										Others					
Megech, Ethiopia	SAED, Senegal	Alaotra, Madagascar	Nakhlet, Mauritania	Juazeiro, Brazil (Maniçoba)	Toula, Niger	Pequin Kavaje, Albania	Sonora, Mexico	Tieshan, China	Adasiyeh, Jordan	Muhurui, Bangladesh	Eastern Uttar Pradesh, India	Gap, Turkey	Senegal Sugar Company, Senegal	Business Farms in Saudi Arabia	West Nile Delta Egypt
										■	■	■	■	■	■
			■				■	■			■		■	■	■
			■				■	■			■		■	■	■
							■	■	■						
■	■	■	■	■	■	■	■	■	■	■			■	■	■
■		■	■	■	■	■	■	■	■	■			■	■	■
■	■	■	■		■	■	■	■				■			
■		■				■		■		■					■

1.12.2. How viable is transfer of investment functions in PPP contracts in emerging economies?

Case studies suggest that private investment in irrigation schemes is difficult. This is because irrigation projects typically are capital intensive which are mostly upfront. Usually projects which support commercial farming activities can aim to recuperate expenses through user-pay arrangement. Therefore, while the number of irrigation PPPs that have transferred, or aim to transfer, the investment function (and contribution to the associated financing costs) to the private sector looks high, in practice, most of the examples of this approach are special cases. Overall, particularly in an emerging economy context, it has been much more common to transfer the OMM functions to the private sector. Arrangements of this nature typically do not have any significant financing requirements from the private partner as seen in the following examples:

- While *Olmos* in Peru is a successful example of the transfer of investment functions to the private sector, there is some uncertainty as to whether the same will occur in some of the schemes that are still in the process of being implemented.
- A number of other examples where the investment functions were transferred were special cases: three of the arrangements were almost completely private initiatives with minimal involvement from the public sector (*CSS project, Dina Farm and Saudi agribusinesses*); and two of the arrangements were exceptional cases of PPPs rather than a genuine transfer of risk to the private sector (*Eastern Uttar Pradesh and the Southeast Anatolia Project in Turkey (GAP*)).
- The *SCP* project in France came about as a government decision to develop the irrigation sector in a specific region that was carried out over forty years ago.
- While the *Guerdane* irrigation scheme in Morocco had genuine transfer of investment responsibilities, in order to make the arrangement financially viable, the government was required to provide a significant contribution to the financing costs in the form of subsidies and soft loans. Furthermore, steps were taken to mitigate some of the key risks around irrigation schemes related to farmers paying for fees associated with the scheme, by requiring some up-front payments to cover the connection costs. Another key feature of the arrangement is that the farmers were producing relatively high-value citrus crops and had access to well-organized arrangements to take products to market. Thus, there was some confidence that the farmers would be both willing and able to pay the service fees over time.
- In the *Muhuri* project in Bangladesh while the Irrigation Management Operator (IMO) is expected to cover the O&M costs associated with rehabilitating and modernizing the irrigation scheme, these financing requirements are relatively low, $4.2 million, compared with the corresponding contribution towards the same project component from the government, $7.6 million, and from the development partner, $46 million.

BOX 1.6: The Guerdane Scheme

Around half of Morocco's citrus crop is produced in a 10,000ha area in Guerdane in the Taroudant region. Before the project, in 2004, hundreds of farms in the region were largely dependent on underground sources of water which were being heavily depleted each year.

The Guerdane Irrigation Project was designed to deliver 45 million cubic meters from a series of dams 40 miles away and was structured as a PPP. A private partner was contracted to build and operate a 300km network to deliver water to the area from the dams and well as secondary and tertiary (distribution) infrastructure to each farm.

A 30-year concession was structured. The government provided $50m in grant and concessional loan finance, while the private bidder would provide $35m and assume some financial risk in addition to operational, commercial, collection, and construction risk. Demand and collection risk were partly mitigated through an initial farmer subscription where farmers paid an initial fee to cover individual connection costs. The concessionaire's construction obligation is to be triggered only if subscriptions for 80 percent of the water is received. The concessionaire is also insulated from water availability (drought) risk by virtue of a cap on revenue losses of 15 percent in the event of drought (with the government covering losses beyond this), and a tariff surcharge for farmers of 10 percent.

The large subsidy component was designed to keep tariffs low. The single bidding criterion for the private sector was the lowest water tariff, such that the government subsidy was passed on to users. The policy aim was to ensure services were as affordable to users as possible (i.e., that consumption was maximized). As a result, following implementation of the PPP arrangement, tariffs were at a similar level to the pumping costs before the project, but the quality of service provided to the farmers was much improved.

1.12.3. A look at significant risks

In terms of major risks which influenced the project structure and PPP arrangements in case studies, we note the following:

Political risk

- For the *Alaotra* case, in light of the past 20 years of Madagascar's history, political risks are quite large. Political risk is considered high to medium. A continuous, double-digit annual inflation is causing regular depreciations in the FMG (Malagasy Franc). Moreover, the opening of the domestic rice import market has been pulling down the rice price (no tariff protection for locally produced rice).

Financial risk

- In the *Pequin Kavaje* case, although the fee paid for water allocation service is substantive as a percentage of farmer income, it does not fully cover the production and supply costs. Farmer would want to see

evidence of real progress in O&M efficiency before accepting the fee increases. This is the case where public support may be needed to fill the gap.

Agricultural off-take risk

- In the *Sonora* case, the major risk for the farmers is the possible reduction of the agricultural produce cost given external factors such as the open market of the North American Free Trade Agreement (NAFTA) and World Trade Organization (WTO) rules. These factors oblige them to compete with North American farmers, particularly with corn, wheat, and sorghum. Crop diversification toward high-value-added crops is the main challenge.

Technical risk

- In the *Tieshan* case, the lack of volumetric water measurement limits the real and effective partnership between the Tieshan Water Supply Corporation (WSC) and WUAs. The next step would be to scale up the WSC's accountability. Volumetric measurement at the farm level would enable documentation of water cost and water value and perhaps also explain the reasons for the very low water use.

Land acquisition risk

- Although the Senegal Sugar Company, Dina Farm and agribusinesses in Saudi Arabia are purely private investments, they have been supported by counterparts from their respective governments, such as the provision of free land, free credit (Saudi agribusinesses) and a free water supply (CSS and Saudi agribusinesses).

- In Megech-Seraba, Ethiopia, in order to accommodate the new irrigation scheme configuration and infrastructure, it was necessary to re-allocate farmers' land, and to reconfigure and restructure plots at the quaternary level to accommodate the in-field irrigation system. This work is being carried out by the regional land administration (EPLAUA) and the survey and re-allocation process is ongoing. The reconfiguration and restructuring of plots will take place during the construction period, as defined in the Resettlement Action Plan (RAP).The management contractor is assisting the authorities in land reallocation and development.

Water supply risk

- During dry years, in Adasiyeh scheme most of the flow of the King Abdullah Canal is pumped for the city of Amman, while high-quality groundwater on the highlands is diverted for politically protected private irrigation. Recurrent droughts over the years (2000-04) have severely reduced water supply, while preserving citrus farms. High gross productivity has enabled the use of unconventional (for example, desalinized water). Urban wastewater from Amman's sewage treatment plant goes through a downstream water reservoir and is being reused for agriculture in part of the Jordan Valley.

- Water supply risk is very high for the *Business Farms in Saudi Arabia*. Because most pumping is done from non-renewable (fossil) aquifers, this is causing a crucial debate about the future of Saudi Arabia's agriculture.

Collection risk

- ITFC in Ghana (where national collection rates in irrigation schemes range from 45-65 percent) provides access to irrigation, necessary inputs and technical assistance to smallholders, who are charged an interest-free loan. Smallholders have to make an in-kind payment, 85 kg of mango valued at $25, to join the scheme, and are required to sell their mangoes through the ITFC. From the fifth year of the scheme, 2016 onwards, the farmer association (OMOA) will repay 30 percent of their sales to the ITFC until the debt is repaid.

Demand Risk

- In the case of Maniçoba, Brazil, a private concessionaire might face risks related with the evolution of the demand from alternative uses of water. According to the water regulatory framework, the allocation of water to irrigation and other uses is decided in Basin Committees, and irrigation is not a priority. In a concession period of 30 years, new and alternative demand may affect the availability of water.

1.12.4. Major sponsors

Most of the developers or sponsors in the case studies are large commercial companies looking to export local products. There are very few companies in the market which are willing to expand their businesses in irrigation services especially in emerging economies. Some of the companies mentioned in the case studies are as follows:

- Commercial agricultural companies, such as WIENCO of Netherlands, Solar Harvest Ltd, Prairie Volta Limited, Premium Foods Limited, Veg Pro International Inc., and GADCO.
- Engineering companies that have extended services to develop and implement irrigation schemes, such as BRL of France in the Megech scheme.
- In the Saudi Arabian case, about eight commercial agriculture products companies are sponsoring the farm. These include HADCO, TADCO, GADCO, JADCO, and NADEC for wheat, alfalfa, and vegetables; AL MARAI and AL SAFI for dairy farming; AL RAJHI for sheep and other livestock breeding. Most business farms have connections with national equipment suppliers.

1.12.5. Competitive Bidding

The most common bidding variable, in those cases for which information is available, is that of the lowest tariff. Even with competitive bidding, PPPs in irrigation is still an emerging sub-sector where number of interested sponsors and lenders willing to finance such schemes are very few. As a result even scenarios where was competitive bidding, there very few bids. For instance, in the proposed West Nile Delta project in Egypt, only two bidders—from China and an Egyptian/European consortium—participated in the pre-qualification process and were invited to prepare financial proposals. The Moroccan Guerdane project received two bids and the financing was largely subsidized. In the Pontal irrigation project, only one bid was received in the first round.

1.13. The other 'P': Involving third parties in public Irrigation schemes

Traditional schemes are usually dependent on government to provide all aspects of agricultural services to the farmers. The case studies show that in general the inclusion of any kind of third party improves both the quality and the reliability of service. Handbook explores several types of third parties, drawn from the case studies.

- The private sector can manifest itself in many forms, for instance, as:
    - Project developer. In Chiansi, Zambia, a private company, InfraCo, injected patient capital to a commercial irrigation project in order to increase attractiveness of this greenfield project. InfraCo sought to divest itself of its equity position at a later date when the project was fully operational and risks better understood.
    - Entrepreneur, such as a commercial agriculture company or equipment manufacturer. Such parties are important in a variety of roles—for instance, as service providers by contracting with WUAs, offering credit loans to farmers, supplying seeds, fertilizers, irrigation equipment, and buying produce, as demonstrated in the ITFC (Ghana), Nakhlet (Mauritania), and Anatolia (Turkey) cases. A prerequisite for making an irrigation service a successful business opportunity for entrepreneurs is have it operate in a community large enough to make the venture viable. In each of the cases mentioned, community (i.e., market) size has helped to reduce fixed costs for farmers, improved credit terms, and enhanced quality and responsiveness of irrigation O&M. In India's Eastern Uttar Pradesh, a diesel-pump dealer acted as a representative for small-scale and poor farmers in dealing with bureaucracies and obtaining loans. In Ghana's ITFC, the local subsidiary of a Dutch company, WEINCO, has become the service provider to farmer associations (OMOA). WEINCO has evolved from an agricultural product company to a service provider. This trend is seen in traditional infrastructure sectors where a construction company or equipment manufacturer can become a service provider—e.g., SERCO, an international service company that is focused on improving efficiency and quality of public services.
    - Investor. This is the traditional mode where a private investor will finance and operate the irrigation scheme as a business.
- **State-owned enterprises as service providers**. In Victoria, Australia, for instance, a "corporative" state-owned authority, the Goulburn-Murray Water Authority (GMWA), was created in 1994 to provide services in irrigation districts. Farmers can feel confident that they have reliable OMM and that the cost they pay is their fair share.
- **Water Technology Institutes**. These can provide technical support to government or WUA in managing an irrigation scheme. For instance, a WUA in the case of Sonora in Mexico turned to the Mexican Institute on Water Technology (IMTA).

- **Water User Associations**. WUAs are water user-based, resource-driven water management organizations that work with farmers and service providers to ensure quality and efficient services and irrigation scheme performance. They are mainly set up by public authorities to provide local management to an irrigation scheme. A WUA can operate on a small scale, represented by a village farmer cooperative (Nakhlet, Mauritania), or on a larger scale of a federation, with more extensive and complex responsibilities and larger area of coverage (e.g., Pequin Kavaje, Albania, where all WUAs fall under a federation of Water User Associations). The WUAs generate their revenues through water user fees and farmer subscription fees, financial assistance from development banks, such as AFD, or financial assistance from government. For example, in SAED, Senegal, seven WUAs and government created a mixed-government WUA fund in which government makes contributions in proportion to the recovered maintenance fees collected by the WUAs.

BOX 1.7: WUAs are becoming an integral part of irrigation schemes

WUAs are important links between farmers and government or private partners, ensuring a quality and efficient water service to farmers. Additionally, as legal entities, WUAs are able to raise financing on behalf of farmers. WUAs offer collaborative decision-making and problem-solving strategies through collective management. Finally, WUAs collect the user fees in a transparent way and allocate them for O&M services. The case studies show that the most common function for WUAs is through O&M.

Case Study	Water delivery	Collect water/ O&M fees	Monitor Service irrigation	Input supply	O&M	Manage	Land Preparation	Set charges	Negotiate contract terms	Raise financing on behalf of farmers
Alaotra, Madagascar		■						■		
CACG, France			■		■					
Megach-Seraba, Ethiopia					■	■				
Nakhlet, Mauritania				■	■	■	■			■
ORMVA, Morocco			■							
Pequin Kavaje, Albania	■				■				■	
SAED, Senegal		■				■				
Sonora, Mexico		■			■	■			■	■
Southeast Anatolia, Turkey	■			Contract PSP	■	Contract PSP				
Tieshan, China		■			■					
Toshka, Egypt					■					
Toula, Niger		■		Material and support staff						

BOX 1.7: WUAs are becoming an integral part of irrigation schemes

These functions vary depending on the regional location and the degree of autonomy and empowerment delegated to WUAs from public parties. Price regulation and setting of O&M fees is performed by WUAs in Alaotra, Madagascar, and Sonora, Mexico, while contract renegotiation is carried out by WUAs in ORMVA, Morocco. Some of the lessons learned are that:

- Government will continue to play a critical role in WUA operations. It provide financial assistance and retain its regulatory and oversight functions, as in the case of the SAED in Senegal where seven diverse WUA-government-financed maintenance funds were created to sustain irrigation schemes. Government's contribution to them is in proportion to the recovered maintenance fees collected by the WUAs.
- Technical and institutional capacities are prerequisites to WUA sustainability and successful operation. Additionally, as observed in the Southern Anatolia project in Turkey, WUAs require long-term business plans and asset management, research opportunities, technical assistance, farmer training, and farmer involvement in project design and implementation. WUAs do not have the institutional and professional capacity to manage complex O&M.
- WUAs improve farmers' resiliency to risks such as weather or credit servicing. The individual farmer's capacity to solve problems is increased through collective sharing, support, and management offered by WUAs. Furthermore, farmers enjoy reduced water tariffs, as in the case of Megech in Ethiopia, where WUAs manage secondary and tertiary canals, thus decreasing the O&M costs.
- WUAs need to have clearly-defined legal rights, empowerment, and autonomy in order to become efficient and contribute to sustainability of their irrigation schemes. As the case studies show, WUAs lack important powers that could enhance their functions in irrigation schemes. It is important to improve the WUAs' legal organization, thereby enabling them to charge and collect water service fees and WUA service fees. Additionally, many of the WUAs identified in the case studies are not legally allowed to employ personnel, select service providers, handle issues related to the irrigation scheme management and rehabilitation, work directly with financial institutions, or sign contracts.

1.14. Impact of PPP schemes in the irrigation sector

As many of the PPPs reviewed have been implemented only recently, or are still in the process of being developed, the impact of the arrangements are less well-established and are yet to be seen. In terms of benefits to farmers, however, the general finding is that water services have improved, though at a higher price with an improvement in net savings with expectations of reduced life cycle costs and fiscal burden to governments. In the process, government has clarified its role from retaining the 'social good' aspect from a traditional 'public good' provider.

Most cases have had measureable impact on the sustainability of the schemes.

- In a number of the recent PPP initiatives that are reviewed, PSP in irrigation is expected to enhance efficiency of operation, and help farmers increase their agricultural productivity and develop value chains that generate commercial surpluses. For example, the management contract in the Megech-Seraba scheme is expected to provide value for money by ensuring efficient construction supervision, specific coverage and service standards to users, rapid customer response times, adequate training and education to small landholders, and enhanced O&M of the irrigation system.[33]
- The experience of the development of the Nakhlet irrigation scheme in Mauritania has shown that involving a third-party in irrigation service provision, in this case through the Water Users Association (WUA), can contribute to reducing fixed costs for farmers, improving credit terms and the quality and responsiveness of irrigation O&M.
- In schemes such as the ITFC irrigation scheme in Ghana, smallholder farmers are expected to benefit from access to inputs (such as seeds, manure and other fertilizers), markets and technical assistance. Extension of the ITFC's scheme to smallholders is expected to increase farmers' yields by 5 percent annually for 500 farmers, while in the planned Pontal scheme, economic analysis predicted that the integrated smallholder farms connected could expect a monthly income of $865–$910 depending on the crop grown. In the latter case, smallholders will also benefit from a guaranteed purchase of their agricultural produce by the agribusiness users.

In most cases, water service fees increased and was not immediately offset by a corresponding rise in farmers' income. While, this was not directly due to increase in cost of inputs but because the government subsidies were eliminated as the service provider entered the irrigation scheme. It still has had an initial negative impact on the willingness of farmers to pay water use fees. Many schemes have sought to address this issue by managing the way in which the increases in water use fees are implemented.

- For instance, Ethiopia's Megech-Seraba scheme involves a tariff transition period, in order to allow a gradual increase in tariffs as farmers realize increased incomes from the use of irrigation. WUAs helped reduce the tariffs to sustain the main PPP portion.
- Similarly, in Albania's Pequin Kavaje and France's CACG/Neste, user fees were raised only after evidence of real progress in OMM efficiency, while the government's authority to enforce collection laws were strengthened in Mauritania's Alaotra and Jordan's Adasiyeh. Furthermore, the experience of the SAED (Senegal), Tieshan (China), and Sonora (Mexico) schemes suggests that farmers' concerns can be managed if the farmer groups are given an influential role in setting and collecting the fees, and also in verifying that the funds are used to improve the quality of the water service.

33 PPIAF. 2012. "PPIAF Support to Private Sector Participation in the Irrigation Sector in Ethiopia."

In terms of fiscal burden it is difficult to say what life cycle costs would have been if the scheme had continued to function under the previous conditions or even with renewed public financing.

1.14.1. Lessons learned from case studies

- **Well-defined legal and regulatory frameworks create favorable investor climates.** Established rules and procedures, in parallel with a well-defined PPP policy, would enable contracts and interaction between the parties to be established with certainty, and would also provide assurance to the private partner for the protection of its investment. In Brazil, there is a mention of PPPs in Irrigation policy. In Ethiopia, there is a regulation on setting up WUAs and their role in irrigation schemes.
- **Regulation of groundwater extraction, soil, and water conservation measures.** In the absence of government control over groundwater use, the shift from surface-based irrigation to an increasing reliance on groundwater pumping, as experienced in regions such as South Asia, can result in a loss of expected revenues for a private partner supplying water to farmers with the right to recover O&M fees. While many countries have taken steps towards setting up a regulatory framework to govern groundwater extraction, in most cases, a more comprehensive legislation is required to prioritize uses.
- **Irrigation is a part of other agricultural and rural sectors, and is interrelated with trade and overall microeconomic policies.**[34] Early evidence suggests that PPPs in irrigation are more likely to succeed if they are implemented within relatively dynamic agrarian sectors. In this context, policy developments surrounding irrigation PPPs should be framed as part of a broader reform process.
- **Institutional capacity and process coupled with political are essential in preparing and carrying out an effective PPP project.** In general, there tends to be multiple government agencies sharing responsibilities across the broader water sector in developing economies. Governments need to introduce capacity building programs in irrigation sector and specifically, developing irrigation PPP, a streamlined decision-making and efficient organization, which includes standardizing tender documents and introducing a single granting authority.
- **Third-party interventions and involvement will create a positive outcome of efficient and quality service minimizing government's risks.** Irrigation schemes need professional third-party providers to ensure external support when governments do not perceive them as viable. The private sector offers financing, efficiency, technological, institutional advancement and innovation, quality service, and lower transaction costs—as presented in the case of Eastern Uttar Pradesh, India. With private-sector involvement, transaction costs declined and the process of acquiring pump pipes has improved.

34 IWMI. 2007. "Policy and Institutional Reform: The Art of the Possible," in Water for Food, Water for Life."

- **Creating the right incentives to encourage transparency and service.** As seen in Megech-Seraba, Ethiopia, the right incentives need to be put in place to enhance service reliability, availability, and quality. The private operator was paid in three ways: (i) lump sum for system design review, (ii) time-based rate for construction works supervision, and (iii) performance based on OMM.

- **Performance monitoring and evaluation are key elements in assuring success of the project in the post-award phase.** Granting authority should apply due diligence in monitoring private operator performance. Capacity to manage, monitoring and evaluation system, although critical in contract management, are often downplayed and even ignored by the granting authorities. Ensuring managerial capacity, securing appropriate monitoring mechanisms and applying due diligence should be undertaken and reinforced by the government in the implementation phase of the project. All this starts with government reconsidering its role and seriousness of this task.

- **Government involvement attracts private investors.** This should include not only regulation but also financial support. A government commitment to providing a minimum amount of remuneration, in the event that revenues are insufficient, would reduce costs associated with demand risks and limited willingness of users to pay the irrigation fees. In the Murray project in Australia, government participation assured stakeholders of viability and success of this business opportunity.

- **Availability of data and information attracts bidders.** Data on the state of existing assets and sites, as well as on inter-basin or international treaties and agreements for the transfer of water and the utilization of the available surface storage, would be essential for investors to assess water availability and ensure effective surface water management.

- **Quality of service, a client-oriented approach is important for efficient and sustainable irrigation scheme.** Farmers are willing to pay for quality and reliable service, as shown in the example of Morocco's Guerdane. Meeting the needs of clients who are free to subscribe or unsubscribe on the basis of performance quality and service cost is therefore vital. System sustainability depends solely on local economic dynamics and loyalty on the part of clients.

1.15. checklist

for selecting an optimal PPP arrangement (Part B)

1 Determine if the irrigation scheme is financially viable ☐

- a. Determine the source of revenue ☐
- b. Risks assessment and valuation ☐

2 Identify the type of PPP model ☐

- a. Description of contract purpose ☐
- b. Length of contract ☐
- c. Capital investment and asset ownership ☐

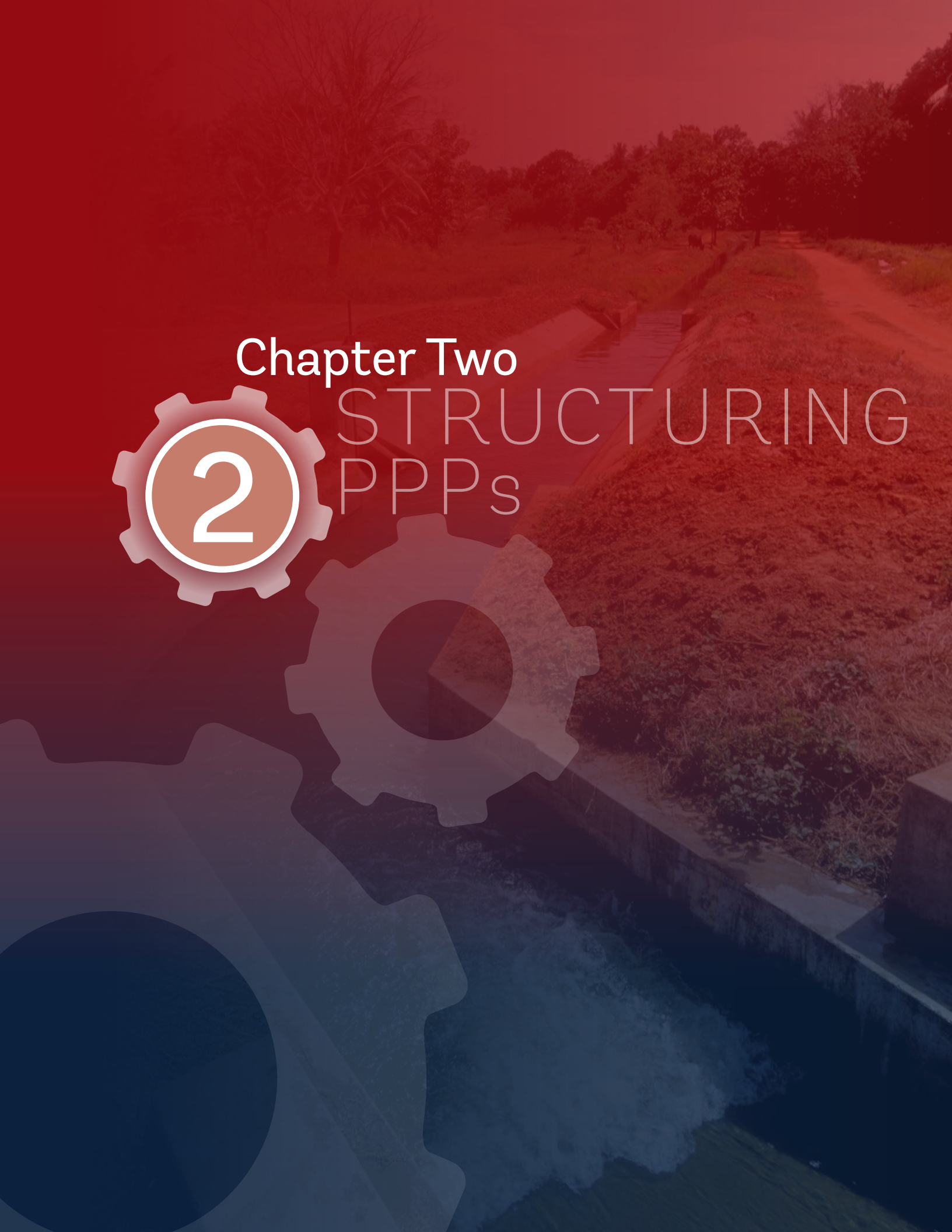
3 Determine public sector capacity to provide optimal support to the project ☐

- a. Set up the project preparation team ☐
- a. Allocate the budget needed for project preparation ☐
- a. Determine the budget availability for government payments ☐

4 Conduct the market assessment to scope the private sector interest and potential for investment ☐

- a. Determine the government's willingness to provide support to create the right incentives encouraging transparency and service ☐
- b. Determine if the third party involvement creates a positive outcome and efficient service ☐

5 Include the feedback received as a result of the market sounding assessment into the optimal PPP arrangement ☐



Chapter Two

2 STRUCTURING PPPs

2.1. Setting up a commercially viable irrigation scheme

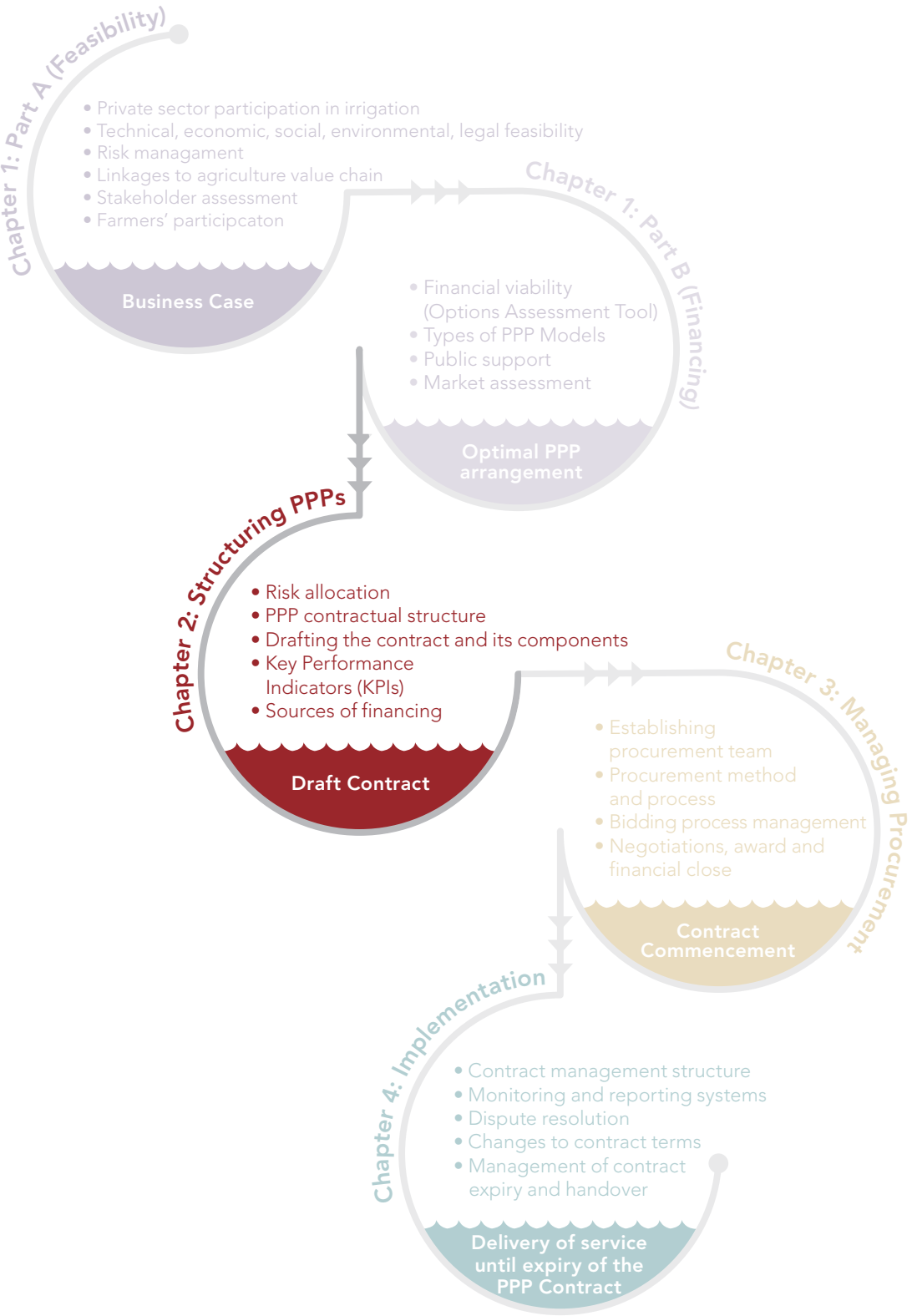
The Public-Private Partnerships unit of the World Bank Group defines PPP as "A long-term contractual arrangement between a public entity or authority and a private entity for providing a public asset or service in which the private party bears significant risk and management responsibility" (WBG PPP website , 2016)

Based on the definition, in order to create a long-term partnership, it is important to set up a project structure that involves the identification of the efficient allocation of responsibilities between the public and private sectors. Ultimately it involves determining which PPP model will fit the specific opportunity that is under consideration. Determining the appropriate structure for the arrangement—which is then formalized in the contract—plays a critical role in enabling the project stakeholders to attract the finance necessary to support implementation.

This chapter considers the main issues involved in structuring a commercially viable scheme. It discusses the basic structure of a PPP contract and allocation of responsibilities, service obligation, and risks that should be included in the contract. The chapter provides an overview of various types of PPP models and associated transfer of functions between the private and public parties. The chapter presents a practical application of the key principles of risk allocation in various PPP irrigation scheme contracts.

The chapter is concluded with a discussion of the financing structure for the contract and the various approaches that can be used to finance the project, including the potential role for government and development partners such as the World Bank Group.

FIGURE 2.1: Roadmap—Structuring PPP Stage



2.2. Integrating PPP arrangements

It is more difficult to establish irrigation PPPs that involve the transfer of investments. It is due to the fact that private firms can find it complicated to finance irrigation projects efficiently due to the pressures of large upfront costs and risks in securing adequate repayment.

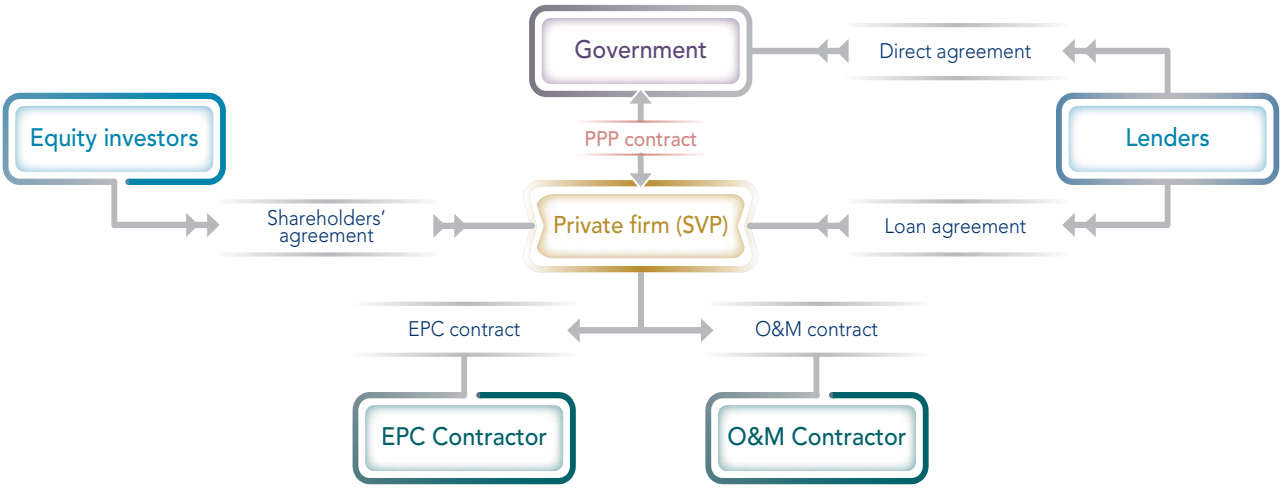
2.2.1. Contractual structure of PPPs

The basic contractual structure of a PPP arrangement is set out in Figure 2.2 below. The private firm taking on the financing responsibilities associated with the scheme typically forms a specific company for the purposes of the project; which is known as a Special Purpose Vehicle (SPV). The SPV is then responsible for securing the financing for the project on a non-recourse or limited-recourse basis. For instance, in the Chiansi Irrigation Scheme, an Infrastructure Service Company (Infra Co) will be formed as a special purpose service company, responsible for building, operating, and financing irrigation assets.

Financing can be raised through a combination of debt and equity. The debt can come from lenders in a variety of forms (bank loans, bonds, etc.); the equity is capital that is injected through the company's shareholders. Equity is generally more expensive than debt because equity holders require a higher return on their investment; this is because in the event of any losses by the SPV the debt holders are repaid first. Interest payments are generally tax deductible. As a result of this, projects often seek to use a higher proportion of debt than equity to finance the project, although lenders typically are the ones that specify the minimum level of equity they require from sponsors in order for them to provide debt.

Within a PPP arrangement, the SPV usually also arranges contracts with other private firms to actually carry out the design and construction and O&M work, though these firms are often affiliated with the SPV or are shareholders of the SPV.

FIGURE 2.2: Basic Legal and Financing Structure of a PPP Arrangement



2.2.2. Principles for allocating the risks

The underlying objective when determining how the different risks should be allocated between the private sector and government in any PPP arrangement is to ensure that risks are transferred to the party that is best able to manage it by either mitigating or absorbing the risk. More specifically, the key principles for allocating the risks are to allocate them to the party:

- Best able to control the likelihood of the risk occurring;
- Best placed to control the impact of the risk on the targeted project outcomes; and
- Positioned to absorb the risk at lowest cost.

This is explained in more detail in Table 2.1:

TABLE 2.1: Principles for Allocating Risks in the Irrigation Sector

Approach	Principle	Explanation	Example
Risk mitigation	Control likelihood	The party with the most influence over the probability that the risk occurs should bear the risk. This is because: • They are in the best position to minimize the likelihood of the event occurring; and • If they don't bear the risk they will have less incentive to control it.	If a party is responsible for designing the irrigation scheme, they should bear the risk of construction cost or time overrun because they are best placed to control elements of construction costs. For instance, the irrigation component of Olmos is being funded solely through private investments from agribusinesses and Odebrecht, the concessionaire responsible for constructing the irrigation infrastructure, electricity transmission, and access roads.
	Control impact	If it is difficult to reduce the likelihood of an event, one of the parties might be in a better position to control the impact by: • Reducing its potential cost; and • Anticipating and responding to the risk.	The party responsible for operating and managing the scheme could be best placed to anticipate issues around payment risks, and would therefore be best placed to ensure that the project is designed appropriately to address these issues. Payment risk in the ITFC scheme is reduced through the choice of repayment method—out-growers must sell their produce through the ITFC until the loan is repaid in full, with the ITFC retaining 30 percent of the value from 2016 onwards.

Approach	Principle	Explanation	Example
Risk absorption	Absorb at lowest cost	Any remaining risks should be allocated to party best able to absorb the risk at lowest cost. This does not lower the risk, but it does lower the cost of bearing the risk, helping to make it more sustainable. The ability of a party to absorb the risk depends on factors such as: • How diversified the party's other assets and liabilities are; • Its ability to pass on the risk to others and the cost of doing so; • Its ability to spread the risk amongst its ultimate risk bearers; and • The extent to which the party will tolerate risk.	There are a number of risks associated with irrigation projects that are uninsurable from the perspective of the private sector, including force majeure events such as poor electricity supply or water shortages. These type of risks will be guaranteed by the government because it is in the best position to diversify the risk and spread the cost of the risk should the event occur. In Guerdane, the revenue deficit of the private operator stemming from water shortages is limited to 15 percent of normal volumes. The remaining potential loss is borne by water users through tariff surcharges of up to a maximum of 10 percent, and beyond this by the government. The government is thus partly responsible for ensuring security of the water supply, and will have to compensate the private operator in the event of a serious water shortage.

Checklist for Allocating Risk and Responsibilities

When considering how to allocate the various risks associated with the PPP, the government should develop a risk allocation matrix (or risk register). The matrix identifies the key risks associated with the PPP and defines which of the PPP parties is responsible for bearing the risk. The risk matrix is put into practice through the PPP contract. To this end, the World Bank devised a checklist[35] for allocating risk and responsibilities between the parties to the PPP contract. The following checklist is based on that matrix:

- ✓ Define the major areas of responsibility (design, build, operate, maintain, and finance).
- ✓ Define specific responsibilities for each area.
- ✓ Identify the risks associated with each responsibility.
- ✓ Note the direct and indirect relationships between risk and responsibilities.
- ✓ Establish how the risks are interrelated.
- ✓ For each risk, identify which party is best able to bear the risk, and in particular, who can:
  - ✓ Predict the risk.

35 The World Bank Group. 2006. "Approaches to Private Participation in Water Services: a Toolkit."

- ✓ Influence the risk.
- ✓ Control the impact of the risk.
- ✓ Diversify and absorb the risk.

✓ Decide whether the risk should be fully allocated to one party or shared.

✓ Check for any constraints on the ability of the parties to bear risk (such as information problems or unwillingness to bear risks that a party may appear best able to manage).

✓ Based on the risk analysis, assign a party to:

- ✓ Assume each responsibility.
- ✓ Bear each risk.

As part of the process of strengthening the PPP policy framework a number of governments have also developed a standard or preferred approach to allocating risk for PPP projects. This standard approach can either be generic across sectors or designed to reflect specific sectors, and is used as the starting point for allocating risks for an infrastructure project. For instance, South Africa has a PPP Manual that includes a standardized risk allocation matrix. This matrix includes a list of the risks relevant to the project, the typical risk mitigation mechanism and defines the PPP party to which the risk has been allocated.

The following subchapter describes how the irrigation PPPs that have been developed have allocated the responsibilities and risks associated with each contract.

The proportion of governments' risks can vary according to what is needed to make the project viable. In general, the various case studies point to varying levels of government involvement across PPP schemes in the irrigation sector. In Chiansi, for instance, government involvement appears to be limited to regulating the irrigation project, whereas in Pontal, the government will be responsible for setting the initial price of water and land, and financing the construction of the scheme's basic road and energy infrastructure, in addition to ceding the land and infrastructure, and providing capacity payments to the SPC.

2.3. The PPP Contract

The PPP contract is the document (or collection of documents) that govern the relationship between the various PPP parties. The contract defines the allocation of responsibilities and rights for the PPP arrangement and provides mechanisms that can be used to enable the PPP parties to deal with any unforeseen changes.

Given the importance of the contract to the functioning of the PPP arrangement, the design of the contract takes a significant amount of time and resources to complete; usually the government makes use of expert financial, economic, irrigation engineering and legal advisers when developing the contract.

The objective when developing the contract is to design a contract that is clear, comprehensive, and provides

certainty for the contracting parties. Though, additionally, given the nature of the irrigation (and other infrastructure) PPPs—i.e., they are agreed over the long-term and involve significant uncertainty—there is also a need for the contract to have some flexibility built in. This enables the PPP parties to, as far as possible, deal with any material change in circumstances within the contract without having to re-negotiate contract terms or terminate the contract. An effective PPP contract therefore manages to balance the objectives of providing certainty and clarity for the parties, while also giving room for some flexibility.

This subchapter discusses the main areas that are typically covered in PPP contracts and presents some case studies of PPP contracts that have been developed for irrigation PPP projects.

2.3.1. Main areas covered in PPP contracts

The content of a PPP contract necessarily varies across different countries and depending on the type of PPP arrangements that has been agreed. However, the main content of a PPP contract together with an explanation of what each term means is set out in the table below.

TABLE 2.2: Typical Content of an Irrigation PPP Arrangement

Sections in Heads of Agreement	Explanation of what is typically covered
Definitions	This is usually a brief section providing definitions of the key terms included in the contract. This should include definition of the relevant parties to the PPP arrangement and that the contract includes each party's "successors and assigns" in case one of the parties is merged or acquired. If this is not clear if disputes arise there can be an issue as to whether the contract still binds the successor entity.
General provisions	The general provisions cover the legal basis upon which the PPP will be established and other key issues related to the structure of the deal such as: • The rights and obligations of the private firm, farmers and government; • The start date of the contract; and • Any specific agreements made by the private firm to enable it to enter into the contract.
Conditions precedent	This presents a summary of the issues that need to be completed prior to the PPP start date for the contract to come into force. In some cases if the actions are not completed prior to contract signature then the contract bit might be signed. The most typical conditions precedent are: • Provision of land, which is usually the responsibility of the government; • Securing any necessary permits, such as the right to abstract water; • Developing and agreeing an asset register; and • Securing the finance necessary to fund the project.
Grant of PPP	This section specifies that the private firm has been granted the rights to provide the irrigation services under the PPP arrangement for the specified location.

Sections in Heads of Agreement	Explanation of what is typically covered
Duration of PPP	This sets out the length of time for which the PPP arrangement will be in place, including a clear indication of: • When the contract commences and expires; • When the obligations that have been set out in the contract become effective; and • Whether the contract can be renewed, and if so the length of time for which it can be renewed. The duration of the project will depend on the nature of the PPP arrangement that has been developed and the level of risk that has been passed on to the private firm; for instance for a management contract there is a more limited risk, therefore projects tend to be shorter while for a BOT arrangement the contract needs to be longer to enable the operator to recover its investment.
Early Termination Payments	In case of early termination of the contract and project assets revert back to the public sector, contract should set out the compensation payment depending on the cause of the early termination. There are three broad reasons for early termination: default by the private party, termination by the public party, whether due to default of for reasons of public interest, and early termination due to some external reason (force majeure).
Handover arrangements	Specifics include the contract close date, and processes in place to manage the on-time termination and handover of any assets at the end of the PPP contract or in the event of an early termination.
Representations and warranties	This defines any warranties in place related to for example the quality of the assets included as part of the PPP arrangement, or the minimum levels of water to be provided to the scheme.
Key Performance Indicators (KPIs)	This section of the contract specifies the required level of quality, quantity of performance for the responsibilities taken on board by the private parties to the agreement. The performance requirements should also specify the monitoring and enforcement mechanisms and the penalties that will apply for failure to achieve performance at the pre-defined level. The main types of service obligations that will typically be specified for an irrigation project include: • Billing procedures and the nature of the contract between the private firm and the customers; • How any new connections should be managed; • A requirement to provide irrigation services at a specified level of standard, e.g. availability of service and pressure of water; • The rights for the private firm to disconnect customers that are not paying for the services on a timely basis; and • The development of a mechanism that enables customers to complain about poor service provision by the private firm.

Sections in Heads of Agreement	Explanation of what is typically covered
Other obligations	This part of the contract should describe any other obligations of the private firm, but also sets out the obligations of the relevant government authority. This will include obligations such as the obligation: • To provide land and specified assets; • To obtain permits for the private firms; • To provide agreed payments to the private firms where relevant; and • To carry out required capital investment, repair, and renewals where relevant.
Tariffs and indexation	The contract will also specify the arrangements that will be put in place for the private firm to receive payment for its services. This should include a clear specification of the tariff setting methodology and the institutions that are responsible for setting the tariff and how the process of indexation and tariff review and adjustment will work.
Periodic and extraordinary tariff adjustments	This section should describe the processes or mechanisms for managing changes to the tariff agreements should also be specified. This will include making changes to the tariff in response to inflation through agreed indexation mechanisms and the development of tariff "re-openers" that allow for changes to the tariff in the event of significant and unexpected changes to the conditions faced by the private firm that might arise over a longer-term contract.
Reporting and data requirements	This part of the contract will detail any reporting and data requirements for the private firm and other parties to the PPP arrangement where relevant. When developing the requirements the following issues should be considered: • The information or data that need to be included in each of the reports and the likely availability of this information or data; • The frequency with which the reports need to be produced; • The government agency responsible for reviewing and acting upon the information or data being produced, and the capacity of the agency to review the information adequately; and • The need for third-party verification or auditing of the information that is being produced.
Monitoring	The contract usually identifies the party responsible for monitoring the performance of the private firm. This can be carried out by the communities, WUAs, or Ministries/Agencies, or a combination of all of them. The private firm is required to provide financial and operational performance data to facilitate the verification of contract compliance. Results of the monitoring evaluation are reported to the granting authority who provides an oversight of the project development and enforces private sector compliance.

Sections in Heads of Agreement	Explanation of what is typically covered
Dispute Resolution Mechanisms	The contract should identify the mechanisms designed to enable resolution of disputes between the parties to the contract, before they become litigated. While traditional mechanisms involve the courts, these may be more or less effective, independent and efficient depending on the country context. Alternative mechanisms may move disputes to a third party forum better suited to handling contractual disputes, and would typically provide for: • Negotiated settlement between the parties; • Conciliation or mediation; • Expert determination; • Adjudication; and • Arbitration.
Force Majeure	See "Early Termination Payments" above

Sources: Authors' notes, Cledan Mandri-Perrott, X. and David Stiggers. 2013. "Public Private Partnerships in the Water Sector Innovation and Financial Sustainability"; Rigby Delmon, Victoria. 2014. "Structuring Private Sector Participation (PSP) Contracts for Small Scale Water Projects".

2.3.2. Defining the Key Performance Indicators (KPIs)

Key performance indicators are metrics to track the progress and/or performance of a project during project implementation in terms of its service objectives. They should describe the desired output or performance levels and not the means or methods of achieving such outputs.[36] Indicators organize information in a way that clarifies the relationships between a project's impacts, outcomes, outputs, and inputs and help to identify problems along the way that can impede the achievement of project objectives.[37] KPIs are subject to further process of refinement, particularly in the long-term contracts as the business environment is more likely to change over time.

2.3.3. Core Performance Indicators used by the World Bank

For internal tracking purposes the World Bank collects and reports data on the following core performance indicators listed below for Irrigation and Drainage projects financed by the World Bank. Project team leaders receive the data on the core indicators from estimates based on project monitoring data on outputs. The data can be supplemented with data available from the irrigation agency responsible for providing irrigation and drainage services in the respective project, and by survey data administered to the irrigation agencies.[38]

36 ADB. 2013. "Exploring PPP in Irrigation and Drainage in India."

37 World Bank. 1996. "Performance Monitoring Indicators Handbook." Technical paper No. 334.

38 World Bank. 2014. "Core Sector Indicators and Definitions: Irrigation and Drainage." Results Platform.

1. **Area provided with irrigation and drainage services (ha)** (i.e., the total area of land provided with irrigation and drainage services under the project).
    - Area provided with irrigation and drainage services—New (ha)
    - Area provided with irrigation and drainage services—Improved (ha)
2. **Water users provided with new/improved irrigation and drainage services (number)** (i.e., number of water users who are provided with irrigation and drainage services under the project).
    - Water users provided with irrigation and drainage services—female (number).
    - Water users provided with irrigation and drainage services—male (number)
3. **Operational water user associations created and/or strengthened (number)** (i.e., number of water users who are provided with irrigation and drainage services under the project).

2.3.4. KPIs in Ethiopia's Megech-Seraba project

This project is an example of a progressive use of KPIs. The notion of KPIs is that they should monitor performance but they should also be reflective of the actual realities of the contract as it evolves over time. In this project, the Incentive Remuneration is payable against the successful completion of Areas of Performance. Five areas of performance have been established. Each area has a set of performance indicators that will be monitored and evaluated during the life of the contract at various project stages and with different frequency depending on its relative importance at a given time. This reflects the evolving nature of the management services contract. For example, capacity building is given more weight at the beginning of the contract while maintenance is not part of performance measurement in the first three years but becomes progressively more important towards the end of the contract.

TABLE 2.3: Areas of Performance with Evolving Weight throughout the Megech-Seraba Management Services Contract Life

Performance area	Performance Indicator	Description	Target value
Staffing and labor	Staffing and labor	Staffing and labor as per staffing and labor schedule (updated each year)	95 percent rate of presence as per schedule

Administration and finance	Users register	Register of all individual users and their irrigated plots is maintained (with GIS system), including IWUA membership and cadastral information transferred to EPLAUA each year following land consolidation process	98 percent of consolidated area covered by register and up-to-date
	Billing and fee collection[39]	The billing and fee collection process is completed satisfactorily and documentation transmitted to relevant authorities for legal action	95 percent of billing duly processed within agreed timeframe
Capacity building and customer services	IWUAs established	The IWUA has held its general assembly, elected its board, kept its financial records and fulfilled all requirements as prescribed in the proclamation; official registration is requested	100 percent of the command area covered by established IWUAs
Operation	Irrigation efficiency	Volume of water distributed at tertiary canal outlet / Volume of water pumped	Above 75 percent of Base Efficiency
	Complaints on irrigation service	Percentage number of complaints on irrigation water supply that are satisfactorily closed after 8 days	Above 95 percent
Maintenance	Accessibility	Percentage km of roads that remain inaccessible more than three days after the last rain	Less than 5 percent
	Flooded area	Percentage of irrigated area that remain flooded for more than 5 days	Less than 5 percent
	Emergency interventions	Number of hectare/days with irrigation service disruption	Less than 12,000 hectare/days

2.4. Approaches to financing irrigation schemes

In general, it is not feasible for private companies to finance irrigation projects completely on their own, especially in emerging economies—the level of risk associated with relying on farmers to pay the service charge for irrigation schemes is too high. For instance, the World Bank Appraisal Report on the Accra Plains project in Ghana concluded that given the tariff levels and payment risk from the farmers, the scheme would not be financially viable for a private investor to carry out the scheme investment activities on its own, thereby providing the rationale for the use of public funds to support the development of the scheme.

While the private sector can walk away from projects with poor projected financial returns, a public authority is usually obliged to take on such investments based on public policy requirements and project economics. This is reflected in the key differences in the principles underlying private and public project finance evaluations. The private sector approach is centered on the financial aspects of the project, focusing on the returns generated, particularly in the early years of a project, for debt repayment obligations, and on ensuring that the project life is long enough to reach profitability. In contrast, the public sector requirements would include economic criteria in its assessments, with a focus on benefits rather than revenues.

39 An additional bonus payment related to the amount collected will be paid once this KPI has been reached, as described in the terms of reference.

The above discussion does not mean that it is not possible for irrigation schemes to be financed by the private sector. Instead, the implication is that government and development partners have a role to play in using public finance to help make private sector participation in the financing of irrigation projects viable. While initial lender due diligence and subsequent monitoring can enhance project transparency and quality, it is also important to ensure that there is a focus from project inception, on developing a bankable project structure which reflects the requirements of lenders such as in terms of risk allocation. In this regard, there is significant benefit in involving transaction and financial advisers with experience in structuring PPP projects and taking them to the market.

Key financing risks are the following:

- **Credit-worthiness of the project.** Private contractor will conduct a full financial and legal due diligence on the project to make sure that the project cash-flow and legal structure are robust enough to withstand certain likely stresses (listed below).
- **Counterparty:** Risk that the public sector grantor (government) will not or partially fulfill its obligations under a concession, lease or other agreement on PPP financing for public infrastructure assets.[40]
- **Offtake.** Water volume consumed is directly related to the agricultural offtake. Whether it is to the public authority or to the farmers, it needs to be certain so as to ensure the private operator's ability to assess the project's ability to generate revenue over the contract's term.
- **Weather effects.** Hydrology can affect the supply of water to the farmers, which in turn would affect the contract's performance.
- **Bankability.** Lenders would generally require some collateral to raise debt in order to ensure that they will be paid back in case the project is unsuccessful.

One option that can be followed by government is to provide the potential private-sector firms with guarantees against certain risks associated with the project. These guarantees effectively provide a backstop against downside risks, making the project a more attractive opportunity for the private sector. In some instances, depending on the credit history of the governing authority of the project, the provision of a sovereign guarantee might not provide sufficient comfort to prospective investors. In these instances, the involvement of IFIs, such as the World Bank Group as in Megech-Seraba or Asian Development Bank as in Muhuri, can provide more confidence to investors.

2.5. Sources of financing in irrigation PPP Projects

There are very few instances of irrigation PPP schemes that are funded purely by the private sector. Most of the case studies that we have reviewed involve some form of financing from the public sector and/or involve support from development partners.

40 Fitch Rating report, "Rating Public Sector Counterparty Obligations in PPP Transactions", July 2015.

2.5.1. Public funding and support

Public funds can be used to finance the entire project. However, not counting the obvious fiscal concerns, there is also the issue that by reducing the amount of private capital committed to the project, the use of public funds could reduce the incentives that the private parties have to improve the efficiency of the scheme, making it easier for the company to walk away from the project if things go wrong. Therefore, governments would need to strike a balance between providing support to enable the private firm to finance the project, without dampening the incentives.

Based on the case studies and other desk-based research, we identify the following options for public financing:

- The provision of **upfront loans or grants** directly to the SPV. In the Guerdane project (see Box 2.3), the private firm benefited from a sizeable grant from government as part of the PPP arrangement. In this case, the public funds covered 45 percent of the total project costs of €195million, and were split equally between a subsidy and a concessional loan with an interest rate of 1 percent and a deferred repayment of 20 years.
- The use of **performance-based availability payments**, such as those received by the private contractor in Megech-Seraba, Ethiopia (see Box 2.4) placed the main responsibilities for the private sector contractor in five areas:
    - Overall management and operation of the scheme
    - Irrigation operational aspects
    - Service aspects
    - Maintenance of the scheme
    - Capacity building of WUAs, training, land allocation support, and establishing a long-term operation & maintenance entity
- A number of governments have established **viability gap funds**. These funds use resources sourced from the national budget to provide up-front capital subsidies for infrastructure projects. Examples include the Pakistan and India Viability Gap Funds. Viability gap funding has also been used in development finance, as is discussed below.
- The provision of **tax exemptions and a tax stability** agreement, such as that granted by the government of Peru to the concessionaire, Odebrecht, in the initial water diversion stage of the Olmos scheme. Further detail on the financing structure of this project is provided in Box 2.2 below.
- Governments can also provide support in the form of **guarantees**, such that government takes on the responsibility of guaranteeing the repayment of the debts associated with the project in the event of default by the private company. For instance, the Federal PPP Guarantee Fund in Brazil has provided the collateral to reduce the concessional funding from IFIs.

2.5.1.1. Optimal conditions for public sector involvement

While the government could fund a PPP project entirely with public resources, doing so could reduce the incentive for the private party (or parties) to improve the efficiency of the scheme, and it could make it easier for the company to walk away from the project if things go wrong. Therefore, the government should be careful to strike a balance in providing sufficient support to enable the private firm to finance the project, but not so much that it would dampen the private-sector incentives. In summary, here are optimal conditions for public sector involvement:

- The contract is long-term
- Scheme delivers value for money for service users and the government
- Risks are allocated to the party best able to manage them
- Public sector can hold the private party accountable for meeting its (private sector) obligations
- Private sector provides an innovating and effective service delivery
- Private sector brings technical expertise

2.5.2. Concessional funding and support from IFIs

Development partners are increasingly finding new ways to provide development finance (different forms of finance on concessional terms) to support the ability of private companies to finance infrastructure investments in emerging economy context. Box 2.1 below describes how development funds are being used to support the implementation of a PPP arrangement for the Chiansi irrigation scheme through patient capital to help make the project bankable.

BOX 2.1: The Chiansi Irrigation Scheme Model

The Chiansi irrigation project, located in the Kafue region of Zambia, has the objective of increasing significantly food production and smallholder farmer incomes through the creation of a shared, commercially managed irrigation system, which will include commercially managed plots and smallholder farmer managed market gardens.

The project is under development. The intention is that an Infrastructure Service Company will be formed as a special purpose service company and be responsible for building, operating and financing the irrigation assets. The company will supply the bulk water and the long-term lease of irrigation equipment and farm equipment to the FarmCo(s) and will also provide irrigation services to the smallholders, in exchange for these services the farmers grant the company the right to extract water from the Kafue river for the duration of the project.

Project structure

The project will involve the provision of irrigation services on up to 2,500 ha of undeveloped land. The engineering works will include pump stations, canals, pipes and storage facilities that will provide water to infield pivots. The project will involve commercial farmers (formed into FarmCo(s)) that will grow wheat, soya and potentially rice and sugar, while smallholders will have access to farming equipment and some technical assistance in addition to the irrigated water.

Project financing

The total finance requirement is estimated to be $30.5 million, which includes the following:

- Capital costs of $25 million, including $13.6 million for one-off start-up costs to build canals, clear land, pay for resettlement of farmers. Remainder will pay for the irrigation facilities.
- Working capital requirement from the commercial farm of $5.5 million.

BOX 2.1: The Chiansi Irrigation Scheme Model

According to a report by InfraCo,[41] raising the full financing on commercial terms would have been unviable due to high revenue risk. The project will rely on relatively poor smallholder farmers for revenues making the investment quite risky for investors and lenders. As a result, lenders would expect a higher risk premium raising the cost of debt. For investors such as the commercial farmers, an expected returns of around 10 percent on equity would be insufficient to justify risking their capital in an uncertain demand scenario.

The project became viable after development partners injected $15 million in patient capital to fund the one-off, start-up costs (patient capital is long-term, subordinated capital invested at sub-commercial costs). By reducing the amount of capital needed to be raised on commercial terms, raised the estimated returns on equity to approximately 16-18 percent—a much more attractive proposition commercially. Involving development partners reduced the risk profile of the project as well showing greater government commitment towards its contractual obligations and transparency. The key point, from a financing point of view, is that the expected returns prior to start-up were commercially unattractive, but became more so once the additional investments offset most of the start-up costs.

This case study shows how a potentially beneficial investment in irrigation, initially unviable because of high upfront financing costs and level of associated risk, was made viable by the injection of patient capital, thereby enabling the project to come to fruition. The economic return is now estimated to be 17 percent, and the income of the 600 smallholders is expected to triple.

The World Bank Group (reference includes IBRD, IDA, IFC and MIGA) has also provided various forms of financing for irrigation PPP projects, such as:

- **Grants.** For instance, the World Bank has contributed 50 percent of the seedling cost to out-growers as a grant under the ITFC scheme in Ghana.
- **Viability gap funding.** The IDA will cover 100 percent of the total cost of $45.5 million for the Accra Plains Project, including viability gap funding of $40 million, potentially in the form of an upfront payment to the project developer.
- **Loans.** The IDA will provide a concessionary loan, with credit for $30 million to cover the total construction costs for the Megech-Seraba scheme, as well as credit for $8 million for the management contract, to cover all associated costs for the O&M operator (including incentives). The IBRD has been planning a market-based loan of $145 million, to cover 85 percent of the total investment and operating cost requirement for the West Delta Irrigation Project in Egypt.

41 InfraCo. 2010. "Chiansi Irrigation: Patient Capital in Action."

In addition, the World Bank Group has been instrumental in providing a range of transaction advisory support services to facilitate the implementation of the PPP schemes, such as:

- **Technical, financial, and legal due diligence.** PPIAF funded a project preparatory support for the Megech-Seraba scheme which included: (i) policy, institutional, and legal reforms needed for private participation; (ii) an estimate of investments necessary to attract private capital; and (iii) the identification of measures to reduce project-related risks, including (partial) bank guarantees, insurance, and other measures. The support enabled the government of Ethiopia and key stakeholders to analyze options and select the most appropriate structure for the project based on the range of PPP models presented.[42]
- **Technical assistance.** The IDA is responsible for providing consistent implementation support to the government of Ghana throughout the Accra Plains project, as well as funding the costs of the feasibility study for the PPP and transaction advice ($3 million), technical assistance in support of the PPP transaction ($1.9 million), and organization of small-holder participation in the PPP ($0.5 million).
- **Support for the development of a transaction advisory.** The PPIAF provided a grant of $75,000 in 2006 to help the Egyptian government develop a conceptual framework and transaction model for implementing the West Delta Irrigation Project (PPIAF 2010). The IFC has also advised the government of Morocco on the structure and implementation of the PPP for the Guerdane irrigation scheme.
- **Support for the transaction process.** The IFC conducted the bidding process for Guerdane. In particular, it led the marketing, prequalified potential investors, drafted bidding documents, and oversaw the bidding process to ensure that it was appropriately competitive and transparent, selecting the winning bidder.

2.5.2.1. Optimal conditions for IFI involvement

International financial institutions, such as the World Bank Group and other development partners, are finding increasingly innovative ways to provide development finance to encourage private companies to finance infrastructure investments in emerging economies. The following optimal conditions facilitate IFI involvement:

- Project is aligned with the overall goals of an IFI
- IFIs' involvement will catalyze additional interest from other sectors and will facilitate project development
- IFI is able to provide innovative financing mechanisms
- The project is a good investment, highly beneficial to the society and economically sustainability
- IFI involvement will enable the process of partnership between the public and private sectors

42 PPIAF. 2012. "PPIAF Support to Private Sector Participation in the Irrigation Sector in Ethiopia, 2008."

2.5.3. Private financing

The private partner is typically responsible for bearing the costs of the irrigation projects not covered by the government. In Guerdane, for instance, the private partner financed 50 percent of the total project costs, covering the investment, design, and construction of the irrigation system, while in Muhuri, the Irrigation Management Operator (IMO) is expected to finance the O&M costs, estimated at around $4.2 million. Both of these schemes have also required farmers to make some upfront contribution to help finance the irrigation scheme. For example, farmers are required to contribute €1600/ha (or equivalent to $1800/ha in October 2015 rates), funding up to 5 percent of the total investment in the engineering assets in Guerdane, while in the Muhuri project, farmers are expected to make a 3 percent contribution towards the rehabilitation or modernization of the tertiary level irrigation system where open channels are being replaced with buried pipes.

In these case studies, we have found very few instances of PPP schemes that are funded purely by the private sector. These include schemes such as the Senegal Sugar Company (CSS), Dina Farm, and the Saudi agri-businesses, which are identified to be almost completely private arrangements, with minimal government involvement. More recently, the irrigation component of the Olmos scheme in Peru, totaling $280 million, is being funded solely through private investment from agribusiness firms and Odebrecht. Further detail on how the different stages of this project are being financed, is presented in Box 2.2 on the next page.

BOX 2.2: The Olmos Irrigation Scheme

The Olmos project in Peru involves the auction of 38,000 hectares of previously uncultivated land to private investors, who will produce high-value crops. It comprises three main stages:

- Water diversion stage. The project diverts the Huancabamba River from the eastern side of the Andes to the western side, so that it will flow to the Olmos plains to provide the 406hm^3 required for irrigation. This diversion involves the construction of a 44 million m3 dam and 20 km tunnel, funded through a public-private partnership with a total investment of $247 million. This stage was awarded in 2004 to Concesionaria Trasvase Olmos S.A, a subsidiary of Odebrecht, through a 20-year contract for $19 million, and was completed in July 2012. The public sector involvement in this stage is through the government of Peru granting tax exemptions and a tax stability agreement to Odebrecht.
- Irrigation stage. The grantor and trustor of the land, Gobierno Regionalde Lambayeque (GRL), has transferred the land to be auctioned into a trust to make the process easier. The stage was fully awarded in June 2010 to the concessionaire H2Olmos S.A., a subsidiary of Odebrecht, which was formed solely for this project. The construction of the irrigation infrastructure was completed in October 2014, with this component funded solely through private investment from agribusiness firms and Odebrecht. Approximately 50 percent of financing has been raised from bonds issued on Lima's stock exchange backed by a partial credit guarantee of $50m from the Latin American bank CAF. So far, 35,000 hectares of land have already been successfully auctioned, which should have raised at least $150 million. These funds will be held in a Land Trust, and split between GRL (to pay for the land) and the concessionaire, with the latter's share of 72 percent used to finance part of the infrastructure investment.
- Energy generation stage. This stage involves the construction of a hydropower generation turbine, with the objective of generating renewable energy to sell to Peru's National Interconnected Electric Grid to enable a reduction in CO2 of up to 200 kt per year. This stage was awarded to concessionaire Union Energy SA (SINERSA) in October 2010, which will be responsible for fully financing the costs of this stage.

2.5.3.1. Optimal conditions for private sector involvement

Private-sector partners are typically responsible for bearing the costs of the irrigation projects not covered by the government. However, a few PPP schemes exist with funding purely from the private sector and minimal government involvement (e.g., Senegal Sugar Company, Dina Farm, the Saudi agri-businesses, and Peru's Olmos scheme). Optimal conditions for private sector involvement in a PPP include:

- The country has favorable business environment and good investment climate that will facilitate private sector participation in bidding and in the implementation of the project

- Public sector has sufficient capacity and accountability to conduct procurement
- Public sector has capacity to make the public payments, implement and monitor a project
- A designated granting authority will work with the private operator through the contract
- Legislative framework allows for the transferability of the profit
- Farmers are willing to work with the private sector and can identify mutual benefit
- Payment, early termination, arbitration, handover at contract end are clearly defined in the contract
- Track record of government acting responsibly towards its contractual obligations

2.6. Further discussion of irrigation PPP contracts

Here we examine the following PPP contracts to consider how some of the issues discussed above have been addressed in the irrigation sector:

- The contract for the Guerdane PPP arrangement (Box 2.3), which includes a clear and transparent explanation of the requirements that are placed on any farmers that want to have access to the irrigation services as part of the arrangement.
- The risk allocation in Megech-Seraba (Box 2.4), between public and private stakeholders, including performance-based KPIs.
- The provisions of the planned Pontal concession arrangement (Box 2.5), which provide a good example of the way in which risk allocation can be specified within a PPP contract.
- The West Delta DBO contract (Box 2.6) that provides an example of the way in which project obligations can be specified within a contract.

BOX 2.3: Guerdane and the Requirements Placed on Farmers

The Guerdane concession arrangement includes a number of clauses that seek to place obligations on the farmers that seek to benefit from the provision of irrigation services from the private company.

The contract specifies the following fees that the farmers are required to pay to participate in the scheme:

- An upfront subscription charge of 1,000 dirhams per hectare of land, which all the farmers were required to pay to join the scheme;
- A connection fee of 7,000 dirhams per hectare of land, which farmers had to pay when their land was connected to the scheme; and
- The ongoing service fees that the farmers were required to pay which was based on the amount of water that they consume.

While the inclusion of specific requirements on the farmers does not completely mitigate the demand risk, the inclusion of the farmers within the contract arrangement gives the private firm a more transparent framework that it can use to stop providing irrigation services to farmers that do not fulfil their contractual obligations. For instance the contract also specifies:

- the time period that the farmers have to settle their fees; and
- the process that the private company can follow in instances where the farmers do not pay on time—the company can issue a warning, if after an additional thirty days the farmer has not paid the company can choose to exclude him/her from the scheme.

BOX 2.4: Megech-Seraba and Risk Allocation between Public and Private Stakeholders

The Granting Authority will:

- Secure the appropriate legislative powers, permits and approvals necessary for the construction and for operation of the Management Services Contract
- Ensure construction of the full irrigation and drainage system to be undertaken under a separate construction contract
- Guarantee the timely delivery of use of the structures, equipment and land for the Management Services Contract, free of legal or physical encumbrances and will meet all costs of such unencumbered delivery at dates as determined in the Contract Program
- Secure the full re-allocation of land related to the Scheme's construction in a timely fashion, and ensure construction of quaternary systems completed in good time to receive irrigation water against the phasing program for scheme completion (940 hectares at end of Phase 1; the balance of the full 4040 hectares by overall project construction period (Phase 2)
- Pay fees and operating expenses to the PSP Contractor as per the provisions of the Contract
- Take all revenue and fee collection risk
- Indemnify the PSP Contractor from all risks and losses arising due to failure to complete these tasks
- Pay for electricity costs associated with the operation and maintenance if the irrigation service fee is not sufficient to cover it
- Pay for major damages resulting from circumstances outside the normal operation and maintenance of the scheme, and for agreed improvement of facilities

BOX 2.4: Megech-Seraba and Risk Allocation between Public and Private Stakeholders

The PSP Contractor will:

- Review the detailed design, and carry out construction supervision and operation, maintenance & Capacity building of the Scheme
- Receive payment for fees and expenses against:
  - Design Review & Endorsement and O&M planning: Lump sum
  - Supervision of Construction: Time based
  - Operation, Maintenance & Capacity Building: Performance based, related to Key Performance Indicators (KPI's)
- Operate and maintain the irrigation water supply and drainage systems in an effective and reliable manner
- Interface with customers in course of normal operation and act as agent on behalf of the Government for collection of water user fees, as required
- Participate in and facilitate the process of establishing IWUAs and coordinate water demand and water balance processes with IWUAs
- Provide customer relations services including advice on water management issues, on farm irrigation and related agricultural issues
- Manage small works contracts within the area of operations at request and on behalf of Granting Authority to be paid on a fee basis
- Establish and develop an effective and sustainable O&M entity

BOX 2.5: Provisions from the Planned Pontal Concession Arrangement

The Pontal concession arrangement contains clear specifications on a number of issues that we have discussed in this section. We discuss some of the key clauses below.

Duration of the Sponsored Concession

Section 3 of the contract defines the duration of the sponsored concession to be 25 years from the assumption date, with no provision for the extension of this time frame.

Risk allocation

For instance Section 20 of the contract provides a clear allocation of the risks associated with the agreement.

The contract states that the private party is responsible for the following types of risks:

- Refusal of users to pay the irrigation service fees,
- Exceeding costs related to the works and services that the private firm is responsible for;
- Technology used in the works and services of the sponsored concession;
- Extinction, destruction, theft, or loss of the infrastructure assets related to the project; and
- Increased cost of capital, including those resulting from increases in interest rates.

The contract also specifies some risks for which the private company is not responsible. This includes features such as:

- Acts of God;
- Social and/or public manifestations that affect the ability of the private firm to provide the irrigation services for greater than a specified length of time; and
- Breaches in the exercise of its powers (related to the contract and/ or its relevant regulatory powers) by the government institution responsible for the project.

The contract also has some clear specifications related to the financing requirements for the project. It states that the firm is responsible on its own for obtaining the finance necessary to deliver the services that are set out in the contract, with BDNES responsible for providing 75 percent of the financing.

It also requires the private party to provide the relevant government institution with a certified copy of the financing and guarantee agreements within five days of the issuance of the execution of the contract. Governments often include these requirements in an attempt to mitigate the risks that arise from the fact that the contract is normally issued before the project reaches financial close.

BOX 2.5: Provisions from the Planned Pontal Concession Arrangement

As we discuss in the following section, a project usually cannot reach financial close before the contract is issued because the lenders want to review the contract as part of their due diligence. This creates the risk that upon their review of the contract lenders will want to change the terms on which they will lend to the private firm and hence create additional delays/a need for government and the private party to renegotiate the terms of the contract.

Tariffs

According to Section 16 of the contract, collection of the tariff can commence upon occupancy of the irrigable area and verification by ANA of the fulfillment of the pre-specified obligations and services of the concessionaire. The tariffs to be charged from each user of the irrigation service shall correspond to a fixed tariff (charged per hectare of land used by the user) and a variable tariff (charged in relation to actual consumption of water by the user). The methodology for determining the tariff is clearly set out in attachment 16.2.1 of the contract.

The contract also provides for tariff adjustment on a pro-rata basis each year, from the date of appraisal of the proposal in the bidding.

Key performance indicators

Under the contract, contraprestação (capacity payments) paid by government will be performance-based, and structured as follows:

- Availability instalment: 10 percent is payable in one single instalment on the date that the concessionaire completes the common infrastructure works
- Occupation instalment: 40 percent will be payable monthly within five years to the extent that the irrigated area is occupied.
- Performance instalment: The remaining 50 percent will be payable monthly as of the date that the irrigated area is fully occupied and throughout the contract.

Monitoring

Section 14 of the contract tasks ANA with the responsibility of exercising inspection powers of performance of the agreement, with access at all times to data relating to management, accounting, and technical, economic and financial resources of the concessionaire as well as the assets of the sponsored concession.

Dispute resolution mechanisms

Section 36 of the contract specifies that any and all disputes and/or questions arising out of, or related to the agreement, shall be settled by arbitration, administered by the CCI and held in the city of Brasilia, Federal District, Brazil.

BOX 2.6: West Delta DBO contract

The West Delta contract sets out the specific obligations that are common in irrigation PPP contracts:

- It specifies the scope of the design-and-build activities that the private firm is required to complete together with the technical specification of the standards that have to be achieved and the timeframe within which the work has to be completed.
- The standards that the firm has to achieve for the operation of the scheme are also set out in a separate Operational Standards Annex.
- The technical process that the firm has to follow for setting the tariff is also clearly defined. The tariff includes a fixed fee that is based on the amount of land that the farmer has and a variable fee that is based on consumption of water (volumetric tariff)—the volumetric fee set on the contract is dependent on both electricity and fuel costs faced by the firm together with the general level of inflation experienced in the country.
- The contract also sets out the specific set of circumstances that will lead to a reassessment of the tariff. These include: changes to the operational standards that the firm has to achieve; changes in the size of the scheme; and the occurrence of force majeure events that are not covered by insurance required by this contract to be obtained and maintained by operator.

2.7. checklist

for structuring a PPP

1 Allocate the risks to the party best able to manage them ☐

a. The party is able to control the likelihood of the risk occurring ☐

b. The party is best placed to control the impact of the risk on the targeted project outcomes ☐

c. The party is positioned to absorb the risks at the lowest cost ☐

2 The government is able to define the allocation of responsibilities and rights for the PPP model in the contract ☐

a. Depending on project specifications, determine the functional allocation ☐

b. Government has identified the skills gap and procured the right advisors to fill the gap (economic, financial, legal advisors) needed to draft the contract ☐

3 Clearly define the structure of the PPP contract ☐

a. The contract represents the selected PPP model based on relevant legislation, optimal allocation of risks, assigned roles and responsibilities ☐

b. The contract ensures clarity, certainty, and flexibility ☐

c. Payment mechanisms clearly described in the contract ☐

d. Key performance indicators are measurable with a system of incentives and penalties/sanctions to monitor progress during implementation ☐

e. Include flexibility to adjust certain provisions in the course of the project lifetime, renegotiation parameters, and early termination in the contract ☐

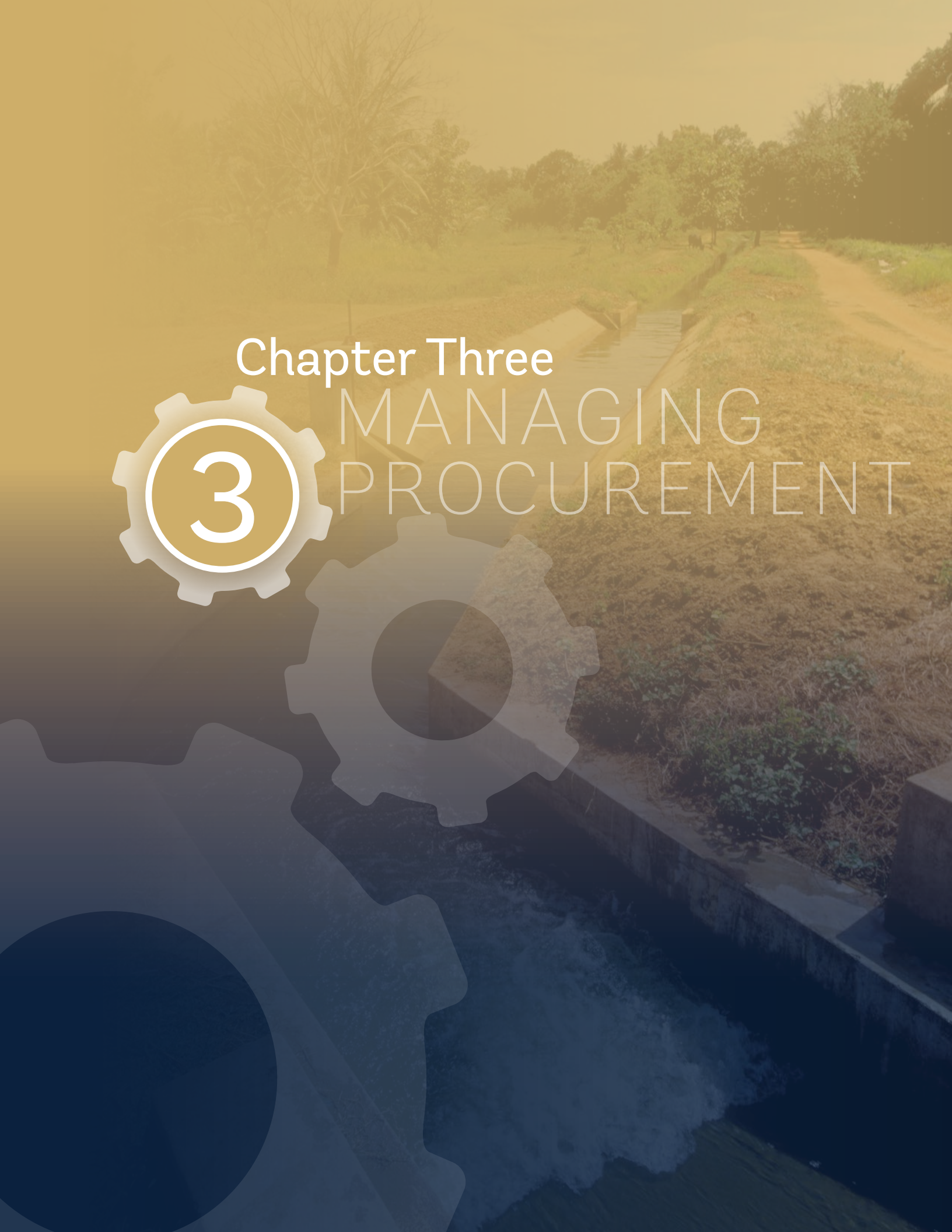
f. Include provisions and requirements on the process of handover of assets upon the expiry of the service in the contract ☐

4 Balance the sources of financing between private and public funds ☐

a. Determine the public support (Direct financing, for example, capital grant, subsidy, availability payments; regulation, for example, setting tariffs, contract monitoring, changes in law) ☐

b. The granting authority ensures fiscal responsibility for the selected type of the support ☐

c. Determine a need for IFI involvement (e.g., technical assistance, financing, policy support, etc) ☐



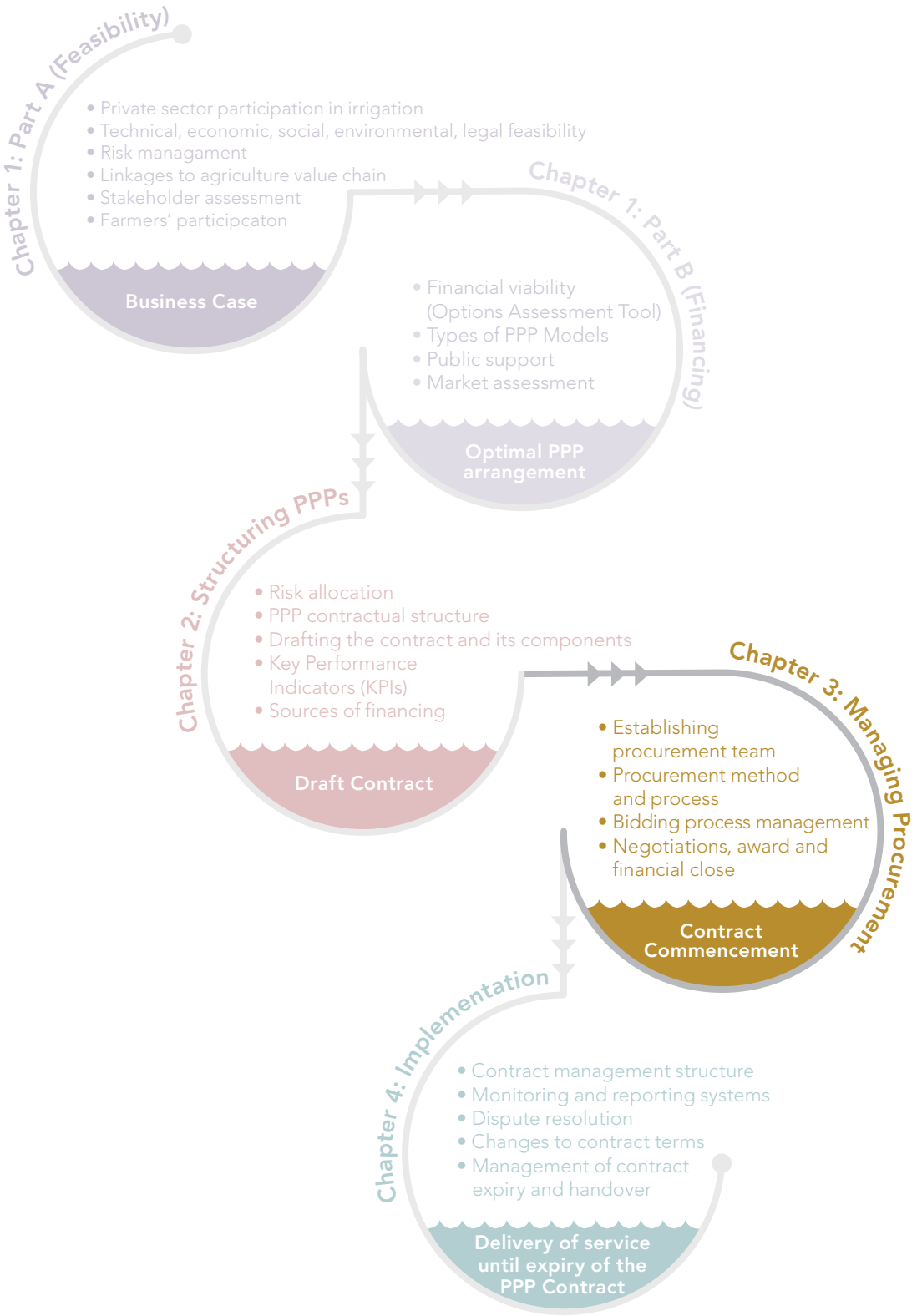
Chapter Three

3 MANAGING PROCUREMENT

3.1. Selecting a private contractor

This chapter focuses on how to select the private partner to build a sustainable irrigation scheme. A PPP is a long-term commitment and many livelihoods depend on its success, so the operational partner must be financially and technically competent to hold up its part of the bargain throughout the life of the project—just as the government, as owner and regulator (or grantor), has to fulfill its side of the bargain. In establishing an irrigation PPP, therefore, it is important to look carefully at the components of partner selection. The contracting authority should weigh up the relative advantages of using competition to drive down project costs, enhance transparency, and encourage innovation against the speed of avoiding a competitive process. The end result of a successful procurement process is contract award leading to financial closure and commencement of the contract.

FIGURE 3.1: Roadmap—Managing Procurement



3.1.1. Fiscal commitments to the PPP project

A government usually opts for a PPP in irrigation because it faces fiscal constraints in the building, operating, and maintaining of that scheme. In doing so it will delegate certain functions and responsibilities to the private sector in the PPP. But, as the case studies show, this does not amount to a sloughing off of responsibility; government will continue to be involved both legally and financially in the provision of the irrigation services. Depending on the type of PPP arrangements, the government may pay a small or substantial part of the life-cycle costs of an irrigation scheme.

In a public scheme, despite the moral obligation to the farmers, there is no legal contract between the beneficiaries of the scheme and the public sector. In a PPP contract, the public obligations—including capital grants, availability payments, contingent payments such as guarantees, etc.—are expected to be fully funded by government; just as the government will expect the private operator to meet its contractual obligations. Any public obligations taken on in a PPP arrangement will create direct and indirect liabilities, which should be accounted for. The fiscal implications of PPP schemes demand special consideration by governments because the undertaking contains a disparity: PPP contracts involve long-term fiscal commitments, yet most countries' budget cycles are just 2-5 years long. One way of resolving this issue of providing long-term funding is to build a fiscal risk management framework applicable to all PPPs that would allow for public sector commitments beyond the public budget cycle. Ideally, in countries where a common PPP legal framework already exists, a supporting fiscal risk management framework should be in place (see discussion of risk allocation and checklist in Chapter Two, sections 2.2.2 and 2.2.3.).

3.2. Suitable procurement process

The objective of the procurement process is to establish an effective method for selecting a private partner that is financially, technically, and operationally capable of the development and long-term operation (or at least managing a third-party capable of operating the scheme) of an effective and sustainable irrigation system under the PPP contract.

Typically, a competitive procurement process is the most appropriate approach. This is because managing such a process can incentivize bidders to compete both in terms of trying to identify the least cost way of delivering the project and/or developing innovative approaches both technically, operationally and in terms of financing solutions. These improved approaches may not have been possible in the absence of competitive tension. For instance, given the government's objectives of making surface water accessible to the largest number of farmers possible, the selection criterion in the Guerdane scheme was based on the lowest water tariff offered by bidders. The competitive bid process resulted in the winning bidder proposing a tariff significantly lower than the price that citrus farmers in the area had typically paid for irrigated groundwater supplies.[43]

43 IFC. 2013. "Public-Private Partnership Impact Stories: Morocco: Guerdane Irrigation."

However, it is not always clear that a competitive procurement process is the most suitable. Table 3.1 below sets out the key questions that a government should consider before determining the choice of the procurement process.

TABLE 3.1: Issues to Consider when choosing the Most Suitable Procurement Process

Question	Issues for consideration
What is the level of prospective market demand?	Market-sounding is important for establishing the appetite among potential contractors, investors, lenders, and operators. It also assists government officials in understanding the nature of any competitive forces that may secure the best deal.
Should unsolicited bids be accepted?	Public authorities may receive "unsolicited proposals" or proposals from private sector consortia made without the issue of any formal tender request. While the government has no obligation to accept or even look at these proposals, they can sometimes offer benefits. For example, the private sector may make unsolicited proposals involving innovative plans for feasible projects that fit into the country's plans for developing additional irrigation schemes for a group of farmers. Authorities need a clear framework in place to deal with the ad hoc nature of unsolicited proposals—possible approaches include a total ban, proposal cost reimbursement, or providing an advantage in an open bidding process.
Does the public sector have sufficient capacity and resources to manage the procurement process?	This is an often under-estimated element of the design of the procurement process. Good project management is critical to ensure that the contracts are awarded on time and in budget and, more importantly, implemented as planned. This involves smooth coordination and communication across the various stakeholders in the government, the private sector, the beneficiaries, and other interested parties. It is important to note that if the private sector does not believe that the government has the capacity to implement a transparent and efficient process it could be deterred from bidding for the project. However, it is not necessarily the case that non-competitive procurement methods would result in projects being implemented more quickly; they could in fact take longer to complete due to contract re-negotiations.

In general, particularly for large complicated projects such as irrigation schemes, the use of the competitive procurement model is preferred. The first stage of the process is to determine the appropriate procurement strategy/process.

3.3. Choice of the competitive procurement process

Typically governments have existing legislation or practices that govern the instances in which the processes that need to be applied when applying a competitive procurement process or when unsolicited proposals can be considered and the way in which either need to be managed.

If the government does not have an established set of procedures in place to help govern a potential PPP deal, it could consider utilizing an existing set of processes, as developed by a country that has a similar administrative or legislative set-up, and publicizing this at the beginning of the process to aid transparency.

Table 3.2 below provides some examples of the guidelines that exist regarding the procurement process for PPP projects across a selection of countries.

TABLE 3.2: Procurement Guidelines for PPP Projects

Country	Reference	Pre-qualification	Bid process	Negotiations with bidders	Basis for award
Brazil	Federal Concessions Law (Law 8987, 1995) and Federal PPP Law (Law 11079, 2004)	Not mandatory to have a pre-qualification step	One-stage bid process	Not specifically referred to in the law	Lowest tariff, or largest payment to government or a combination of the two.
Egypt	Executive Regulations under PPP Law	Pre-qualification based on set compliance criteria	Can use either one-stage or two-stage process. First stage bids are non-binding	Competitive dialogue allowed in the two-stage procedure before final bids are submitted	Financial or combined financial/ technical
Philippines	BOT Law Implementing Rules and Regulations	Pre-qualification the norm	One-stage bid process	Direct negotiations allowed if only one firm qualifies	Financial (following pass/fail qualification and technical criteria)
South Africa	South Africa PPP Manual Module 5: Procurement	Pre-qualification; the number of bidders "must be kept at a minimum of three and maximum of four"	Single stage process, unless there is no clear preferred bidder, in which case a Best and Final Offer stage can be included	Feedback from pre-qualified bidders strongly advised before issuing RFP. Dialogue allowed with bidders prior to issuing request for Best and Final Offer	Combined financial, technical and Black Economic Empowerment

Source: PPIAF (2012)

The following subchapter describes the main stages involved in a competitive bidding process and highlights some of the key issues associated with the implementation of an efficient process.

3.4. Stages in a competitive PPP procurement process

The various stages of a competitive PPP procurement process typically involve:

- Marketing and publication of the PPP opportunity;
- Expression of Interest (EoI);
- Pre-qualification;
- Request for Proposal (RFP); and
- Post-bid negotiation.

The process of marketing the PPP is crucial to ensure that sufficient interest is generated for the project so that there are enough potential bidders involved. This can also help government to see which firms might bid for the opportunity so that it designs the qualification criteria to reflect the market of potential bidders—i.e., if all the firms willing to bid for an irrigation PPP have no more than five years' experience in the country, the qualification criteria should not require bidding firms to have ten years of experience.

To market the PPP opportunity, the government can simply advertise the launch of the process. Going beyond this, the government can conduct investor presentations or road shows to present the project opportunity, or carry out a more concerted effort to advertise the project by releasing information about the opportunity over time to generate sufficient interest.

The remaining stages are discussed in Table 3.3 and subchapter below, together with a description of the approach to evaluating each stage and the main pros and cons involved are shown in the table on the next page.

TABLE 3.3: Stages of a Competitive Procurement Process

Stage	Description	Evaluation	When used?
1 Expression of Interest (EoI)	The government can use this to gauge the level of interest in the project from private companies.	Not usually binding.	Not always necessary to issue an EoI; can be helpful to provide information on level of market interest in project.
2 Request for Pre-Qualification (RPFQ)	Bidder(s) provide details on: (a) experience and capacity (e.g., no. of staff, no of similar projects completed etc.) and (b) financial capability (e.g., balance sheet for last 3 years) to show business expertise and strength to demonstrate suitability for project and meet pre-qualification criteria.	Pass/fail evaluation to limit number of bidders to pool of private firms with suitable capacity and experience.	Can be used for projects where government wants to limit the number of bidders to firms with suitable experience and capacity. Though in cases where there are unlikely to be an excessive number of bidders this can simply make the process more lengthy.
3 Request for Proposals (RFP)— One-stage bidding	The bidders submit a technical and financial proposal at the same time, usually in separate envelopes.	Usually the technical proposals are evaluated; in a transparent process there will be a series of criteria assessed, with weights attached to each. Bidders achieving a pre-specified technical score will have their financial proposals reviewed. The technical and financial bids are combined to identify the winning bid.	A one stage bidding approach is typically used where the contract value of the project is relatively small and, or the probable technical solution for the project is simple.
4a RFP—Two-stage bidding	One approach to the two stage RFP process involves the government issuing a preliminary RFP to bidders requiring completion of the technical proposal. The government reviews the different technical proposals, chooses the preferred one and then gets firms to submit a technical and financial proposal based on the preferred approach.	A similar approach to the one stage bidding process is used to evaluate bids.	Can be a lengthy process, firms with the best technical approach to addressing problem have limited incentive to provide details of their proposed technical approach in the first round of the process.
4b RFP—Two-stage bidding	An alternative to the two-stage process discussed above, is to simply get all firms to submit a technical proposal which is then evaluated. The winning bidder is then requested to submit a financial proposal.	The evaluation is initially on just the technical bid. The government then needs to come to an agreement with the winning bidder on an acceptable price for the project.	Can be quite a difficult and protracted process for government and the winning bidder to agree a mutually acceptable price. Losses the benefit of competition to drive down price.

Source: Rigby Delmon, Victoria (2014). "Structuring Private-sector participation contracts for small scale water projects".

3.4.1. Post-bid negotiation

In addition to the competitive processes described above, for a complex project such as an irrigation PPP there will also probably be a significant amount of post-bid negotiation following the selection of a winning bidder. Although some governments (e.g., India) do not allow post-bid negotiations, nor does the World Bank Group.

At the post-bid negotiation phase, the government and the winning bidder enter into additional dialogue which enables them to agree upon the final PPP contract. Government should try to limit the extent of the negotiations to clarifications and fine-tuning of the proposals, rather than substantive discussions around the requirements and/or the price of the project. This is because at this stage of the process there is limited competitive pressure on the private bidder and thus the private firm might try to incorporate changes that do not meet the government's requirements or increase the price beyond an acceptable level.

3.4.2. Managing a competitive bid process

Navigating the various stages that we have outlined above can be a challenging task for government. It needs to be able to manage the various technical and financial elements of the bids as well as managing relations with private sector firms as well as other stakeholders relevant to the project to keep everything on track. In the subchapters below we discuss some of the different approaches to managing the different elements of the bid process.

3.4.2.1. Establishing a steering group or technical team

One of the key first steps in the procurement process is for the government to develop a management team that has the capacity to manage the completion of the process. This is likely to include some form of steering group that includes representatives from the key government agencies that are relevant to the project and individuals with the necessary technical expertise to review and evaluate the bids. The individuals included in the technical team will (in the case of an irrigation PPP) need to include at least experts with experience of managing a PPP deal, irrigation engineers, financial experts, economists and lawyers. It is typical for the government to make use of external advisers with the necessary skills to support the completion of the process.

3.4.2.2. Provision of information

The team managing the procurement process will need to be careful with the way in which it manages the provision of information to both prospective private sector bidders and other relevant stakeholders. The provision of clear and complete information throughout the process will help to ensure that bidders:

- Will be able to prepare bids that meet the contracting authority's requirements;
- Have a common understanding of requirements enabling them to provide bids that are broadly comparable with each other; and

- Limit the scope for bidders to think that the process has been carried out in an unfair or politically-driven manner, which reduces the chances of challenges to the validity of the process.

The procurement management team will need to provide information, to the best extent possible, on the status of the existing irrigation scheme assets (in the case of a rehabilitation or modernization project), or on the land, water, and construction requirements (for a new greenfield investment). This will include information on:

- The proposed site for the project—e.g., size, type, condition, and use of land, water resources, current ownership of land and land surrounding the project area, farming practices, etc.
- In the case of a rehabilitation or modernization, an inventory of the main existing irrigation system assets and information on the current financial performance and service standards provided by the scheme.

To make this type of information available to prequalified bidders, the procurement team can include information in the bidding documents and/or set up a data room which can be used to store commercially sensitive securely. In addition the team can arrange meetings between the bidders and relevant institutions (e.g., in the case of a rehabilitation or modernization, the senior management team of the existing irrigation scheme).

3.4.2.3. Managing bid costs

For a large irrigation PPP, the various stages outlined in the previous subchapter can be time-consuming, expensive, and risky for both the private bidders and the government. One of the key issues for government to manage during a procurement process is the bid costs, to prevent firms from withdrawing from the process.

There are various approaches to dealing with the issue of the bid costs. These include:

- Requiring bidders to submit a bid bond to ensure commitment to the process and to prevent the firm that wins the bid from withdrawing from the process without any good reason. For example, in the Philippines the government requires private firms to provide a bond of between 1 percent and 2 percent of the estimated project costs for any BOT project. While this is an option that can be effective in securing adequate engagement from the bidding firms, the additional costs involved can limit the number of bidders that are willing to submit a bid in the first place.
- In contrast to the approach suggested above, in some countries such as Australia, the government has the option of sharing bid costs with the bidders in order to encourage more firms to participate. The Australian PPP Guide states that bid costs can be reimbursed, but only in limited circumstances.

Overall, to ensure that the PPP procurement process is managed effectively, government should commit to carrying out the process in a transparent and efficient manner. This requires the government to set out the rules of the process upfront, establish time-lines for the completion of the procurement stages that it sticks to, and keep open lines of communication with the private bidders—where appropriate—to provide clarifications on the process and requirements (making sure that responses are provided to all bidders at the same time so that each has the full information set required to make an effective bid).

3.5. International examples of procurement for irrigation PPPs

Whether it is a simple management contract or a concession, a PPP arrangement in the irrigation sector is likely to involve quite a complicated procurement process that has to be managed carefully—not least because irrigation projects can often have quite complicated technical requirements and because of the multiple stakeholders that are usually involved in them. There are various examples of irrigation PPP projects that have failed to reach implementation stage because they have not gone through the tender process. We examine three projects that were bid competitively. Pontal in Brazil and Guerdane in Morocco, that involved IFC as the transaction advisor, and Megech-Seraba in Ethiopia, that involved the World Bank (through IDA credit) with a grant from the PPIAF, that served as both the main financier and strategic transaction advisor.

Guerdane in Morocco: The success of the government of Morocco in completing the Guerdane PPP is often cited as an example of an efficient procurement process. Even in Guerdane, though, the scheme had to be rebid as there was insufficient subscription from farmers in the first round. Working with support from the IFC as transaction advisor, the government managed a process described as being "highly competitive and transparent".[44]

Key details in the procurement process used for the Guerdane scheme were as follows:

- The tender evaluation was done in one-phase, with no formal pre-qualification stage. The government made a call for tenders that was open to all investors wishing to participate. The technical and financial criteria were checked immediately, with only bids from qualified firms being opened.
- In an attempt to ensure transparency, the bids were evaluated on the basis of a single criterion: the projected surface-water charge or fee to farmers.
- Using the water fees as the single evaluation criteria was also a way to make use of competition to minimize the fee that farmers would face.

Eventually, just two firms (both part of wider consortia) submitted bids for the project: Omnium Nord Africain (ONA), which submitted a bid of \$1.48/m^3 (before the 7 percent value tax) and Holding-YNNA (HY), which submitted a bid of \$1.88/m^3 (also pre-value tax). ONA was selected as the winning bidder.

Pontal in Brazil: The procurement process for Pontal scheme was spread over five years without reaching a successful conclusion. This is despite the fact that the project is proposed for a relatively small area (for an irrigation project) of 5,000 ha and was situated near to a well-established irrigation network and commercial agricultural hub with direct access to a local airport used for exporting. There was only one bidder for the project, who withdrew because of the level of political interference in the procurement process and uncertainty among the prospective private bidders about the true costs involved in meeting the government's requirements

44 http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/0,,contentMDK:20244053~menuPK:247614~pagePK:2865106~piPK:2865128~theSitePK:256299,00.html

and construction costs. In addition, the government's desire to retain responsibility for setting the price of water user fees, given the sensitivity of handing over responsibility to a private firm, proved to be a difficult stumbling block for the process. These issues are fundamental to the design of a successful PPP arrangement. The lesson from the Pontal scheme is that such issues should have been addressed upfront before trying to complete the procurement process.

Megech-Seraba in Ethiopia: This is the first IDA-funded irrigation PPP contract. Based on the risk assessment and market sounding the procurement was done separately for civil works construction and for the enhanced management PPP contract. Both contracts were procured using the World Bank procurement system including its procedures and documents. For the PPP contract, international two-stage bidding was conducted. Some of the key features of the procurement process were as follows:

- The contract was developed by linking O&M to the actual improvements in farmers' livelihoods. As a result, procurement was done on both technical (quality) and financial (price) proposals. Payment will be done three ways:
    - Lump sum payment for incorporating review of the construction designs;
    - Time-based payment for construction supervision; and
    - Periodic payments during O&M phase as a function of base remuneration for availability plus incentive remuneration for performance
- Evaluation was done first on mandatory criteria as a pass or fail and then on a) technical criteria (general qualification, approach, methodology, work plan and staffing plan) as a minimum score and b) financial (total of all three payments).
- Methodology in technical proposals included approach to build capacity, operationalizing the newly formed WUAs, training programs, operation and maintenance procedures.
- Five bids were received. One bid did not meet the minimum criteria. Remaining four were evaluated by a panel based on criteria stated above.

In April 2012, the government of Ethiopia entered into an eight-year contract with the French operator BRL Ingénierie for the O&M of the Megech-Seraba irrigation project. The operator will also be in charge of construction supervision, and establishing and building the capacity of WUAs. It is anticipated that the PPP will increase water availability to over 6,000 landholdings over a 4,040 hectare irrigated area.

3.6. checklist

for Managing the Procurement Process

1. Screen the market for potential contractors, lenders, investors, operators for irrigation PPP ☐

2. Review relevant legislation governing procurement process ☐

3. Ensure adequate amount of resources to manage the procurement process ☐
   a. Prepare bidding documents (e. g., EoI, RFQ, RFP, draft contract) ☐

4. Establish procurement team to manage the process: ☐
   a. Ensure availability of multi-disciplinary skills ☐
   b. Determine if external advisers are necessary ☐
   c. Establish the data room to store commercially sensitive information ☐
   d. Establish the rule of process ☐
   e. Define the timeline ☐
   f. Establish the lines of communication ☐

5. Decide on the appropriate procurement process: competitive bidding, competitive negotiation, or direct negotiation ☐

6. Define selection criteria to match the procurement process ☐
   a. One-stage/two-stage ☐
   b. Technical and financial qualification requirements ☐

7. Review and follow appropriate process stages depending on the appropriate procurement process chosen: marketing; EoI; pre-qualification; RFP; and post-bid negotiation ☐

8. Set a bid bond amount for the bidders to ensure commitment to the process ☐

Chapter Four

IMPLEMENTATION

4

4

IMPLEMENTATION

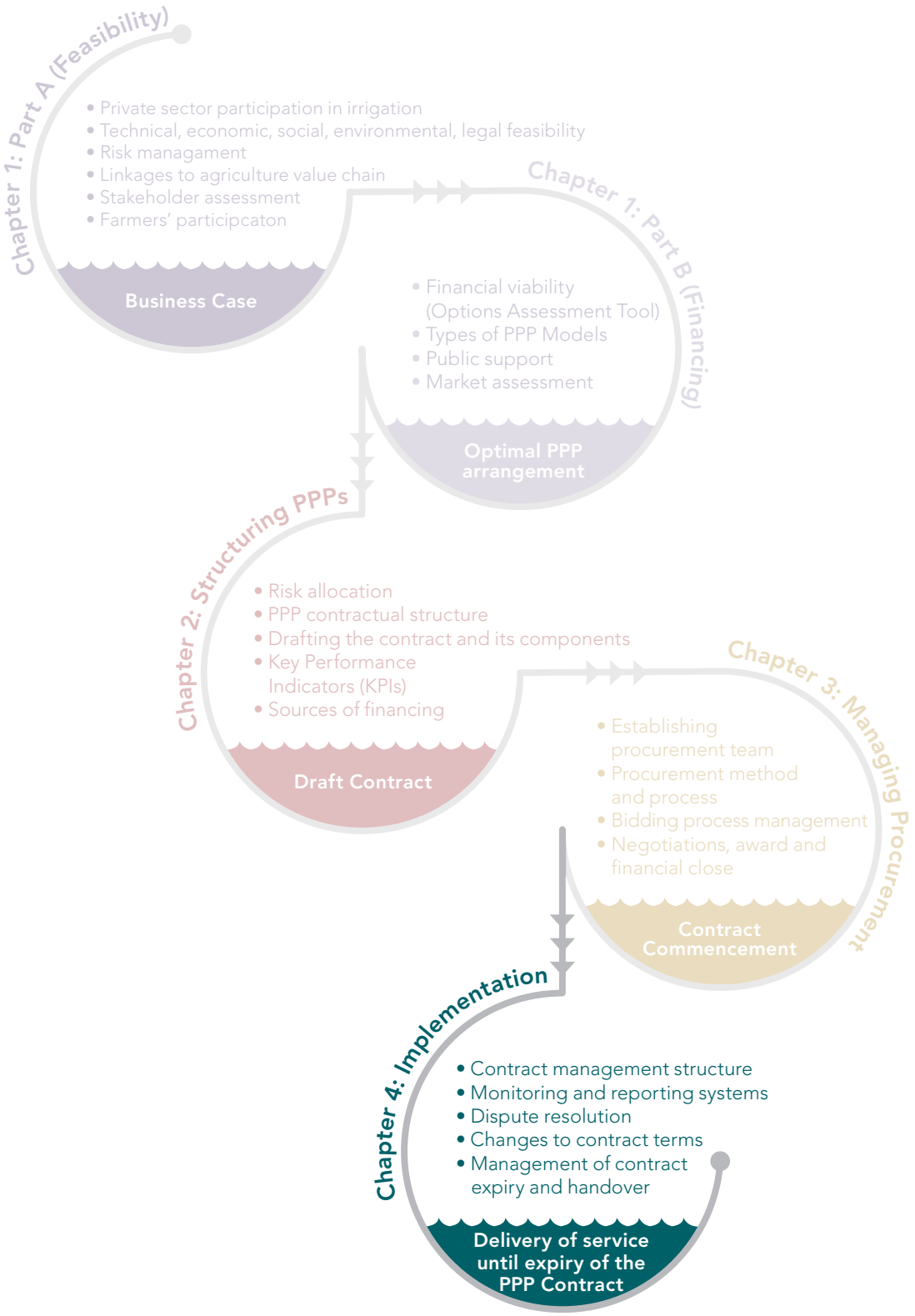
4.1. Managing the PPP contract

Ultimately, the success of a PPP for an irrigation development is determined not by the fact that it has achieved financial closure, but by the extent to which it has enabled farmers to access a satisfactory and affordable irrigation service. For this to occur, the PPP contract has to be designed effectively, and also has to be managed throughout the life of the project. This is because a PPP is effectively regulated by the enforcement of the terms of the contract, which should specify the arrangements for the management of the PPP—e.g., the responsible institution(s), the budget for the post-implementation phase, and the processes used to govern the contract.

This chapter considers the main aspects for the development of an effective regime to manage the post-implementation phase of a contract. It covers:

- The approach to establishing the PPP contract management institutions;
- The monitoring of the PPP contract including some suggestions on how to use performance bonds and avoidance of persistent minor breaches;
- How the government should deal with changes to the contract terms; and
- The approach to managing contract expiry.

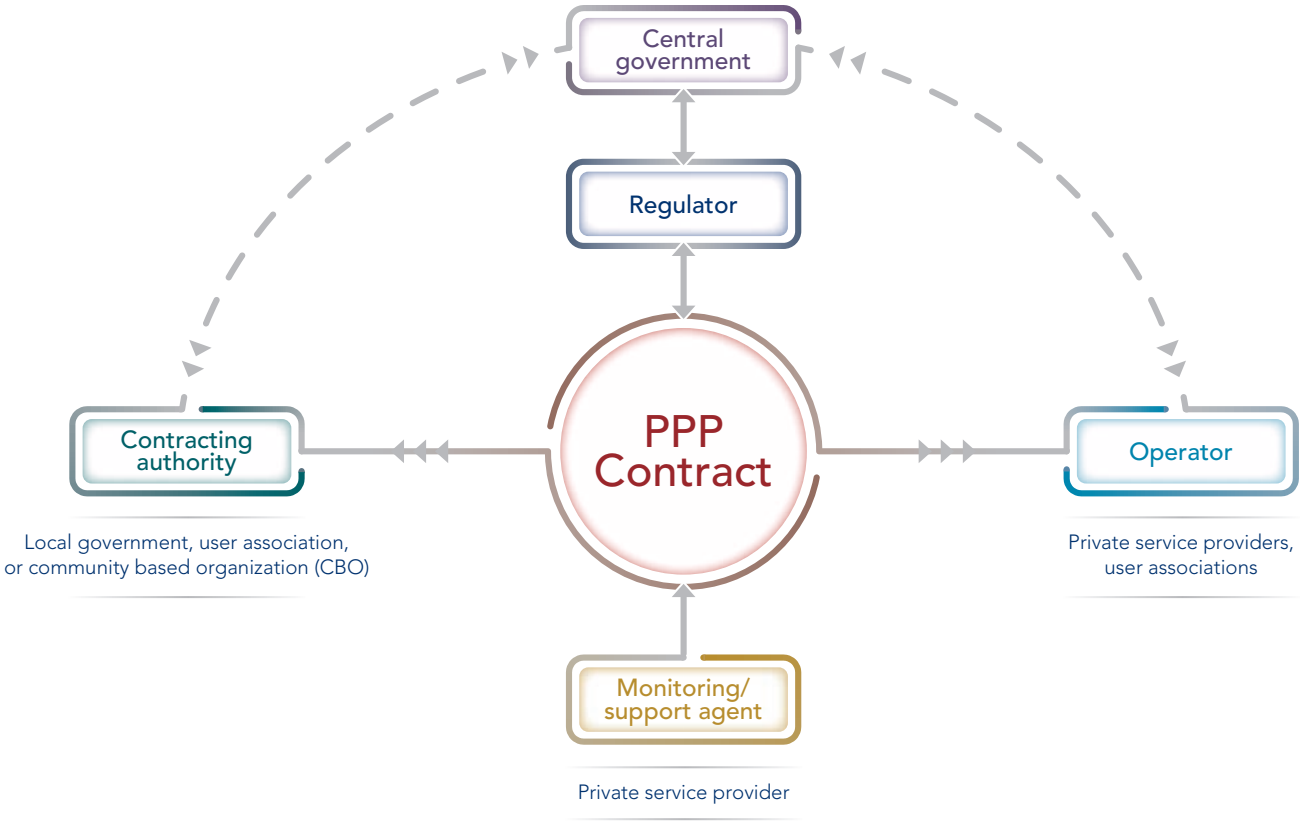
FIGURE 4.1: Roadmap—Implementation Stage



4.2. Establishing the PPP contract management structures

The contract management structure is based on the roles and responsibilities that each of the PPP framework stakeholders is assigned. An example of a potential relationship among the stakeholders is depicted in a Figure 4.2 below:

FIGURE 4.2: Monitoring Structure within a PPP Framework



Common Functions and Roles:

- Contracting Authority
- Operator
- Regulator
- Monitoring and support services
- Local Governments
- Private Service provider
- Government services
- Private service provider; local government; WUAs; non-profit organizations

Source: Water and Sanitation Program (2010) [45]

45 Water and Sanitation Program. 2010. "A Review of Progress in Seven African Countries: Public-Private Partnerships for Small Piped Water Schemes." Retrieved from http://www.wsp.org/sites/wsp.org/files/publications/PPPs_for_small_piped_water_schemes_English.pdf

The government needs to set out clearly the roles and responsibilities of the different institutions that will be involved in managing the PPP contract. This should include at least:

- **Ministry of Finance.** The financial fiduciary role will be with the Ministry of Finance (MoF), which should be consulted at project preparation, structuring and implementation phases. In PPP contracts, the MoF undertakes the fiscal risk assessment and oversees public money support for capital grants, loans, and availability payments etc. to the scheme over the life of the contract.

- **Ministry of Water.** Since the MoW is entrusted with provision and management of water and water-related services, setting water policies, and tariffs, the Ministry of Water (MoW) must be involved. Its primary role in contract management is that of a policy maker and setting strategic priorities for development. The MoW supports the implementation of policy proposed under the road map of a PPP project, and approves procurement of works.[46]

- **Regulatory agency and relevant policymaking institutions in the sector**. This regulatory agency should be independent and free to act and take decision without influence. Generally, these agencies are public institutions (as in the example of Brazil, where the regulatory agency, ANA, advises the government of Brazil regarding when to make capacity payments to the irrigation schemes, and is also responsible for the water grant). An agency in this capacity fulfils enforcement of regulation and policies, monitoring to ensure to contract compliance, advisory and arbitrary functions. It may also be involved in helping to manage or assess the validity of proposed changes to the tariffs set by the private company providing the service.

- **Contracting authority.** This could be subnational or a local government or a public entity such as a Local Water Board, and would be in charge of the procurement—effectively the public counterpart to the private company in the PPP contract. It will be in charge of the daily management of the contract. This entity could be an owner of the land and/or fixed assets or has been delegated to exploit the assets owned by the government.

- **Project steering committee.** The project steering committee represents a committee of members from various relevant governmental agencies (Ministry of Water, Environment, Finance, Agriculture, local jurisdictions, and possibly a PPP unit), chaired by the granting authority. The committee's primary responsibility is to ensure inter-governmental coordination.

- **PPP contract manager.** This role is performed by a specific individual or an entity, and is appointed and assigned as the main point of contact within the government on all matters relating to the PPP project. For instance, the Accra Plains project will be implemented by Project Implementation Unit (PIU) under the responsibility of the Ministry of Food and Agriculture in Ghana. The government needs to ensure that the manager has sufficient technical skills, resources, relevant contacts, and credibility to manage the contract and fulfil his responsibilities. The PPP contract manager will draw on technical support related to the PPP from a centralized PPP unit (if the contract has one).

46 ADB. 2014. "Project Administration Manual. Bangladesh: Irrigation Management Improvement Project."

- **Public development bank.** This entity will be involved in contract monitoring from the perspective of its fiduciary role as the lender to the project company or the concessionaire.

4.3. Monitoring the PPP contract

The effective monitoring and evaluation of the contract is a key task to help ensure that the PPP arrangement delivers value for money for the service users. Throughout the life of the contract, the PPP contract manager needs to ensure that the service standards specified in the contract are monitored and that any performance-based bonuses or penalties are applied in a transparent and consistent manner.

The detailed monitoring of performance standards is a task that can be typically delegated to a regulator or government department that has sufficient sector expertise. To monitor the contract's performance standards the authorities will need access to data from the private party—the PPP contract should include requirements for the private party to provide the necessary data in a regular format. The government can also choose to make use of independent experts to carry out checks on the service standards provided and may also consult the service users to get feedback on the performance of the private company. For instance, in Ethiopia's Megech-Seraba, two independent entities have been set up: a Consultative Committee and an Independent Expert (Box 4.1).

BOX 4.1: Establishing Independent Monitoring & Management Entities in Megech-Seraba

Consultative Committee. This joint committee comprises representatives from both the Ministry of Water & Energy (MoWE) and the private sector participant (PSP) contractor to monitor and facilitate continuous consultation on the implementation of the contract. The objective will be to optimize contract implementation and the provision of services to customers. Key issues on which MoWE and the PSP contractor will consult at the level of the committee will include planning, implementation or changes to Irrigation Service Fee (ISF), regulation or statutory issues, social issues, including customer service, and issues requiring arbitration.

Independent Expert. The MoWE has appointed an Independent Expert to advise them on issues related to the contract. The Independent Expert will carry out audits and reviews on project progress, including technical and financial aspects. The PSP contractor will support the Independent Expert in obtaining the necessary data and providing information as required.

The PPP contract manager will also need to ensure that any government responsibilities that have been specified in the contract are being fulfilled effectively. A tool that government can use to do this is a risk management plan.

A risk management plan lists the main risks and associated responsibilities that are either wholly or partly the responsibility of government together with the main risks that might undermine the sustainability of the PPP contract. For each of the risks included in the plan, the information or data required to monitor the risk should be specified, together with the responsibilities for gathering the information or data and assessing it. Again, these information or data requirements should be specified in the contract. Ultimately the PPP contract manager is responsible for monitoring the different risk indicators and assessing the extent to which action needs to be taken to address any emerging risks.

Contract management structures and monitoring procedures have been well defined at the outset for the Muhuri irrigation project in Bangladesh. Box 4.2 provides further details on how these responsibilities have been allocated across the relevant government institutions.

BOX 4.2: Roles and Responsibilities set out in the Muhuri Irrigation Scheme

The Muhuri Irrigation project will involve the rehabilitation of the current irrigated sections of the Muhuri scheme, estimated at 11,800 ha, and the phased increase of the irrigated area to 17,000 ha. To ensure that the scheme is developed into an efficient and sustainable system, the project will undertake a range of activities—from repairing the flood embankments and existing flow control structures to excavating 460 km of channels to increase drainage and water access, upgrading or replacing pumps, replacing open tertiary/field canals with buried pipes and providing prepaid card meters and control systems. Under the scheme, the Irrigation Management Operator (IMO) will be responsible for the design, construction supervision of the modernization works, provision of agriculture extension services, operation and maintenance of the pump systems, canals and other infrastructure, and for collecting the irrigation service charge.

The contract management structure under the PPP contract has been established as follows:

- **Bangladesh Water Development Board (BWDB).** The BWDB is the contracting authority and executing agency for the project, and will be responsible for monitoring the IMO, for making payments to contractors based on the progress certificates and at certain contract-defined stages, and for agreeing on the water charge with the Implementation Coordination Committee (ICC). The BWDB will also be expected to make its skilled staff available to provide services to the IMO when required, though the IMO will be required to pay for these services. While the BWDB will retain its O&M responsibilities in the role of main regulator, the IMO will take over responsibility of canals, drains, and minor structures.

BOX 4.2: Roles and Responsibilities set out in the Muhuri Irrigation Scheme

- **Project Management Unit (PMU).** The role of the PMU will include procuring the IMO services for the scheme, and for administering the contract of the IMO and supporting the transition between the first and second IMO terms. The PMU will also procure the contractors who will undertake the engineering rehabilitation and modernization works, in addition to monitoring the overall implementation plan and progress, for which they will assign a project director. They will be responsible for monitoring the safeguard progress, financial and management reporting, and for ensuring that any land acquisition and resettlement procedures conform to Bangladesh law and requirements of the project's development partner, the Asian Development Bank (ADB).
- **Government of Bangladesh.** The government will own all of the assets and finance (though Asian Development Bank (ADB) all modernization works and costs of the IMO.

4.4. Penalties and government's ability to intervene for persistent minor breaches[47]

Given the long-term nature of irrigation PPP contracts, it is necessary to allow for situations where persistent breaches by the sponsor occur but that by themselves do not justify termination of the contract. The introduction of a *persistent minor clause* within the PPP contract allows for a specific mechanism for remedy by the "grantor," or government partner. It allows for deductions or financial penalties, but in the event these are insufficient consideration should be given to the use of warning notices with pre-defined resolutions procedures with the ultimate sanction to a right to early termination.[48] Clearly, such arrangement needs to go hand-in-hand with specific penalties if the service standards are not met.

It is accepted good practice to specify penalties for all breaches of the contract, with the penalty proportionate to the harm done by the breach.[49] Care must be taken to ensure that the inclusion of such penalties is allowable. For example, in common law countries it may not be possible to including penalties within the PPP contract itself. Penalties may have to be introduced as for example liquidated damages, or including penalties in specific regulations. Research also shows that it is advisable to cap the level of penalties the developer (private sector partner) would be liable for as a result of any specific incident or over any given period and to allow for

47 Throughout the rest of this chapter focusing on the contractual side of PPP contracts, the term "grantor" is used to denote the government (or granting) partner and "developer" to denote the private-sector partner, since the latter is usually charged with development of a scheme. This is for the sake of conformity with contractual terminology generally found in PPP contracts.

48 This is not a remedy normally used in this sector. However, there are positive experiences of this in other infrastructure sectors, e.g., public transport services in the UK and the UK's Private Finance Initiative procedures (HM Treasury, 2008).

49 A good example is the provisions of the Port Vila, Vanuatu concession contract. This involves a monetary penalty for the developer for any instance where it fails to fulfil its obligations. The monetary penalty for any failure is then found by taking the prevailing volumetric tariff multiplied by the appropriate multiplier. For a particular failure for example interrupted supply or insufficient water pressure, a specific number of cubic meters is pre-specified as a multiplier. As service standards will be clearly defined in the contract, it was envisioned that this approach will enable penalties to be easily determined when such standards are breached.

a procedure for expedited resolution in the event of disagreement about the application of a penalty.[50] The cap should be set at a level which is high enough to provide the developer with a strong incentive to perform, but low enough to protect the developer from financial distress caused by penalties (Operators Roundtable, World Bank 2004). Additionally, and in the interest of equitable treatment of parties to the PPP contract - sanctions also need to be provided against contracting authority non-performance.[51] The form of such penalties may be a direct penalties or set-off rights as discussed below.

4.5. Performance Bonds and Set-off rights

Research suggests that the use of performance bonds is a widely used technique for PPP schemes in infrastructure development projects.[52] The reason is due to the "limited recourse" nature of project finance. The water and wastewater sector is no exception. Many contracts have included performance bonds posted by the developer.

A performance bond is an amount of money lodged with a neutral third party, such as a bank or financial institution, which the grantor may claim in the event the developer breaches pre-specified obligations detailed in the PPP contract. The bond ensures the developer faces a penalty for non-performance, and that a sanction can be imposed. Without a performance bond, the public authority might need to sue the developer for non-performance, which can be costly and time-consuming, and even if the court finds in the public authority's favor, it might be difficult to actually make the developer pay.

It is good practice to include performance bonds in contracts. However, problems have arisen where the conditions under which the bond may be called have not been well defined, thus creating risk. A related problem has been "first-demand" bonds—those which are callable without the public authority having to show that the developer has defaulted. The idea of "first-demand" bonds is to protect the public authority by avoiding delays and litigation when the public authority believes the developer has defaulted. However, they have in some cases unbalanced relationships by putting in the public authority's hand a substantial sanction which it can exercise at will. Emerging options to improve practice include:

- Avoiding "first demand" bonds, and instead including a provision that the bond may be called when the independent monitoring unit certifies that relevant breach has occurred
- Making lodging of performance bonds reciprocal. In many cases the developer is required to post a bond to protect the government from risky behavior, but not vice versa. Where the developer is required to lodge a bond to ensure it meets its obligations, the government should also lodge a bond for its obligations.

50 Where there is a dispute as to whether or not a service standard has been breached, the penalty would not be applied until a final legal determination on the matter had been reached. Although a provision like this may be advisable, care must be exercised to avoid nullifying the effect of the penalty provision. What is meant by this is that the provisions of the PPP contract must not allow the developer to shield itself and unduly delay the application of a given penalty until there is a legal determination on the matter. That is why it is recommended that the PPP contract includes procedure(s) that allows for an expeditious resolution on this. If the parties cannot agree then the other dispute resolution procedures contained within the PPP contract would apply.

51 Arguably a provision like this may have helped in the case of Guayaquil, where the Regulator ECAPAG had too much discretion. This is a personal opinion based on my assessment of the situation when I was employed as a mediator for a dispute between the Interagua and ECAPAG between 2004 and 2005.

52 Performance bonds have been used extensively in the water and wastewater sector. For example, of the contracts analyzed for this research Guayaquil, Manila, Sofia, Estonia, Trinidad and Tobago, Port Vila, amongst others, had performance bonds linked to their respective PPP contracts.

- Using set-off rights which would allow the developer to unilaterally adjust cash payments, service obligations and any investment roll-out if the grantor breaches the PPP contract in ways which increase the developer's cost or reduce its revenue. Similarly, the government should be able to withhold payment of any fees payable to the developer to set-off any money owed by the developer. If either party is unhappy with such an adjustment, the process of dispute resolution (outlined below) should be followed.

4.6. Enforcement of customer payments

A developer cannot be financially viable if it cannot collect payment for customers. This means it needs a way to sanction non-payers. Disconnection or disruption of service is the most effective tool. It is accepted practice that developers should have available all the normal sanctions against customers who do not pay, including the ability to disconnect after a specified period. Developers may be required to report on the number of disconnections, but should not be required to report in advance of disconnection, or to seek approval to disconnect. However, this needs to be balanced with mechanisms to protect consumers. These may include, for example, a requirement that in cases where a farmer disputes the bill, he has the right to take the issue to an independent body, and service must not be disconnected until the dispute has been settled, or that the developer is obliged to offer reasonable terms for settlement of payment arrears. Another possible suggestion is that the grantor set up a fund with the discretion to pay bills on behalf of families in genuine hardship, and which can work with them to provide budgeting and other assistance. Such a fund and agency would recognize the role of the government in social assistance, allowing the developer to focus on commercial performance.

4.7. Dealing with changes to the PPP contract

A PPP contract for an irrigation development can last 25-30 years, during which there are likely to be material changes in the operating environment for the PPP company that were not (and could not have been) predicted when the contract was originally signed.

It is possible that if and when these changes occur the private company and the contracting authority will get into a dispute about how the changes should be interpreted and managed. In some circumstances this can lead to a renegotiation of the contract or even an early termination.

A well-designed PPP contract will have flexibility built into it to enable the government and private firm to manage a degree of uncertainty. This will include provisions that facilitate a regular review of the tariffs that the private firm can set and of the O&M costs that it faces to make sure that things remain broadly in line with market conditions. For instance, the Megech-Seraba scheme[53] will involve a tariff transition period to take into account the expected increased capacity and willingness of farmers to pay the irrigation service charge over time. Depending on the type of adjustments these can be broadly classified as periodic, extraordinary and emergency adjustments (HM Treasury, 2007).

53 See discussion in item 1.9 of Part B of Chapter One.

- **Periodic Adjustments**[54] are applied at regular intervals to bring tariffs back in line with costs. These essentially correct for errors in the indexation mechanism. The main objective of these adjustments is to allow a reasonable rate of return for an efficient developer.

- **Extraordinary Adjustments,**[55] which alter tariffs in response to specific, unexpected but manageable changes in cost resulting for example from changes in laws; new environmental standards; or demand movements over a specific level. The main objective of these adjustments is to restore the financial position that the developer would have been in had the event not occurred.

- **Emergency Adjustments**[56] are designed to keep the contract working in the face of unexpected changes. These changes are considered so significant that they would otherwise bankrupt, have a major negative financial effect on the developer or lead to a renegotiation of the terms of the PPP contract. The main objective of this adjustment is to ensure continuity of the service and enable the developer to return to normality after a reasonable period of time.

Irrigation projects, as with many PPP projects, rely on the availability of cash flows. These cash flows derive fundamentally from the tariffs that the developer is allowed to charge for the services it provides. As discussed in Chapter Two, the rules by which tariffs are set and by which variations are allowed are fundamental to the sustainability of the PPP contract. Depending on the type of PPP contract, opening tariffs will be specified either in the initial bids or in the contract, and indexation provides a mechanism for keeping opening tariffs in line with costs and allowing the developer to pass on cost increases to customers through its tariffs. Essentially, any tariff adjustment mechanism will have to allow for (a) cost pass-throughs and (b) tariff indexation.

- **Cost pass-throughs** effectively allow for changes in the costs of certain inputs that are immediately passed on through the tariff to the customers. Cost pass-throughs are typically allowed for major cost items over which the developer will have no control. These include, for example, changes in taxation regime, price of bulk water arrangements etc. In the case of cost pass-throughs, one must be careful not to allow for costs for which a normal and diligent developer should be responsible. For example, if a grantor is considering allowing for the cost of electricity to be a cost pass-through, it must do so in a way that does not relieve the developer from seeking reductions in its operating costs that it could adequately manage through reduced pumping or using low electricity tariffs at night.

- **Tariff indexation** formulas also seek to protect the developer from costs which are beyond its control, and these formulas seek to anticipate certain changes in the cost of providing a service. Some of the contracts that have been evaluated in this research suggest that there are two main problems with this provision: (a) problems with approval of adjustments, and (b) problems with using indexation to offset the effects

54 Manila is a good example where tariffs are adjusted at five-yearly intervals to allow a rate of return for an efficient developer.

55 Bucharest: tariffs can be adjusted for events such as changes in laws. The amount of the adjustment is the required tariff change to offset the change in cash flow resulting from the event.

56 UK Shipwreck clause (as contained in the England and Wales Water Licenses): tariffs can be adjusted if an event occurs that results in a change in cash flows by more than 20 percent of turnover, which could not have been avoided with prudent developer action.

of foreign exchange devaluation. The indexation formula needs to be flexible enough to protect against certain items such as general inflation, changes in prices of particular inputs (e.g., electricity and chemicals increase by more than the average rate of inflation), prices of inputs such as fuel, personnel, imported goods and import taxes.

If changes to conditions occur that are catered for within the contract, it is the responsibility of the private firm and government to adhere to the terms and conditions as required. In the event that the nature of the change is so significant that it is not catered for in the contract, the PPP parties will need to work together to manage the situation in the spirit of the contract.

4.8. Contract expiry and handover of assets

At the end of the PPP contract, any assets that have been temporarily transferred to the control of the private firm should be passed back to the government. The PPP contract should include the provisions to guide this process.

The PPP contract should include specific information on the assets that will be returned to the government and the required quality. In addition it should specify exactly how the quality of the assets will be defined and assessed. As many of the PPPs for irrigation that have developed are relatively new, there is less experience of how this process works in practice, though the UK Ministry of Finance has provided some guidance on this issue.[57] There are two distinct types of contract approach which deal with how assets are handled upon expiry of the service period (HM Treasury, 2007):

- Contracts where it represents value for money for the grantor to take over the assets on expiry. These also include assets which have no other feasible alternative use and is only of value to the public sector entity.
- Contracts where the residual value of the Assets is best transferred to the Developer. Such assets have alternative uses and are not required in the long term by the public sector. Residual value refers to the market value of the assets associated with the contract at the time of contract expiration. This is classified as a risk because the residual value of the assets is unknown at the time of signing the contract. Estimations of the value of assets will be made and this will be incorporated into the financing structure of the contract.

The key allocation questions to be considered are:

- Which party retains the assets on termination?
- Do these assets have alternative uses?
- How does this affect the termination payment (if any) payable by the grantor?

57 HM Treasury. 2009. Operational taskforce note 4: contract expiry guidance.

The UK government's PFI Unit recommends that the contracting authorities long term objectives will be best served by requiring either automatic transfer or reversion of the assets to itself on the expiration of the contract or at the very least, an option to purchase the assets at nominal cost. This is the case where legal constraints prevent any practical alternative option or when assets have a useful economic life if retained by the grantor and conversion of the assets for other uses may be costly. The grantor may also require the asset in order continue providing service. The grantor should protect itself by not reducing the options it has available at or just before the termination of a contract. These options include:

- Taking possession of any assets at no cost;
- Retendering the service provision with the outgoing Developer making any assets available to the grantor at no cost; and
- Removing any assets.

Where the grantor retains the assets at no cost, considerations should be made as to the Developer's obligations to deliver the assets in a serviceable condition. This does not apply if the assets have reached the end of their useful economic life. Importantly, the grantor should use operational requirements as their modus operandi rather than attempting to generate residual value interest.

4.9. Preserving the conditions of the assets on expiry

In the past, terminal payments related to the value of the assets at the end of the contract, were used as an incentive mechanism for the Developer to maintain high standards of service throughout the contract period. However, this system is flawed in that it confuses payments for services and payments for asset transfer, as the assets may be well maintained but the quality of service low.

4.10. checklist

for the implementation & management process

1 Establish a clear PPP contract management structure and process

- a. Identify the responsibilities of various institutions involved in contract management and monitoring
- b. Assign a contract manager
- c. Determine the mode of public support to the private sector during the construction and operation phases
- d. Establish and communicate a contract management plan including risk management and contingency plans

2 Identify contract monitoring mechanisms

- a. Assign a contract monitoring team
- b. Determine a contract monitoring and reporting structure
- c. Determine a performance bond for the private sector to ensure it is in compliance with its obligations
- d. Identify the set-off rights

3 Include mechanisms in the contract that will enable the parties to deal with changes/adjustments

- a. Periodic
- b. Extraordinary
- c. Emergency
- d. Tariff adjustment mechanism allowing for cost-pass through and tariff indexation

4 Identify contract monitoring mechanisms

- a. Allow the private sector to enforce the sanctions

5 Establish a dispute resolution process

Continued next page.

4.10. checklist (cont.)

for the implementation & management process

6. Establish a clear PPP contract management structure and process ☐
   a. Include the provisions to guide the handover process in the PPP contract ☐
7. Determine the process of asset inspection and conduct verification by an independent expert ☐
8. Determine the termination compensation paid upon the handback ☐
9. Government need to have a plan for asset management and service provision upon the expiry of the contract and/or re-signing of a PPP contract ☐
10. Conduct a post implementation review to assess achievement of the expected outcomes, VfM and/or the need for mid-course corrections ☐

CONCLUSION

CONCLUSION

This handbook has been developed to provide governments, public authorities and other interested stakeholders with a practical guide on how to design and tender sustainable public-private partnership (PPP) arrangements in the irrigation sector.

To assist in this purpose, we have organized the handbook's chapter numbers to correspond with the four practical steps that executives should take in establishing a PPP in irrigation: Preparation, Structuring, Management of Procurement, and Implementation. In addition there is an Executive Summary, Introduction and this Conclusion, which are note numbered, in order to avoid confusion with the practical chapters. The chapters provide (i) a high-level review (in two parts, A and B) of the issues that policy makers should consider to establish the viability of introducing a private-sector partner into a specific irrigation project; (ii) a functional guide to the structuring of the PPP; (iii) step-by-step direction of procurement of a PPP partner, and (iv) how to implement the scheme itself to ensure that the PPP will be sustainable and viable for the life of the scheme.

The section checklists provided at the end of each section of the report detail the key issues presented in the analysis. Thus in this conclusion section we focus on the main overarching issues that constrain the development of irrigation PPPs emerging from the process of completing the report, particularly drawing on the case studies.

BOX 5.1: Key principles behind PPPs in irrigation

- Sustainability: developing a scheme that ensures a minimum level of funds to enable the replacement of assets at the expiry of the scheme's life (AMP).
- Affordability: establishing a level of tariff that is affordable to the farmers
- Fiscal responsibility: related to previous as what is affordable to the public sector in terms of both financial and regulatory support it provides to the scheme.
- Creditworthiness: maximizing the strength of system's internally generated revenues (primarily through water user charges or tariff income), and using such revenues to raise private funds
- Efficient use of public funds: an upfront recognition that a major public contribution will be required to support the capital investment requirements in the form of either a capital grant and or, as appropriate an "availability payment."
- Contractual Framework: a strengthened contractual arrangement that allows for a level of risk transfer to the private sector to manage cash generation and contain capital expenditure costs.

5.1. Securing private sector involvement

Ultimately a private firm will only be willing and able to take on the responsibilities defined in the PPP contract if they judge that they have a good prospect of recovering any costs incurred in providing the services and achieving a reasonable rate of return commensurate with the main risks that surround the implementation of the scheme. There are a multitude of important factors that will determine this but main amongst them is the extent to which the private firm believes that it will be able to charge and collect adequate service charges (from either farmers or government) over the full duration of the proposed contract. The analysis of the case studies shows that this is an issue that is crucial to the successful implementation of a PPP arrangement.

In many emerging economies contexts setting cost reflective charges for water is a difficult and politicized issue, as farmers often view access to water as a free resource. Therefore we have set out some of the different approaches that have been used to enable firms to set and collect adequate water charges.

- **Understanding farmers' willingness to pay**. The Megech-Seraba irrigation scheme in Ethiopia has shown the importance of carrying out detailed analysis of the amount that farmers are willing to pay to receive the irrigation services. Following the completion of a willingness to pay survey it was determined that it would only be viable to introduce private sector involvement if government part subsidized the irrigation service charges. It is expected that overtime as farmers gain the benefits from the irrigation services their willingness to pay will increase and the subsidy required by government will fall. It is thus assumed that the proportion of the tariff paid by farmers will change over time to reflect this.

- **Securing payments upfront**. The Muhuri irrigation project in Bangladesh has taken on the lessons from the Barind system which makes use of a system of pre-pay coupons to reduce the collection risks around irrigation service charges from farmers. Key to this approach is the ability to control adequately the supply of water to farmers, so that they actually get the amount of water for which they have paid up-front. This was done in Guerdane and is planned for West Delta as well.

- **Contract farming arrangements**. An alternative approach that has been used to secure adequate water service charges is the use of contract farming arrangements. An example is the case of the Integrated Tamale Fruit Company (ITFC) irrigation scheme in Ghana. In these arrangements the farmers enter into a contract with the private firm such that the provision of irrigation services is guaranteed dependent on the farmers providing a proportion of their produce in return (the irrigations service provider can either act as the off-taker or have a contractual arrangement with an off-taker). These arrangements typically work best for commercial crops where the commercial off-taker has an ongoing financial incentive to ensure that the farmers receive the irrigation services. In addition it is important to have an enabling environment within which stakeholders have some confidences that contractual provisions can be enforced adequately. The Kaleya irrigation scheme in Zambia provides a good example of this approach.

Box 5.2 below provides an additional example of this approach from India, where it has been difficult to apply water charges to farmers.

BOX 5.2: Contract farming of onions and fresh fruit in Maharashtra

Jain Irrigation System Limited (JISL) has established an onion dehydration and fruit processing plant in Jalgaon, Maharashtra. It is a 100 percent export-oriented unit. JISL has entered into a contract farming arrangement with the farmers within a radius of 200 km of Jalgaon to buy good quality onion bulbs and fresh fruits at an assured price. JISL helps the farmers produce more and better quality produce by providing genetically superior HYV planting materials, an efficient water and fertilizer management system and agronomical guidance. Farmers have to ensure optimal utilization of the available water resources. The involvement of the state government is minimal.

JISL volunteers provide first-hand knowledge of how to grow onions, technical know-how, and other extension services to the farmers, and are a pivotal link between the company and the farmers. Senior scientists of the company also visit the farms and exchange views on the latest developments. JISL has helped the local farmers to bring more than 80 percent of the onion crops under efficient micro-irrigation systems like drip irrigation and sprinklers. Farmers benefit since they receive good quality seeds at reasonable prices. The company gains from buying the fruits and vegetables from the growers and processing them at modern processing facilities to produce high quality dehydrated onion and vegetable products, aseptic fruit purees, pulps and concentrates for export. The company has also put into place a dispute resolution mechanism which has been working well so far. The JISL experiment, which combines for-profit contract farming with focused assistance to improve water use efficiency, has proved beneficial and could potentially be replicated in other parts of India as well.

5.2. Need for public support will continue

The key decision for the government is how much it can afford and how to use the same funds more efficiently. Often government has three options: a) continue services as has been, which means usually provision by a public company, b) procure a private company to invest and deliver services or c) use a combination which enables the government and farmers to share the risk and costs with the private contractor. Perhaps the best option is for government to retain the governance function and using its resources to incentivize the right party to improve the economic benefits to the farmers.

5.3. Third party involvement

Most cases have shown to include a third party between the government and farmers. Not only these parties have taken over some of the risks but also have augmented the burden to increase productivity of the produce. For instance in Megech-Seraba, plan is to set up WUAs who would eventually take over the OMM functions increasing reliability and productivity of the small-holders farms. In ITFC, the commercial company acted as the agriculture off taker and a service provider at the same time.

5.4. Securing finance for irrigation infrastructure

One of the main theoretical objectives behind attempts to implement PPPs is to bring in private investment to provide an alternative source of finance for irrigation schemes. The analysis that we have presented suggests that in practice, most of the PPPs that have developed have had limited success in securing private finance. This is because many of the projects are not seen as providing bankable investment opportunities for the private sector, in part due to risks associated with primary agriculture but also, in the case of greenfield projects or major rehabilitations because of project development risk, which, in the agriculture sector typically involves issues around land and water allocation as well as accommodating community needs. There are different approaches that projects have sought to implement to reduce the risks associated with the irrigation projects and thus increase the potential for private sector investment.

- **Use of innovative financial instruments.** Capital investments in irrigation schemes typically necessitate high up-front costs while facing uncertain revenue streams given the nature of the demand risks highlighted in this handbook. As a result irrigation schemes often face difficulty in attracting commercial finance because the available financial instruments, particularly in emerging economies, are not best placed to support investments with the characteristics required by irrigation schemes. The development of more innovative financial instruments could help to support more investment in irrigation infrastructure. One approach is the use of patient capital (patient capital is long-term, subordinated capital invested at sub-commercial costs) could help to provide additional sources of finance for the irrigations sector. This is an area where development partners, particularly the IFIs, could play a lead role in supporting the implementation of PPP irrigation projects by considering which financial instruments can be used to facilitate private investment.

- **Alternative sources of funds for irrigation projects.** Given the issues around the ability to set water charges at the required level (discussed above), PPPs in the sector often involve other revenue streams to ensure that the scheme is financially self-sustaining. For instance, in the Pontal irrigation scheme the plan is that the irrigation service provider will be able to charge the private agribusiness firm for use of the land at the site. While at the Muhuri irrigation scheme in Bangladesh they are investigating the potential to lease the assets of the scheme (including the land and water) to aid cost recovery.

- **Need for Collateral or a guarantee.** While the private sector can provide the necessary expertise and often times the certainty of off take, the irrigation scheme by itself offers little opportunity for the lenders to lend long term moneys to the private company. The risks are too high to offer a reasonable promise of repayment based on future cash-flow. Collateral put up by the parent company or a government guarantee is often required even in other infrastructure sectors.

5.5. Concluding remarks

Irrigation is much the same as any other public service, especially when a business opportunity exists. As this report has highlighted, there is a growing demand for the PPP as a vehicle to provide irrigation services to farmers in emerging economies. Given that many of the PPP arrangements are still quite new or in an evolving phase, policymakers are still trying to come to terms with the impacts, both positive and negative, that the projects might have in their varied forms. The World Bank 2007 report suggests that PPPs have the potential for real improvement in the efficiency with which irrigation services are provided to farmers.

This report has sought to explain the key considerations policymakers and other stakeholders need to make to ensure that the irrigation PPP project they are contemplating really does deliver on its stated potential for efficiency while at the same time providing value for money in terms of public expenditure, farmers' income, and private investment.

As a practical handbook, the report serves all PPP stakeholders. It describes the type of simple upfront screening analysis that policymakers can and should do to determine whether a PPP in fact is viable: will it deliver cost-effective, efficient service while also giving private contractors acceptable returns on their investment? Will it overcome the affordability constraints faced by governments? Will the farmers' reliance on the sale of their agricultural produce cover the service fees related to the irrigation scheme?

There is no one-size-fits-all solution, but there are enough similarities in the way PPP irrigation schemes are structured that a road map such as this provides practical value. Fundamentally, governments need to ensure that they have a sound set of regulatory and legal policies in place, carry out robust pre-feasibility and feasibility assessments, seek to achieve prudent risk allocations, and more generally put in place a robust project implementation process, supported by sufficient capacity, to secure effective irrigation PPP projects.

Government has a constant role to play in maintaining social benefits, not only in irrigation but across the entire agricultural value chain, and related sectors. In doing so, it can more effectively progress to achieving social equity and prosperity for its people and even the region as whole. Self-sustaining, viable, and effective irrigation projects are among the key building blocks of a vibrant agriculture sector. But these must be cemented with sound enabling regulations to ensure sustainable use of natural resources and hold all stakeholders accountable to the highest standards of performance and, ultimately, the public good.

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FINANCIAL MODEL

PPP OPTIONS ASSESSMENT TOOL IN IRRIGATION USER MANUAL

ANNEX 1

CLEDAN MANDRI-PERROTT AND JYOTI BISBEY

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LIST OF abbreviations

ANNEX 1

A/c	Account
Ave	Average
B/f	Balance brought forward (=Beginning balance)
Bps	Basis points
CapEx	Capital expenditure
C/f	Balance carried forward (=Closing balance)
CF	Cash flow
CFADS	Cash flow available for debt service
COD	Commercial Operation Date
Con	Construction (period)
CPI	Consumer price index
DSCR	Debt service cover ratio
DSRA/c	Debt service reserve account
EBT	Earnings before tax
EBIT	Earnings before interest and tax
EBITDA	Earnings before interest, tax, depreciation and amortization
FM	Financial model
Gvmt	Government
ha(s)	Hectare(s)
IAS	International Accounting Standards
IDC	Interest during construction
IRR	Internal rate of return
I&D	Irrigation & drainage
LLCR	Loan life cover ratio
Max	Maximum
Min	Minimum
MM	Major maintenance
MMRA/c	Major maintenance reserve account
Mth(s)	Month(s)
N/A	Not applicable / Not available
NBV	Net book value

NPAT	Net profit after tax
NPV	Net present value
SPV	Special purpose vehicle
OpEx	Operating expenditure
Ops	Operations (period)
O&M	Operations & Management
QoS	Quality of service
p.a.	Per annum
p.	Period
PLCR	Project life cover ratio
PPP	Public-private partnership
p.p.	Per period
USD	United States Dollar
VAT	Value added tax
VBA	Visual Basic for Applications
VGF	Viability gap funding
WACC	Weighted average cost of capital
WAL	Weighted average loan life
WUC	Water usage charges
Yr	Year
Yr(s)	Year(s)

FORMATTING STYLES USED IN THE PPP Options Assessment Tool

In line with best practice, this tool makes extensive use of internal formatting conventions to guide users, distinguish input cells, and avoid erroneous entries. Only light blue shaded cells are input cells where you can enter assumptions. Black cells represent technical inputs and constants, which a priori should not be changed by the average user. Standard cells are using black fonts, except for calculations referring to other worksheets, which are colored green ("off-sheet" references). Outputs generated by the excel data table are using brown font on grey fill. Below is a full list of all formatting styles used in the present tool:

Assumptions

100	*Assumptions*	**Data input**
100	*Technical input & constants*	A priori not to be changed

Output

100	*Normal / Grid / InSheet*	Hardcoded
100	*Offsheet reference (= formula refers to other sheet)*	Hardcoded
100	*Insheet / table*	
100	Data table limits with data table output	Hardcoded, data table
100	*Cell used by macro for pasting*	Macro output
100	Result or integrity alert	Hardcoded
Ok	*Check: OK*	Hardcoded
Fail	*Check: Integrity fail*	*Hardcoded*
Fail	*Check: Result fail*	*Hardcoded*
100.00	*Line summary*	Hardcoded
	Empty cell (or: Needs to be zero)	Hardcoded

Flags

1	*Alert flag, integer*	Hardcoded
1	*Control flag, integer*	Hardcoded

Number styles

US D	*Unit*	Hardcoded
1,000	*Standard number*	Hardcoded
1.00	*Comma number*	Hardcoded
1.00 x	*Ratio*	Hardcoded
10.00 Yr(s)	*Years*	Hardcoded
100 Bps	*Basis points*	Hardcoded
10 Day(s)	*Days*	Hardcoded
10 Mth(s)	*Months*	Hardcoded
100.00%	*Percentage*	Hardcoded
24 Dec 10	*Date*	Hardcoded
Yr 1	*Year*	Hardcoded
Sem 1	*Semester*	Hardcoded
Qtr 1	*Quarter*	Hardcoded
Mth 1	*Month*	Hardcoded

Formatting of Headers / Dividers

Table Heading	*Table Heading*
Heading Chapter	Heading Chapter
Header 0	*Header0*
Header 1	*Header1*
Header 2	*Header2*
Header 3	*Header3*
Hyperlink	*Link*

introduction

Purpose of the PPP Options Assessment Tool

One of the challenges in structuring public private partnerships ("PPP") is balancing the converging interests of the various stakeholders, i.e. the public sector, end consumers, and the private investor (or "sponsor") along with commercial lenders. The purpose of the current tool is to illustrate various structuring options for the irrigation sector, and to examine the resulting impact on stakeholders. While building the tool[1] per se is already a challenging task, simulating how to balance interests between the stakeholders of a PPP equates to a "multiple optimization" problem, which – depending on the desired level of sophistication and processing speed – may require advanced modelling techniques, for instance optimization macros written in VBA[2] or Python[3].

We have designed the present tool in accordance with best practices applied in the project finance industry. However, the present spreadsheet is not meant to fill the role of a full-scale, bankable options assessment tool used for transaction structuring. We simplified some aspects, for example, avoiding any of the advanced features required for multiple optimization – such as custom goal seek functions. Besides reducing overall complexity, this approach helps illustrating the raw impact of changes in key assumptions. At the same time, the tool offers sufficient flexibility and data granularity to allow modelling a wider range of potential structuring scenarios.

The results obtained from options assessment tool often tend to give users a false sense of certainty with regard to the outcome of a transaction. However, no tool can comprehensively simulate all possible interdependencies between the large numbers of variables usually involved. Rather than attempting to simulate one future scenario with full accuracy, the philosophy behind options tool is to assess the upper and lower boundaries for the viability of a transaction following changes in key assumptions.

Recommended prior knowledge

Before using the tool, it is recommended that you possess at least a basic knowledge of the following areas:

- Use of excel and spreadsheet-based financial modelling;
- Financial accounting;
- Cash flow-oriented / non-recourse lending or project finance[4];
- Capital budgeting techniques;
- Various forms of private sector participation in public assets.

1 en.wikipedia.org/wiki/Financial_modeling

2 en.wikipedia.org/wiki/Visual_Basic_for_Applications

3 en.wikipedia.org/wiki/Python_%28programming_language%29

4 en.wikipedia.org/wiki/Project_finance

Providing a complete introduction about each of these topics is beyond the scope for the present user manual. In addition, make sure the tool uses reasonable assumptions for the agricultural calculations, most importantly crop yields, agricultural off-take and associated operating costs. For best results, we recommend consulting with experts in the agricultural field.

Some handling instructions

The present version of the tool works best if used with Microsoft Excel[5], starting with version 2010. It has not yet been thoroughly tested with alternative spreadsheet programs, such as the open source solutions LibreOffice[6] provided by the Document Foundation, Apache OpenOffice[7], or other popular alternatives to Microsoft Excel. While most features of the tool are expected to work properly in alternative spreadsheet programs, certain formula functions or cell formats may not be compatible, which could affect usability and results.

Only light blue shaded cells are input cells where you can enter assumptions. The "Input" sheet centralizes all the assumptions used throughout the tool. Inputs are structured by area, and can be collapsed / expanded as needed for better oversight. Be careful not to enter hardcoded values in non-input cells, as this can break the entire tool or falsify results. For a full explanation of the color code employed, refer to the cell formatting legend in the present manual.

The tool employs Excel's *data table* technology for scenario analysis. The data table is located at the bottom of the "Input" sheet, and the corresponding output area uses a distinctive cell format (brown fonts on grey-shaded cells). For best results, make sure that Excel's settings allow automatic calculation of data tables [Excel 2013 Menu: *Excel Options > Formulas > Calculation Options > Workbook calculation > Automatic*], or alternatively press keyboard "F9" at regular intervals to update data table results. Also note that, if various Excel workbooks are opened in parallel on your device, the calculation settings of the workbook first opened will usually override those of workbooks opened afterwards.

Certain calculations required for project financing are prone to circular logic, most importantly capitalized costs during construction. The tool's design and calculation methods are optimized around the idea of avoiding circular logic. Switch off the option "Enable iterative calculation" [Excel 2013 Menu: *Excel Options > Formulas > Calculation Options > Workbook calculation*], so that Excel can detect any accidentally introduced circular logic while handling and modifying the tool.

5 office.microsoft.com/en-us/excel

6 www.libreoffice.org

7 www.openoffice.org

1. Basic model structure

1.1. Structure by sheet names

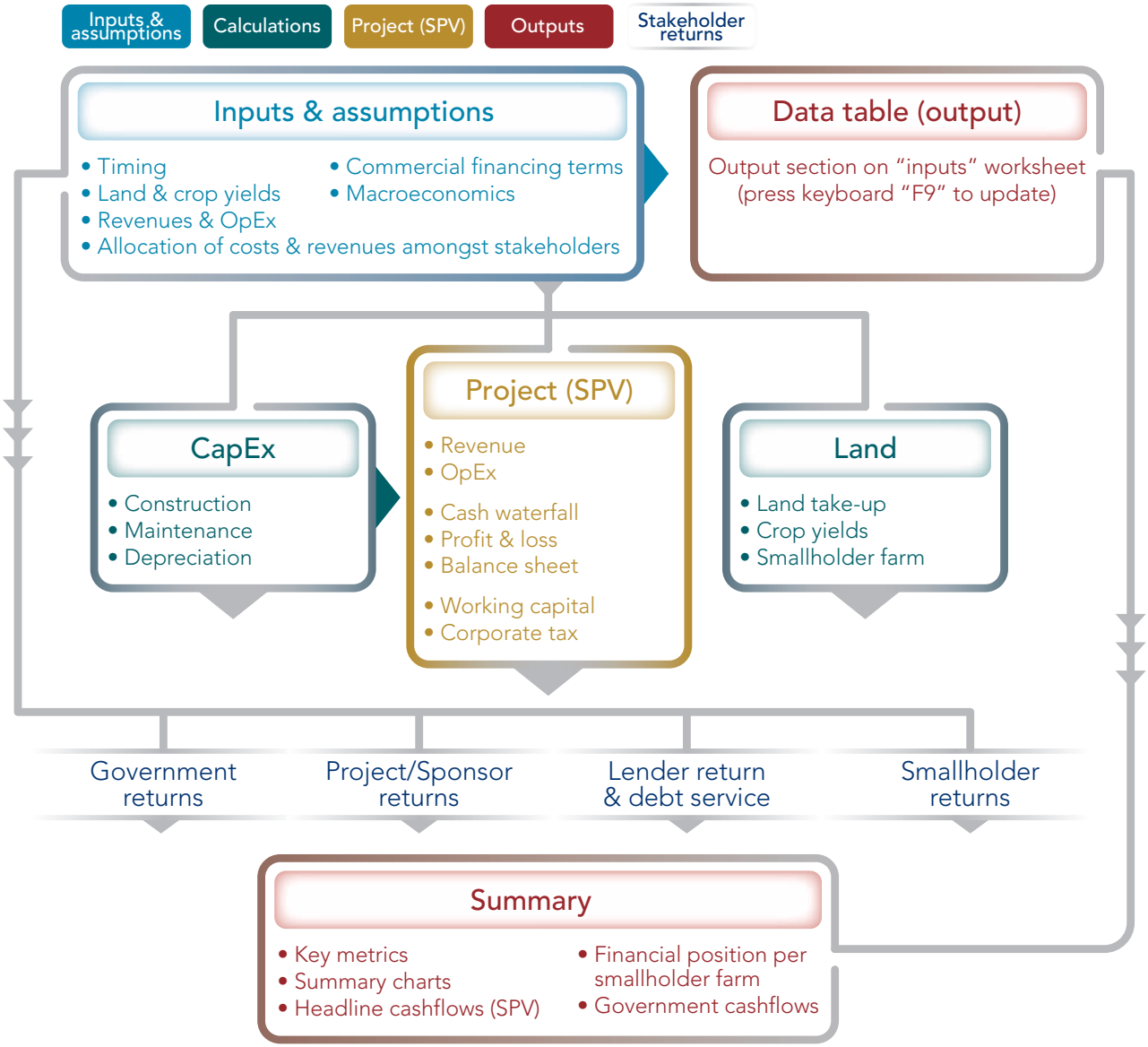
The tool is structured into the following sheets:

TABLE A1.1: Basic structure of financial model

Sheet name	Description	Key output
Cover	• Legal disclaimer • Formatting legend • Abbreviations • Technical inputs and constants	• N/A
Summary	• Print summary output for the currently active scenario	• Print or screen summary
Inputs	• Inputs and assumptions for the entire tool (only light blue-shaded cells), structured into vertical scenario paths	• Data table output
CapEx	• Capital expenditure (CapEx) and funding on an annual basis (for simplicity), both during initial construction and maintenance • Depreciation • Net book value (NBV) of assets	• [Calculations]
Land	• Calculation of land take-up, crop-yields and average smallholder farm sizes	• [Calculations]
SPV	• Transaction flows from the perspective of the Special Purpose Vehicle (SPV) or project company	• Cash waterfall • Profit & loss (P&L) • Balance sheet
Government	• Transaction flows from the perspective of the public sector / government	• Government internal rate of return (IRR) • Government net present value (NPV)
Smallholder	• Transaction flows from the perspective of independent smallholders or farmers	• Impact of Water Usage Charges (WUC) • Net cash flow per smallholder farmer
Sponsor	• Transaction flows from the perspective of the equity investor (or sponsor) in the SPV or project company	• Project / equity internal rate of return (IRR) • Project / equity net present value (NPV)
Lender	• Transaction flows from the perspective of the senior debt lenders in the SPV or project company	• Cash flow available for debt service (CFADS) • Debt service cover ratio (DSCR)
Time	• Principal flags and counters to control the time line across the tool	• [Calculations]

1.2. Abstracted Model Flow Chart

FIGURE A1.1: Abstracted flow chart of the financial model.



2. Scenario management

The tool offers a flexible and efficient way to perform scenario analysis. You can configure up to 10 distinctive scenarios. Each scenario comes with its own vertical scenario path on the "Input" sheet, where you enter all respective assumptions. By clicking on any of the drop-down lists in the top left corner of each worksheet, you can access and select each of the scenarios previously entered in the scenario manager. Changes between scenarios are reflected immediately across the entire workbook and the print summary without any further user intervention required.

3. Transaction structuring options

The present tool is a simplified project finance model8, along with some specific features for simulating the most common structuring options in the irrigation sector (referred to as "structuring options" in the present manual). Among the structuring options that have been taken into account are (in order of increasing private sector participation):

- Status quo
- Fully public financing
- Management / service contract
- Lease / affermage (not pre-configured)
- PPP concession
- Fully private financing

For all of the structuring options above (except for "Lease / affermage"), you find preconfigured scenarios on the "Input" sheet using the "default" values listed in the assumption section below. The tool is currently optimized for simulating "greenfield" projects9. You can configure a parallel "status quo" scenario for benchmarking. However, due to the greenfield approach, no pre-completion revenues for funding or OpEx (the later which could be either expensed or capitalized) are taken into account during the construction phase, which may distort some of the results when comparing to a status quo scenario without construction period. The standard currency of funding and applied throughout the tool is USD.

For simplicity, the present version of the tool does not model any Quality-of-Service (QoS) indicators, albeit typical and required for most PPPs, such as reward / penalty mechanisms applied to revenues based on the concessionaire's performance.

4. Inputs and assumptions

The idea of the present tool and its manual is to provide initial guidance to users on how to configure each of the structuring options listed above. To this purpose, we list a range of possible "default" values for each structuring option in the tables below. Whenever applicable, we also provide an "idle" setting, which allows switching a model feature off. Besides reconsidering the default values, we strongly recommend that you discuss and reconfirm any technical values for the agricultural side (i.a. crop yields, agricultural off-take and associated operating costs) with experts in the field and in function of each particular project, as the values used in the present tool are for illustrative purpose only.

8 en.wikipedia.org/wiki/Project_finance_model

9 en.wikipedia.org/wiki/Greenfield_project

4.1 Timing

Model projections start at the first day of month following the month entered as "Model start" date. Accordingly, for a clean, annual calendar timeline, enter any date in December before the first construction year. The tool allows projecting a total project duration of up to 30 years, including the construction phase. Maximum duration of the construction phase is 7 years (84 months), in which case the resulting maximum operations phase is 23 years. You should modify and configure the timeline with care, as the inputs are critical for the mechanics applied throughout the entire model.

Concessions frequently have contract terms between 20-30 years and more, whereas management contracts, lease or affermage arrangements tend to be shorter in duration, typically 3-10 years. Shorter terms often result in additional costs for the grantor because of the necessary renegotiations when contracts expire. Such renegotiation costs, however, are not part of this calculation. For the purpose of comparability, the present tool assumes the same contract terms (and construction periods) for all PPP options considered, including management contract and PPP concession.

TABLE A1.2: Suggested project durations for various structuring scenarios.

Tool control	Status quo	Public financing	Management / service contract	PPP concession	Fully private financing
Duration of operations (or concession), all-in	25 yrs.	25 yrs.	25 yrs. (typically 5–10 yrs.)	25 yrs.	25 yrs.
Duration of construction period (if any)	36 Months (no impact on CapEx)	36 Months	36 Months (no impact on CapEx)	36 Months	36 Months

4.2 Land & crop yields

Enter the total amount of irrigated land surface for each year in hectares, which includes land cultivated by both smallholders and commercial farms (if any). The total land area is multiplied by crop yield percentages, which may ramp up for up to 10 years depending on crop type, soil, irrigation and other factors. Crop yield ramp-up percentages apply only to new land added on year-on-year basis, as mature land will eventually reach the maximum crop yield of 100%.

4.3 Revenues & Operating expenditures (OPEX)

4.3.1 Land & agricultural offtake by farming scheme

Split irrigated land and the corresponding agricultural offtake between smallholder farms, i.e. land independent from any project SPV / PPP concession, and land for commercial (or "PPP") farms. For the purpose of the

present tool, commercial (or "PPP") farms are considered integral part of the project SPV: All CapEx, agricultural offtake and OpEx related to irrigated land categorized as commercial (or "PPP") is factored into the SPV's assets, revenues, and costs. Accordingly, for modelling an "irrigation-only PPP" – that is, without any agricultural offtake factored into the concession revenue – you should assign all irrigated land to smallholders. Irrigated land multiplied by average crop yield produces the total agricultural offtake available to either smallholders, or commercial farms, respectively. Agricultural offtake and OpEx is then allocated to commercial (/PPP) farming and smallholders in proportion to allotted land.

TABLE A1.3: Suggested allocation of irrigated land between commercial (/PPP) farming and small holder farming in various structuring scenarios.

Tool control	Status quo	Public financing	Management / service contract	PPP concession	Fully private financing
Land and agricultural offtake by farming scheme:	Typically 0% commercial farming (= 0% agricultural offtake for the SPV)	0% commercial farming (= 0% agricultural offtake for the SPV)	0% commercial farming for irrigation-only contracts; up to 100% for contracts involving agricultural offtake	0% commercial farming for irrigation-only PPPs; up to 100% for PPPs involving agricultural offtake	0% commercial farming for irrigation-only PPPs; up to 100% for PPPs involving agricultural offtake

4.3.2 Commercial (/PPP) farming scheme

Enter agricultural offtake per hectare for commercial (/PPP) farms. Values here depend heavily on the underlying agricultural factors. Typically, you should expect agricultural offtake for commercial or PPP-based farming to be higher than that of smallholder farms.

Irrigation operating expenditure ("Irrigation OpEx") of commercial (/PPP) farms depends on the individual characteristics of each transaction, and may or may not include items such as pumping energy costs, staff costs, regular maintenance and inspection, among others. With the goal to make the tool as flexible as possible, OpEx calculations are abstracted. Choose between the following calculation methods:

- Fixed costs, as percentage of initial CapEx, per annum
- Fixed costs, per hectare, per annum

Other operating expenditure ("Other OpEx") of commercial (/PPP) farms refers to all other costs typically associated with agriculture, and depends on the individual land and crop characteristics of each transaction, and may or may not include items such as fertilizers, staff costs, and regular maintenance of machinery, among others. Like above, OpEx calculations are abstracted. Choose between the following calculation methods:

- Variable costs, as percentage of the agricultural offtake from commercial (/PPP) farming
- Fixed costs, per hectare, per annum

OpEx is allocated to commercial farming in proportion to land allotted. Cost efficiencies tend to be higher in commercial (/PPP) farming compared to smallholder farms.

We recommend that you consult with technical experts for reasonable offtake and OpEx estimates related to commercial (/PPP) farms for your region and crops of interest.

TABLE A1.4: Suggested assumptions for commercial (/PPP) farming in various structuring scenarios.

Tool control	Status quo	Public financing	Management / service contract	PPP concession	Fully private financing
Agricultural offtake	Typically expected lower	Typically expected lower	Typically expected higher	Typically expected higher	Typically expected lower
Irrigation OpEx	*Please consult with technical experts*				
Other OpEx	*Please consult with technical experts*				

4.3.3 Smallholder farming scheme

For estimating the financial impact per smallholder farm, you can assume an average smallholder size in hectares, along with a potential growth of the average smallholder's farm size over the course of the project. Enter agricultural offtake per hectare for smallholder farms. Values here depend heavily on the underlying agricultural factors. Typically, you should expect agricultural offtake for smallholder farming to be lower than that of commercial or PPP-based farming.

Irrigation operating expenditure ("Irrigation OpEx") of smallholders depends on the individual characteristics of each transaction, and may or may not include items such as pumping energy or staff costs, among others. With the goal to make the tool as flexible as possible, OpEx calculations are abstracted. Choose between the following calculation methods:

- Fixed costs, as percentage of initial CapEx, per annum
- Fixed costs, per hectare, per annum

Other operating expenditure ("Other OpEx") of smallholders refers to all other costs typically associated with agriculture, and depends on the individual land and crop characteristics of each transaction, and may or may not include items such as fertilizers or staff costs, among others. Like above, OpEx calculations are abstracted. Choose between the following calculation methods:

- Variable costs, as percentage of smallholders' agricultural offtake
- Fixed costs, per hectare, per annum

OpEx is allocated to smallholders in proportion to land allotted. Cost efficiencies tend to be lower in smallholder farms compared to commercial (/PPP) farming.

We recommend that you consult with technical experts for reasonable offtake and OpEx estimates related to smallholder farms for your region and crops of interest.

TABLE A1.5: Suggested assumptions for smallholder farming in various structuring scenarios.

Tool control	Status quo	Public financing	Management / service contract	PPP concession	Fully private financing
Agricultural offtake	Typically expected lower	Typically expected lower	Typically expected higher	Typically expected higher	Typically expected lower
Irrigation OpEx	*Please consult with technical experts*				
Other OpEx	*Please consult with technical experts*				

4.4 Capital expenditure (CapEx)

4.4.1 Construction CapEx

Initial construction CapEx refers to depreciable CapEx during the construction phase as projected by the technical consultants. Users enter values by construction year and before inflation. The tool applies inflation to further calculations automatically, in accordance with the inflation forecast added further below. The share of initial construction CapEx financed by the private sector is added to the balance sheet of the SPV, while construction CapEx financed by the public sector does not affect the SPV's balance sheet. This approach avoids overstating the SPV's tax shield caused by depreciation.

Because the current version of the tool is optimized for greenfield projects, no pre-completion revenues for funding or OpEx (the later which could be either expensed or capitalized) are taken into account during the construction phase.

4.4.2 Initial cash & success fees

In order to ease cash flow shortfalls of the SPV during ramp-up of operations, a starting cash balance may be included at the end of the construction phase as part of initial CapEx. This cash balance will only apply in those structuring scenarios where an SPV is required for construction. Also, for PPP concessions, the government may organize a competitive tender among potential equity sponsors, in which case the winning bidder would typically pay a success fee to the transaction advisors. The bid success fee is then considered an amortizable investment cost from the SPV's point of view, and as such part of initial CapEx.

TABLE A1.6: Suggested cash and success fee configuration for various structuring scenarios.

Tool control	Status quo: Default values	Public financing: Default values	Management / service contract: Default values	PPP concession: Default values	Fully private financing: Default values	Idle position
Initial cash balance	0	0	0	Depends on ramp-up CF	Depends on ramp-up CF	0
Success fee paid by winning bidder	0	0	0	Depends on PPP tender process	Depends on PPP tender process	0

4.4.3 Major maintenance CapEx

Major maintenance (or expansion) CapEx refers to depreciable CapEx during the operational phase as projected by technical consultants. Enter values by operational year and before inflation. The tool applies inflation automatically, in accordance with the inflation forecast added further below. The share of major maintenance CapEx financed by the private sector is added to the balance sheet of the SPV, while major maintenance CapEx financed by the public sector does not show up on the SPV's balance sheet. This approach avoids overstating the SPV's tax shield caused by depreciation.

4.4.4 Major maintenance reserve account (MMRA/c)

Major maintenance CapEx may be financed from cash flow only, or through a combination of operational cash flow and the MMRA/c, and with or without additional government financing. In most project financings, where major maintenance CapEx is significant relative to operational cash flow, lenders would typically require the SPV / project company to set up an MMRA/c, to make sure sufficient cash is put aside to match the SPV's ongoing CapEx. The MMRA/c is usually funded up to certain target balance, which in the current tool may be set at 12, 24 or 36 months of projected major maintenance CapEx (less major maintenance CapEx eventually financed by the government, if any). It may even involve a fixed minimum balance, which users can define separately. In order to ease cash flow during ramp-up of operations, the MMRA/c may also be pre-funded on the last day of construction, and then built up from cash flow according to minimum and target balances.

In terms of seniority in the cash waterfall, cash flow available to fund MMRA/c is usually ranked after operational cash flow, but takes precedence over debt service payment. The modelling approach of the MMRA/c as suggested by the tool avoids the occurrence of any circular references in its calculation. Also, for reasons of simplicity, the current tool ignores any potential interest income on reserve account balances.

TABLE A1.7: Suggested MMRA/c configuration for various structuring scenarios.

Tool control	Status quo: Default values	Public financing: Default values	Management / service contract: Default values	PPP concession: Default values	Fully private financing: Default values	Idle position
Accumulate MMRA/c?	"No"	"No"	"No"	"Yes" (for large MM CapEx)	"Yes" (for large MM CapEx)	"No"
Initial funding of MMRA/c (at construction end)	0	0	0	Depends on CapEx and CF	Depends on CapEx and CF	0
Minimum balance during operations	0	0	0	Depends on CapEx and CF	Depends on CapEx and CF	0
MMRA/c target (forward-looking MM)	N/A	N/A	N/A	12-24 months	12-24 months	N/A

4.4.5 Depreciation

For simplicity, the tool applies a standard, straight-line depreciation across all asset classes. While a default value of 20 years is assumed for the purpose of the tool, fixed irrigation assets typically have depreciation periods of several decades. Depreciation only plays a role for the structuring options involving private sector financing, reducing the net book value (NBV) of commercially financed assets, and providing a corresponding tax deduction on the profit & loss (P&L) statement.

4.5 Allocation of costs & revenues amongst stakeholders

4.5.1 Funding of initial CapEx

In order to avoid the circular logic10 which typically affects a project financing due to the capitalization of construction costs, senior debt funding needs to be entered both as percentage ratio of total funding, and as maximum amount made available for drawdown. For the purpose of the present tool, drawdown is on a "pro-rata" basis only (i.e. the same percentage in each year of construction), as opposed to other common drawdown mechanics like "equity-first" or "milestone-driven". The table below shows typical funding ratios for each of the structuring options under consideration.

Once you entered the senior debt financing ratio in percentage, it must be matched by its corresponding

10 A classic example for this type of circular logic is that of interest on a deposit or a loan account, where the interest is calculated on the average balance and the interest accumulates within the account, which is what typically happens during the construction period in project financings due to interest during construction (IDC) and fees. In a bankable financial model, such optimisation is typically achieved through macros.

funding amount in numbers, taking into account the impact of interest during construction (IDC), commitment fees, and inflation on initial CapEx (same as capitalized CapEx). Ideally, the maximum amount of senior debt does not exceed the required amount by more than 10%, as any outstanding loan balances not effectively drawn will result in unnecessarily high commitment fees for the borrowing SPV. For commercial financings, any funding shortfall is made up by additional sponsor equity, up to the amounts required to match capitalized CapEx. Finding the adequate senior debt funding amount may require a couple of attempts.

TABLE A1.8: Suggested configuration of initial CapEx for various structuring scenarios.

Tool control	Status quo: Default values	Public financing: Default values	Management / service contract: Default values	PPP concession: Default values	Fully private financing: Default values	Idle position
Equity	0%	0%	0%	20%	30%	0%
Government (grant) financing [1]	100%	100%	100%	40%	0%	0%
Senior debt	0%	0%	0%	40%	70%	0%

For simplicity, the present tool models the construction period on an annual basis only. Project finance best practice, however, consists in modelling construction phases on a quarterly basis at least. Lower periodicities allow calculating interest during construction (IDC), commitment fees and other costs with more accuracy. Accordingly, you should be aware that the present tool might misrepresent the true costs of capitalized construction, as compared to a full-scale, bankable project finance model.

4.5.2 Funding of major maintenance CapEx

Major maintenance CapEx (or expansion CapEx) may be financed internally either from the SPV's cash flow (which equates to equity financing), from additional external government funds, or a combination of the two. Internally financed major maintenance can also draw from the MMRA/c, if applied. The share of major maintenance CapEx financed by the private sector is added to the balance sheet of the SPV, while major maintenance CapEx financed by the public sector does not affect the SPV's balance sheet.

TABLE A1.9: Suggested configuration of major maintenance CapEx for various structuring scenarios.

Tool control	Status quo: Default values	Public financing: Default values	Management / service contract: Default values	PPP concession: Default values	Fully private financing: Default values	Idle position
Internal funding from CF ratio % (=equity)	0%	0%	0%	100%	100%	0%
Government funding ratio (%)	100%	100%	100%	0%	0%	0%

4.5.3 Allocation of irrigation OpEx and Water Usage Charges (WUC)

The allocation of irrigation OpEx and Water Usage Charges (WUC) will depend on the chosen structuring option and economic model. In the present tool, you can flexibly allocate to various stakeholders the following financial flows:

- Irrigation OpEx related to commercial (/PPP) farming assets: Charged to either the private operator / concessionaire / sponsor, or the public sector. OpEx is calculated in proportion with any land allocated to the commercial (/PPP) side of the transaction.
- Irrigation OpEx related to smallholder farming: Charged to either the public sector, the private operator / concessionaire / sponsor, or to individual smallholders / farmers (in case of a scheme fully run by smallholders themselves). OpEx is calculated in proportion with any land allocated to the smallholder side of the transaction.
- Water Usage Charges (WUC): Received by either the public sector, or the private operator / concessionaire / sponsor.

The table below summarizes the recommended configuration for the standard structuring options considered in the present manual.

Table A1.10: Suggested allocation of irrigation OpEx and Water Usage Charges (WUC) for various structuring scenarios.

Tool control	Status quo: Default values	Public financing: Default values	Management / service contract: Default values	PPP concession: Default values	Fully private financing: Default values	Idle position
Irrigation OpEx of commercial (/PPP) farming assets	Paid by private sector	Paid by private sector	Paid by private sector	Paid by private sector	Paid by private sector	N/A
Irrigation OpEx of smallholder farming assets	Paid by public sector	Paid by public sector	Paid by private sector	Paid by private sector	Paid by private sector	N/A
Water Usage Charges (WUC)	Received by public sector	Received by public sector	Received by private sector	Received by private sector	Received by private sector	N/A

Water Usage Charges are paid by smallholding farmers, either to the Government (in a purely publicly financed structure), or to the private operator (in a PPP or privately financed approach).

Users enter Water Usage Charges (WUC) as starting value per hectare per annum, which is then increased (or decreased) according to an annual percentage growth path. The "starting value + growth path" approach allows users to perform a manual goal seek for cost-reflective – or "minimum return" – water usage charges, if required. The ideal amount of water usage charges will depend on factors as diverse as smallholders' willingness to pay and affordability, the ratio of public grant financing, the level of CapEx and OpEx, the level availability payments by the public authorities, revenues from agricultural offtake, and the return expectations of sponsors.

For simplicity, the present tool does not include any sophisticated functions or macros for multiple optimization, which is why you need to perform manual goal seeks if certain target outputs need to be achieved. For some basic guidance on how to do this, refer to the dedicated section below.

4.5.4 Private remuneration options

The two main types of remuneration options of the private sector considered in the present tool are:

- Availability payments11: Paid by the public sector to the private operator / concessionaire / sponsor, typically based on defined quality-of-service or performance indicators. Enter a first year starting value, which you can then increase or decrease by an annual percentage factor. You can also control the duration of availability payments, however, if debt financing is involved, the duration is always equal to debt tenor at the minimum. The approach facilitates goal seek operations on the optimum amount of availability payments.
- Management / service fees: Paid by the public sector to the private operator / concessionaire / sponsor, ideally based on defined quality-of-service or performance indicators. Can be entered either as fixed (and indexed) payment stream, or as a fee per hectare.

Given their potentially complex nature and dependence on technical quality-of-service parameters, the tool does not contain any performance penalty / reward mechanisms at present. The table below summarizes the recommended configuration for each of the structuring options. Inputs will depend strongly on the transaction, and typically become subject of more or less intense negotiations between the public and the private sector.

TABLE A1.11: Suggested configuration of private remuneration options for various structuring scenarios.

Tool control	Status quo: Default values	Public financing: Default values	Management / service contract: Default values	PPP concession: Default values	Fully private financing: Default values	Idle position
Availability payments	Not applied	Not applied	Not applied	**May be applied**	Not applied	Not applied
Management / service fees	Not applied	Not applied	**Applied**	Not applied	Not applied	Not applied

11 Availability payments are a specific type of remuneration under a PPP contract and often used in a situation where the private sector would not accept the commercial risk of the transaction, either because the (regulated) tariff is too low to cover costs, or payment risk and/or demand risk from end users is significant. Instead of availability payments, governments also pay operational subsidies to the concessionaire. Operational subsidies typically come on top of the private sector remuneration to fund the gap between what the concessionaire is allowed to charge to end users (most often by regulation) and operating costs. Governments also provide guarantees, which are used only in last recourse in cases where demand is lower than expected, or where end users fail to pay. Often, operating subsidies and guarantees are temporary and removed after the achievement of certain milestones, for example following a successful ramp-up of revenues in the first years of a PPP. In contrast, availability payments represent a constant, contractual payment stream over the concession term. Accordingly, in the case of an irrigation PPP, it would usually be reasonable to assume that - where the concessionaire receives an availability payment – Water Usage Charges (WUC) should be received by the public sector rather than the private sector. However, for reasons of simplicity, the present version of the tool does not offer a separate mechanism for government operational subsidies or guarantees, which is why the PPP options available should be applied and combined more flexibly, if needed.

4.5.5 Public remuneration options

The tool summarizes the remuneration options of the private sector as concession / lease / affermage fees, paid by the private operator / concessionaire / sponsor to the public sector. They can be entered either as fixed (and indexed) payment stream, as a fee per hectare, or as a percentage of agricultural offtake.

TABLE A1.12: Suggested configuration of public remuneration options for various structuring scenarios.

Tool control	Status quo: Default values	Public financing: Default values	Management / service contract: Default values	PPP concession: Default values	Fully private financing: Default values	Idle position
Concession / lease / affermage fees	Not applied	Not applied	Not applied	**May be applied**	**May be applied**	Not applied

4.6 Commercial financing terms

4.6.1 Senior debt

Senior debt controls are similar to what can be found in other corporate financial models. The assumptions only apply when debt financing is involved at the level of the SPV, which is typically the case for a PPP, or a fully privatized operation. You need to configure the following parameters:

- Tenor (all-in): The overall debt tenor in years, including drawdown period during construction, grace period on principal and effective repayment period. The value should not exceed the project duration.
- Principal grace period (@ operational start): For commercial debt, we recommended that grace period on principal should not exceed 1-2 years following the commercial operation date ("COD").
- Repayment style: Choose between standard annuity repayment, and a repayment profile based on a target debt service cover ratio ("DSCR").
- Repayment target DSCR: The annual debt service cover ratio ("DSCR") applied in the target DSCR repayment method. You may need to perform trial-and-error on both target DSCR and debt tenor in order to find the adequate input. DSCR should not be lower than approx. 1,40x, strongly depending on the transaction's risk profile. Target DSCR repayment may be interesting in cases where the SPV's revenue ramp-up is too slow to allow a full annuity repayment during the first years of operation.
- Senior debt - Interest margin during construction (IDC): Interest p.a. applied to the senior debt outstanding balance during the construction period.
- Senior debt - Interest margin during operations: Interest p.a. applied to the senior debt outstanding balance during the operational period.

- Commitment fee on unused loan balances: Interest paid on senior debt loan balances made available by the lender, but not (yet) drawn down by the borrower.
- Upfront fee: A one-time fee charged by lenders to the SPV at the beginning of drawdown period.

Most of the above senior debt parameters are usually the subject of intense negotiations between the private operator / concessionaire / sponsor and their lenders, and values may vary considerably depending on countries, industry sectors, and market cycles. In addition, keep in mind that a bankable tool would calculate IDC and commitment fees during the construction phase on a monthly or quarterly basis, and that the annual calculation used in the present tool may understate or misrepresent true capitalization costs.

TABLE A1.13: Suggested configuration of debt financing for various structuring scenarios.

Tool control	Status quo: Default values	Public financing: Default values	Management / service contract: Default values	PPP concession: Default values	Fully private financing: Default values	Idle position
Tenor (all-in)	N/A	N/A	May not apply	**8-15 Yr(s), depending on project time line and risk profile**	**8-15 Yr(s), depending on project time line and risk profile**	N/A
Principal grace period (@ operational start)	N/A	N/A	May not apply	**1-3 Yr(s)**	**1-3 Yr(s)**	0 Yr(s)
Repayment style	N/A	N/A	May not apply	**Annuity**	**Annuity**	N/A
Repayment target DSCR	N/A	N/A	May not apply	**1,40x**	**1,40x**	N/A
Senior debt: Interest margin during construction (IDC)	N/A	N/A	May not apply	**Depends on loan market and transaction risk profile**	**Depends on loan market and transaction risk profile**	0%
Senior debt: Interest margin during operations	N/A	N/A	May not apply	**Depends on loan market and transaction risk profile**	**Depends on loan market and transaction risk profile**	0%
Commitment fee on unused loan balances	N/A	N/A	May not apply	**Depends on loan market and transaction risk profile**	**Depends on loan market and transaction risk profile**	0%
Upfront fee	N/A	N/A	May not apply	**1-3 % of senior debt made available**	**1-3 % of senior debt made available**	0%

4.6.2 Equity, dividends & minimum cash

Equity controls only apply when commercial financing is involved at the level of the SPV, which is typically the case for a management contract, lease / affermage operation, PPP, or fully privatized operation. You need to configure the following parameters:

- Dividend payout ratio (% of cashflow available for dividends): The dividend payment ratio determines how much cash is distributed and retained by the SPV / project company. This has an impact not only on the equity return, but also on the cash balances and internal financing capacity of the SPV. You may need to do trial-and-error to find the optimum payout ratio.
- Minimum cash balance: Allows introducing a minimum cash balance to be maintained by the SPV (or project company) during construction, taking into account e.g. the overall transaction volume, sales cycles, ongoing CapEx requirements, payment risk from end-users and other factors.
- Covenant minimum DSCR: If the transaction involves debt financing, users can apply a covenant for minimum debt service cover ratio (DSCR), to make sure no dividends are distributed if debt service cover is not sufficient.
- Disbursement not allowed before operations yr.: For transactions where ramp-up of revenues during the first years of operations in slow, users can simulate a dividend distribution block during the first 1 to 3 years of operations.

TABLE A1.14: Suggested configuration of equity, dividends and minimum cash balance for various structuring scenarios.

Tool control	Status quo: Default values	Public financing: Default values	Management / service contract: Default values	PPP concession: Default values	Fully private financing: Default values	Idle position
Dividend payout ratio (% of cashflow available for dividends)	N/A	N/A	70-100%	70-100%	70-100%	100%
Minimum cash balance	N/A	N/A	May not apply	**Depends on transaction volume**	**Depends on transaction volume**	0
Covenant minimum DSCR	N/A	N/A	May not apply	**Minimum DSCR 1.20x**	**Minimum DSCR 1.20x**	N/A
Disbursement not allowed before operations yr.	N/A	N/A	**0-1 Yr(s)**	**1-3 Yr(s)**	**1-3 Yr(s)**	**0 Yr(s)**

4.6.3 Cost of capital

The tool allows calculating the cost of capital for the project as a weighted average cost of sponsor equity, government grant and senior debt (weighted average cost of capital, or "WACC"). Free cash flow to project can be discounted either at cost of debt or at WACC, while free cash flow to equity is always discounted at cost of equity. You should factor any country-specific risk premiums directly into the cost of equity, government funding and debt, respectively.

4.6.4 Working capital

Working capital is entered in days of cash owned by debtors (same as accounts receivable) and cash owed to creditors (accounts payable), which are then used to calculated a net working capital impact on cash flow. The cash flow impact is considered separately for the SPV / project company, and smallholders. A reasonable working capital estimate for the agricultural sector should take into account the impact of harvest cycles on cost and revenues for both farmers and the project SPV.

TABLE A1.15: Suggested working capital configuration for various structuring scenarios.

Tool control	Status quo	Public financing: Default values	Management / service contract: Default values	PPP concession: Default values	Fully private financing: Default values	Idle position
Project SPV: Debtor days	N/A	N/A	90 days	90 days	90 days	0 days
Project SPV: Creditor days	N/A	N/A	30 days	30 days	30 days	0 days
Smallholding farm: Debtor days	30 days	30 days	30 days	30 days	30 days	0 days
Smallholding farm: Creditor days	90 days	90 days	90 days	90 days	90 days	0 days

4.7 Macroeconomics

4.7.1 Tax

The tool suggests a standard approach to calculate corporate taxes. However, depending on the country where the project is located, actual tax calculations may be very different. Corporate taxes apply to the SPV / project company and the smallholders, whereas withholding tax is charged only on dividends distributed to the private

investor / project sponsor. For the purpose of the present tool, no tax holiday has been assumed, and the tax loss carry forward has no expiration period. For a bankable tax calculation, make sure the tool follows the applicable domestic tax regime.

4.7.2 Inflation & base interest rates

Enter inflation and base interest rates for each project year, based on official forecasts and / or market estimates. For real cash flows instead of nominal cash flows to be used across the entire tool, set all yearly inflation rates to zero. Interest rate stress tests could require changing both the interest base rate, and the senior debt margin, as applicable.

5. Outputs

5.1 Results & integrity alerts

The tool comprises a flexible result and integrity alert system to help you spot and trace errors, and issues related to results. Each worksheet contains result and integrity signaling flags on the top left corner, which display yellow for "result", and pink for "integrity" alerts. Clicking on the flags takes you straight to the bottom of the "Input" sheet, where the "Result" and "Integrity" checks informs you about issues and errors found:

- Result: Triggered by insufficient returns, debt service cover ratios (DSCR), or cash balances, for instance. Most "Result" issues can be managed and resolved by changing assumptions where possible, until achieving the desired results. Some deal configurations, however, may always trigger a "Result" alert. Make sure you understand the results of your simulation.
- Integrity: Triggered by mismatching balance sheets, funding uses and sources, or discrepancies between financial statements across worksheets, for example. Integrity issues normally indicate a more serious problem with the tool, which will need to be fixed by diving deeper into the formulas.

5.2 Data table output

The tool makes use of Excel data table technique for calculating scenario results. Depending on your calculation settings in Excel, you may need to press keyboard "F9" at regular intervals to update data table results. The data table is situated at the bottom of the "Input" sheet (grey-shaded area with brown fonts). It provides a side-by-side comparison between the different scenarios along key output parameters, such as CapEx, return to stakeholders, contractual configuration, government cash flows, as well as integrity checks and result alerts for the entire tool. For technical reasons, the data table needs to be located on the "Input" sheet, within reach of the scenario manager. To learn more about data table techniques, refer to one of numerous free tutorials available on the internet.

5.3 Screen and print summary

The screen and print summary provides users with a complete overview for the currently active scenario, including key results, core financial statements and graphs. You may need to adjust the page breaks for printing in paper formats other than the standard output A4 or US Letter. For changing between scenarios, select from the drop-down list in the top left corner.

5.4 Manual goal seek of target returns (IRR, NPV)

In order to reduce complexity, the tool does not contain any optimization macros, such as VBA scripts for target return iterations. However, you can perform a manual goal seek using Excel's built-in goal-seek function. Below are some basic instructions on how to perform a goal seek for two common optimization targets, based on Excel 2013:

- Water usage charge (WUC) required for achieving target IRR / NPV: Make sure you have the right scenario selected in the Scenario Manager. Go to [Data > What-If Analysis > Goal seek] to open the "Goal seek" dialogue. In the "Set cell" box, select the cells where IRR or NPV results are calculated for either the equity investor ("Sponsor" sheet, cell names "IRR_Project", "NPV_Project", IRR_Equity" or "NPV_Equity", respectively), or the government ("Government" sheet, cell names "IRR_Government" or "NPV_Government"). In the "To value" box, enter the desired target IRR as decimal number, for example 0.15 for 15%, or the desired nominal target NPV amount. In the "By changing cell" box, select the "Water Usage Charge (WUC) per hectare, p.a., 1st yr." cell for the active scenario (!). The corresponding section on the "Input" sheet may need to be expanded first before being able to select cells from the goal seek dialogue. Click "OK". Excel should now iterate for the desired target value, or alternatively interrupt the iteration loop after a number of runs in case there is no solution.

- Availability payment required for achieving target IRR / NPV: Follow the same instructions as above, but in the "By changing cell" box, select "Availability payment, 1st yr. of operations" for the active scenario (!), and run the iteration.

The interdependencies between the various modelling variables can be very complex at times, and not all configurations may actually have an optimum solution. Make sure you understand the results of your simulation, their interdependencies, and the logical limits to multiple optimization.

CASE STUDIES
OF PPP SCHEME CONTRACTS

ANNEX 2

CLEDAN MANDRI-PERROTT AND JYOTI BISBEY

ANNEX 2

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introduction

This Annex provides case studies of 29 irrigation PPPs around the world. Twenty-one of these were described in the World Bank's 2007 report; the remaining eight—relatively recent schemes in Sub-Saharan Africa and South Asia—are drawn from publicly available information and desk research.

It should be noted that some of the schemes are still in the planning or developmental phases. Thus, the structure of the projects covered may change as further project design and development activity takes place. Table A2.1 below groups the 29 cases according to project type, and shows scheme location, agricultural off-take, and current status. Table A2.2 indicates the schemes' Irrigation and Drainage contract functions—financing, design, construction, management of water allocation, maintenance, and system operation—with the highlighted cells indicating which functions are present in each project):

TABLE A2.1: PPP Irrigation Schemes in This Study

	Scheme	Country	Agricultural Off-Take	Current Status	Type of PPP
1.1	Chiansi	Zambia	Mixed	Implementation	Concession
1.2	ITFC	Ghana	Mangoes	Implementation	Concession
1.3	Olmos	Peru	Mixed	Implementation	Concession
1.4	Pontal	Brazil	Mixed	Planning	Concession
1.5	Accra Plains	Ghana	Mixed	Planning	Concession
1.6	CACG/ASA	France	Mixed	Closed	Concession
1.7	ORMVAs	Morocco	Mixed	Closed	Concession
1.8	Dina Farm	Egypt	Mixed	Closed	Concession
1.9	SCP	France	Mixed	Closed	Concession
1.10	CACG/NESTE	France	Mixed	Closed	Concession
1.11	Murray	Australia	Mixed	Implementation	Concession
1.12	Toshka	Egypt	Mixed	Closed	Concession
1.13	Guerdane	Morocco	Citrus	Implementation	Concession
2.1	Megech-Seraba	Ethiopia	Mixed	Implementation	O&M
2.2	SAED	Senegal	Mixed	Closed	OMM
2.3	Alaotra	Madagascar	Rice	Implementation	OMM
2.4	Nakhlet	Mauritania	Rice	No current info available	OMM

	Scheme	Country	Agricultural Off-Take	Current Status	Type of PPP
2.5	Maniçoba	Brazil	Tropical fruits	Closed	OMM
2.6	Toula	Niger	Rice	No current info available	OMM
2.7	Pequin Kavaje	Albania	Mixed	Closed	OMM
2.8	Sonora	Mexico	Mixed	No current info available	OMM
2.9	Tieshan	China	Cash-crops	Closed	OMM
2.10	Adasiyeh	Jordan	Citrus	Closed	OMM
3.1	Muhurui	Bangladesh	Mixed	Planning	Management & Lease
3.2	Eastern Uttar Pradesh	India	Mixed	Closed	Management
3.3	Gap	Turkey	Cotton	Closed	Management
3.4	Senegal Sugar Company	Senegal	Sugarcane	Closed	Private
3.5	Business Farms	Saudi Arabia	Mixed	Closed	Private
3.6	West Nile Delta	Egypt	Mixed	Planning	Design Build Operate

TABLE A2.2: Irrigation and Drainage Functions for the Listed PPP Irrigation Schemes

I&D functions	Concession Contracts													
	Chiansi, Zambia	ITFC, Ghana	Olmos,Peru	Pontal, Brazil	Accra, Ghana	CACG/ASA, France	ORMVAs, Morocco	Dina Farm, Egypt	SCP, France	CACG/NESTE, France	Murray, Australia	Toshka, Egypt	Guerdane, Morocco	Megech, Ethiopia
Financing	■	■	■	■				■	■	■	■	■	■	
Design	■	■	■	■		■		■	■	■	■	■	■	
Construction	■	■	■	■				■	■	■	■	■	■	
Management of water allocation			■				■		■	■	■		■	
Maintenance	■		■	■	■	■	■	■	■	■	■	■	■	■
System Operation	■		■	■	■		■	■	■	■	■	■	■	■
WUA Participation							■			■		■	■	■
IFI Involvement	■	■	■	■	■								■	■

	O&M Contract									Others					
	SAED, Senegal	Alaotra, Madagascar	Nakhlet, Mauritania	Juazeiro, Brazil (Maniçoba)	Toula, Niger	Pequin Kavaje, Albania	Sonora, Mexico	Tieshan, China	Adasiyeh, Jordan	Muhurui, Bangladesh	Eastern Uttar Pradesh, India	Gap, Turkey	Senegal Sugar Company, Senegal	Business Farms in Saudi Arabia	West Nile Delta Egypt
										■	■	■	■	■	■
			■				■	■			■		■	■	■
			■				■	■			■		■	■	■
							■	■	■						
	■	■	■	■	■	■	■	■	■	■			■	■	■
		■	■	■	■	■	■	■	■	■			■	■	■
	■	■	■		■	■	■	■				■			
		■				■		■		■					■

1. Concession Contracts

This section describes 13 irrigation schemes that were procured through concession contract—some new or planned and others already in operation for several years (in some cases, decades). Under concessionary PPP arrangements, the government pays the concessionaire to carry out the development and implementation of the scheme and allows the operator to collect user fees for a number of years before transferring the scheme back to full government ownership. In most cases, ownership of the scheme's assets remains with the government; demand risk is transferred to the concessionaire.

Table A2.3 below summarizes key features of the 13 irrigation schemes. Thereafter, each scheme is examined in greater detail with tabular representation.

Table A2.3: The 13 Concessionary PPP Schemes

Scheme	Size, ha (Irrigated)	Further details
Chiansi, Zambia (Planned)	2,500 (2,500)	• 600 smallholder farmers, some commercial. • Greenfield development. • Innovative financing: use of "patient capital" increases the return on equity to ensure the project's viability.
IFTC, Ghana	202 (202)	• The 15-year (2011-2026) scheme for 500 farmers is an extension to the scheme which began in 2001. • Smallholders have to provide a $25 bag of maize to join the scheme, and repay a set percentage of their sales. • ITFC benefits from securing greater market power in the organic mango export market.
Olmos, Peru	43,500 (43,500)	• Includes a PPP constructing a dam and tunnel to divert water through the Andes to the project site ($247 million). • Irrigation and energy generation are further privately funded sections of the scheme.
Pontal, Brazil (Planned)	33,500 (8,000)	• At least 25 percent of the land is to go to at least 100 smallholders, with the purchase of their produce guaranteed. • Uses a federal PPP guarantee fund to provide collateral to reduce the financial risk to private investors.
Accra Plains, Ghana	11,570 (11,000)	• Part of a wider IDA/USAID project, GCAP. • At an early stage (end of pre-feasibility). • The project is split into two areas, one of which will have a management or lease contract and the other a concession contract, as the pre-feasibility recognises different risk- and cost-sharing requirements.
(CACG)/(ASAs), France	200,000	• Long-term contract with government to implement dams and networks. • Phased out operation subsidies in 1970s.

Scheme	Size, ha (Irrigated)	Further details
ORMVAs,, Morocco	375,000	• Will set up privately managed companies (IDSPs) receiving a public service delegation. • The existing WUAs won't receive management responsibility but will become client committees to represent farmers' contract terms and monitor the service quality.
Dina Farms, Egypt	4,400	• Though an entirely private investment, the government of Egypt, provides a partly free groundwater supply at an estimated average of 20,000 m3/ha/ year
Société du Canal de Provence (SCP), France	80,000	• Long-term contract to implement and manage multifunctional hydraulic infrastructure in south-eastern France. • The $2 billion in assets—dams, canals, tunnels, and networks—allow delivery of water for industrial, urban, and irrigation uses.
CACG/NESTE, France	60,000	• In addition to the standard functions of OMM for canals and dams, the IDSP takes on a new function of water allocation including management of users' files and assessment of demand and resource balance year after year. • The PPP has been successful in the Neste system, with local authorities now trying to apply the same arrangement to other basins.
Murray, Australia	900,000	• In this framework, different water management entities are in charge of water service in the Murray-Darling Basin. • Reform achievements include separation of services; full cost recovery for services and improvements of asset and natural resource management.
Toshka, Egypt	230,000	• In addition to the Mubarak Pumping Station, the project involves the construction of 50 km of main transfer canal and irrigation infrastructure. • The project aims to double the region's arable land, develop and extend agricultural production and create new jobs and population centres away from the confines of the Nile Valley.
Guerdane, Morocco	10,000	• Concessionaire, farmers, and government share the financial risk of water shortage.

1.1. Chiansi, Zambia (Planned)

Project details	Country	Zambia
	Project size (hectares)	2,500
	Cost of project	$30 million
	Number of farmers targeted	600 smallholder farmers and some commercial farmers
	Irrigation technology employed	Pump stations will draw water from the Kafue river, and a series of canals, pipes, and storage facilities will distribute the water to a center pivot and tap and those irrigation systems to irrigate the farmers' plots.
	Crops covered	• Commercial farms will grow wheat, soya and, potentially, upland rice and sugar. • Smallholder farmers will produce maize and possibly vegetables
	Type of PPP	Concession arrangement
	Project developer	InfraCo
	Private sector service provider	Chiansi Infrastructure Services Ltd.
	Public sector institutions	Ministry of Agriculture and Livestock
	Current Status of Project	Implementation. Financial close 2014.
Allocation of Irrigation scheme functions	Investment	Development partners (PIDG) & private sector investment
	Governance	Arrangement regulated by government
	O&M and management	Chiansi Infrastructure Services Ltd
	Agricultural production	Commercial farmers and local smallholders formed into a co-operative

Project structure

The project is a greenfield development that will involve the provision of irrigation services on up to 2,500 ha of undeveloped land.

The project will involve commercial farmers (formed into FarmCo(s)), while smallholders will have access to farming equipment and some technical assistance in addition to the irrigated water.

Roles and responsibilities

Smallholder farmers. Under the arrangements the smallholder farmers have agreed to combine 80 percent of their land (which is currently unused) into landholder co-operatives which will enter into 20-year leases with the FarmCo(s). Each smallholder has the opportunity to earn a return from their equity in the FarmCo(s) over the life of the lease. In addition, the 600 smallholders involved in the scheme will produce crops on 0.2 ha plots of irrigated land, with no payment required for the access to irrigation facilities. Cooperative societies will be formed to help manage the interests of the smallholders, technical assistance will be provided from USAID to help with guidance on the establishment of these cooperatives.

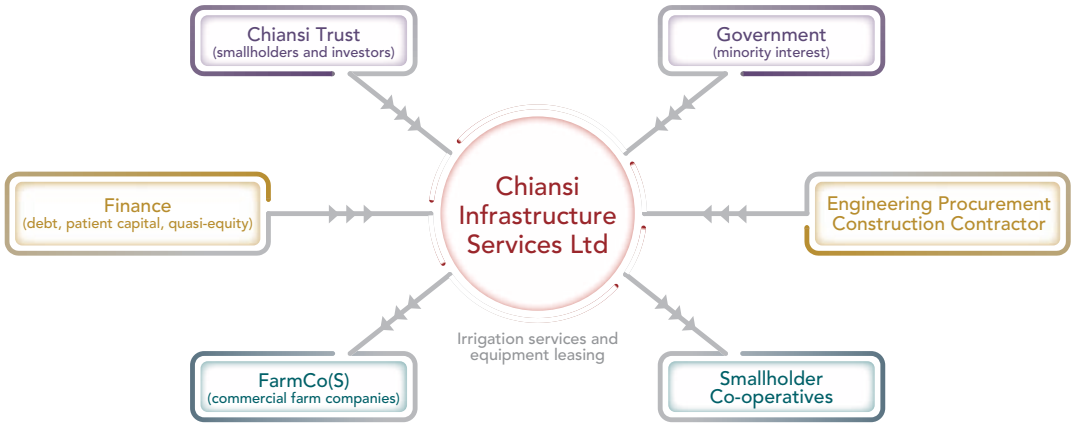
Commercial farmers (FarmCo(s)). These will be established under ownership of the commercial farmers and smallholder cooperatives. The FarmCo(s) will pay service charges for the irrigation facilities to the service provider. A management contract will be put in place to facilitate oversight of the operations of the commercial companies.

Infrastructure Service Company. This will be formed as a not-for-profit, special purpose infrastructure service company and be responsible for building, operating and financing the irrigation assets. The company will supply the bulk water and the long-term lease of irrigation equipment and farm equipment to the FarmCo(s) and will also provide irrigation services to the smallholders.

The Board of the company will include representatives of the local farmers and providers of the investment capital. After 25 years, full control of the organisation will transfer to local farmers who will own alongside the government.

The high-level structure of the proposed arrangement is set out below:

FIGURE A2.1: PPP Arrangement



Financial arrangements	The total finance requirement is estimated to be $30.5m, which includes the following: • Capital costs of $25m, which includes $13.6m for one-off start-up costs to build canals, clear land pay for resettlement of farmers with the remainder to pay for the irrigation facilities. • Working capital requirement from the commercial farm of $5.5m. According to analysis presented by InfraCo,[1] with these high upfront costs the project would not have been able to be established if a private investor were expected to cover the costs through commercial sources. This is because the expected returns of around 10 percent on equity would not be sufficient to attract commercial funds given the level of risk entailed by the project. InfraCo's analysis shows that through the injection of $15m of patient capital by development partners to fund the one-off start-up costs of the project (patient capital is long-term, subordinated capital invested at sub-commercial costs) the estimated returns on equity increase to approximately 16-18 percent, making it a much more viable proposition from a commercial perspective. Following a two-year period of consultations by InfraCo with local communities and detailed commercial structuring of the project, the first phase (210 ha) is complete. According to the PIDG, it is in development, and is expected to generate annual tax payments of approximately $440,000.
Lessons learned	The key lesson from this emerging scheme relates to the way in which an innovative financial solution has been proposed to enable a project to become more bankable. The use of patient capital has in this case helped to provide a proposed solution to the barriers to the use of commercial finance on greenfield irrigation schemes, where the high up-front costs required to develop the necessary irrigation infrastructure, uncertain demand and other risk can make it impossible to attract commercial finance. This is because in a developing country context a greenfield primary agriculture investment without contracted offtake is typically very high risk. Given this context it is unlikely that an irrigation scheme will generate sufficient revenues to attract commercial finance. The injection of patient capital by development partners has been proposed to cover the high up-front costs and some of the costs of the very long-life assets. With these costs covered, the project should be able to attract additional commercial finance, which could then be repaid credibly through the expected revenue stream of the emergent irrigation scheme.

1 InfraCo (2010), "Chiansi Irrigation: Patient Capital in Action".

1.2. Integrated Tamale Fruit Company (ITFC), Ghana

Project details	Country	Ghana
	Project size (hectares)	202 (1 acre per smallholder)
	Cost of project	• Initial investment: $4 million • Annual operating cost: $32,500 (15 years)
	Irrigation technology employed	Drip irrigation systems which will use the water from the White Volta, pumped from weirs constructed at Nabogu.
	Number of farmers targeted	500 (800 more are not connected to the irrigation as they do not require it)
	Crops covered	Mangoes
	Type of PPP	Concession
	Project developer	ITFC
	Private sector service provider	ITFC
	Public sector/IFI	Government of Ghana, World Bank, Millennium Challenge Account.[2]
	Current Status of Project	Implementation
Allocation of Irrigation scheme functions	Investment	ITFC
	Governance	ITFC
	O&M and management	ITFC
	Agricultural production	Smallholder farmers (approx. 1300)

2 The government of Ghana contributed the building that currently houses the offices of the ITFC and OMOA, which was built under the ASIP. The World Bank contributed 50 percent of the seedling cost to out-growers in the form of a grant. The UNDP, CORDAID, and ADF have strengthened OMOA to build capacity. The project was connected to the national grid with the assistance of the Millennium Challenge Account.

Project structure

The scheme provides irrigation services to the nucleus and nursery facilities run by the ITFC and 500 of the smallholders through pumps that have been connected to the drip irrigation schemes—an additional 800 smallholders are not served because their mango trees are said to be over three years old and surviving without the need for irrigation services. While the irrigation scheme began with investment in 2011, the overall ITFC outgrowers' scheme began in 2001. Since it began, some farmers have been removed from the scheme as they have not adhered to the required standard of farming practices. Up to the time of this report, the irrigation scheme had not generated any revenue and was still experiencing a lot of changes in terms of crops planted. The output was mostly being exported to the Italian market.

At first, the main crops covered were organic mangoes, which require no chemicals at all. However, this situation didn't last because the land produced very low yields for lack of chemicals supplements. By the time of this report, the organic mango project had been given up, and replaced with the cultivation of ordinary mangoes that were dried or turned mainly into mango juice.

Roles and responsibilities

ITFC. In the model, the ITFC operates a nursery and a 160 ha mango farm in the Savelugu-Nanton District of the Northern Region of Ghana. Attached to this is an additional 800 ha of land managed by 1,300 smallholder farmers. The ITFC provides inputs (access to irrigation services, cutlasses, bags of manure, and seedlings) and technical assistance to the smallholders, who are charged in the form of an interest free loan. The ITFC also helps farmers obtain licences and certification, a requirement for organic exportation. It was originally intended that 2,000 farmers would be under the wider ITFC scheme, however this is currently limited to 1,300 while ITFC addresses organisational issues amongst the farmers.

Organic Mango Outgrowers Association (OMOA). To strengthen local participation in the management of the scheme, the farmers are organised into an association known as the Organic Mango Outgrowers Association (OMOA). This association plays an intermediary role between the ITFC and the contracted farmers; it is also the farmers' advocacy platform. The OMOA meets quarterly with its members and monthly with ITFC management. OMOA begun with funding from ITFC and later from the government through the Agricultural Sector Improvement Project (ASIP), The African Development Bank and nongovernmental organisations CordAid, Senter, and Wienco. The ultimate aim is for the OMOA to become self-sustaining using the contributions from its membership.

Smallholder farmers. To join the scheme, the smallholders have to provide an 85kg bag of maize upfront (which is equivalent to around $25). From the fifth year onwards the outgrowers will repay 30 percent of their sales to the ITFC until the debt is repaid. Until the debt is repaid in full, all mangoes must be sold through the ITFC, but thereafter they may sell to any buyer.

3 Amevenku, F.K.Y., K.K. Kankam-Yeboah, and E. Obuobie. (2012), "An Assessment of the IFTC Outgrower Scheme in Ghana". AgWater Solutions Project Case Study. September 2012.

4 Amevenku, F.K.Y., K.K. Kankam-Yeboah, and E. Obuobie. (2012), "An Assessment of the IFTC Outgrower Scheme in Ghana". AgWater Solutions Project Case Study. September 2012.

Financial arrangements	The total investment is expected to be approximately $4.5 million, which is made up of: • Initial investment of $4 million; and • Annual operating cost of $32,500. The scheme was calculated for 15 years (2011-2026), with income projected to begin in 2014. The average farm was expected, in 2014, to have total revenue of $726. With 500 farmers and the expected 5 percent annual increases in yield, annual repayments to the ITFC loans in 2016 (the first year in which the ITFC will take its 30 percent cut) will total approximately $120,000, while each outgrower will earn $560 after these repayments. The total investment costs approximately $22,000/ha, which is high considering that irrigation schemes in Sub-Saharan Africa typically cost $10,000 per ha. The main reason for the high costs is that the scheme involved investing in more than just the pumps and accessories, and covered larger investments which make investments in pumps more viable, such as constructing weirs and booster stations. The ITFC has a low financial IRR of only 0.1 percent, while the outgrowers benefit from a financial IRR of 6 percent.[3] Once higher fruit yields are achieved, it is expected that the IRR may increase "appreciably", but the uncertainty and budgetary constraints of the government required donor funding to implement the project in the medium term.
Lessons learned	The ITFC's main benefit from the outgrower scheme was based on an expectation of increased market power through organic mango exports. By providing interest-free capital on uniform, relatively small plots to outgrowers, the ITFC was able to target such market power without incurring undue expense or difficulty in acquiring the land itself. Through its choice of repayment method for the farmers, the ITFC (as the private firm in this scheme) reduced its risk: until the loan is fully repaid, outgrowers are required to sell all of their produce through the ITFC, which then returns the appropriate amount to the outgrower (100 percent until 2016 and then 70 percent). **Operational issues** The experience of this project demonstrates some of the difficulties involved in trying to manage a large group of smallholder farmers. None of the outgrower farmers kept independent records of their yields, calculations of expected yields and increases in yields were for a hypothetical farmer and are based upon assumptions of average yields and it is difficult for the ITFC to verify the increases in yield which the scheme has brought about. An additional operational issue with the scheme comes from complaints from those farmers that have been on the scheme prior to the 2011 investment: the farmers claim that they have not always been receiving their portion of the value of their produce on time after the ITFC had deducted its percentage for repayment of the loan. If these issues are not addressed over time they will reduce the sustainability of the scheme.[4] On a more positive note, the scheme has been successful in targeting poorer farmers; the restriction on the size of land to one acre per grower, coupled with the distances involved and transportation difficulties may have discouraged wealthier people from larger towns joining the scheme.

1.3. Olmos, Peru

Project details	Country	Peru
	Project size (hectares)	43,500 (38,000 previously uncultivated will be auctioned to private investors, and 5,500 is owned by local farmers)
	Cost of project	• Water diversion: $247 million[5] • Irrigation: $280 million[6] • Energy generation: $60-80 million
	Irrigation technology employed	Tbc
	Number of farmers targeted	Up to 41 commercial and several local farmers
	Crops covered	Sugarcane, cotton, paprika pepper, asparagus, vegetables, and fruit (grapes, citrus)
	Type of PPP	Concession
	Project developer	Regional Government of Lambayeque
	Private sector service provider	Stage 1: Concesionaria Trasvase Olmos S.A, Odebrecht subsidiary Stage 2: Odebrecht subsidiary Stage 3: Union Energy SA (SINERSA)[7]
	Public sector institutions	Government of Peru, Regional Government of Lambayeque
	Current Status of Project	Ongoing contracts (signed in 2004 for the bulk water at the tunnel outlet, and in 2010 for irrigation services). On November 19, 2014 president inaugurated the irrigation scheme.
Allocation of Irrigation scheme functions	Investment	Concessionaires
	Governance	ProInversión, on behalf of the Government of Peru[8]
	O&M and management	H2Olmos S.A. Odebrecht
	Agricultural production	Commercial and local farmers

5 http://www.asce.org/cemagazine/Article.aspx?id=23622325766 Irrigation to Transform Desert Region of Peru: Civil Engineering

6 http://www.asce.org/cemagazine/Article.aspx?id=23622325766 Irrigation to Transform Desert Region of Peru: Civil Engineering, and http://www.securities.com/Public/company-profile/PE/Concesionaria_Trasvase_Olmos_SA_es_2399374.html

7 http://en.h2olmos.com/proyecto_olmos/proyecto_descripcion

8 See paragraph 5.2 on ProInversión's responsibilities, in Inter-American Development Bank – Peru: Plan of Operations. Olmos Project for Irrigation Water Piping and Distribution Works

9 http://rou.sika.com/ro/group/project-references/concrete-reference-projects/olmos-tunnel-project--peru.html

10 http://www.odebrechtonline.com.br/materias/01101-01200/1153/

Project structure

This project involves three main stages, as follows:

1. **Water diversion stage:**
   The project diverts the Huancabamba River from the eastern side of the Andes (flowing to the Amazon) to the western side of the Andes so that it will flow to the Olmos plains to provide the 406hm3 required for irrigation. This stage was awarded to Concesionaria Trasvase Olmos S.A, an Odebrecht subsidiary[9] as a $19 million, 20-year contract in 200410 and was completed in July 2012.11

   The public sector involvement in this stage is through the government of Peru granting tax exemptions and a tax stability agreement to Odebrecht.[12]

2. **Irrigation stage:**
   Of the 43,500 ha involved, 38,000 ha was previously wasteland that is being made available for auction so as to be brought into production. The other 5,500 ha was already owned by local farmers. Construction of the irrigation infrastructure was completed in October 2014.

   The state reserved 110,000 ha of land for the project in the 1990s in order to make it easier to attract private investors when the project finally did get off the ground.[13]

   This stage was awarded fully to concessionaire H2Olmos S.A. in June 2010.[14] H2Olmos is a subsidiary of Odebrecht, and was formed solely for this project.

3. **Energy generation stage:**[15]
   This stage involves the construction of a hydropower generation turbine at the exit of the tunnel created in stage 1, to generate renewable energy to sell to Peru's National Interconnected Electric Grid to enable a reduction in CO2 of up to 200 ktonnes per year. It will have a capacity of 51MW, expected to generate up to 303 GWh/year.[16]

   This stage was awarded to concessionaire Union Energy SA (SINERSA) in October 2010.[17]

Roles and responsibilities

Gobierno Regionalde Lambayeque (GRL). GRL is the Grantor and the Trustor of the land. After transferring the land into a trust to make the process easier, the land and irrigation rights were transferred to the private parties which won the auctions for the 41 plots of land (38,000 hectares).

The funds raised through the auction are therefore held in this trust (the Land Trust) rather than being held directly by GRL, with a percentage to be passed onto the concessionaire to cover some of the costs of implementing the infrastructure.

Funds raised through the auction process will be held in a trust (the Land Trust) and will be used to pay the GRL for the land and to finance part of the infrastructure investment.

Concessionaire. The concessionaire, H2Olmos S.A. Odebrecht, will be responsible for constructing the irrigation infrastructure, electricity transmission, and access roads. Also in charge of the operation and maintenance throughout the 23-year renewable contract.

11 http://en.h2olmos.com/proyecto_olmos/proyecto_descripcion/fases_y_etapas

12 http://www.eurodad.org/Entries/view/1546074/2013/11/27/Getting-the-priorities-right-Key-takeaways-from-the-Lima-workshop-on-private-finance-and-infrastructure-financing

13 http://assets.panda.org/downloads/pipedreams18082009.pdf

14 http://en.h2olmos.com/proyecto_olmos/proyecto_descripcion/fases_y_etapas

15 http://cdm.unfccc.int/filestorage/j/f/XECW20UVI56ZDP1KAJ3F8OYMS9RBL7.pdf/CDM_PDD Olmos 1.pdf?t=dE58bjI5eG5ifDCZ5abmmda1BfuXBQY3O6NQ

16 UNFCCC/CCNUCC Project Design Document for Olmos 1 Hydropower Plant, 14/11/2012

17 http://en.h2olmos.com/proyecto_olmos/proyecto_descripcion/componentes

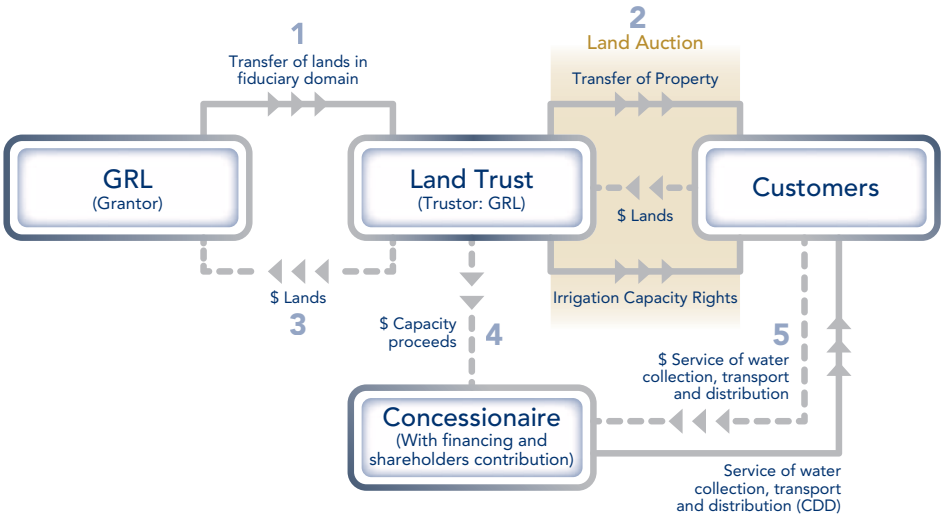
Project structure (cont.)

H2Olmos will receive the capacity fee portion of the auction proceeds (minus tax), which is approximately 72 percent of the anticipated $160m, and will also receive a flat service fee of $0.07 per m3 for the water which is used. With an average usage of 10,000 per ha/year, this could equal $26.6m each year.

Customers. The farmers will acquire the title to the land and the right to the irrigation services, with an obligation to pay the service fee of $0.07 per m3 for water used to irrigate their farm. This is a "C" contract, meaning that if the farmers do not take the water supply from the concessionaire they will be liable to pay a penalty.

The transaction structure is illustrated below:

FIGURE A2.2: Transaction structure



Source: Olmos Irrigation Project: Opportunity to Acquire Farmlands with Irrigation Rights in Peru. Ibpartners, October 2010.

Some of the 38,000 ha of land auctioned was sold to a combine of Peruvian and foreign companies, 70 percent of which are Peruvian, with the main investor being Grupo Gloria, with 15,000 hectares of highly-mechanized sugarcane production. A further 4,000 ha was sold to a US investment fund focused on grapes, avocados, and other crops; with shares also held by California's Mission Produce, Peru's Grupo Arato, and European investment funds. The sale of about 10,530 ha to Odebrecht in the auction had yet to be completed at the time of this writing. The company planned to sell a block of 5,750 ha, in lots of 1,000 ha at a base price of $6,500 each and 250 ha at $ 7,500 each. It had already sold 50 percent of these lots by the time of writing. Another consortium, Grupo Wong was interested in acquiring land to plant sugarcane and for potential integration of the textile industry. Odebrecht was still evaluating what to do with its remaining land allocation, and might decide to hold onto it.

4. Excavation of the tunnel through the Andes and a 2km tunnel in the coastal area has been completed. On November 19, 2014, the President of Peru inaugurated the irrigation. However, local daily newspaper, *Gestión*, reported at about that time that despite the project's completion, 25 percent of the land was not yet ready for agricultural production, which would primarily disadvantage local producers.[18]

18 http://www.freshfruitportal.com/2014/11/17/peruvian-mega-irrigation-project-seeks-new-farming-investors/?country=others
http://www.peruthisweek.com/news-perus-olmos-irrigation-project-is-85-complete-102669

Financial arrangements	The project has been split into three main stages, as follows: 1. **Water diversion stage $247 million—PPP funded**[19] Diverting the water towards the project involved the construction of a 44 million m3 dam and 20km tunnel, funded through a public-private partnership with a total investment of $247 million. The feasibility studies ($1.9 million) were funded by the Japanese Special Fund (JSF, $1.28 million), the government of Peru (through ProInversión), and the regional government of Lambayeque (GRL, through the Olmos-Tinajones Special Project (PEOT)).[20] 2. **Irrigation stage $280 million—privately funded**[21] This component is being funded solely through private investment from agribusiness firms and Odebrecht, with approximately 50 percent from bonds issued on Lima's stock exchange backed by a partial credit guarantee of $50 million from the Latin American bank, CAF.[22] 3. **Energy generation stage $60-80 million—privately funded**[23] This stage is being funded by the concessionaire, SINERSA, who will recoup its investment through the sale of generated energy. Energy generation is expected to cost around $4.75 per MWh, and be sold at an estimated $38.30 per MWh.[24] The IRR of this component of the project is 9.51 percent.[25] The 38,000 ha of lots to be auctioned have been broken into six lots of 500 ha and 35 lots of 1,000 ha, which all face a price of $0.07 per m3 for the irrigation water.[26] 35,500 ha had been successfully auctioned by the time of writing,[27] which had raised at least $150 million.[28] The money raised from these auctions is split between GRL and the H2Olmos S.A. Odebrecht, with the latter's share of 72 percent provided to repay the costs of implementing the infrastructure.
Lessons learned	With 38,000 of the 43,500 hectares being kept to be auctioned to private investors (who will produce high-value crops) and 35,500 ha already successfully auctioned, the development and design of this irrigation scheme reinforces the view that expensive and large-scale schemes such as Olmos are most typically feasible only when developed to support commercial farming activities.

19 http://www.asce.org/cemagazine/Article.aspx?id=23622325766 Irrigation to Transform Desert Region of Peru: Civil Engineering

20 http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=863190

21 http://www.asce.org/cemagazine/Article.aspx?id=23622325766 Irrigation to Transform Desert Region of Peru: Civil Engineering

22 http://www.bnamericas.com/news/waterandwaste/caf-approves-us50mn-guarantee-for-olmos-irrigation-project1

23 http://www.bnamericas.com/news/waterandwaste/caf-approves-us50mn-guarantee-for-olmos-irrigation-project1

24 http://cdm.unfccc.int/filestorage/j/f/XECW20UVI56ZDP1KAJ3F8OYMS9RBL7.pdf/CDM_PDD Olmos 1.pdf?t=dE58bjI5eG5ifDCZ5abmmda1BfuXBQY3O6NQ

25 http://cdm.unfccc.int/filestorage/j/f/XECW20UVI56ZDP1KAJ3F8OYMS9RBL7.pdf/CDM_PDD Olmos 1.pdf?t=dE58bjI5eG5ifDCZ5abmmda1BfuXBQY3O6NQ

26 The water demanded by a crop in the region can range from 5,260 m3/ha/year to 16,540 m3/ha/year, with the higher volumes required for fruit. Averages are around 10,000 m3/ha/year

27 http://www.gatewaytosouthamerica.com/en/info-peru.php?id=206&type=farm

28 This is given the minimum price set at $4250 per ha, made up of the following: $605 for the land, none of which is tax, and $3645 as a 'capacity fee', $582 of which is tax.

1.4. Pontal Irrigation Project (Planned)

Project details	Country	Brazil
	Project size (hectares)	8,000 irrigated (of 33,500 acres)
	Cost of project	Approx. $120 million, the government is willing to pay a maximum of $150 million over the 25 years.[29]
	Irrigation technology employed	Final design of a 5,000 ha irrigation project with three pumping stations and 60km of concrete-lined principal canal with Avis and Avis downstream-type control structures.[30]
	Number of farmers targeted	At least 100 smallholders, unknown number of commercial farmers (up to 6,000 ha for commercial farmers)
	Crops covered	Crops may include: sugarcane, orange, tobacco, citrus, banana, melon, papaya, tomatoes, coconuts, grapes, mangos, pineapples, passion fruit, and cotton.
	Type of PPP	Concession arrangement (25-year sponsored)
	Project developer	Yet to be announced
	Private sector service provider	Yet to be announced
	Public sector institutions	Government of Brazil via its agency, Codevasf
	Current Status of Project	• First bidding process unsuccessful in 2010 with concession model. • Second bidding process ongoing
Allocation of Irrigation scheme functions	Investment	Special Purpose Company (SPC)
	Governance	The arrangement will be regulated by Brazil's ANA (National Water Agency)
	O&M and management	Yet to be announced
	Agricultural production	Commercial farmers and smallholders. At least 25 percent[31] of the land is to go to at least 100 smallholders, each having no more than 20 ha.

29 ITFC. 2011. "Handshake": "Tetto SPE, a Brazilian company, was the winning bidder, requesting the integration of 51 percent of the total irrigable land and a total government payment of $119 million."

30 http://qpec.org/FOQbio.html

31 While this is a minimum, one of the two main components of the budding will focus on the bidders' commitment to bringing smallholders onto the scheme above the required 25 percent.

Project structure

The Pontal Project will encompass over 33,500 ha, of which 7,717 ha will be destined for irrigation. The rest of the area will be a national park. With a need to improve the provision of irrigated agriculture in the region, the decision to structure the project as a PPP was due mainly to a set of World Bank studies that showed that irrigated agriculture, if conducted under sustainable and entrepreneurial standards, promotes regional development. Among all economic activities, agriculture has proved to be one that generates most social impact as it requires low investments per job created.[32]

Roles and responsibilities

Government of Brazil. The government will cede the land, and the existing infrastructure, which already covers approximately 70 percent of the target area, to the private partner. The government will also be responsible for setting the initial price of the water and the land, which would afterwards be adjusted annually, according to inflation. The government would also finance construction of Pontal's basic road and energy infrastructure.

The private partner. The private sector partner will form a special purpose company (SPC) which will complete the construction of the common infrastructure, and then ensure that the agribusiness users allocate the land to farmers within six years of the signing of the SPC's contract with the government. The SPC will be required to operate and maintain the common infrastructure throughout the 25-year contract.

Once the land has been allocated (the SPC will have discretion over the physical arrangement of the lots), the SPC will also be responsible for ensuring that the agribusiness users comply with the requirement for 25 percent of the irrigable land to be allocated to (local) smallholder farmers (up to 20 ha each), and for those smallholders to be integrated into the agricultural production chain of the larger commercial farmers.

The SPC will receive remuneration for these actions through three streams:

1. Tariff collection from the agribusiness company on water (maximum of $19.72 per 1,000m3) and land (maximum of $364.24 per ha/year);
2. Contraprestação (capacity payment) paid by the government; and
3. Additional revenues generated by project, if any.

Government payment will occur when the concessionaire achieves pre-defined targets related to indicators such as water availability and occupation of the land.

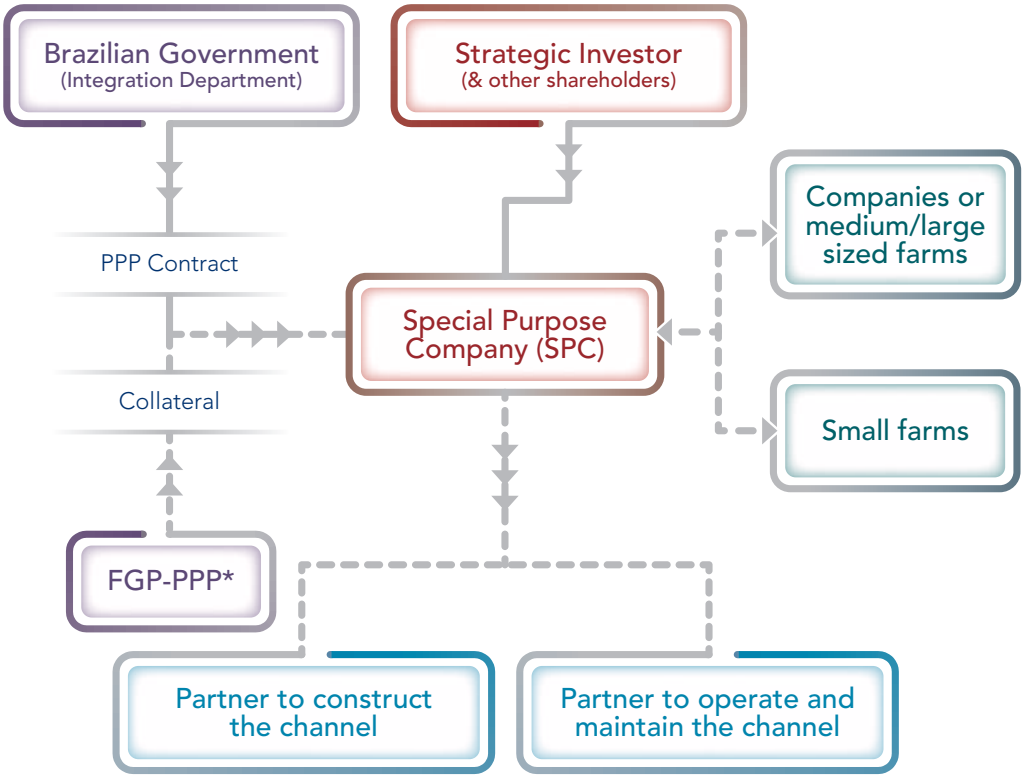
The agribusiness company. The agribusiness company will be allocated land from the SPC and then be required to allocate it to the commercial and smallholder farmers, ensuring that at least 25 percent of irrigable land is allocated to smallholder farmers. The agribusiness company is free to select which crops which will be grown, and train the smallholders on farming techniques and quality standards. The agribusiness company will be responsible for paying water and land tariffs to the SPC. They have the option of collecting the smallholders' irrigation tariffs in the form of a portion of the smallholders' production.

32 Série Água Brasil, Volume 2, World Bank Group

Project structure (cont.)

The chart below represents the contractual obligations arising from the PPP design of the Pontal Project.

FIGURE A2.3: Contractual obligation



**The Federal PPP Guarantee Fund (FGP) guarantees 100 percent of compensation payment in case The National Integration Ministry (Ministério da Integração Nacional) fails to do so. Source: http://www.pontal.org/docs/Teaser_ENG2.pdf*

Financial arrangements

Investors in Pontal will be given the right to use the land for free for 25 years, with the expectation that the government will benefit from regional development and the subsequent increases in tax revenues.

There was only one bidder for the Pontal project, who eventually withdrew.[33]

Estimates of the cost of the irrigation project vary between $105 million and $143 million.[34] Approximate reimbursements from the government to the SPC will be:

- $50-60 million to cover the cost of building the remaining irrigation infrastructure (the private portion of the project)[35]
- $2.8 million annual payments (for 25 years), which is approximately $360 for each irrigated hectare each year.

29 De Nys, Erwin (2012), "Brazilian PPPs in the Irrigation Sector: Some operational lessons". SDN Forum, Feb 23 2012.

30 http://www3.tesouro.fazenda.gov.br/english/hp/downloads/brazil_partners/investment_guide.pdf pg16

31 http://www.forumchinaplp.org.mo/en/notice.php?id=965

The government payments will be payable in three instalments:

- **Availability instalment:** 10 percent is payable in one single instalment on the date that the concessionaire completes the common infrastructure works
- **Occupation instalment:** 40 percent will be payable monthly within five years to the extent that the irrigated area is occupied.
- **Performance instalment:** The remaining 50 percent will be payable monthly from the date that the irrigated area is fully occupied, and throughout the contract.

Across the whole project, an annual gross income of approximately $32 million is expected, generating the creation of around 24,000 direct and indirect jobs.[36] It is expected that integrated smallholder farms could expect monthly incomes as follows:

TABLE A2.4: Estimated Income for Integrated Smallholder Families

Product	Farm Size(ha)	Monthly Income (est. $)
Banana	19	867
Pineapple	17	895
Lemon	37	869
Sugar cane	33	875
Citrus	35	883
Cotton	20	911
Semi-processed vegetables	7	911

Source: Bell, D. E., M. F. Neves, L. T. Castro, and N. Kindred. Harvard Business School case 510-042 "Codevasf". December 3, 2009.

The agribusiness users will guarantee the purchase of the smallholder farmers' produce, and will also be committed to exploring several sources of income, which may include: organic milk powder for export; bovine and cattle genetic material for milk production; pisciculture; and coconut. They will provide the initial 50 milk-producing cows to the relevant smallholder farmers.

36 http://www3.tesouro.fazenda.gov.br/english/hp/downloads/brazil_partners/investment_guide.pdf

Lessons learned

Compared to other public irrigation projects, Pontal seemed to present fewer challenges due to its smaller area, advanced stage of infrastructure construction, and proximity to a well-established irrigation and fruticulture hub.[37] One of the challenges which the project does face, the low credibility of a guarantee from the government (for example, due to the risk of default), is planned to be solved by having the Federal PPP Guarantee fund provide the collateral to reduce the financial risk to private investors.

The development of the PPP proposal has been described as "painstaking" and "protracted", and took five years, mainly due to the political sensitivity associated with privatising a government programme. The level of political involvement is apparent by the fact that the government chose to set the price of the irrigation services instead of leaving it to the private sector, which one might have expected since it is the SPC that is responsible for providing the service and collecting the charges.

In the end there was only one bidder for this project, which can be attributed in part to some potential bidders considering that the investment costs had been underestimated, highlighting the importance of an up-to-date financial model.[38]

Impact on other schemes

The Accra Plains Irrigation Project in Ghana derived several important lessons from the Pontal Irrigation Scheme, including the need for a strong water sector regulator, the handling of risk allocation in the project design, and connecting irrigation to commercial agriculture and infrastructure development.[39]

If Pontal succeeds, irrigation PPPs could potentially be replicated on as much as one million hectares throughout the semi-arid São Francisco River valley, though additional work will be needed to take the Pontal project to the implementation stage.

37 https://www.ppiaf.org/sites/ppiaf.org/files/documents/Brazil_Irrigation_PPP_April_2009.pdf

38 De Nys, Erwin (2012), "Brazilian PPPs in the Irrigation Sector: Some Operational Lessons". SDN Forum, Feb 23 2012.

39 http://wbi.worldbank.org/sske/story/public-private-partnerships-irrigation

1.5. Accra Plains, Ghana (Planned)

Project details	Country	Ghana
	Project size (hectares)	11,570, of which 11,000 ha will be irrigated.[40]
	Cost of project	• Construction: $76.9 million • Operation and Management: $7.9 million This may change, as the project is currently at the end of the pre-feasibility stage (pre-feasibility study was submitted in late 2013).
	Irrigation technology employed	For the Accra scheme: • Gravity irrigation for rice production downstream to the canal • Pressure irrigation for commercial farm upstream to the canal, with each farm choosing their own water delivery method
	Number of farmers targeted	Approx. 5,720 smallholder farmers in the Accra Plains (2,500 in KIS, 2,720 in NDIS).
	Crops covered	Mainly rice, also bananas
	Type of PPP	Project has only recently completed pre-feasibility stage, but the World Bank pre-feasibility study recommended a single, 15-25 year concession for each of the project's two sites: the Kpone Irrigation Scheme (KIS) and the New Development Irrigation Scheme (NDIS)[41]
	Project developer	Ministry of Food & Agriculture, Ghana Irrigation Development Authority (GIDA)
	Private sector service provider	Project has recently completed pre-feasibility stage
	Public sector institutions	Government of Ghana, the World Bank Group (IDA)[42]
	Current Status of Project	Feasibility to explore a PPP structure is being conducted.
Allocation of Irrigation scheme functions	Investment	The World Bank Group (IDA) will fund the upfront investment costs under the Accra Plains Irrigation Project
	Governance	World Bank and the government of Ghana will be responsible for overseeing the implementation
	O&M and management	Private and public sectors under a management contract or lease (at KIS) or concession (at NDIS)
	Agricultural production	Smallholders and commercial farmers

40 Percentage for smallholders target on Accra Plains: Year 1, 0 percent; Year 2, 25 percent; Year 3, 35 percent, Year 4 onward, 40 percent. Percentage for utilising technology/management both on Accra Plains and SADA zone: Year 1, 20 percent; Year 2, 40 percent; Year 3, 60 percent; Year 4 onward, 80 percent.

41 The benefits of this choice are as follows: fewer resources required in the preparation of contracts and sourcing of investor; more attractive for the private sector; avoid conflicts which might otherwise arise with two private concessionaires using the same water sources; and achieves equity in water management between the two schemes.

42 Ministry of Food and Agriculture, Ghana Irrigation Development Authority, Republic of Ghana. Pre-feasibility study consultant for the Accra Plains PPP Project.

Project structure

The Accra Plains Irrigation Project is an intervention under the Ghana Commercial Agriculture Project (GCAP). One of the GCAP's key aims is to secure PPPs and smallholder linkages in the Accra Plains, with the purpose of supporting the development of value chains in areas with a good potential for agricultural growth.

More specifically, the project will include:[43]

- The rehabilitation and expansion of the existing gravity-based Kpone Irrigation Scheme (KIS), irrigating 4,100 ha of the 4,310 ha. This component includes 1,100 ha of greenfield land.
- The construction of the New Development Irrigation Scheme (NDIS), irrigating 6,900 ha of the 7,260 ha; including 5,900 of greenfield land.

The Accra Plains Irrigation Project will include viability-gap funding potentially in the form of an upfront payment to the project developer. The precise structure of the PPP arrangements for each site (i.e., KIS and NDIS) are still to be determined, as the project has only recently completed the pre-feasibility stage.

Responsibilities and roles

World Bank. The World Bank (IDA) will provide consistent implementation support to the government of Ghana throughout the project.

Government of Ghana. The government is responsible for implementing the GCAP, and for facilitating the acquisition of land by private investors.

Investors. Investors may have an interest in providing monetary and non-monetary benefits to communities, such as infrastructure rehabilitation or resources for development projects. However, the conditions of the PPP contracts have yet to be chosen because the project is still in its infancy.

Financial arrangements

The following table gives estimates from the construction and operation and maintenance costs forecast for each of the project's two sites. These are only preliminary figures as the project is still evolving. In total, the project is forecast to cost $84.8 million.

TABLE A2.5: Cost forecast for KIS and NDIS

	KIS	NDIS	Total
Construction costs, $million ($/ha)	13.8 (3,353)	63.1 (9,150)	76.9
O&M costs, $ million ($/ha)	6.6 (164.8)	1.3 (185.8)	7.9
Total, $ million	**20.4**	**64.4**	**84.8**
Benefits/costs	1.8	1.7	

The project will be implemented by a Project Implementation Unit (PIU) under the responsibility of the Ministry of Food and Agriculture. The World Bank Appraisal Report concludes that, given the tariff levels and payment risk from the farmers, it will not be financially viable for a private investor to carry out the scheme investment activities on its own, hence the need for public funds to support the development of the scheme.

43 Ministry of Food and Agriculture, Ghana Irrigation Development Authority, Republic of Ghana. Pre-feasibility study consultant for the Accra Plains PPP Project.

Financial arrangements (cont.)

Funding for the Accra Plains Irrigation Project will be channelled through the GCAP. Of GCAP's total forecast cost of $145 million, the Accra Plains Project is expected to constitute slightly more than 30 percent (or $45.5 million)—of which 100 percent is expected to be sourced from the World Bank Group's International Development Association (IDA). USAID is also a GCAP sponsor but is supporting other interventions.[44] The specific funding split for the Accra Plains Project is presented below:

- Technical assistance in support of the PPP Transaction ($1.9 million)
- Full Feasibility Study for the PPP and Transaction Advice ($3.0 million).
- Organizing small-holder participation in the PPP ($0.5 million).
- Viability gap funding for the PPP ($40 million).

As the project has just completed the pre-feasibility stage, the financial arrangements between the private and public sector entities have still not yet been agreed, or even fully defined. Despite this, consultants have recommended PPP contract types for each of the two sites, as listed in the table below. The table allocates project risks (and therefore project costs) between the PPP contract parties. Under the KIS scheme, either a management or lease contract is the recommended PPP contract type. Under the NDIS scheme, a concession is the recommended PPP contract type.

TABLE A2.6: Key Risks

Project Risk/Cost	KIS		NDIS
	Management contract	Lease contract	Concession
Design	Private	Public	Public
Construction	Public	Public	Private
Operational	Shared	Shared	Shared
Commercial	Public	Private (high)	Private
Political	Private (low)	Private (low)	Private (low)
Financial	Public	Public	Shared
Exchange rate	Private (low)	Private (low)	Private
Force Majeure and natural risks	Shared	Shared	Shared

Source: Ministry of Food And Agriculture, GIDA, government of Ghana, pre-feasibility study for Accra plains.

By August 2014, the pre-feasibility report for the proposed Accra Plains irrigation PPP and preparation of the TORs for the full feasibility study had been completed. In addition, a modernization plan for the Ghana Irrigation Development Authority was completed. The first round of the matching grant scheme was also awarded to 31 grantees for a total of $ 9.5 million.

Lessons learned

Capacity issues in structuring the right project to attract the private sector led to delays. While the IDA funds were committed to be used as VGF or in any other way that might incentivize a private company, the viability and land access issues slowed the appraisal process. It appears unlikely that the PPP, as envisaged in the original project document, will be achievable within the remaining project timeframe.

44 World Bank Appraisal Document for a Commercial Agricultural Project, February 27th, 2012.

1.6. Compagnie d'Aménagement des Coteaux de Gascogne (CACG)/ Associations Syndicales Autorisées (ASAs), France

Project details	Country	France
	Project size (hectares)	200,000
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Maize, vegetables, fruit
	Type of PPP	Concession (long-term)
	Project developer	CACG / ASA
	Private sector service provider	CACG
	Public sector institutions	Government of France
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	ASA
	Governance	
	O&M and management	ASA / CACG
	Agricultural production	
Project structure	Since 1960, Compagnie d'Aménagement des Coteaux de Gascogne (CACG)[45] has been constructing and operating irrigation schemes in southwestern France under a long-term government concession contract. The $600 million in assets—dams and networks—allow irrigation on 200,000 ha. It is a leading private sector company with 50 percent ownership of the public shareholding owned by the local government.[46] CACG constructed 55 schemes with a total of 80 dams with capacity of 250Mm3, managing 500 Mm3 yearly. The schemes served 10 000 users and provided urban water for 200 000 people. CACG operated on a foothill territory with numerous watercourses with extensive pipe networks and river supply. Infrastructure developed by CACG served multiple purposes: over 80% for agriculture, about 10%, servicing urban water supply and less than 10% for industries adapting the tariff policy to every use. The present case study does not address this model, well documented elsewhere, but presents why and how CACG was enticed into proposing maintenance contracts to financially autonomous water user associations (WUAs), the French Associations Syndicales Autorisées (ASAs).	

45 One of the three French SARs (Sociétés d'Aménagement Régional).

46 http://www.indiaenvironmentportal.org.in/files/file/ppp-irrigation-drainage-sector-india.pdf

Project structure (cont.)

From 1960 to 1970, CACG had been operating irrigation with comfortable financial support from the government. In 1972 the water price paid by the farmers covered barely 10 percent of the irrigation costs in spite of large investment subsidies. At that point, the government began a drastic reform: phasing out all operation subsidies over the next 10 years and reducing CACG's financial risks.

The first change was for CACG to adapt the management of the concession model: create a user committee (Commission Permanente des Irrigants); cut operating costs (50 percent staff reduction); and increase water prices for the irrigators. More important, CACG switched to a demand-driven investment policy: all small- and medium-size irrigation schemes were to be tended by ASAs, the French WUAs. The concession model would be reserved for larger investments such as reservoir dams. But the question was how to succeed with this new ASA model: how could CACG combine an acceptable water price for farmers with sound maintenance practices?

CACG water management practice was based on three pillars: consultation, accountability and technology. Because CACG usually handles the design function, it can standardise equipment and guarantee that its technical choices will allow easily maintenance in the future. It integrated all the skills from design to Operation and Maintenance of hydraulic infrastructure and environment and local engineering into one frame offering support to farmers for irrigation and agriculture imrpovment. Thus, the maintenance contracts proposed by CACG to ASAs include the following:

- Preventive maintenance by CACG specialists before the start of the irrigation season;
- Around-the-clock repair service during the irrigation season;
- Stock of spare parts for fast repair service;
- Binomial fee to ASAs (a fixed part for preventive maintenance plus a variable part for actual repairs); and
- Under a one-year renewable contract, CACG must be fully accountable to the contracted ASAs.

This new CACG/ASA model is giving good results in southwestern France. Moreover, it widens CACG's experience when consulted in management reforms and irrigation management transfer (IMT) to WUAs.

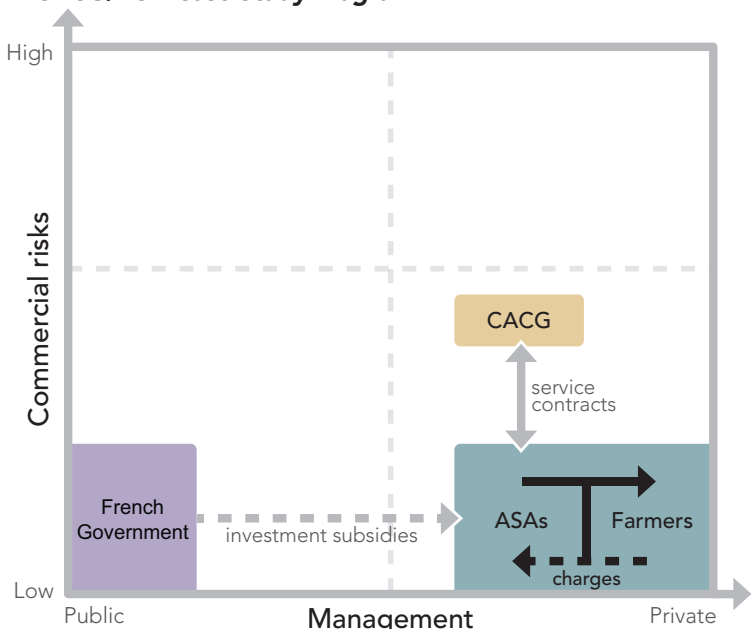
Project structure (cont.)

Risks

In France this model was created to reduce the risks run by CACG as a full-service provider. Two risks remain:

- Financial risk. The remaining financial risk consists of financing the spare parts inventory.
- Social risk. In a bureaucratic culture, the social risk consists of imposing on personnel 24-hour availability.

FIGURE A2.4: CACG/ASA Case Study Diagram



Financial arrangements

TABLE A2.7: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	$1.0/m3 (as an average for 1,500 m3/ha)
Irrigation water value	$0.20/m3 (up to $1.0/m3 for high-value-added crops)
Total irrigation cost	$0.15/m3 (for 1,500 m3/ha)
Price of the maintenance service	$36/ha, that is, $0.024/m3 (approximately 50 percent for the fixed part)

Lessons learned

Private type management and private accountancy used by CACG delivered high quality sustainable results. It was obliged to maintain constant balance between costs and income, recovering its costs entirely on commercial gain (water fees) in 30 years thus minimizing its dependence on sate support. For the private sector, this maintenance service is not risky because the bill is not paid directly by farmers. It could be a first step toward a broader service provision, including operation and billing. When reforming I&D government agencies, setting up such a maintenance service could be fruitful. The best personnel would be transferred to an efficient service provider.

1.7. ORMVAs, Morocco

Project details	Country	Morocco
	Project size (hectares)	375,000 irrigated
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Cereals, fodder, sugar beet and sugarcane, citrus, vegetables
	Type of PPP	PSD, Concession
	Project developer	ORMVA
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	ORMVA
	Governance	Basin agency and ORMVA
	O&M and management	Allocation: IDSP (between irrigators), basin agency (between uses) Actual: IDSP
	Agricultural production	Farmers

Project structure

In Morocco, major irrigation schemes are managed by public irrigation agencies (Offices Régionaux de Mise en Valeur Agricole, ORMVAs). For 10 years, the government has been driving a reform with the World Bank's support to restore financial sustainability and deal with the lack of maintenance (see also Guerdane). The Second Plan for Improvement of Large-Scale Irrigation (PAGI-2) has been partly successful in introducing new tools and methods derived from private management and in raising irrigation water prices. Nevertheless, "sound" maintenance has not been reached everywhere, and the water-charge collection rate has been declining due to late payments.

The next projected phase of water reform consists of removing water service from the public bureaucracy and considering the new entity in charge a private I&D service provider (IDSP), using private accounting and private personnel-management practices. Financial sustainability seems near at hand because part of the water price covers the cost of extension services and heavy overheads. If water only has to "pay for water," reaching a "sound" level of maintenance will require only a limited price increase (four cases out of five).

The former option of management transfer to WUAs has been abandoned or, rather, reserved for the southern ORMVAs, where there is a collective management tradition. The idea is to set up privately managed companies (IDSPs) receiving a public service delegation, with a choice of legal statute: either ORMVAs subsidiaries, regional Sociétés d'Economie Mixte (SEMs) associating public governance and private management, or fully private companies.

Although the existing WUAs will not receive management responsibility, they should be reactivated as client committees to represent farmers relative to the IDSP in negotiating contract terms and monitoring service quality.

Risks

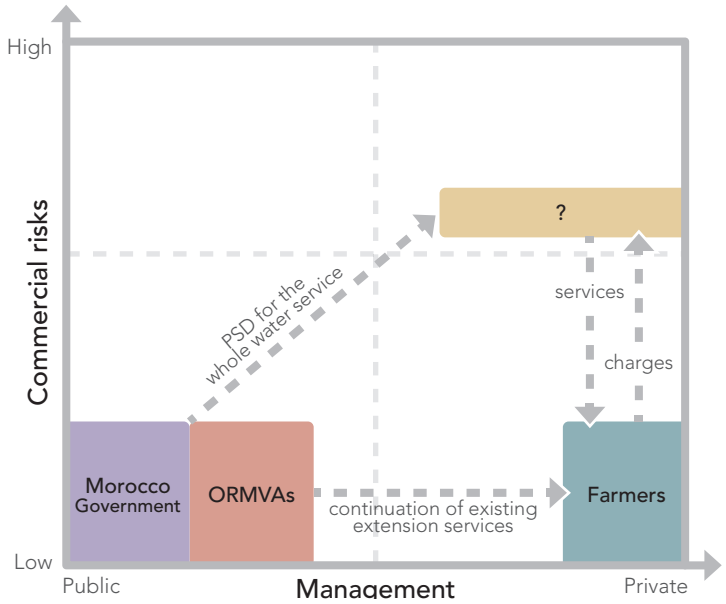
The main risks have been identified as follows:

- **Political risk.** There is no major political or country risk, but there are some risks connected to agricultural policy (European Union, World Trade Organization) concerning the price of irrigated cereals.
- **Social risk.** The present staff of the ORMVAs will be concerned about the reform; their reassignment to new functions in the IDSP constitutes a social risk if not dealt with carefully.
- **Revenue risk.** This risk is limited to working capital needed to cover the staggered collection of water charges. A "good deal" in irrigation consists of accepting a large part of the payment after the harvest. Current payment delays, however, often exceed one year.
- **Water supply risk.** The water supply risk has been well documented in the basin plans (PDAIRE) but it is thought that the Agences Hydrauliques de Bassin will assume the risk if it respects the order of priority-assigned competing uses.

Project structure (cont.)

- **Water demand risk.** This risk resides in farmers' ability to progress toward higher-value-added agriculture to adapt to higher water prices. The ORMVAs should continue to support extension services; good service quality will enable the IDSPs to develop new subscriptions as a result of improved efficiency in the distribution networks (water savings).

FIGURE A2.5: ORMVA Case Study Diagram



Financial arrangements

TABLE A2.8: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	$0.35/m3 (for the Doukkala 5,700 m3/ha)
Irrigation water value	$0.26/m3 (for the Doukkala 5,700 m3/ha)
Water pricing	$0.032/m3 (for the Doukkala 5,700 m3/ha) $0.030/m3 (5 ORMVAs average)

Lessons learned

In the proposed reform, the legal form of the privately managed IDSP is optional. Great opportunities would be open for the local and international private sectors to propose innovative arrangements. It is clearly stated that the private sector's role is not to finance rehabilitation or new investments but to introduce sound management practices within a private accounting framework. There will be no major financial risk on assets and only some risk on working capital.

If this reform succeeds, the companies involved will have excellent credentials for further projects, considering that several other governments are also plagued by poor maintenance. The experience of the French SARs proves that public service delegation in irrigation can be financially sustainable: faultless service wins clients' loyalty and allegiance.

1.8. Dina Farm, Egypt

Project details	Country	Egypt
	Project size (hectares)	4,400 ha
	Cost of project	
	Number of farmers targeted	600
	Irrigation technology employed	Center pivots; drip irrigation
	Crops covered	wheat, berseem clover, alfalfa, corn, banana, tomato, potato, other vegetables
	Type of PPP	Concession
	Project developer	Dina Farm
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	Dina Farm
	Governance	Dina Farm
	O&M and management	Government will allocate 20,000 m3/ha/year, otherwise Dina Farm allocates, operates, and maintains
	Agricultural production	Dina Farm
Project structure	Dina Farm, a large irrigated private farm, located a few dozen kilometers outside Cairo on the highway to Alexandria, was created in 1987 on 600 ha by a local private company. With around 4,400 ha today, it can be considered one of the world's main case of public-private partnership (PPP) in agribusiness. The farm is large but not unique in Egypt and the Middle East countries, where private capital often is invested in farming. Located in a desert area on the west ridge of the Old Nile Delta, Dina Farm exploits groundwater from three different aquifers. The farm combines some staple crops (wheat, berseem, alfalfa, corn) irrigated by center pivots and used mostly in milk-cow breeding, as well as intensive cash crops (banana, tomato, potato, other vegetables) under drip irrigation. It runs its own staff training facilities and experimental station (120 ha), and employs 600 individuals, most of whom live on the farm. Though an entirely private investment, the first P of the acronym PPP corresponds to a number of counterparts from the government of Egypt, including a free groundwater supply partly connected to the Nile River through the Old Nile Delta water table, at an estimated average of 20,000 m3/ha/year (up to 30,000 on drip-irrigated bananas).	

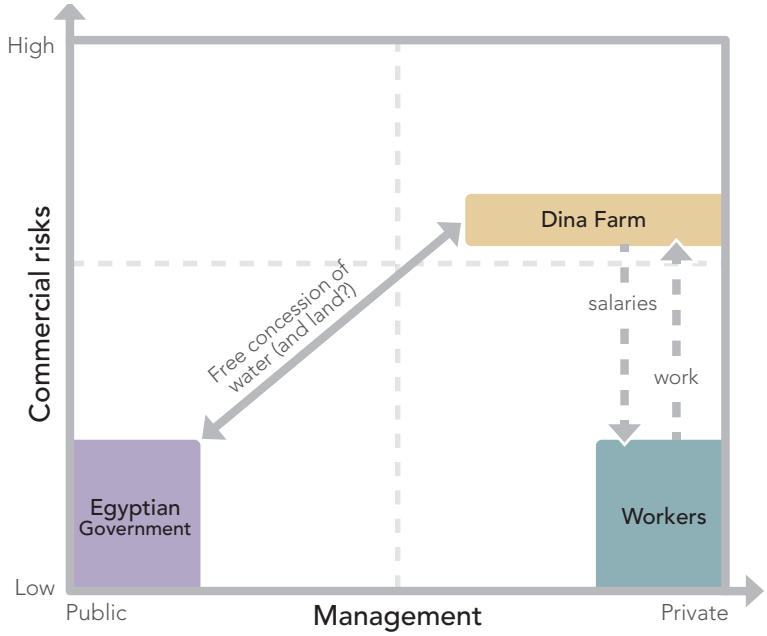
Project structure (cont.)

Risks

Political risk is considered medium, depending on the country's changing political climate; and the risk of devaluation is low. A black market poses the highest commercial risk.

Water-specific risks are limited at present but rising due to other intensive pumping withdrawals from the aquifers; Dina Farm has asked for (free) additional water from the Nile River, not trusting the government-announced groundwater availability of 5 million m3 for the next 50 years.

FIGURE A2.6: Dina Farm Case Study Diagram



Financial arrangements

TABLE A2.9: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	$0.32/m^3 (banana)[b]
Irrigation water value	
Water pricing	

Lessons learned

Though not transparent, the Dina Farm type of PPP sometimes appeals to governments in developing countries that consider guaranteed output, jobs, and tax revenue worthwhile benefits. Some sort of public control should nevertheless be exercised over both economic and social aspects of the project.

1.9. Société du Canal de Provence (SCP), France

Project details	Country	France
	Project size (hectares)	80,000
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Vegetables, fruit, seeds
	Type of PPP	Concession
	Project developer	• Design: Water resource manager (IDSP) = SCP • Implementation: Water resource manager (IDSP)/private subcontractors
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	Water resource manager (IDSP) = SCP
	Governance	Government officials and water resource manager, with governments' approval
	O&M and management	• Management: Water resource manager (IDSP) = SCP • Operation: Water resource manager (IDSP) • Maintenance: Water resource manager (IDSP)/private subcontractors
	Agricultural production	Farmers
Project structure	In France, large, modern irrigation schemes were set up and are being managed by semipublic agencies known as Sociétés d'Aménagement Régional (SARs, regional development corporations) for the past 75 years. These SARs were created to undertake public-interest initiatives and given a unique public-private partnership (PPP) status: local government authorities (régions and départements) and the joint shareholders are private sector (representing socioeconomic interests, including those of the agricultural sector). Public shareholders control a part of the stock to make sure public-interest objectives are fulfilled, but these SARs, which are legally Sociétés Anonymes (SA, public limited companies), have the same balanced management and cost-effective imperatives as private enterprises. Having water rights, SARs represent tools for sustainable development of diversified and intensive agriculture through developing water storage, transfer and distribution infrastructure.	

Project structure (cont.)

The Société du Canal de Provence (SCP), one of the three (remaining) SARs, was entrusted by the French government with a long-term concession contract to implement and manage multifunctional hydraulic infrastructure in southeastern France. The $2 billion in assets—dams, canals, tunnels, and networks—allow delivery of water needed for economic development in the Provence region. The water delivered is split almost evenly among industrial, urban, and irrigation uses (80,000 ha, 30Mm3).

This case study does not address this model, which is well documented elsewhere. Instead, it examines why and how irrigation has benefited from the scale economies associated with the system's multifunctional nature.

The extent of investment could not be economically justified if it only provided irrigation water to the currently equipped 80,000 ha.

The impact of demand variations can be cushioned for each separate use according to changing climatic and economic circumstances. Irrigation also benefits from the high operational quality necessary for the more demanding industrial and urban uses.

Because of the role of agriculture in socioeconomic regional development, the synergy between the different activity sectors is especially beneficial to farmers.

With less than 65 percent public funding of investments, SCP had to borrow from banks and self-finance the schemes with water fees.. In 1996, SCP reaches a balance in costs versus income, with all the income coming from water fees. As the debt commitment declines, SCP is able to use its water sales revenues for structural renovations according to the age of the installations and clients' service quality and security needs. Currently, SCP is undertaking huge rehabilitation programs.

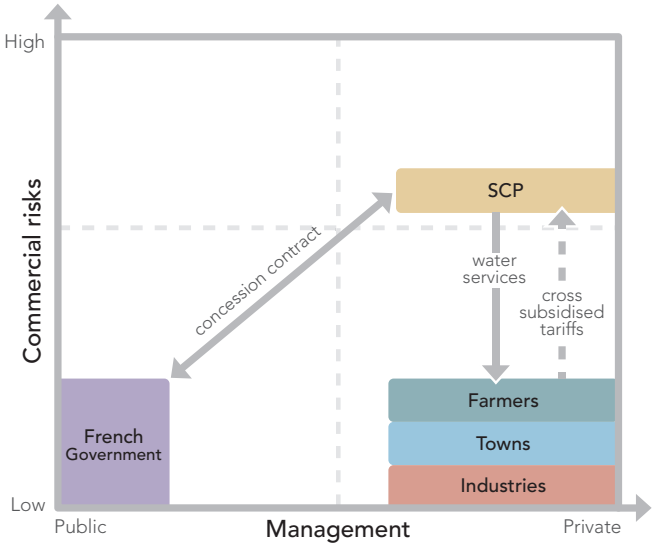
Marginal cost pricing for long-term development makes consumers accountable for investment and operational expenses required to fulfill their specific needs. It provides a fair and objective basis for setting fees according to the different uses. Farmers get a government-authorized reduction in their irrigation fees, set at 60 percent by SCP, thus highlighting the synergy between the different activity sectors in favor of agriculture., farmers pay almost nothing for capital costs, but they pay their share of current OMM. The other uses pay almost the full cost (including investment and renewal), which makes the overall balance sustainable.

Risks

- **Political risk.** Will the principle of solidarity between agriculture and other uses be sustainable in a changing socioeconomic context?
- **Financial risk.** Will shareholders continue to give priority to sustainable development through a sound policy of maintenance and asset renewal, or will they be tempted to skimp in order to lower the tariffs or to get their money back quickly?
- **Water service.** All is implemented in the house (design and construction with development of necessary skills, operation and maintenance, and business development).

Project structure (cont.)

FIGURE A2.7: SCP Case Study Diagram



Financial arrangements

TABLE A2.10: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	N/A
Irrigation water value	$0.200/m^3 to $1.0/m^3 (and more, for high-value-added crops)
Water pricing	• $0.150/m^3 (irrigation) • $0.500/m3 (other uses) • $0.375/m3 (average)

Lessons learned

Every public or private stakeholder (water user, manager, public body) is expected to contribute equitably to expenses so that all uses are legitimately funded. Yet, almost 50% of the investment was covered by water fees, the rest was provided by public funding (from Europe, government, and local authorities) and bank loans. The hydraulic infrastructure has a structural and sustainable role and therefore warrants investment subsidies. Local governments (SCP shareholders) and the central government have determined that irrigated agriculture should benefit from other users' and public bodies' solidarity, and trigger financial sustainability through multi-use of infrastructure among agriculture, urban supply and industry. Tariff policy is set individually for every use. Income from water sales enables SCP to reimburse the self-financed portion of its investments and cover all operational, maintenance, and renovation expenses without any subsidies. Under these conditions, system sustainability depends solely upon local economic dynamics and loyalty on the part of clients who are free to subscribe or unsubscribe at will. Meeting their needs with respect to performance quality and service cost is therefore vital.

SCP has public shareholding and enjoys a decentralized governance, yet it applies commercial management with private accountancy and efficiency.

1.10. CACG/NESTE, France

Project details	Country	France
	Project size (hectares)	60,000 (two-thirds collective, one individual)
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Maize, vegetables, fruits
	Type of PPP	Concession
	Project developer	Water resource manager (IDSP), i.e., CACG
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	Water resource manager (IDSP), i.e., CACG
	Governance	Government officials
	O&M and management	Water resource manager (IDSP), i.e., CACG
	Agricultural production	Farmers

In France, irrigators do not benefit from actual water rights on river waters. According to the 1992 Water Law, they may be authorized to withdraw a predefined amount of water during the irrigation season. The authorization is theoretically given for only one year, so the government can change the water allocation in case of new demands for agricultural, environmental, or domestic uses. This allocation can also be changed in case of unusual water shortages.

In southwestern France, rivers are frequently used to convey water from dams to irrigated areas over a distance of roughly 100 km, with hundreds of irrigators and other users along their courses. Although the 1992 Water Law clarified the issue of water allocation and the role of the government, particularly as regards law enforcement, it soon appeared impossible for the few public officials to manage users' files and to assess demand and resource balance year after year. The law foresaw a possibility for the government to delegate part of its role but contained no specifics.

Project structure

CACG, as a SAR with a state concession for irrigation and water since 1960, proposed to explore this new type of delegation of water allocation. It is a leading private sector company with 50 percent ownership of the public shareholding owned by the local government.[47] The main challenge was to separate clearly the role of the water resource management service provider (WRMSP, a new kind of IDSP) from the government's role as regulatory authority.

In addition to the standard functions of OMM for canals and dams, the IDSP takes on the new function of water allocation, consisting of the following:

Preparing the annual file of authorizations supported by impact analyses establishing the demand and resource balance. For the Neste system, the file consists of 1,500 registrations, each listing the geo-referenced withdrawal points, details about the client, and the authorized water "quota". Every year 10 percent of the authorizations are subject to modifications.

Monitoring, maintaining, and reading the meters. Each year, 5 percent of the meters are repaired or changed. Public officials are informed of any illegal withdrawals.

Negotiating with users' representatives and other stakeholders (the Commission Neste) in case of unusual water shortages.

Applying the tier pricing system, with a high deterrent price for any water consumption beyond the quota.

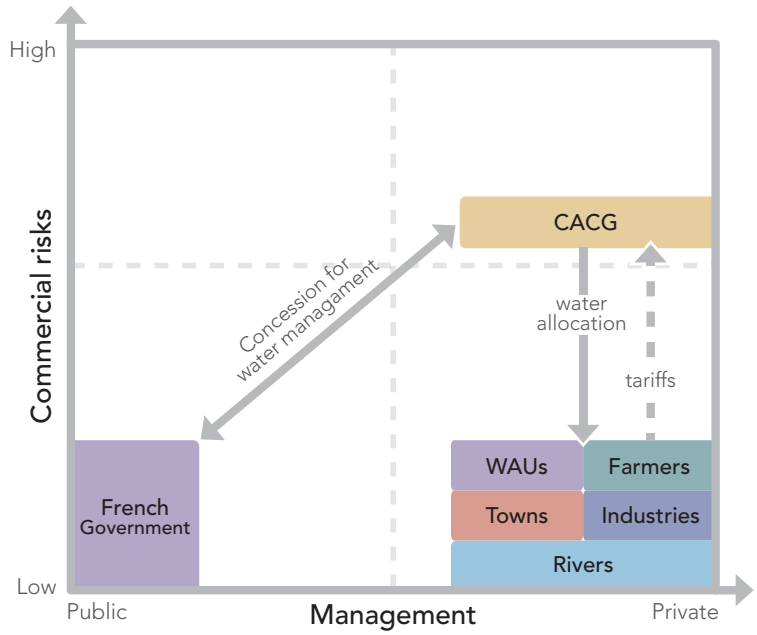
The government retains its role of giving a comprehensive authorization to the entire file, controlling how the IDSP ensures resource-and-demand balance and respects the minimum permissible flow at fixed points along the rivers, and enforcing the law in cases of illegal user activities.

Risks

- **Political risk.** Courage is needed to clarify inequitable arrangements. Bureaucratic wariness on the part of state officials, fearing loss of some of their power or distrusting the private operator, can jeopardize success.
- **Financial risk.** Although the cost of the water allocation service is not high, it cannot easily be broken out and charged separately. This service must be coupled with standard canal and dam OMM to be accepted by users in a joint package together with demand and resource management service.

47 http://www.indiaenvironmentportal.org.in/files/file/ppp-irrigation-drainage-sector-india.pdf

Figure A2.8: CACG Neste Case Study Diagram



Financial arrangements

TABLE A2.11: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	\$1.0/m³ (as an average for 1,500 m³/ha)
Irrigation water value	\$0.20/m³ (up to \$1.0/m³ for high-value-added crops)
Price of the river water service	\$0.015/m³ and \$0.10/m³ beyond the quota; ¼ of this price covers the costs of authorization, monitoring, and water allocation; the remaining ¾ are devoted to standard functions of OMM of dams.

Lessons learned

The PPP has been successful in the Neste system, with local authorities now trying to apply the same arrangement to other basins. Prerequisites for the successful replication of such a contract include the political courage to clarify water authorizations, and the presence of a service provider who can and will assume the water development and management activities and technical construction.

Opportunities

For the private sector, this service (water allocation) is not a large piece of business, but it gives the IDSP credibility for a larger job: resource management. Sharing river water between irrigation and environmental uses is a recurrent problem in France, even when releases from dams can increase low flows during the irrigation season. All stakeholders are interested in innovative solutions. Water markets are not a feasible solution. Instead, the water allocation service has been identified, and this function has been successfully delegated to a professional provider in the Neste system.

1.11. Murray, Australia

Project details	Country	Australia
	Project size (hectares)	900,000, 60 percent irrigated annually
	Cost of project	$2.1 billion
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Field crops and horticulture, pastures and dairy farms
	Type of PPP	
	Project developer	Goulburn-Murray Water Authority (GMWA)
	Private sector service provider	Goulburn-Murray Water Authority (GMWA)
	Public sector institutions	State governments
	Current Status of Project	Implementation
Allocation of Irrigation scheme functions	Investment	GMWA
	Governance	Government
	O&M and management	Management: Murray-Darling Basin Agreement (resource) Murray Irrigation Ltd (distribution) O&M: GMWA
	Agricultural production	Farmers
Project structure	Water management in the extensive Murray-Darling Basin is under the jurisdiction of state governments. A basin agreement, the Murray-Darling Basin Agreement (MDBA), was signed by five state governments as a basis for water sharing among the states of the basin; basin natural resource management policy; control of surface water diversions from basin streams; and interstate water trading. In this framework, different water management entities are in charge of water services. In Victoria, for instance, a "corporative" state-owned authority, the Goulburn-Murray Water Authority (GMWA), was created in 1994 to provide services in irrigation districts (900,000 ha agricultural area), as well as bulk water supply and diversions licensing. The asset value is worth AU$3,000 million ($2,250 million). Of this value, district services represent AU$1,500 million. The turnover is about AU$30 million ($22.5 million). The annual diversions approximate 3.5 billion m3.	

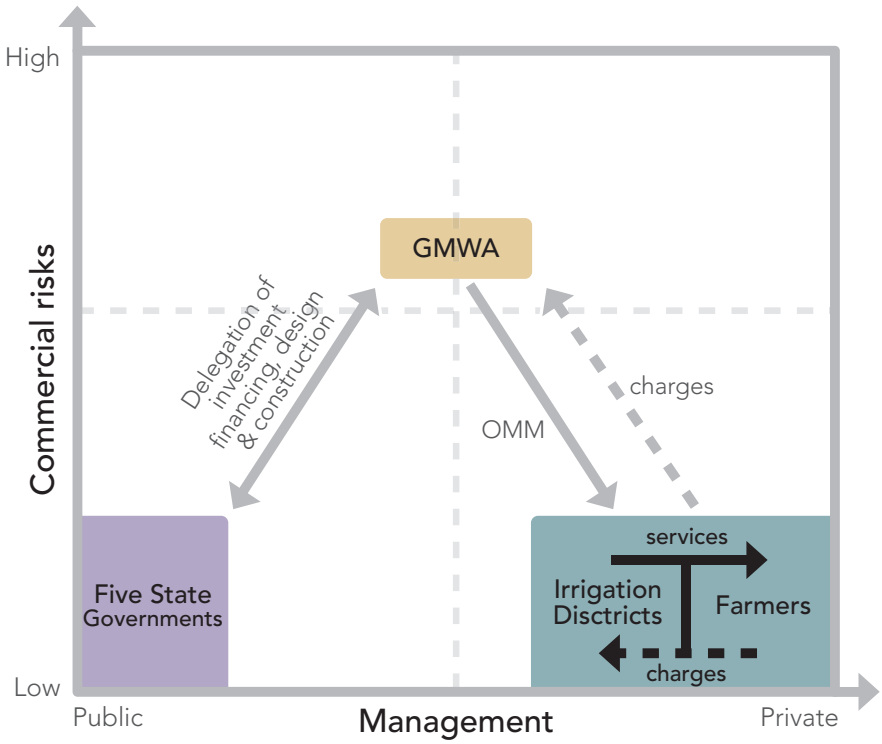
Project structure (cont.)

Reform achievements, since the creation of the GMWA, can be summarized as follows: separation of services; open and transparent financial reporting; customer involvement via water services committees and strong sense of ownership in irrigation districts; environmental management improvement; asset management improvement; 14 percent reduction in operating and administrative expenditures; full cost recovery for services; water trading development; and improvement of natural resource management.

The $2.1 billion Goulburn-Murray Water Connections Project aims to provide the Goulburn Murray Irrigation District with a more efficient irrigation delivery system. The project has been implemented in two stages, with the objective of achieving water savings of 225 gigaliters in Stage 1 and 204 gigaliters in Stage 2.

The state-owned enterprise for irrigation modernisation in Northern Victoria, trading as Northern Victorian Irrigation Renewal Project (NVIRP), was initially established in 2007 to plan, design and deliver the project. However, following a restructuring, Goulburn-Murray Water (G-MW) has been responsible for the governance of the project since July 2012. Since June 20 2013, both Stages 1 and 2 of the project have been underway.[48]

FIGURE A2.9: Murray Case Study Diagram



48 http://www.audit.vic.gov.au/puSampleblications/20131126-AFR/20131126-AFR.html#s44

Financial arrangements

TABLE A2.12: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	AU$0.4/m3 = AU$1,400 million (farm gate value/3,500 million m3)b
Irrigation water value	Not calculated
Water pricing	AU$0.013/$m^3$ = AU$45 million (for district/3,500 million m^3)

The following table summarises the budget, as well as actual and committed expenditure as of June 30 2013:[49]

TABLE A2.13: Budget and expenditures

Component	Revised budget (AU$ million)	Expenditure to date (AU$ million)	Committed expenditure (AU$ million)
Stage 1			
Capital expenditure	592	532	29
Farm connection costs	361	244	16
Operating costs	51	45	1
Subtotal	**1,004**	**821**	**46**
Stage 2			
Capital expenditure	289	19	26
Farm connection costs	710	35	4
Operating costs	60	9	1
Subtotal	**1,059**	**63**	**31**
Total	2,063	884	77

Source: Victorian Auditor-General's Office

Lessons learned

The concept of professional service provider acting as a state-owned and mission-entrusted third party is a success. Farmers can feel confident that they have reliable OMM and that the cost they pay is their fair share. Such a concept is designed to achieve the following: clarification of business boundaries and financial relationship with government; financial viability of services; asset reconfiguration; clarification of the water rights framework; environmental sustainability; and cooperative catchment cultures.

49 http://www.audit.vic.gov.au/publications/20131126-AFR/20131126-AFR.html#s44

1.12. Toshka (Southern Valley Development Project), Egypt

Project details	Country	Egypt
	Project size (hectares)	230,000 irrigable
	Cost of project	n/a
	Number of farmers targeted	
	Irrigation technology employed	Drip irrigation or central pivot irrigation
	Crops covered	On experimentation: grapes, fruit trees, vegetables under greenhouses, trees
	Type of PPP	Concession; PSD
	Project developer	Main works: MWRI Distribution system: Private sector (KADCO)
	Private sector service provider	
	Public sector institutions	MWRI
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	• Main works: MWRI • Distribution system: Private sector (KADCO)
	Governance	Ministry of Water Resources and Irrigation (MWRI)
	O&M and management	• Main works: MWRI • Distribution system: IDSP (or WUA federation potential in operation)
	Agricultural production	
Project structure	Regional water resources are the Nile River's waters at the entrance of the Nasser Lake, upstream Assouan Dam: 90 billion m3 a year on average, with a 185 billion m3 storage capacity in the reservoir. According to a previous agreement between Egypt and Sudan, Egypt normally gets an average 55 billion m3 and Sudan gets 35 billion m3. This does not seem to raise important problems between the two countries, because Sudan's irrigation development remains low and its annual water requirements are far less than 35 billion m3 a year. But other countries within the Nile watershed, such as Ethiopia, are excluded from the sharing agreement and seek renegotiation, arguing that more than 80 percent of the resources come from rainfall inside Ethiopia. The problem, at the moment, is not acute because the other countries' requirements are low and have so far been met. Inside Egypt, water requirements are high. They consist of water for irrigation, industries, domestic use, hydropower, and navigation. Egypt's water consumption is not monitored internationally, but it seems that more than the agreed allocation of 55 billion of m3 is being used. In addition, at full development, the Toshka project will require a significant part of the Egyptian allocation (at least 10 percent).	

Project structure (cont.)

For that reason, the Ministry in charge of project design and completion is trying to provide the right conditions for the highest possible hydraulic yield of water use. Some technical principles are applied or are planned: a supervisory control and data acquisition (SCADA) system for water operation in conveyance works; concrete-lined canals for transportation and distribution (or distribution under pressure in some cases); drip irrigation or central pivot irrigation (surface irrigation prohibited); reuse of drainage water; and control, monitoring, and measurement of discharges and volumes supplied. Unit consumption restrictions are supposed to set the water allocation lower than the annual evaporation rate, consequently demanding a real water-saving effort from future irrigators.

In addition to the Mubarak Pumping Station, the Toshka Project also involves the construction of 50km of main transfer canal (Sheik Zayed Canal), four additional 22km side branches and 800m of feeder pipeline, at a final anticipated cost of around $70 billion. The project aims to double the region's arable land, develop and extend agricultural production and create new jobs and population centres away from the confines of the Nile Valley.

The project is sponsored by the Ministry of Water Resources and Irrigation (MWRI) in Egypt. Design of the Mubarak Pumping Station was completed by a JV between Hamza Associates and Lahmeyer, while the construction consortium partners were Arabian International, Skanska and Hitachi. A strategic partnership between KADCO and Sun World form the project development and management team.[50]

I&D functions

The I&D functions are divided as follows:

- Investment and Financing via the government budget.
- Design and construction. The Ministry of Water Resources and Irrigation (MWRI) (one department for the pumping station, another department for the conveyance works).
- Water allocation. Nearly all the water will be devoted to irrigation. The requirements for domestic uses are low. At full development, an estimated 400,000 people will settle in the area. Requirements for industrial uses have not yet been considered, but no one can imagine that they will compete with irrigation requirements, no matter what type of agribusinesses settle in. The MWRI will be in charge of transportation and allocation of water at the head of the distribution works.
- Water monitoring (allocation control). MWRI will be responsible for water control at the head of the distribution system. Who will be in charge of water control within the distribution system has not yet been decided. Two main options are being considered: either a water user association (WUA) or a WUA federation, or a company that will collect water distribution fees and pay for operation, maintenance, and management of the distribution system.

50 http://www.water-technology.net/projects/mubarak/

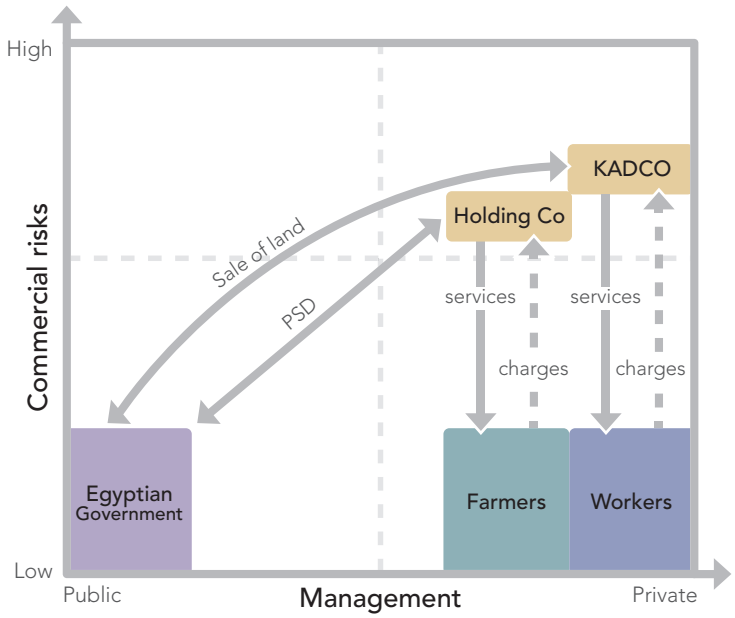
Project structure (cont.)

- Maintenance control. MWRI, the owner of the production and conveyance assets, is in charge of maintenance control. The owner of the distribution assets is either a WUA, a federation of WUAs, or a specific company. MWRI is supposed to be in charge of maintenance works control.
- Actual maintenance and operation. MWRI is responsible for O&M of the production and transportation works.
- Agricultural production (water value optimization). There is no planned control of water use. The government deals mainly with limitations on the annual water use volume, but not by use, as long as water for agricultural use is clean and the wastewater is disposed of outside the Nile River Basin. The private sector is expected to be attracted by the project and would be able to get the optimized water benefit within the restricted water consumption standard.

Risks

- Among commercial risks, construction is satisfactory, and time schedules are respected, but prices are increasing rapidly. In operations, there is little experience operating a main canal and no experience recovering charges. On the upside, new management technologies are being developed (for example, remote control, SCADA).
- Water-specific risks. Water resources are plentiful, but in case of successive dry years restrictions will be applied, posing possibly drastic water supply risk after full development but not in the development phase. Because no farmer but KADCO has settled down in the area, the water demand is zero.

FIGURE A2.10: Toshka Case Study Diagram



Financial arrangements	According to the financial principles underlying the project, water will be paid for, with progressive charges for water production and transportation, from 4 cents of the Egyptian pound (EGP) per m3 (around $0.005) for a low-unit consumption up to 6 cents per m3 for a high-unit consumption. However, these prices do not appear to adequately cover the cost of pumping from Nasser Lake. As regards the pumping and conveyance infrastructure, the government does not seem able to take care of most expenses sustainably. Water fees collected by the Ministry for abstraction and conveyance of water barely cover the pumping costs. Some budgeting problems may therefore crop up over the long term. As for the distribution system, the fees to be collected are not known yet, but they should in principle cover all the investments when the private sector (KADCO) takes over the distribution system and a fraction (to be determined) of the investments in case of a delegated management arrangement. In this case, the system should become sustainable under the responsibility of the private partners, investors, or delegated management. An investor for the first 25 percent of the area was found reasonably quickly, demonstrating interest in the project.
Lessons learned	There have been some suggestions that the project was too political, and that not all technical considerations had been taken into account prior to commencement of implementation, with a lack of overall transparency about the project. These together have led some to suggest that the project has not been a success.[51]

51 http://www.egyptindependent.com/news/toshka-new-valleys-mega-failure

52 http://siteresources.worldbank.org/EXTWAT/Resources/4602122-1213366294492/5106220-1213804320899/8.0Morocco_Guerdane_Irrigation_Concession_Contract.pdf

53 http://www.syngentafoundation.com/content/api/org_files/ppp_guerdane_morocco_mr_arrifi.pdf

54 http://siteresources.worldbank.org/EXTWAT/Resources/4602122-1213366294492/5106220-1213804320899/8.0Morocco_Guerdane_Irrigation_Concession_Contract.pdf

55 Other members included Morocco's Fond Igrane and Infrastructure Development and Management (Infra Man), an Austrian firm. Source: 'Success Stories – Public-Private Partnerships. Morocco: Guerdane Irrigation' – WB IFC.

1.13. Guerdane

Project details	Country	Morocco
	Project size (hectares)	10,000
	Cost of project	$85 million for infrastructure[52]
	Number of farmers targeted	670[53]
	Irrigation technology employed	Pressurised for drip
	Crops covered	Citrus
	Type of PPP	30-year concession[54]
	Project developer	
	Private sector service provider	A consortium led by Omnium Nord-Africain (ONA), a Moroccan industrial conglomerate[55]
	Public sector institutions	Government of Morocco
	Current Status of Project	Ongoing contract signed in 2004
Allocation of Irrigation scheme functions	Investment	IDSP
	Governance	• Water monitoring: Basin agency • Maintenance and pricing control: ORMVA Souss-Massa
	O&M and management	Management: IDSP (between irrigators); basin agency (between uses) O&M: IDSP
	Agricultural production	Farmers
Project structure	In Morocco, major irrigation schemes are managed by public irrigation agencies (Offices Régionaux de Mise en Valeur Agricole, ORMVAs). For 10 years, the government has been driving a reform with the World Bank's support to restore financial sustainability. Another way is also being explored: attracting the private sector in financing, implementing, and managing new investments. Vast areas have already been equipped but, because of water scarcity, few new irrigation investments are in the pipeline. Its main characteristics are as follows: • A total of 600 farmers grow irrigated high-value crops and have well-organized marketing arrangements, but their water resource is a fast-declining aquifer also used for municipal purposes. The technical-best solution is a 70 km–long pipe transferring 45 million m3 from the Chakoukane Dam to a gravity-pressurized network of 10,000 irrigated ha at Guerdane. • The I&D service provider (IDSP) is asked to finance an investment estimated at $80 million, including $40 million in government funds, to design and construct the project on the basis of farmers' subscriptions, and to provide water service for 30 years. This is a concession contract, which includes all the transferable functions. The winning bid will be the one proposing the lowest water price for the farmer.	

Project structure (cont.)

- The final price is estimated by International Finance Corporation (IFC) experts at between $0.15/m3 and $0.20/m3, close to the current costs of pumping underground water. This price is acceptable to the farmers relative to the obtained water value but is much higher than the public water price in the neighboring ORMVA ($0.05/m3).

Before the last call for tenders, other solutions had been attempted for five years on approximately the same technical basis. A first project was supported by Agence Française de Développement (AFD) through water user associations, more in line with management transfer than public-private partnership (PPP). The project failed because of insufficient farmer subscription (between 50 percent and 70 percent), probably due to the heavy financial engagement required from farmers and their agricultural bank (Crédit Agricole du Maroc) at the beginning of the process. A second project, a concession, was proposed by the Suez Group. It's more attractive conditions elicited a higher level of subscriptions, but the process was interrupted by the IFC tender.

Roles and responsibilities

All three parties will share the risk of a water shortage, allocated as follows:

- The concessionaire may have up to a 15 percent consequential loss in revenue;
- The farmers face a tariff surcharge during drought-induced shortages, which may be up to 10 percent of the irrigation tariff; and
- The government will financially compensate the private operator in the event of serious water shortage (which would otherwise result in more than 15 percent loss in revenue).

Government of Morocco. The government is responsible for ensuring water security, and are also responsible for compensating the private operator if water shortages cause more than a 15 percent loss of revenue.

Private operator – the two main obligations of the private operator are:

- Financing 50 percent of the costs for the investment, design, and construction of the irrigation of 10,000 hectares, which includes construction of a 90km pipe and a 300km distribution network to transport the water, and a distribution system to deliver it to farmers based on the size of their citrus groves; and
- 30 years of operation and management of the irrigation system, and all related costs which will be reimbursed through irrigation tariffs paid by the farmers.

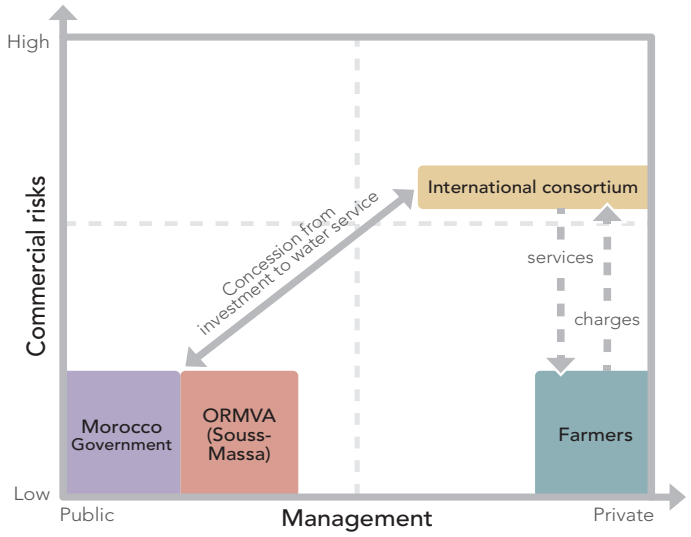
The obligation to commence construction was delayed until enough farmers had subscribed (and paid the initial fee) to cover 80 percent of the water supply expected through the scheme.

Commercial farmers. Farmers paid an initial fee (subscription charge) to cover the average cost of an on-farm connection to the irrigation scheme, which mitigated the risk to the private operator. This cost is set at approximately €1600 for each of the 10,000 hectares.

Project structure (cont.)

International Finance Corporation (IFC). The IFC advised the government of Morocco on the structure and implementation of the PPP irrigation scheme, including technical, financial, and legal due diligence. The bidding process was also conducted by the IFC, who led the marketing, prequalified potential investors, drafted bidding documents, oversaw the bidding process to ensure that it was appropriately competitive and transparent, and selected the winning bidder.

FIGURE A2.11: Guerdane Case Study Diagram



Risks

- **Political risk.** There is no immediate political or country risk. There is no apparent risk either in agricultural policy (European Union, World Trade Organization) because production is limited to cash crops. A minor political risk could lie in the public officials' aversion to change regarding the IDSP, having to switch from a bureaucracy to a customer-oriented relationship.
- **Financial risk.** Taking into account the big capital investment usually needed in irrigation projects, particularly in the Guerdane project, this is the major risk. Roughly two-thirds of the water price would be devoted to covering the capital cost. It must be kept in mind that the financial risk would generate a supplemental cost to the farmer because the private cost of capital will be higher than the public one.
- **Water supply risk.** As well documented in this project, the water risk consists first of the insufficient filling up of the Chakoukane/Aoulouz reservoirs, a risk partly covered by the government. The second water supply risk comes from water allocation between uses; but the government is clearly committed to respecting the order of priority between uses.
- **Water demand risk.** Demand risk does not consist of a breakdown of the agriculture economic model. But another risk for the future is permanent competition between the project surface water (price) and groundwater (pumping cost) if the Water Law is not properly enforced. If the evolution of the aquifer is not as bad as foreseen, quality of service will enable the IDSP to meet that competition.

Financial arrangements

The infrastructure for the project will cost approximately €170 million,[56] while the total project cost is expected to be approximately €195 million.

The concessionaire signed the 30-year agreement in 2004. The investment for the hydraulic assets will be divided as follows:[57]

- The private partner will contribute 50 percent;
- Farmers will fund up to 5 percent, each contributing €1600/ha; and
- Public funds will make up 45 percent, split equally between subsidy and a concessional loan with an interest rate of 1 percent and a deferred repayment of 20 years.

Farmers subscribe to water on the scheme and pay an initial fee of approximately $800/ha, and any water which is not subscribed for is reallocated among the subscribed farmers who need more.[58]

TABLE A2.14: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	$1.0–$2.0/m^3 (for 8,000 m^3/ha)[b]
Irrigation water value	N/A
Water pricing	$0.15–$0.20/m^3

Lessons learned

The IDSP winner of the Guerdane bidding has the first real opportunity to implement what looks like a promising irrigation concession contract in a developing country. This reference will be of prime importance for future projects, considering that several other governments are in a similar context of demand for irrigation investment and public budget constraints. The rate of return on capital will probably be less attractive than in the telecom sector, but the experience of the French SARs proves that a concession contract in irrigation can be financially sustainable when flawless service wins client loyalty and faithfulness.[59]

56 http://www.syngentafoundation.com/content/api/org_files/ppp_guerdane_morocco_mr_arrifi.pdf provides estimates in United Arab Emirates Dirham.

57 Technical Assistance to the Philippines' Department of Agriculture for the development of an analytical framework on public-private partnership in the irrigation sector.

58 http://siteresources.worldbank.org/EXTWAT/Resources/4602122-1213366294492/5106220-1213804320899/8.0Morocco_Guerdane_Irrigation_Concession_Contract.pdf

59 World Bank (2007), "Emerging Public-Private Partnerships in Irrigation Development and Management".

2. O&M Contracts

This section presents 10 case studies of a PPP scheme type in which the private sector performs functions related to the operation and management of an irrigation scheme.

An operation and maintenance (O&M) contract is an agreement between the project company and the operator. The project company delegates the operation, maintenance and often performance management of the project to a reputable operator with expertise in the industry under the terms of the O&M agreement. The main common features are that the awarding authority engages the contractor to manage a range of activities for a relatively short time period (2 to 5 years).

The simplest O&M contract involves the private operator being paid a fixed fee by the awarding authority for performing specific tasks - the remuneration does not depend on collection of tariffs and the private operator does not typically take on the risk of asset condition. Where the contracts become more performance-based, they may involve the operator taking on more risk, even risk of asset condition and replacement of more minor components and equipment.

Table A2.15 provides a list of the case studies presented in this section and schemes' pertinent details. The section contains new case studies (Megech-Seraba, Ethiopia) and cases studies produced in the World Bank 2007 case study report.

TABLE A2.15: The 10 O&M Contract Schemes

Scheme	Size, ha	Further details
Megech-Seraba Irrigation and Drainage Scheme, Ethiopia	4,000	• Farmers were willing to pay just 15 percent of the cost of the irrigation, requiring partial government subsidy.
Société d'Aménagement pour l'Amenagement et l'Exploitation des Terres du Delta et du Fleuve du Sénégal (SAED), Senegal	40,000	• Crop diversity increased but with low intensity. • Original irrigable area was 90,000 ha but some already irrigated land is inactive.
Alaotra, Madagascar	4,000	• Reviving previous irrigation which had deteriorated due to issues with the previous set-up and withdrawal of foreign aid in 1994 due to Madagascar's political and financial issues.
Nakhlet, Mauritania	27	• Village scheme/cooperative with 29 farmers. • Finances the cropping season with its working capital.
Maniçoba, Brazil	4,300	• Rehabilitation and modernisation of the systems and administrative functions. • Users pay two fees: one for infrastructure and renewal, and another for the system O&M.
Toula, Niger	350	• The government provides the water for free, so users share the costs of the pumping only. • A good system with governmental agencies playing a regulatory role.

Scheme	Size, ha	Further details
Pequin Kavaje, Albania	100,000	• The water fee is kept lower than the long-term sustainability cost, otherwise it would be too high for farmers' incomes. • Part of Albania's second rehabilitation project which began in 2000 (the first began in the early-1990s).
Sonora, Mexico	3,300,000	• Successfully transferred irrigation districts to farmer management through WUAs, with support from the government.
Tieshan, China	25,800	• Established self-management of irrigation in Hunan (one of the two provinces within the project). • Lacks volumetric water measurement, limiting the effectiveness of the partnership and probably causing the low water use.
Adasiyeh, Jordan	400	• A successful experiment, whereby quotas were enforced and well respected as an alternative to the incumbent rotation of water distribution for water management.

2.1. Megech–Seraba Irrigation and Drainage Scheme

Project details	Country	Ethiopia
	Project size (hectares)	4,000[60] (6,000 landholdings)
	Cost of project	$10.955 million[61]
	Irrigation technology employed	Pumped to main reservoir and then gravity
	Number of farmers targeted	Smallholders (2,000 households, inexperienced in irrigation)
	Crops covered	Over 70 percent of farmers cultivate chickpeas, teff, finger millet, and/or sorghum[62]
	Type of PPP	Operation and Management[63]
	Project developer	
	Private sector service provider	BRL Ingénierie
	Public sector institutions	Government of Ethiopia, Amhara Bureau of Water Resources, PPIAF
	Current Status of Project	Implementation: Management contract signed in April 2012
Allocation of Irrigation scheme functions	Investment	Investment by the government (funded by IDA)
	Governance	Government of Ethiopia and regional government
	O&M and management	Contract signed April 2012—BRL Ingénierie
	Agricultural production	Smallholders

60 World Bank-Ministry of Irrigation and Water Development—Public Private Partnership Options. Study and awareness raising for irrigation investments in Malawi.

61 https://www.ppiaf.org/sites/ppiaf.org/files/documents/IrrigationPPP-Ethiopia-Study-Final-Report.pdf

62 https://www.ppiaf.org/sites/ppiaf.org/files/documents/IrrigationPPP-Ethiopia-Study-Final-Report.pdf

63 http://www.unece.org/fileadmin/DAM/SPECA/documents/kdb/2012/Seminar_Kyrgyzstan/Smith2.pdf

Project structure

As of 2008 there were 13,600 farming households in Megech, each averaging about 2 ha (most are between 1 ha and 3 ha) and bringing in approximately $245/year. These are subsistence farmers, cultivating chick peas, teff cereal, finger millet, and sorghum. Only 11 percent of the land in the area of the Megech project is irrigated.

The project will involve two contracts:

- Construction, and
- Management, including supervision of the first contract and Operation and Management functions—an $8 million, eight-year contract was signed between the government of Ethiopia and a French operator, BRL Ingénierie in April 2012.

Responsibilities and Roles[64]

Government of Ethiopia. The government will finance the project with a World Bank concessionary loan. This includes procuring infrastructure and related equipment required for the irrigation from the pumping station at Lake Tana to bring the water to field level. There will be approximately 1,000km of channels.

The government will also set up a trust account which will receive subsidies and other payments under the PPP contract. This trust account will be managed by a private financial institution such that it is isolated from government interference. The private operator therefore understands that the payments which are owed to it from the government are, and will continue to be, available.

Amhara Bureau of Water Resources. The regional branch of the Ministry of Water Resources will be responsible for providing support to the farmers in completing the irrigation structure with implementing the irrigation works at the ground level.

Water User Association. A regulation was passed in 2010 to recognize WUAs. Their primary responsibilities include coordination among users and maintenance of tertiary water channels. The users will be responsible for the actual cost of water, which will include the energy costs of pumping water from the lake. The government will be responsible for user fee collection.

After eight years, the O&M responsibilities will be undertaken by a public entity trained by the PPP contractor.

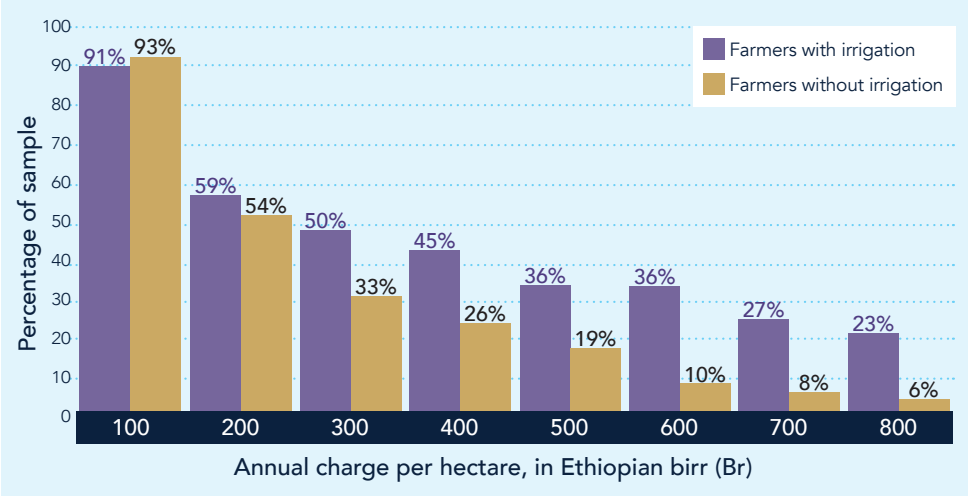
Farmers. Financing and constructing irrigation works at the ground level, with support from the government. Farmers are expected to share a portion the costs of the project through paying user fees to the private sector agent.

65 ADB. "Exploring Public-Private Partnership in the Irrigation and Drainage Sector in India, A Scoping Study."

The project will be financed through a World Bank International Development Association (IDA) credit of $30 million.[65] IDA is also providing the $8 million in credit for the management contract. The economic rate of return is 22 percent.[66]

The need for this project to become a PPP was made clear through a PPIAF survey[67] which found that the farmers' willingness to pay was too low to cover the estimated operating and maintenance costs of the systems. The private operator in the project would therefore need to be partially subsidised by the government.

FIGURE A2.12: Farmers' Willingness to Pay in Megech



Source: Castalia Willingness-to-pay survey

To provide for the average willingness-to-pay of about Br 300, the subsidy required has a present total value of Br 220 million (about $11 million). Four percent of this is for O&M, with the rest as a capex subsidy. This is in line with the O&M costs of Br 1,157/ha/year compared to the capital costs of Br 213 million.

Tariff payable by farmers

It was recommended that the tariff start at the willingness to pay of approximately $15/ha/year (Br 310), just 15 percent of the $100/ha/year (Br 2,000) cost paid by others on similar schemes in Ethiopia. The tariff will increase towards $100/ha/year over a seven-year transition period, with larger increases towards the end of the period allowing smaller increases nearer the start to account for the non-linear increase in farmers' incomes. It is expected that, as farmers begin to see the benefits of irrigation, their willingness-to-pay will increase. This is supported by the results of the survey of farmers in Megech who do and do not have irrigation, displayed in the figure above, where farmers who already use irrigation had an average willingness-to-pay much higher than those without irrigation, of Br 495 compared to Br 310.

65 http://www.ppiaf.org/sites/ppiaf.org/files/publication/PPIAF-Impact-Stories-PSP-in-Irrigation-in-Ethiopia.pdf

66 https://www.ppiaf.org/sites/ppiaf.org/files/documents/IrrigationPPP-Ethiopia-Study-Final-Report.pdf

67 https://www.ppiaf.org/sites/ppiaf.org/files/documents/IrrigationPPP-Ethiopia-Study-Final-Report.pdf

Financial arrangements (cont.)

The table below shows suggested increases in tariff.[68] As the year 7 (and beyond) amount is greater than the O&M costs, the government may be able to recover some of the initial subsidy funds.

TABLE A2.16: Increase in tariff

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Tariff (ETB/ha)	300	375	488	658	954	1384	2006
% change		25	30	35	45	45	45

Performance indicators[69]

Key performance indicators are built into the O&M contract and are linked to the performance remuneration. There are five areas of performance including:

- Staffing and labor;
- Administration and finance (User and WUA registration; billing and collection of fees);
- Capacity building and customer service (demonstration plot, establishment of IWUAs, long term O&M entity);
- Operation (irrigation service delivery, efficiency); and
- Maintenance (irrigation and drainage service disruptions, access roads).

Lessons learned

The difference between the willingness-to-pay of those farmers with and without irrigation schemes already in place provides valuable information which allows a more effective tariff path to be chosen, to the benefit of both the farmers and the investors.

This project thus provides an interesting example of an approach to developing the farmers' willingness and ability to pay for an irrigation scheme to a point at which it can potentially cover the O&M costs and enable some recovery of the up-front development costs.

While the civil works and operation & maintenance contracts are separate, the O&M contract commences at the design phase itself. The O&M contractor reviews designs, supervises the construction and then operates and maintains the scheme. Meanwhile, the O&M contractor will be building capacity and training the local water users associations (WUAs) to take over the scheme once its contract ends. By having an enhanced O&M contract, the project not only brings elements from a traditional BOT type of concession, it also brings sustainability by preparing the actual users to operate and maintain the scheme properly.

68 https://www.ppiaf.org/sites/ppiaf.org/files/documents/IrrigationPPP-Ethiopia-Study-Final-Report.pdf. The increases displayed in the table do not account for inflation, therefore the actual nominal increases will be higher

69 http://www.unece.org/fileadmin/DAM/SPECA/documents/kdb/2012/Seminar_Kyrgyzstan/Smith2.pdf

2.2. Société d'Aménagement pour l'Aménagement et l'Exploitation des Terres du Delta et du Fleuve du Sénégal (SAED), Senegal

Project details	Country	Senegal
	Project size (hectares)	40,000 (mostly collective)
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	Gravity irrigated
	Crops covered	Rice (50 percent), crop diversification (50 percent)
	Type of PPP	OMM
	Project developer	
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	
	Governance	SAED
	O&M and management	OMVS
	Agricultural production	Farmers

Project structure

In 1999/2000, the French Aid Agency, AFD, financed a study to determine the maintenance needs of the 40,000 ha of the Senegal River left-bank irrigation schemes and the response the various stakeholders were ready to give. The study's client was Société d'Aménagement pour l'Aménagement et l'Exploitation des Terres du Delta et du Fleuve du Sénégal (SAED, the governmental local development operator). The study was conducted by BRL (a French SAR, Société d'Aménagement Régional), with CACG (another French SAR) as SAED's consulting engineer.

The most significant features of irrigation on the left bank of the Senegal River Valley, as outlined in the 1989 CACG-Euroconsult-Gibb Master Plan, are as follows. The left-bank potential for sustainable irrigation is about 90,000 ha, taking into account the competing needs of the Manantali hydropower plant and the annual artificial flooding required for environmental preservation. As of the year 2000, roughly 90 percent of that potential had theoretically been implemented, but more than half was out of order and out of production. It had been developed in a rudimentary way, either by companies seeking short-term profit or by unorganized villagers. As a result, the real irrigable area was estimated at only 40,000 ha. Of this area, about three-fourths (30,000 ha) consist of some 40 large-scale, publicly funded schemes, originally managed by SAED but now transferred to WUAs (locally known as GIEs [Groupements d'Intérêt Economique], federated into Unions de GIE). The remaining 10,000 ha consist of well-run, small-scale, private, or village irrigation schemes.

All 40,000 ha are gravity irrigated, making use of large diversion feeder canals (adducteurs) and large drainage outlet channels (émissaires). All canals and drains (aménagements structurants) are still under SAED management and (government) funding. Pumping stations withdraw water from the feeder canals into the irrigation networks.

The valley cropping pattern has slowly but gradually evolved from single cropping (paddy rice) to a much more diversified type, including tomatoes, onions, groundnuts, sweet potatoes, and maize. For the first time, in 2000, these new crops represented just over half the cropped area. Cropping intensity has, however, remained disappointingly low, some years barely reaching the 100 percent mark.

Since the management transfer, WUAs have been charging O&M services at 60,000 CFA per hectare (about $100), roughly broken down into: a third for pumping costs, a third for regular upkeep, and a third for heavy maintenance as a set-aside in DAT investment accounts (Dépôts à Terme are investment accounts with the Crédit Agricole du Sénégal), but these funds were often used for purposes other than those planned.

In terms of maintenance, SAED was engaged on two fronts: maintaining feeder canals and drains with unpredictable government funding and helping the water user associations (WUAs) maintain the pumping stations and irrigation schemes. For that purpose, an independent department had been created in 1998 within SAED, the Division Autonome de Maintenance (DAM), which could act as the government's maintenance team on feeder canals and drains and as maintenance service provider to WUAs through private contracting and billing.

The study, a highly participative process, produced the following recommendations, and their implementation has begun:

- ***For the feeder canals and drains*** a mixed WUA-government-financed maintenance fund, the FOMAED (Fonds de Maintenance des Adducteurs et Emissaires de Drainage) has been set up. The total cost of this heavy maintenance is estimated at $1.1 million a year for the 40,000 irrigated ha ($27.50/ha). Farmers have agreed to pay between $15/ha/year and $25/ha/year, depending on the type and quality of the services provided. The government is to top off the fund in proportion to the charges recovered. Seven mixed-management committees (representing government and WUAs) will control the funds and the outsourcing of maintenance works.

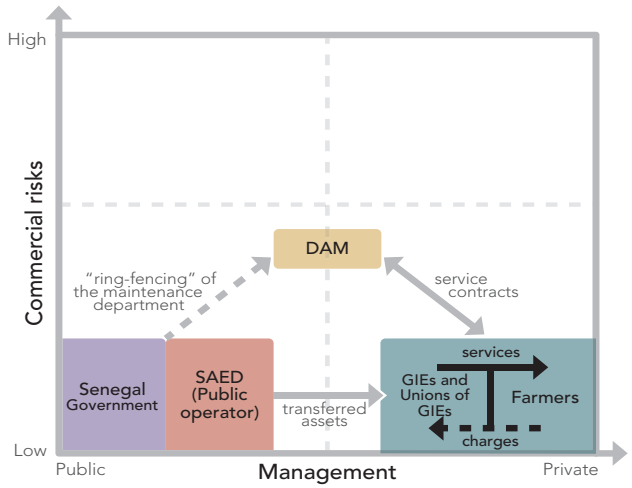
- ***For the pumping stations of the transferred*** schemes a WUA-financed maintenance and renewal fund, the FOMER (Fonds de Maintenance et de Renouvellement) will be created. The farmers' annual contribution, estimated at $0.5 million, will be managed by a federation of GIEs under governmental supervision (limited to veto right). This fund will replace the present DATs.

Risks

Among country risks, the political risk and the risk of devaluation are low. The main risk lies in the nearly total lack of protection for domestic rice against the opening up of the Senegal urban market to cheap rice imports from Asia.

- **Commercial risks.** Farmers' insolvency, linked to rice import risk, is considered moderate.
- **Recovery risk.** The WUAs will collect maintenance charges, so recovery risk is considered low.
- **Water-specific risks.** Because no other water resource is available in the valley, the water demand risk is nil. The water supply risk is considered low, because OMVS (the three-country Senegal water authority) is supposed to take into account all water needs in a balanced way.

FIGURE A2.13: SAED Case Study Diagram



Financial arrangements

Funding has been slow to materialise, even though the study and decision-making processes were highly participative.

The greater part of both funds will come from farmers' contributions, which go some way toward fulfilling the "water must pay for water" goal.

The government—through SAED—will still keep an eye on both funds; however, this is an arrangement farmers consider financially safe and technically sound.

No contribution is expected from third parties—for example, rice mills—which is somewhat disappointing.

TABLE A2.17: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	\$ 0.06/m^3 (5,000 kg/ha x 100 CFA/kg/15,000 m^3/ha)[b]
Irrigation water value	\$0.06/m^3 (identical, since gross margin without irrigation = 0)
Water service price	\$0.0024/m^3 for maintenance (FOMAED \$20/ha + FOMER \$16/ha)

Lessons learned

There are two interesting elements in the ongoing reform. First, the mixed funding of the seven FOMAED committees, where the government's contribution is in proportion to the recovered maintenance charges, seems promising. Second, the government's veto right on the FOMER maintains public (SAED) supervision and control over the maintenance of transferred irrigation schemes.

2.3 Alaotra, Madagascar

Project details	Country	Madagascar
	Project size (hectares)	4,000 irrigated
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Rice
	Type of PPP	OMM
	Project developer	Design and implementation: IDSP
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	A "project revival" study, conducted by CACG in 2000, led to a series of proposals that are being put into practice.
Allocation of Irrigation scheme functions	Investment	AFD and WUAs
	Governance	WUA Federation
	O&M and management	IDSP / WUA Federation (between farmers)
	Agricultural production	Farmers

Project structure

Malagasy farmers know Lake Alaotra as the country's "rice granary." Sheltered in a natural volcanic depression 200 km north of Antananarivo are 100,000 irrigated ha, which until 1990 were under the overall command of a government operator, SOMALAC (Société de Mise en valeur Agricole du LAC Alaotra). When the government closed down SOMALAC, farmers were hastily organized into compulsory WUAs (known as AURs, for Association d'Usagers des Réseaux) and left to their own devices.

The 4,000 ha of the AURs known as "the southeast valleys" (Marianina and PC15) organized themselves into a federation (FAUR) (With the help of French aid from AFD and an AFD-contracted, private irrigation service provider, BRL Madagascar) with promising results in terms of irrigation management and cost recovery. Each AUR sets water charges yearly for "secondary and tertiary" O&M expenditures and makes contributions to the federation's "primary" O&M expenditures (dam, major canals, and tracks). The cost-recovery rate is high (80-85 percent).

There are, however, two major shortcomings. Farmers' actual weight in the decision-making process was limited in comparison with the private service provider's, especially because BRL Madagascar was directly contracted and financed by AFD. Water charges were also low in relation to gross output (1 percent compared with 8 percent in the Senegal Valley) and covered only day-to-day operation and (light) upkeep of the irrigation schemes.

The situation deteriorated after 1994, when all foreign aid–supported projects were abruptly terminated due to Madagascar's political line and financial insolvency. Six years later, after the country's comeback, AFD decided to give it a second chance. A "project revival" study, conducted by CACG in 2000, led to a series of proposals that are being put into practice. The PPP involves an OMM service contract with fees charged to local clients. In this case, the service provider is a sub-contractor, the local branch of the int. company BRL Madagascar. The client is the private IDSP and WUA[70 71]

Risks

In light of the past 20 years of Madagascar's history, country risks loom large. Political risk is considered high to medium. A continuous, double-digit annual inflation is causing regular depreciations in the FMG. Moreover, the opening of the domestic rice import market is pulling down the rice price (no tariff protection for local rice).

Commercial risk. The production risk, and farmers' risk of insolvency, is shared to some extent between farmers and the I&D service provider.

Recovery risk. The cost-recovery risk depends on the government's authority in enforcing the law.

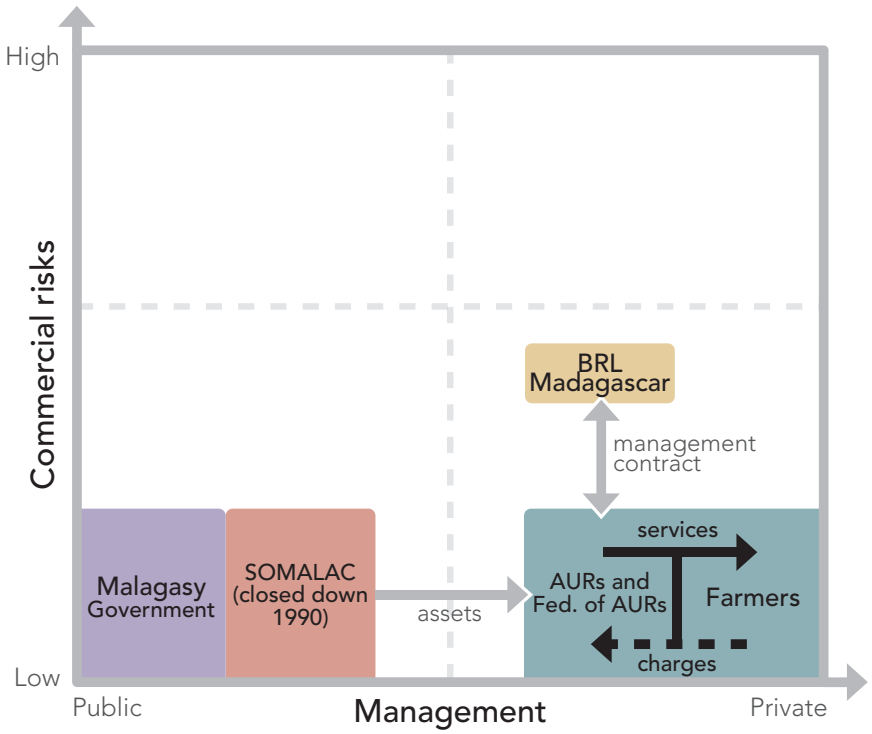
Water-specific risks. Because there is no alternative water resource, the water demand risk is nil. On the supply side, the control dam (Bevava) has been regularly silting up for years, depleting reservoir capacity.

70 http://www.icafrica.org/fileadmin/documents/Water_Meeting_2008/presentations/1.2._Winpenny_Finance_instrument_Keynote_Paper_EN.pdf

71 http://zenileabbay.files.wordpress.com/2013/05/sylvain-perret-stefano_farolfirashid-hassanw-water-governance-for-sustainable-development.pdf

Project structure (cont.)

FIGURE A2.14: Alaotra Case Study Diagram



Financial arrangements

TABLE A2.18: Economic Indicators of Project

Indicator	Value
Gross irrigation productivity	$0.08/m^3 (4.4 tons x FMG 1,000/kg/7,500 m^3)[b]
Irrigation water value	$0.04/m^3 (alternative dry crop = cassava)
Water service price	$0.004/m^3 (FMG 200,000)

Lessons learned

Two components in the Alaotra "revival project" may represent attractive opportunities for other potential PPP cases.

All irrigation functions are covered by actual negotiated, binding contracts. Among these contractual links, the most significant is the (proposed) direct link between rice yields and water charges.

The rice mills' participation in the maintenance fund, if confirmed (so far, it is just willingness), would constitute a real breakthrough in the PPP sphere.

2.4. Nakhlet, Mauritania[72]

Project details	Country	Mauritania
	Project size (hectares)	27.5 ha, with 119 fields cultivated by 29 farmers[73] (village scheme)
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	Pumping
	Crops covered	Rice, grown in wet season and yielding 8-9 t/ha;[74]
	Type of PPP	OMM, design
	Project developer	Design and implementation: IDSP and Village Cooperative
	Private sector service provider	
	Public sector institutions	
Allocation of Irrigation scheme functions	Investment	
	Governance	Village Cooperative
	O&M and management	Village Cooperative with IDSP support
	Agricultural production	Farmers with IDSP support

72 Vidal, A., and A. Nepveu de Villemarceau. 2001. "Irrigated Rice Agriculture in Sahelian Africa: Performance Analysis of Three Irrigation Schemes." GRID Bulletin, 17: 10–11.

73 http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/2131.pdf

74 http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/2131.pdf

Project structure

On the small (27 ha) village scheme of Nakhlet, Mauritania, operated by the village Coopérative (local village-based WUA), PSI-CORAF has proposed and tested a package of assistance and advice to farmers on water management and agriculture.

The monitoring, conducted in a series of agricultural campaigns, provided an overall diagnosis of the scheme. It included a technical design assessment (canals recalibration, improved engine/pump adaptation), as well as a management assessment (establishing irrigation frequency/crop yield relationships, proposal for enhanced water turnout and monitoring tools).

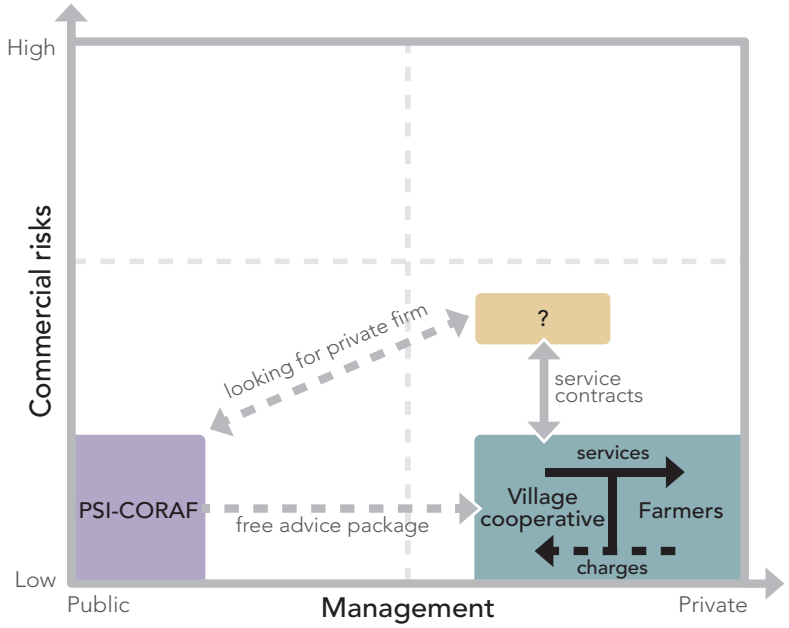
Results were shown to farmers and discussed with them, using a geographical information system (GIS) to improve the representation and understanding of critical issues. This support action resulted in technical and organizational changes and in a 50 percent increase in crop yield. It was proposed that this type of assistance and advice on design and O&M be later provided by a private I&D service provider. The cropping season is financed using working capital.[75]

The project pumps water from a tributary of the Senegal River, with the government agency handing over management control of the irrigation assets to a farmers cooperative (WUA).[76] The WUA is also responsible for raising credit to lend to farmers, and managing water pumping, input supply (herbicides, fertilizers, fuel etc.) and land preparation.[77]

Risks

The main risk identified is the financial sustainability of this service provider, because of the small size of the scheme. Private activity in this context is affordable and viable only if it can broaden its intervention to include several schemes.

FIGURE A2.15: Nakhlet Case Study Diagram



75 http://publications.iwmi.org/pdf/H030874.pdf

76 http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/837.pdf

77 http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/2131.pdf

The gross farm gate price is $880/ha per season (average yield 5.5 t/ha).

The model employs a range of cost recovery instruments, including variable user fee payments made by farmers to the WUA for agricultural inputs; irrigation services (covering O&M) and depreciation of irrigation equipment. Farmers also contribute fixed subscription payments to guarantee the servicing of the WUA's debts which have been accrued in raising capital to lend to the farmers.

The principal costs to farmers are summarised in the table below:

TABLE A2.19: Principal costs to farmers

Cost parameter	US $/ ha/ season
Labor (family and hired in)	191
Agricultural inputs (seeds, fertilisers, hire of machines)	120
Irrigation charges (operations and maintenance)	67
Share of depreciation of pumping equipment	20
Servicing of credit	22
WUA/cooperative charges	1

Source: http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/2131.pdf

Findings suggest that the project has achieved an internal rate of return of 103 percent to farmers per season, with a break-even yield of 2.7 t/ha.

TABLE A2.20: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	$0.030/m^3
Irrigation water value	$0.015/m^3 (with gross margin supposed nil without irrigation)
Price of the water service	$0.002/m^3

Lessons learned

The public service delegation in Nakhlet should be replicable on comparable rice-cropping, small-scale schemes in West Africa, limited to assistance and advice on design, O&M, or both. Local private entrepreneurs seem to be willing to take up the challenge, as long as they can operate in enough small village schemes to make the venture viable.

The high IRR of the project indicates that involving a third party in irrigation service provision can contribute to reducing costs for farmers, improving credit terms and enhancing the quality and responsiveness of irrigation O&M. Commercial risks such as those stemming from a poor harvest one year, may also be reduced as for instance, the risks of servicing the credit is cushioned to some extent by the WUA, rather than falling entirely on the farmer as before. Financial pressures are also reduced as short-term credit and inputs are more favorable, given the collective strength of the WUA.

Other advantages include the fact that financing is on a seasonal basis and limited to supporting only O&M, thereby reducing a key risk associated with non-recourse PPPs, whereby predictions in growth use are not realized.

In general though, as the model is centered on farmer involvement in public service delegation, key constraints are inexperience, member disputes, high administrative costs and inefficiency. As such, there is scope to focus on enhancing the professionalism of the third party.

2.5. Maniçoba, Brazil[78]

Project details	Country	Brazil
	Project size (hectares)	4,300 collective
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Tropical trees
	Type of PPP	OMM
	Project developer	Design and implementation: Government
	Private sector service provider	
	Public sector institutions	
	Current Status of Irrigation	Closed
Allocation of Irrigation scheme functions	Investment	Decision / financing: Government and users
	Governance	Irrigation district (water bailiffs), government
	O&M and management	Basin agency, irrigation district.
	Agricultural production	Farmers

78 Fernandez S. 2001. "Emancipation des périmètre irrigués du Nordeste Brésilien: Quels outils et règles de gestion de l'eau d'irrigation? —Application au périmètre irrigué de Manicoba—Pôle Pétrolina-Juazeiro." Mémoire de DEA EERN.

Fernandez, S., K.A. Chohin, T. Rieu, and E. De Nys. 2001. "Water Pricing In Maniçoba Irrigation System in the Northeast of Brazil: Toward Sustainable Water Management?" Proceedings of the first seminar Management of the Irrigation Systems in the Northeast of Brazil. CIRAD-Codevasf - Juazeiro, Bahia, Brazil, December 2000.

Rieu, T., K.A. Chohin, and S. Fernandez. 2002. "Rôle et stratégies des acteurs dans le contexte d'émancipation des périmètres irrigués dans le Nordeste au Brésil." Irrigation Water Policies, World Bank conference, Agadir, Morocco, June 15–19, 2002.

Project structure

Irrigated agriculture in Brazil's northeast expanded rapidly from the 1950s to the 1980s, financed and managed by the government through national and provincial agencies of the Codevasf. The government also ran settlement programs for small family plots of 3 to 8 ha within larger schemes. When the debt crisis struck, the Brazilian government, under high financial pressure, decided to transfer irrigation management to local water service providers and promote access to the irrigated land for agricultural companies (from the south of Brazil) and foreign companies.

Water service management was initially transferred (1980-89) to already existing cooperatives, which were also in charge of marketing agricultural output. In most collective irrigation systems of the region, the transfer process is still going on, with co-management between the local water service providers and the government, represented at the provincial level by the Codevasf.

In 1989, to improve financial sustainability and management transparency of the irrigation systems, irrigation districts were created by government agencies and given the specific function of providing water service. They are nonprofit civil associations, often with privileges and immunities not available to other private sector organizations. The public service demand came from the government, which wanted to reduce its financial support to irrigation. The offer was represented by independent local providers that could be hired to work for the irrigation district (district manager, water bailiffs, and maintenance technicians) or by local companies to provide specific and single rehabilitation and modernization work.

This is the case of the Maniçoba irrigation system, located in the Petrolina-Juazeiro irrigation pole (São Francisco River, Bahia and Pernambuco provinces). The system is still co-managed by the Codevasf for rehabilitation and modernization of the systems and other administrative functions linked to, for example, land tenure, and by the irrigation district for administrative, technical, and financial aspects of scheme operation and maintenance (O&M).

The district operation (fee reviews, O&M choices) are controlled and approved by an administrative council consisting of the district manager (usually an outside professional), users' representatives, and a representative from the Codevasf. A fiscal council, including users' representatives, audits the district's books.

Risks

The uncertain political and economic environment may affect payment behavior (following Coface[79] classification). The overall country risks are rated "B."

- **Commercial risks.** The risk of farmers' insolvency is considered low.
- **Recovery risk.** This risk is also low, because sanctions are applied for defaulting on payment.

79 Coface is a French private company of loan insurance and loan service management whose role is basically to facilitate exports (http://www.coface.fr/).

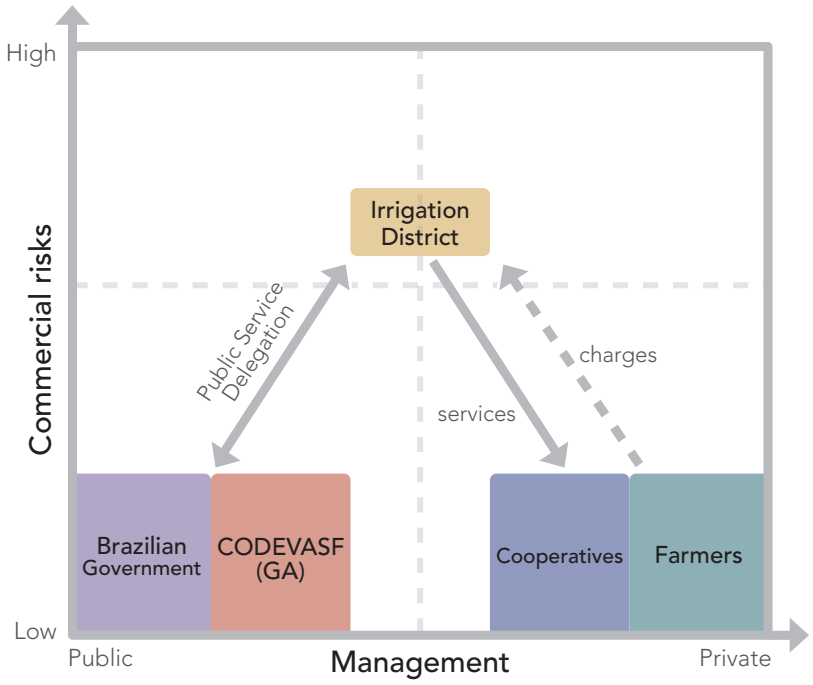
Project structure (cont.)

- **Financial risk.** In 2001 the analysis carried out showed that funds supposed to finance rehabilitation of modernization were partly used for O&M in 1995-2001. This was due in part to financial management problems: opacity leading to difficulties negotiating price increases and accounting problems linked to the disequilibrium between the two parts of the K2 fee. A high volumetric part was more easily accepted by users and hence more easily negotiated. However, K2 also covered fixed costs, which created accounting problems during the rainy season and in especially wet years. The evolution of the K2 observed in November 2001, after negotiations among the district, users' representatives, and the Codevasf, reflects determination to balancing the district's budget.

- The main risk is related to the lack of clear separation of the financing mechanisms linked to K1 and K2, leading to lack of transparency—limiting users' willingness and compromising the district's financial sustainability. This risk would increase if public funds allocated to the irrigation sector and used for modernization and rehabilitation were further reduced.

- **Water-specific risks.** Water-demand risk is low, because humid years that significantly curtail water demand are rare (decennial rainfall). The water supply risk is also low and was affected recently only during the exceptional drought of 2001, during which limits were put on water withdrawal linked mainly to electricity quotas. Before 2001, there was neither "physical" nor "economic" scarcity—the river always provides enough water, and infrastructure development responds to demand. Water demand is generally well taken into account for service delivery (reliable, flexible).

FIGURE A2.16: Maniçoba Case Study Diagram



Financial arrangements

Users have to pay two different fees for water delivery: K1 and K2 fees. The Codevasf is responsible for the infrastructure and renewal and collects the K1 fee for this purpose. The district is responsible for the system O&M, financed by the K2 fee.

The K1 fee, according to the national irrigation law, is supposed to pay for investment depreciation, even if the investment is related to public infrastructures that will remain public after management transfer. In theory, the benefits from the K1 could be paid back into irrigation through rehabilitation and modernization. However, K1 income is insufficient for such financing and must always be combined with public funds. The K1 fee has a monomial structure, and its value is $26.72/ha/year.

The K2 fee has a binomial structure. The constant part of the fee ($/ha) covers OMM fixed costs (for example, salaries), and the volumetric part ($/m3) covers variable costs directly linked to water distribution (for example, electricity). The resulting K2 value was as follows:

- From 1994 to October 2001. $0.0085/m3 + $2.54/ha/month, which corresponds to an average price of $0.011/m3/year
- November 2001. $0.0036/m3 + $7.51/ha/month, which corresponds to an average price of $0.012/m3/year

The resulting total price paid on average by farmers was $0.014/m3/year before November 2001 and $0.015/m3/year after the November 2001 changes.

TABLE A2.21: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	$0.30/m^3/year[b]
Irrigation water value	N/A
Water pricing	• Users pay two different fees • K1, the investment participation fee paid to Codevasf K2, the water service fee paid to the district • Total average price paid by farmers

Lessons learned

Results obtained in Maniçoba—compared with other collective irrigation systems of the same area (such as Mandacaru, where the cooperative plays the role of water service provider)—show interest in and opportunities for separating water service from other functions (for example, production commercialization) to improve financial sustainability.

Although the definition of the K1 fee remains unclear, the district's tasks are relatively clear, which makes the definition of O&M costs easier—a first step toward more transparent and sustainable management. The evolution of the K2 fee observed in November 2001—after negotiations among the district, users' representatives, and the Codevasf—shows willingness to improve the district's budget balance. Heterogeneity of demand between users is also receiving consideration, with discussions about the possibility of optional pricing.

2.6. Toula, Niger

Project details	Country	Niger
	Project size (hectares)	350 collective
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	Hydraulic
	Crops covered	rice
	Type of PPP	OMM
	Project developer	
	Private sector service provider	
	Public sector institutions	
Allocation of Irrigation scheme functions	Investment	Decision and financing are the co responsibility of IDSP director (not water manager), governmental agency, and coopérative (joint signature needed)
	Governance	Co-responsibility of water manager (IDSP) and coopérative
	O&M and management	Co responsibility of water manager (IDSP) and coopérative
	Agricultural production	Water manager (IDSP) with coopérative members

Project structure

In Niger, water management public service delegation (PSD) was initiated by PGI on two rice-growing schemes: Toula (350 ha) and Koutoukalé. The objective was to test an innovative way of improving hydraulic management. This was made possible by establishing a contractual relationship between the irrigation coopérative (a local water user association, WUA) and a service provider for water service, operation and maintenance (O&M), and financial management. The first step was to test both private and public I&D service providers (IDSPs). After evaluation, it was decided to conduct the pilot phase with the private one only (called SENAGRHY). Up to now, a contract has been in effect between the IDSP and the Rice Office of PGI—which has decided to second the function and act as a governmental agency—and not the coopérative. The coopérative has in turn signed a memorandum of agreement with the Rice Office, which shares responsibilities between the coopérative and the IDSP.

On the Toula scheme, PSD was introduced after physical rehabilitation and organizational and financial modernization. Rehabilitation created an environment that facilitated PSD: appropriate infrastructure and institutional and financial stabilization of the WUA. However, rehabilitation does not seem to be a necessary condition for PSD, which aims to avoid the total degradation of the irrigation scheme through sustainable use and infrastructure maintenance. In Koutoukalé, a similar test is being conducted on an un-rehabilitated scheme. What is needed, though, is support from the Coopérative and of its members.

A water management committee was set up, chaired by the water manager (Responsable Gestion de l'Eau [RGE], a staff member of the IDSP). This committee is accountable to the general assembly of the coopérative. The water manager is in charge of the administrative, technical, and financial aspects of the scheme operation, while the coopérative provides him with material and staff support. Equity is overseen both by the coopérative and the water manager, which together define rules and penalties related to water distribution. Beyond this pilot operation, if successful, the present arrangement is expected to evolve into a contract linking the IDSP directly with the coopérative.

As seen in the table below, power consumption for pumping is 70 percent higher in Lata than in Toula, where water management has been delegated to a private water manager. Other factors contribute to this difference, but most of it results from better hydraulic management.

TABLE A2.22: Pumping costs in $/ha

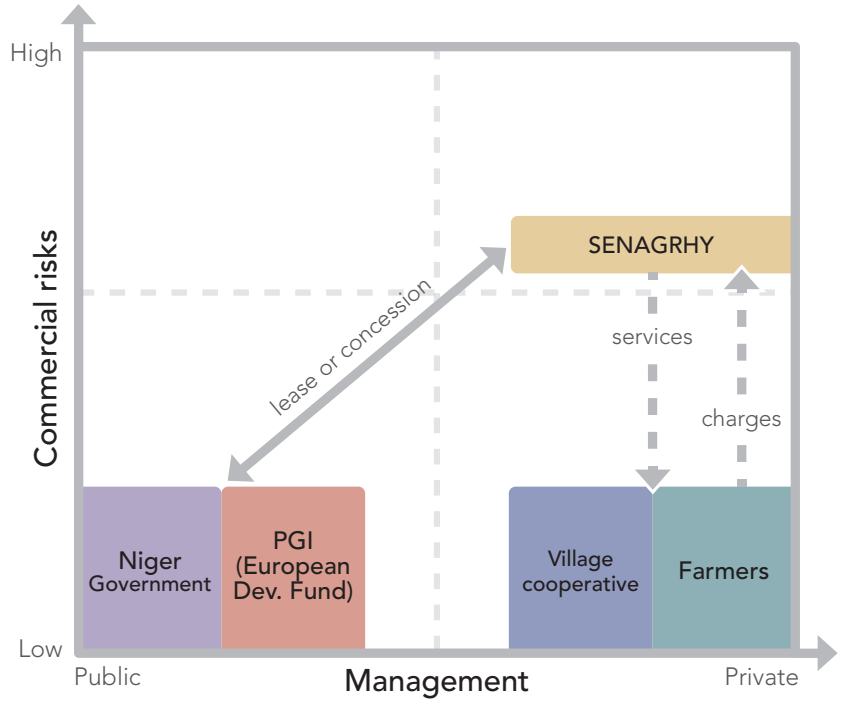
	Toula	Lata
During monsoon	21.63	37.47
During dry season	23.10	41.43

Project structure (cont.)

Risks

The main risk is the financial sustainability of this IDSP. The resulting cost equals the pre-PSD water service costs—that is, doubles the total water service cost. The resulting lowering of pumping costs (as compared to a neighboring scheme) hardly makes up for this increase.

FIGURE A2.17 Toula Case Study Diagram



Financial arrangements

The government provides the water for free. The only water service costs, for pumping water from the Niger River to the scheme, are shared among users (around 5 percent of Toula's total expenses).

TABLE A2.23: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	$0.05/m^3
Irrigation water value	$0.02/m^3
Water pricing	N/A

Lessons learned

Compared with other PSD examples on smaller schemes in West Africa (see the Nakhlet, Mauritania, case) limited to irrigation advice, the present PSD should be applied to comparable rice-cropping medium- to large-scale schemes in West Africa, with governmental agencies keeping a regulatory role in contracts linking IDSPs to WUAs (coopératives).

2.7. Pequin Kavaje, Albania

Project details	Country	Albania
	Project size (hectares)	10,000 collectives
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	Pumping & mixed (both pumping and gravity)
	Crops covered	Maize, alfalfa, watermelon, wheat
	Type of PPP	OMM (water supply)
	Project developer	
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	PMU
	Governance	FWUA with the help of the PMU
	O&M and management	FWUA with the help of the PMU and WUA members of FWUA
	Agricultural production	Farmer

Project structure

Since the early 1990s, Albania has undergone deep structural reforms, including the creation of a multiparty system and a market economy. So far, however, the country has remained import dependent, and it is running a trade deficit.

Agriculture is the mainstay of the country's economy (between 50 percent and 55 percent of gross domestic product [GDP] in 1999 and 2000, respectively, compared with 15 percent for industry and 11 percent for construction). In 1991, Albania began land reform in an effort to revitalize its agriculture. Land, which in the past had been worked collectively, was allocated in equal amounts to villagers in rural areas.

Between 1994 and 1999, a first rehabilitation program (IRP-I), supported by the World Bank and other financial agencies (Netherlands, Italy, the OPEC Fund, and the Kuwait Fund), led to the rehabilitation of a few thousand ha of irrigable land out of the 400,000 ha in the country. At the same time, a start was made on transferring distribution network operation (secondary canals) by creating approximately 200 water user associations (WUAs). The institution that implements this program, called the Project Management Unit (PMU), was created in 1992 as part of the Albanian Ministry of Agriculture and Food and supported by the World Bank.

During this period, the difficulties encountered by the government operator (Water Enterprise, WE) responsible for managing the conveyors (main canals) led the Albanian authorities to recommend the transfer of these facilities and their operation to federations of WUAs. Since 1998, 12 FWUAs were thus created on the first rehabilitation project (IRP-I) command areas, and 12 more are planned in the second project area (IRP-II), on which work began in 2000.

Project structure (cont.)

This is the case of the Pequin Kavaje irrigation system (command area: 10,000 ha), located 50 kilometers south of Tirana and managed by one FWUA. The federation of Pequin Kavaje, formed in 1998, comprises 12 WUAs. Two of them, located upstream in the Pequin district, use pumping stations; the other 10, located in the Kavaje district, use a mixed system (gravity and pumping). The Pequin Kavaje main canal is a water conveyance, storage, and supply structure. It is supplied by an intake structure in the Shkumbinit River.

Supported by the PMU, each winter the federation of Pequin Kavaje prepares a plan for the next irrigation season, with impact analyses demonstrating the demand-resource balance—that is, approximately 200 records for each irrigation season. Other federation functions are monitoring and maintaining the hydraulic infrastructures; operating the main canal to supply water to the WUAs; negotiating with the WUAs in case of exceptional water scarcity; and collecting fees from farmers.

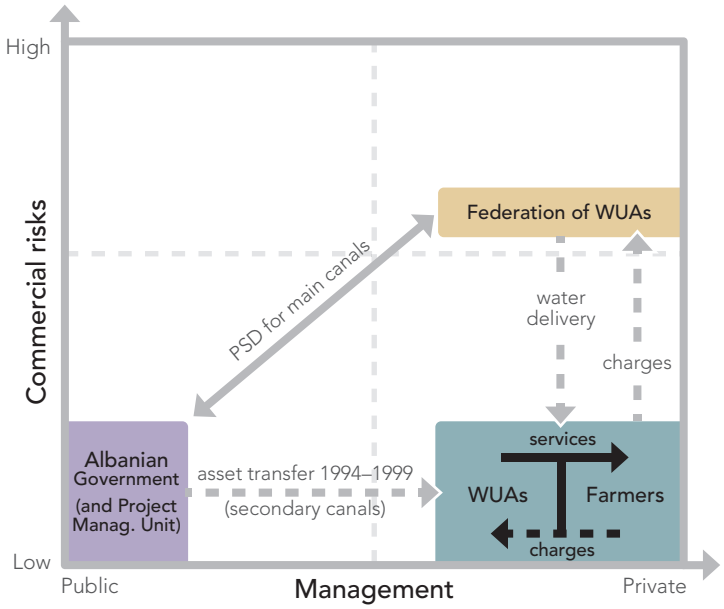
Risks

Two risks are identified:

- **Political risk.** Courage is needed to rectify inequitable arrangements and to involve state officials in moving away from bureaucratic procedures.
- **Financial risk.** Although the fee paid for the water allocation service is high compared with farmers' income, it does not yet cover the sustainable cost. Evidence of real progress in O&M efficiency is necessary to persuade users to accept the fee increases in a comprehensive package of demand-resource management service.

WUAs and FWUA personnel must be trained in hydraulic system management.

FIGURE A2.18: Pequin Kavaje Case Study Diagram



Financial arrangements

TABLE A2.24: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	N/A
Irrigation water value	$0.02/m^3
Water pricing	FWUA fee: All WUA members pay the FWUAs 200 lek/year per farmer Water service price: For every delivery of irrigation water, farmers pay 3,000 lek/ha, which corresponds to about $110/ha/year, at an average of four deliveries per crop. Revenue from this fee is not quite enough to cover the long-term sustainability cost, but the fee is high compared to farmers' present income.
OMM	Thirty percent of the fees contribute to main canal OMM, and 70 percent goes to distribution system OMM. Public funds, obtained through the World Bank, are required for rehabilitation and modernization.

Lessons learned

Sustainable development of irrigation for this kind of network requires efficient management of the water resource, sustainable infrastructures, and good quality of service for water users. Service quality in the short, medium, and long terms is a decisive factor for agricultural production.

Water resource. The different uses of water resources (irrigation and energy) should be formally linked. This can happen only if all the actors involved—government, managers, and users—realize that their interests converge in implementing a concerted and participatory polity of economic water management.

Assets. Sustainable development of the entire command area depends on the sustainability of the Pequin Kavaje canal infrastructures. Continued investment to improve the system's efficiency is also vital for more intensive agricultural production and for any extension of supply. All this makes it imperative to define an infrastructure management function to be entrusted to the Pequin Kavaje federation. This federation must have adequate human and financial resources. Here, again, the nature of this development calls for mobilization of all stakeholders: government, managers, and users.

Water service. Water users need reliable and sustainable water service to apply appropriate amounts of water to crops at the right time. Without this, investing in plot development, mechanical equipment, and plants is useless. Water service quality depends on sound technical management (O&M) and scrupulous and transparent commercial and financial management based on a fair pricing structure. Prices must be financially justified and realistic in social and economic terms; they must make sense in "customer-supplier" relations.

2.8. Sonora, Mexico

Project details	Country	Mexico
	Project size (hectares)	3,300,000; 82 water user associations/irrigation districts
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Cereals, beans, sugarcane, cotton
	Type of PPP	OMM and Modernisation
	Project developer	
	Private sector service provider	
	Public sector institutions	
Allocation of Irrigation scheme functions	Investment	Government subsidies plus loans from Mexican and foreign banks
	Governance	CAN
	O&M and management	WUA between farmers; CNA between uses
	Agricultural production	Farmers
Project structure	Of Mexico's 6 million ha under irrigation, 4 million ha rely on surface water and 2 million rely on groundwater. Half the irrigation and drainage (I&D) systems are government owned; the other half are privately owned and include systems built and managed by farmers. Management transfer of Mexican irrigation districts to farmers was achieved through the creation of large farmer-managed water user associations (WUAs). This process began in 1991 on a pilot basis with strong political commitment and support at the highest (presidential) level after creation of the water government agency (Comisión Nacional del Agua [CNA]). Eighty-two districts, covering approximately 3.3 million ha (530,738 farmers), have been transferred to farmer WUAs. However, headworks are still operated by the government agency (CNA).	

Project structure (cont.)

Most WUAs have proven capable of operating and maintaining their irrigation schemes efficiently, even schemes larger than 50,000 ha. They recover almost 72 percent of O&M costs through the irrigation service fee. Maintenance, repairs, and irrigation operations are adequate, timely, and professionally performed on schedule. Funding is available, efficient modern technology has been introduced, and personnel are well trained and motivated. The WUAs hire the technical staff.

Increasing investment and speeding up the modernization path have been a problem, although these actions can help improve productivity. Currently, because funding is tight, WUAs are negotiating with equipment dealers who supply machinery and other goods for system O&M.

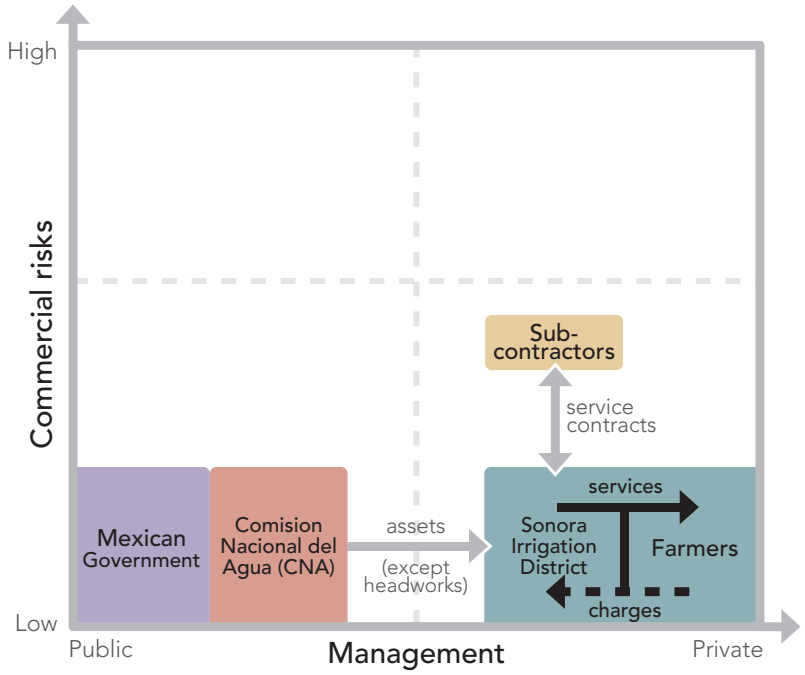
The private sector has been involved in activities through banking and lending to WUAs—only Mexican banks to begin with, but foreign banks now want to join the party.

Risks

International competition is the main risk, with financial ramifications.

- **Financial risk.** WUAs now bear all the costs of all OMM and some investments for modernizing the distribution system. But the CNA-operated headworks are currently free for farmers. In the future, this situation may evolve, inducing new water fees matching this new risk.
- **Commercial risk.** The major risk for the farmers is the open market of the North American Free Trade Agreement (NAFTA) and World Trade Organization (WTO) rules obliging them to compete with North American farmers, particular in corn, wheat, and sorghum. Crop diversification toward high-value-added crops is the main challenge.

FIGURE A2.19: Sonora Case Study Diagram



Financial arrangements

TABLE A2.25: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	$0.21/m^3 (2000)
Irrigation water value	N/A
Water pricing	$6/ha/year (no metering method); 10 percent to CNA

Lessons learned

The successful transfer of Mexican irrigation districts to farmer management through WUAs has been a model for many other projects around the world. The main reason for this success is the continuous support of the CNA throughout the process with technical support from the Mexican Institute on Water Technology (IMTA) and financial support from the government through subsidies for machinery acquisition and modernization (sprinkler and drip irrigation).

WUAs usually perform maintenance with their own personnel. Some outsourcing for heavy repairs is expected to occur to reduce OMM costs and allow farmers to concentrate on farming and marketing. This could well happen for WUAs in Sonora where competition with U.S. farmers is the greatest.

2.9. Tieshan, China

Project details	Country	China
	Project size (hectares)	25,800 (crop intensity of 2.48)
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Paddy, cash crops
	Type of PPP	OMM for dam and main canals
	Project developer	Tieshan Water Supply Corporation (WSC)
	Private sector service provider	Water Supply Corporations
	Public sector institutions	
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	Hunan provincial government
	Governance	Hunan provincial government
	O&M and management	WSC (dam and main canals); WUAs (laterals)
	Agricultural production	Farmers

Project structure

The Tieshan irrigation project includes two main canals (North and South) fed by a 635 million m3 reservoir completed in 1982 (World Bank 2002b). The Yangtze Basin Water Resources Project financed by the World Bank (1992–2002) included irrigation and drainage (I&D) works in Hunan and Hubei provinces. The Hunan component aimed to improve and develop irrigation in the Tieshan North area through construction and extension of the North Main canal, two sub-main canals, and branch canals, including tunnels, aqueducts, and laterals supplying irrigation water to 25,800 ha. The project has also introduced the concept of self-financing irrigation and drainage districts (SIDDs).

Before the project, there was some confusion about what were taxes and what were water charges, meaning that municipal government viewed irrigation water fees as a source of revenue with little obligation of transparency in their use after collection. This remains the case in the Hubei component of the same project, where farmers pay 58 percent for operation, maintenance, and management (OMM) when the fair share for agricultural water use would be 24 percent.

The institutional development objective was completed at Tieshan in establishing SIDDs. The Tieshan Water Supply Corporation (WSC) at the reservoir and main canal level and 24 water user associations (WUAs) at branch and lateral canal levels were intended to improve irrigation OMM through farmer management of the I&D system and farmer control over fee collection and use.

Project structure (cont.)

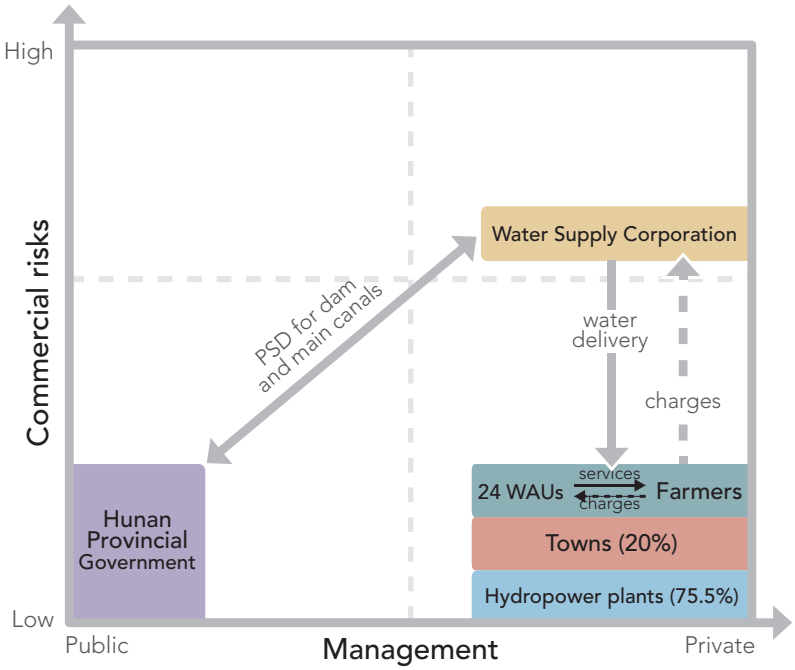
The new Tieshan WSC (with 500 personnel) is a strong, financially self-sufficient enterprise, with diversified sources of income but with a recognized responsibility for all matters related to water. It is no longer under the control of municipal governments. WUAs generally take care of the control of funds. Previous destruction of irrigation facilities and water use conflicts are progressively disappearing. WUAs and the WSC enter into partnerships to fund system improvements and expansion, and farmers pay at least 75 percent of the costs in labor or in cash.

The provincial government has given a strong lead to the separation of policy, planning, and regulation from water operation and maintenance in the water sector. This new direction is modeled on the strong WSC in Hunan, which constitutes a basis for professionalized, privatized management. A WSC or WUAs are now responsible for collecting service fees; village administrations remain responsible, under Chinese law, for collecting agricultural taxes.

Risks

- **Financial risk.** The financial stability of the I&D service provider (IDSP) depends on substantial income derived from other water activities such as hydropower and urban water. The provider's income looks like inter-sectoral cross-subsidization, or at least a sharing of corporate overheads.
- **Technical risk.** The lack of volumetric water measurement limits the real and effective partnership between the WSC and WUAs. The next step would be to scale up the WSC's accountability. Volumetric measurement at the farm level would enable documentation of water cost and water value and perhaps also explain the reasons for the very low water use.

FIGURE A2.20: Tieshan Case Study Diagram



Financial arrangements

TABLE A2.26: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	• Paddy: 10–12 t/ha • Supplementary irrigation: 1,800-5,200 m^3/ha (1997-2000)
Irrigation water value	Crop yield without irrigation is not documented
Water pricing	WUAs pay a canal water fee of Y 0.032 per m^3 to WSC (one-fourth of total water used) [c] Farmers pay total water service to WUA at Y 500–600/ha (half in personal labor)

Lessons learned

The project had a considerable impact on policy reform and the organization of water administration, operation, and maintenance in Hunan through the separation of responsibilities for regulation, technical assistance, planning, and monitoring under the Bureau of Water Affairs, and for OMM under the WSC and WUAs. The concept of farmers' self-management of irrigation is now well established in Hunan as a result of the project, and the project has become a model for water-sector reform throughout China. The Wuhan Hydropower University has established an overall monitoring system, enabling the province to understand the benefits of the new institutional arrangements for self-financing I&D.

The concept of professional service provider acting as a third party independent from the government is proving to be a success and gives the opportunity for farmers to control OMM and to pay their fair share of its cost. At the end of the reform process, the Tieshan WSC model could be benchmarked against the French SARs with a corporate culture and probably an auditing process implemented by the government.

2.10. Adasiyeh, Jordan[80]

Project details	Country	Jordan
	Project size (hectares)	400 collectives
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	Pressurised irrigation
	Crops covered	Citrus
	Type of PPP	OMM
	Project developer	JVA
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	
Allocation of Irrigation scheme functions	Investment	JVA
	Governance	JVA , some to IDSP in future
	O&M and management	JVA , to IDSP in future
	Agricultural production	Farmers
Project structure	During the 1990s, the Jordan Valley Authority (JVA), the governmental agency in charge of water management in the Jordan Valley (39,000 ha) converted most of the open-channel distribution networks into pressurized networks and also modernized the King Abdullah Canal. Despite this modernization program, JVA still delivers water to farmers by rotation and enforces a water quota system based on crop type and location in the Jordan Valley, with a quota reduction in some very dry years. Optimizing water use requires some flexibility in meeting farmers' local constraints and capacities, while water scarcity imposes some rigidity in managing water so that everyone has a fair share. This situation constitutes a vicious cycle, where JVA maintains a rigid distribution system to keep farmers from exceeding their quotas, but farmers use as much water as long as possible, thus making the pressurized system inefficient. JVA also faces economic and institutional challenges. Water tariffs are still low ($0.023/m3), representing less than 5 percent of farm production costs. Both water accounting and enforcement of quotas and water rules are limited. Finally, an improvement in the farm environment is required to address priority marketing of products, access to credit, and purchase of quality-controlled inputs.	

80 Ahmad M. 2000. "Water Pricing and Markets in the Near East: Policy Issues and Options." Water Policy 2: 229–42;

Prevost F., F. Sanfilippo, and R. Courcier. 2001. "Optimization de l'irrigation dans la vallée du Jourdain." Proc. Hydrotop 2001, Marseilles, France, April 24–27, 2001;

Vidal A., and C. Abbott. 2001. "Water Conservation R&D and Technology Transfer Opportunities in Jordan." IPTRID/FAO Program Formulation Report No. 8. Rome: International Program for Technology and Research in Irrigation and Drainage (IPTRID)/FAO, April;

Vidal A., and A. Nepveu de Villemarceau. 2001. "Improvement of On-Farm Irrigation in the Jordan Valley." Report on Duty Travel to Jordan, May 26–June 4, 2001. Rome: International Program for Technology and Research in Irrigation and Drainage (IPTRID)/FAO, June;

World Bank. 1997. "The Hashemite Kingdom of Jordan, Water Sector Review." World Bank Report No. 17095-JO. 2 vols. Washington, D.C.: World Bank.

Project structure (cont.)

An interesting experiment was conducted with farmers in a 400 ha secondary command area, Adasiyeh, located in the northern part of the Jordan Valley, where the bottleneck for improving on-farm irrigation was at the interface between farmers and JVA, at the farm turnout level. Almost all the farms still using surface irrigation were equipped with pressurized irrigation (open tube or micro-sprinkler on citrus, drip on bananas) and received a public subsidy (from French bilateral aid). Quotas enforced by the JVA (down to 50 percent in dry years) were generally well respected and appeared a good incentive to save water.

JVA replaced 12 l/s flow limiters with 6 l/s devices to return to the original design of the system and enforced new rules for pumping: the pump operator delivers a fixed daily volume and then stops the pumping station but does not regulate the flow delivered by the pumping station. JVA checks to make sure farmers comply with the collective schedule and flow imposed by the JVA rotation to every farm gate. The farmers open and close the gates themselves, but the pump operator is entitled to fine farmers who take water out of turn. The operator is also entitled to enforce these rules more strictly by stopping the station when the head pressure falls below a set level. Chasing down illegal farm-gate openings resulted in better equity and more stable flows and pressures. In a few cases, contractual arrangements have been set up between farmers and the JVA to define their respective rights and duties. The next step to be considered by JVA and farmers is to transfer pump operations to a private operator who would work under contract to JVA and the farmers.

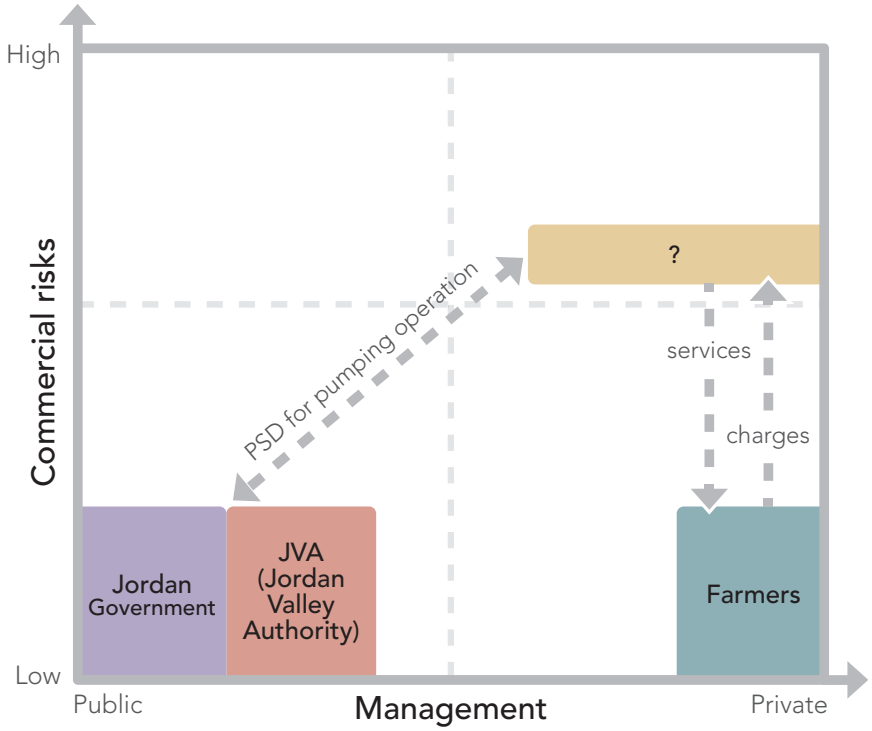
Risks

Farmers in the Jordan Valley are highly productive and grow high-value crops such as citrus.

- **Country risks.** The political risk is considered medium in light of the country's recent stability.
- **Export market.** The export market that drives the valley's high-value crops is always subject to strong fluctuations, however, especially for valley farmers who are not well organized for marketing.
- **Commercial risks.** Considering valley farmers' high gross productivity, the risk of insolvency is low.
- **Recovery risk.** The cost recovery risk depends on the government's authority in enforcing the law, which has proven low in the past years.
- **Water-specific risk.** The Jordan Valley is not high in the country's water demand priorities.
- **Water demand risk.** In dry years, most of the flow of the King Abdullah Canal is pumped for the city of Amman, while high-quality groundwater on the highlands is spoiled for politically protected private irrigation.
- **Water supply risk.** Recurrent droughts over the last five years (2000-2004) have severely reduced water supply, while preserving citrus farms. High gross productivity, however, would enable the use of unconventional (for example, desalinized) water. Urban wastewater from Amman's sewage treatment plant goes through a downstream water reservoir and is already being reused for agriculture in part of the Jordan Valley.

Project structure (cont.)

FIGURE A2.21: Adasiyeh Case Study Diagram



Financial arrangements

TABLE A2.27: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	$2.72/m^3
Irrigation water value	$2.49/m^3 (citrus)
Total irrigation cost	N/A
Price of the water service	$0.021/m^3

Lessons learned

The pilot tests conducted on Adasiyeh show that farmers are ready to enter into contractual relationships with JVA in general, and with an intermediate operator for O&M of pumping stations and secondary network. This supports the idea promoted by the World Bank (1997) to establish WUAs in the Jordan Valley. However, Vidal and Nepveu de Villemarceau (2001) suggest that farmers in the Jordan Valley are less familiar with such collective organization (WUAs) than with clear contractual relationships with a reliable service provider (for example, a mobile phone provider). The recent private-sector boom in Jordan could extend to the water (and irrigation) sector, which could hire competent professionals from the overstaffed present water administrations (JVA and the Water Authority of Jordan [WAJ]).

3. Other Contract types

This third and final section of Annex 2 presents case studies of six PPP irrigation schemes that are neither concession nor operation and management types. Instead, they are examples of management, design-build-operate, a type of PPP lease, and a private contract.

From the cases presented in this section, the high level of risk translates into investor reluctance to invest and potentially higher costs. If the public sector wants to attract 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 PPPs as applied in the irrigation and drainage sector and will require guarantees of different kinds to attract private investors.

The following table provides a list of the case studies presented in this section and a summary of each scheme's pertinent details.

TABLE A2.28: The 6 DBO, Management and Lease, and Other Contracts

Scheme	Size, ha	Further details
Muhuri Irrigation project, Bangladesh	17,000	• Will use a pre-paid water metering system, to improve water use efficiency. • Rehabilitating and expanding a 25-year old irrigation project by the World Bank.
Eastern Uttar Pradesh, India	2,400,000 –3,200,000	• The private diesel-pump dealer became the scheme coordinator, which reduced the farmers' transaction costs for accessing the subsidy and loans, and accelerated the process.
Southeast Anatolia project, Turkey	100,000	• GAP is an overall development project, broken into smaller sections, with hopes that some can be irrigated using PPPs. • The government planned to privatize its free irrigation advice service.
Senegal Sugar Company, Senegal	12,000	• Though this is an entirely private investment, the government of Senegal provides a 99-year, free lease of 12,000 ha, up to 30,000 m^3/ha/year of free water supply and full tariff protection against sugar imports from the rest of the world. • Although it is not transparent, this CSS-type of PPP sometimes appeals to developing-country governments that consider guaranteed output, jobs, and tax revenue worthwhile benefits.
Business Farms in Saudi Arabia	2,000,000	• As part of a vast program of highly subsidised irrigated agriculture launched by the kingdom in 1980, the government offered free land, free (underground) water, free credit, and a guaranteed purchase price of $1,000/ton of wheat. • The program covered eight highly capitalistic business farmers; medium-sized farms, and traditional Bedu farms.
West Nile Delta, Egypt	37,500	• The project was designed as a PPP with the private partner to perform Design-Build –Operate functions. • The government is keen to share implementation and other related risks .

3.1. Irrigation Management Improvement Project or "Muhuri Irrigation Project", Bangladesh

Project details	Country	Bangladesh
	Project size (hectares)	17,000
	Cost of project	$58.0 million
	Irrigation technology employed	Electric low lift pumps, prepaid SIM card meters buried pipes, surface water
	Number of farmers targeted	Approximately 24,000 (at 0.7ha/farmer)
	Crops covered	Rice, potato, vegetables, pulses
	Type of PPP	• Stage 1: Design, Construction supervision, Operation & Maintenance, Agriculture Extension 5 years • Stage 2: Lease contract, 15 years, renewable
	Project developer	
	Private sector service provider	Irrigation Management Operators (IMO) : ANZDEC in association with BETS
	Public sector institutions	Government of Bangladesh
	Current Status of Project	Contract awarded January 2016
Allocation of Irrigation scheme functions	Investment	Government of Bangladesh, ADB
	Governance	Bangladesh Water Development Board (BWDB)[81]
	O&M and management	BWDB and IMO[82]
	Agricultural production	Mostly tenant farmers, average 0.7ha

81 Ibid.

82 Ibid.

Project structure

The Irrigation Management Improvement Project will involve the modernization of the Muhuri Irrigation Project, estimated at 11,800 ha, and the phased increase of the irrigated area to 17,000 ha. It is expected that around 24,000 families, with an average of 0.7 ha each, will benefit from the scheme.[83] The project will also prepare the modernization of Ganges Gobadak and Teesta irrigation projects which may also involve private sector participation of management operation and maintenance of the scheme. The Project was approved by ADB board on 30 June 2014. It is expected to be completed by June 2019.[84]

The project will rehabilitate and modernise the existing irrigation and energy infrastructure. There has been a gradual loss of area under irrigation since the World Bank Muhuri Irrigation Project was completed in 1989.[85] This has been caused by several factors, including: reduction in the reservoir storage, reduction in river flows, and the cost of providing water, particularly to low-profit crops.

To ensure that the scheme is developed into an efficient and sustainable system, the project will undertake the following activities:[86]

- Repair the embankment and associated structures;
- Repair existing flow control structures, and introduce new ones;
- Protect communities by creating river bank protection in localised areas to protect communities;
- Excavate 460km of khals (channels) to increase drainage and access to water;
- Upgrade pumps, replace open field channels with buried pipes, install prepaid meters;
- Upgrade local electrical distribution system and solar power;
- Provide pre-paid SIM card meters and control systems; and
- Repair and provide office space for BWDB and IMO.

The project's main aim is to promote farm production, while the scope for including non-farm income activities to complement those related to increasing farm incomes will also be assessed.

The project is expected to increase Rabi season irrigated area and increase agricultural productivity and crop diversification. It will restore the protection against flooding, and will have a positive impact on temporary (construction) and permanent (operation and agricultural) job opportunities in the area.

The Muhuri project will implement a pre-paid water metering system that has proven successful in the Barind project.[87] This system would allow farmers direct control of their water usage, as water will flow when they enter their (in-credit) smartcard into the meter. This water system will not directly measure the water volume used, but will measure the energy used to pump water which will be directly proportional to the volume pumped. This more flexible and transparent system is expected to lead to 30 percent water use efficiency gains, a flexible and on-demand

83 ADB Project Preparatory Technical Assistance Irrigation Management Improvement Investment Program.

84 Draft Terms of Reference For Muhuri Irrigation Management Operator, September 2013

85 World Bank Project Completion Report, Muhuri Irrigation Project, April 1990.

86 Draft Terms of Reference For Muhuri Irrigation Management Operator, September 2013

87 Down to Earth (website): Barind's Three-crop revolution, http://www.downtoearth.org.in/content/barinds-three-crop-revolution

Project structure (cont.)

supply of water, 100 percent cost recovery from farmers, elimination of exploitation by pump owners and operators through eliminating cash payments, and an increase in the numbers reached by irrigation.[88]

Responsibilities and roles[89]

- **Government of Bangladesh.** The government will own all of the assets and finance (through ADB) all modernization works and the cost of the IMO. Improved system efficiency and shift from diesel pumping to electric pumping will allow reducing the cost of the irrigation service fee while covering the full cost of the management operation and maintenance including reimbursement of the IMO. No subsidies of the irrigation service fee were envisaged during the preparatory technical assistance stage.

- **Bangladesh Water Development Board.** The BWDB is the contracting authority and executing agency and will be responsible for monitoring the IMO, for making payments to contractors based on the progress certificates and at certain contract-defined stages, and for agreeing the water charge with the Implementation Coordination Committee (ICC).

While the BWDB will retain its O&M responsibilities in the role of main regulator, the IMO will take over responsibility of khals, drains, and minor structures.

- **Project Management Unit.** The role of the PMU will include procuring the IMOs (below), administering the contract of the IMO and supporting the transition between the first and second IMO terms. They will also procure the contractors which will undertake the physical works, in addition to monitoring the overall implementation plan and progress. As part of this, they will assign a project director. They will be responsible for monitoring the safeguard progress, financial and management reporting, and for ensuring that any land acquisition and resettlement procedures conform to Bangladesh law and ADB requirements.

- **IMOs.** The IMO will be responsible for the design and construction supervision of the modernization works, provision of agriculture extension services and the operation and maintenance of the pump systems, khals, and other infrastructure, and for collecting the irrigation service charge. They will therefore be expected to finance the $4.2 million in O&M costs, which they will recoup by levying a 10 percent administration fee for collecting the charges.

- **Farmers.** Farmers are expected to make a 3 percent contribution towards the rehabilitation of the tertiary level irrigation, and will pay for their water usage through a pre-paid metering system with smartcards. Farmers can recharge their smartcards using hand-held "mobile vending units", which will be kept by local dealers

88 ADB Project Preparatory Technical Assistance Irrigation Management Improvement Investment Program.

89 Ibid.

Financial arrangements

The expected $58.0 million cost is broken down as follows:[90]

TABLE A2.29: Cost breakdown

Project component	ADB	IMO	Farmers	Government	Total
Project cost: ($m)	46	4.2	0.2	7.6	**58.0**

Cost recovery will have three main components:

- Irrigation water charges, on the pre-paid metered system;
- Lease of assets including the land and water inside the MIP; and
- Other cost recovery opportunities which will be investigated and piloted during Stage 1 of the project.

Analysis for the ADB preparatory technical assistance showed that once the project reaches Stage 2 (when it moves from a management to a lease contract) the annual water tariff required to ensure full recovery of Operation and Management costs is $125/ha. This amount falls below the $131/ha which was determined as affordable for a farm whose production has improved through irrigation, though the actual tariff amount is yet to be determined by the BWDB and ICC.

As of January 2016, the Irrigation Management Improvement Project is under implementation. Procurement for khal excavation works is completed and work will start early 2016. On 18 January 2016 the IMO contract was signed with FCG ANZDEC Limited in association with BETS.

Lessons learned

1. Intensive involvement and consultation with farmers were critical in building confidence of BWDB on Private sector Participation.
2. Information and consultation with local private sector was critical in securing reasonable interest for the IMO role.
3. Study tours were instrumental in developing BWDB and farmers understanding of the proposed project modernization strategy.

90 Ibid.

3.2. Eastern Uttar Pradesh, India

Project details	Country	India
	Project size (hectares)	2.4-3.2m
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	Diesel pumps
	Crops covered	Rice, wheat
	Type of PPP	Management
	Project developer	Farmers, diesel-pump dealer
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	Diesel-pump dealer
	Governance	
	O&M and management	Farmers
	Agricultural production	Farmers

Project structure

While much of South Asia suffers from acute overexploitation of groundwater resources, eastern India possesses more than a quarter of India's usable groundwater resources; but less than a fifth of it is being developed. Stimulating groundwater development in the region is not only central to creating livelihoods and welfare for its poor but also to addressing its syndrome of extensive waterlogging and susceptibility to flooding. A series of public policies have been designed to promote groundwater development over the past 50 years. Until the mid-1980s, all these well-intentioned "minor-irrigation subsidy schemes" had produced little minor irrigation. When electric pumps predominated in groundwater irrigation, and later when diesel pumps began to replace them, farmers—particularly, small farmers from poor communities—found the hassle and "transaction costs" involved in accessing the Free Boring Scheme (FBS) prohibitive and intimidating. This is still the situation in north Bengal, Orissa, and, to a lesser extent, in north Bihar.

Eastern Uttar Pradesh, however, managed to transform the diesel-pump subsidy scheme into a powerful instrument of smallholder irrigation. During the mid-1980s, a series of changes occurred in the design and implementation of the FBS, which turned the private diesel-pump dealer into a central scheme coordinator. These changes sharply reduced the transaction costs that small farmers had to bear for access to the subsidy and loan scheme. All that an eligible small farmer has to do now is to give the dealer his/her photograph and land documents. The dealer then takes over and completes the entire process of getting governmental and bank approvals and clearances. The pump and pipes are delivered to the farmer the same day, and he can hire local rig operators to do his boring. Within a week of applying, his tubewell is commissioned. By then, the dealer has cleared all the formalities, and the transaction is completed. Financially, this farmer-dealer commercial arrangement is a win-win solution: the farmer pays the same price and often gets a more reliable pump than the brand he would get from government subsidies. The dealer offers cheaper prices and keeps the difference (between 8 and 10 percent) to pay for his service: quick and easy pump delivery.

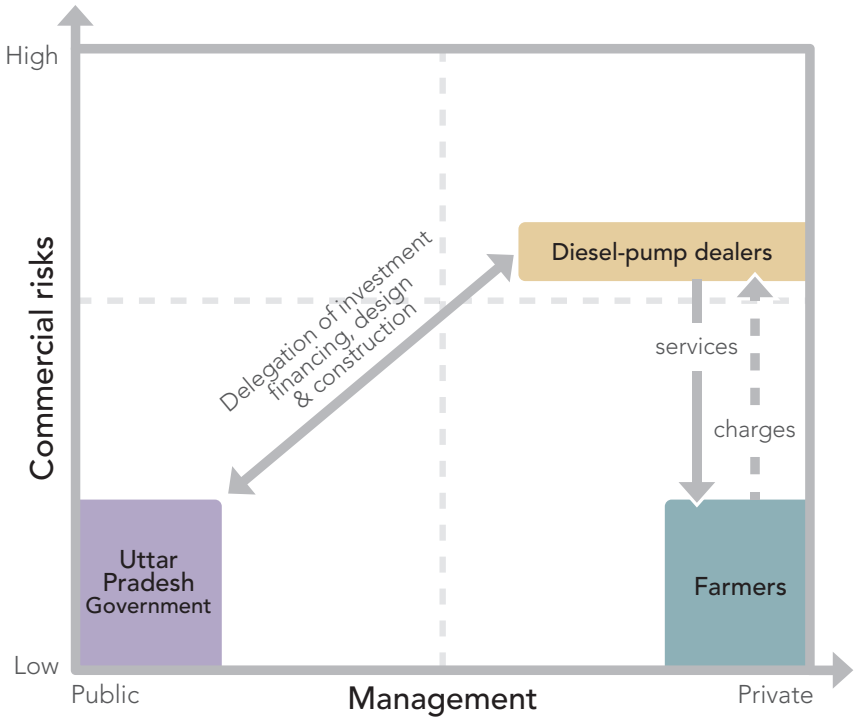
The diesel-pump dealer thus became the one-stop-shop for farmers wanting to set up a tubewell under the FBS. Since 1985, under the FBS, more than 800,000 small diesel-pump–operated tubewells have been installed in eastern Uttar Pradesh (UP), irrigating a gross area of between 2.4 million ha and 3.2 million ha. This rapid increase in diesel-pump density is considered to be at the heart of eastern Uttar Pradesh's belated Green Revolution.

Risks

A peculiarity of this case is the abundance of the groundwater resource, which does not seem to require either pumping regulation or allocation between uses or within each use by any public agency. This is not, by and large, the case in other parts of India or Asia, where similar private operator involvement caused a "boom" in individual and private groundwater pumping, with the unfortunate result of severe water table drawdown. Since the environmental (water supply) risk is much higher in such a case than the financial risk, it seems that all pump market stakeholders, farmers and dealers, greatly benefit from it.

Project structure (cont.)

FIGURE A2.22: Eastern Uttar Pradesh Case Study Diagram



Financial arrangements

TABLE A2.30: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	$0.132/m^3 [b]
Irrigation water value	N/A
Water pricing	$0.076/m^3 (pumping costs only, without the pump capital cost)

Lessons learned

This example of PPP is limited in terms of risk and involvement in management, because most of the risk and investment and all the O&M are borne by poor farmers and their individual pumps. However, it demonstrates that there is space for non-farmer private initiative, even in one of the world's poorest agricultural regions where public initiatives, policies, and subsidies have failed—mostly due to heavy administrative burdens and related transaction costs. Private initiative in this case seemed to be the only way out. Poor farmers can access the (groundwater) resource, significantly improving their livelihoods, because the pump dealer negotiates the administrative hurdles for them.

3.3. Southeast Anatolia Project (GAP)

Project details	Country	Turkey
	Project size (hectares)	100,000 (collective)
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Cotton
	Type of PPP	
	Project developer	DSI
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	State hydraulics works (Devlet Su Isleri [DSI]), Göktepe
	Governance	DSI
	O&M and management	DSI, Irrigation associations, projected private irrigation advisory services
	Agricultural production	Farmers

Project structure

The Southeast Anatolia Project (GAP) is an ambitious development project. The hydro-agricultural development of the Şanlı Urfa-Harran Plain, and the overall development it has generated, are a core aspect of this vast undertaking. About 100,000 ha are under operation, land is being farmed, and the agricultural impetus is obvious. Irrigation unions (water user associations, WUAs) already operate and maintain secondary and tertiary hydraulic works. The Şanli Urfa region's economy is being boosted by the agricultural development. This momentum is driven mostly by the private sector, which is gradually assuming government's role in irrigation.

But many discrepancies between the original plans and the present situation jeopardize the sustainability of this development. These include soil salinity, wasteful irrigation practices, short-term horizons for WUA asset management, almost no extension of research results, insufficient technical assistance and farmer training, and inadequate farmer involvement in project design and implementation. Besides this large scheme, collective groundwater schemes (for example, Ikicırcıp, 80 km east of Şanlı Urfa, involving 9,000 ha) were developed and transferred to WUAs, which have neither technical competence nor financial sustainability, and have to face a continuous water table drawdown due to the unregulated and increasing withdrawal by outsiders.

The Turkish approach to irrigation management transfer (IMT), presented at international levels as a model, leaves much room for private initiatives because the government no longer ensures some of the essential functions, and WUAs have not (yet) taken them on. To illustrate this trend:

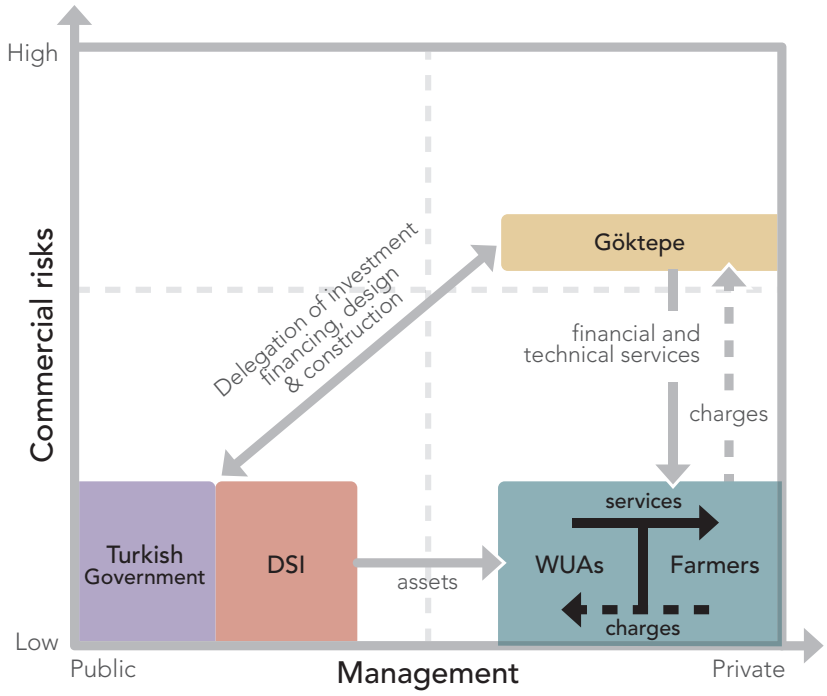
Göktepe, a private company and country leader in on-farm irrigation equipment (gated pipes, sprinklers, micro-irrigation), has made large investments since 1996 to the point of seriously competing with Israeli manufacturers. It now provides farmers with credit for modernizing their mostly traditional irrigation. However, the Ministry of Agriculture, which has been in charge of irrigation advisory services with decreasing means, is now planning to privatize this service. It already has offers from the private sector (for example, from Göktepe and others) as well as demand from farmers who claim they have more confidence in paying for private advice than getting it free from the government

Risks

With strong government disengagement, the main risks for private initiatives such as the ones mentioned in this case are financial, related to a possible decrease in water value (that is, productivity), should subsidies to cotton be dropped. This risk is low on large schemes because the water value would remain high without subsidies ($0.08/m3), but it is significant on groundwater schemes where water table drawdown induces an increase in water fees to a level where, without subsidies, the water value would become very low ($0.02/m3). However, for groundwater schemes, the main risk is the physical and financial inaccessibility to the resource if aquifers continue to drop.

Project structure (cont.)

FIGURE A2.23: GAP Case Study Diagram



Financial arrangements

Göktepe provides credit to farmers and subsidies to modernised irrigation.

TABLE A2.31: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	\$0.17 /m³
Irrigation water value	\$0.11/m³ (Şanlı Urfa–Harran), \$0.05/m³ (Ikicırcıp)
Water pricing	\$0.003/m³ (Şanlı Urfa–Harran), \$0.028/m³ (Ikicırcıp)

Lessons learned

With an IMT "model" that looks like an abandonment of management (for example, Ikicırcıp), much room is left for private sector initiative in the GAP region. This conclusion applies not just to the irrigation sector, because government reforms seem to encourage or result in the emergence of a dynamic water sector. Whether the schemes are in crisis (Ikicırcıp) or not (Şanlı Urfa–Harran), WUAs and farmers seem open to contracting with private firms for various functions related to irrigation (operation, maintenance, finance management, advisory service). This is happening with the use of credit facilities offered by local irrigation equipment manufacturers, which motivates farmers to modernize their irrigation by shifting from surface to drip or sprinkler irrigation. The high value of irrigation water and productivity, partly due to local subsidies to the cotton price (up to 15 percent of the gross product), facilitates this momentum.

3.4. Senegal Sugar Company (CSS)

Project details	Country	Senegal
	Project size (hectares)	12,000 entirely private
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Sugarcane
	Type of PPP	Free concession of land and water
	Project developer	CSS
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	CSS
	Governance	CSS
	O&M and management	CSS
	Agricultural production	CSS
Project structure	The huge sugar complex at Richard Toll (12,000 irrigable ha, 900,000 tons of cane per year, 100,000 tons of sugar per year, 8,000 jobs) is a prime example of public-private partnership (PPP) in agribusiness. It was initiated in 1970 by the private Compagnie Sucrière Sénégalaise (CSS). Though an entirely private investment, the first P of the acronym PPP corresponds to a number of counterparts, or rather gifts, from the government of Senegal, including the following: a 99-year free lease of 7,300 ha initially, 12,000 ha today; free water supply from the Senegal River (private diversion canal), up to 30,000 m3/ha/year; and most important, full tariff protection against sugar imports from the rest of the world, which keeps the domestic sugar price a good 10-20 percent above world market prices—in effect, a true monopoly. For its part, CSS provides Senegal with a reliable output of good-quality sugar to meet the best part of local needs (100,000 tons of sugar for 10 million people = 10 kg/person/year); an annual value added of CFA 20 billion ($30 million); and most important, an average of 8,000 jobs per year (60 percent permanent, 40 percent seasonal) that help sustain nearly 80,000 people—almost the entire Richard Toll population.	

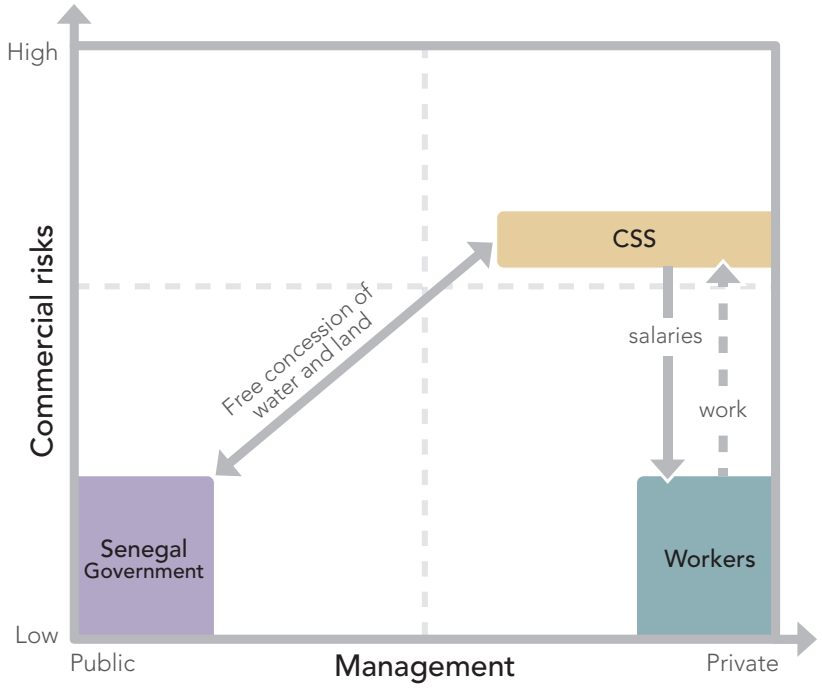
Project structure (cont.)

Risks

Political risk is considered medium, depending on Senegal's changing political climate, and the risk of devaluation is low. The black market is considered the highest commercial risk.

Water-specific risks are nil, because CSS owns the sugarcane plantation and runs its own diversion channel.

FIGURE A2.24: CSS Case Study Diagram



Financial arrangements

TABLE A2.32: Economic and Financial Impact

Indicator	Value
Gross irrigation productivity	Estimated at $0.27/m^3 (10 t/ha x CFA 350/kg/20,000 m^3)[b]
Irrigation water value	Identical, because gross margin without irrigation = 0
Water pricing	N/A

Lessons learned

While not transparent, the CSS-type PPP sometimes appeals to developing-country governments that consider guaranteed output, jobs, and tax revenue worthwhile benefits. Some sort of public control should nevertheless be applied both on economic and social aspects.

3.5. Business Farms, Saudi Arabia

Project details	Country	Saudi Arabia
	Project size (hectares)	2 million entirely private
	Cost of project	
	Number of farmers targeted	
	Irrigation technology employed	
	Crops covered	Wheat, alfafa
	Type of PPP	
	Project developer	Business farms
	Private sector service provider	
	Public sector institutions	
	Current Status of Project	Closed
Allocation of Irrigation scheme functions	Investment	Business farms
	Governance	Business farms
	O&M and management	Government manages allocation. Business farms operates and maintains.
	Agricultural production	Business farms
Project structure	Except for some parts of the mountainous coast along the Red Sea, Saudi Arabia is a desert, with 0 mm rainfall. Still, 1.3 million ha are under irrigation. This paradox has an explanation. Bearing in mind the 1973 US threat of a food embargo, the kingdom, in 1980, launched a vast program of highly-subsidized irrigated agriculture (mostly wheat, and alfalfa for dairy farms). To promote this venture, the government offered free land, free (underground) water, free credit, and a guaranteed purchase price of $1,000/ton of wheat (50 percent to 120 percent above world prices). These exceptional conditions must be viewed in the wealth context of the oil economy. Agriculture also offered an avenue for income redistribution, self-reliance in food, and a way of occupying a huge, unpopulated territory. Three types of farms were involved in the "gold rush": • Eight highly capitalistic business farms (80 percent of the irrigated surface), whose stocks are quoted on the Riyad stock market, were formed: HADCO, TADCO, GADCO, JADCO, and NADEC for wheat, alfalfa, and vegetables; AL MARAI and AL SAFI for dairy farming; and AL RAJHI for sheep and other livestock breeding. Most business farms had connections with national equipment suppliers. The average farm size is between 5,000 ha and 15,000 ha, with between 100 and 300 center pivots. Their only business strategy is to provide stockholders with the highest possible capital return.	

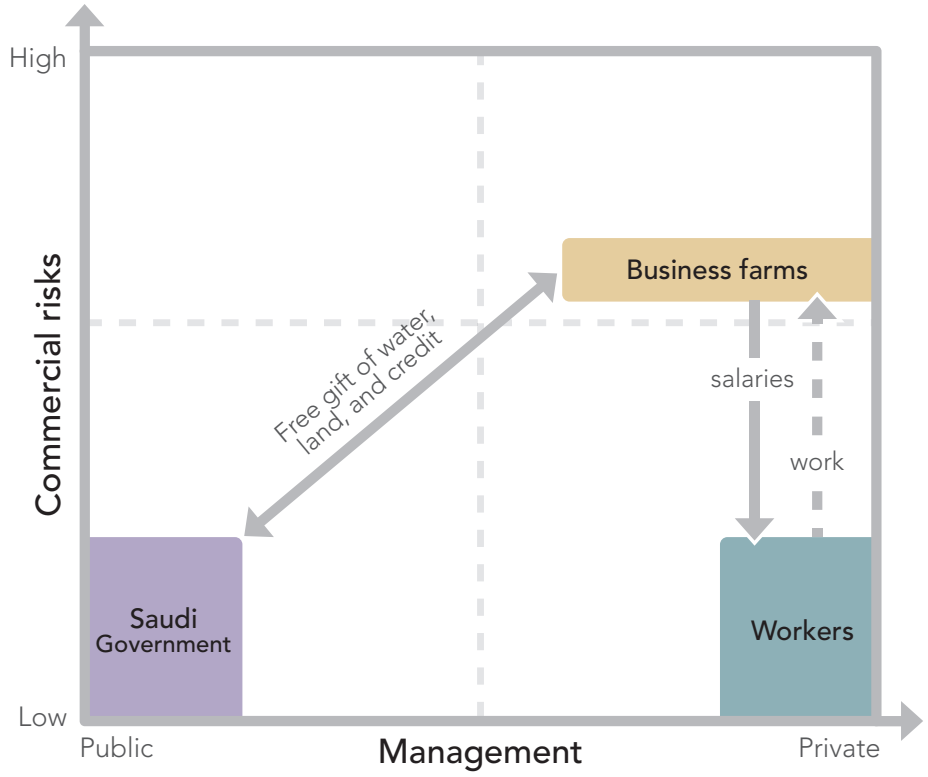
Project structure (cont.)

- Medium-sized farms (15 percent of the irrigated surface) with the same technical characteristics as the major business farms but far less capitalistic (individual enterprises). This group is representative of Saudi Arabia's real agriculture.
- The traditional Bedu farms (5 percent of the irrigated surface), involving between 1 and 10 center pivots, run by traditional small farmers but also a significant number of "weekend farms" owned by well-off urban dwellers, civil servants, university teachers, crown princes (an estimated 10,000 of them), preoccupied with the survival of the "Bedu culture."

Risks

- Political and devaluation risks are considered nonexistent.
- Commercial risks. The counter-production measures gradually decided on by the kingdom (price reduction, export ban, fuel price rise) make the desert agriculture far less profitable.
- Water-specific risks. Water demand risk is nil, but water supply risk is very high. Because most pumping is done from non-renewable (fossil) aquifers, the practice is fuel for ongoing debate about the future of Saudi Arabia's agriculture.

FIGURE A2.25: Business Farms Case Study Diagram



3.6. West Nile Delta, Egypt (Planned)

Project details[91]	Country	Egypt
	Project size (hectares)	75,000 ha (190,000 feddans, or small plots)
	Cost of project	$205,000 million
	Number of farmers targeted	About 400,000 people
	Irrigation technology employed	Surface water irrigation system
	Crops covered	High value fruits and vegetables
	Type of PPP	Hybrid scheme DBO
	Project developer	
	Private sector service provider	
	Public sector institutions	Government of Egypt
	Current Status of Project	The project has been stalled since 2012
Allocation of Irrigation scheme functions	Investment	
	Governance	
	O&M and management	
	Agricultural production	
Project structure	The West Delta area consists of approximately 110,000 ha of highly productive farmland on the fringes of the Delta. Since the early 1990s, the area has developed into a flourishing agricultural economy which today contributes between $300 million and $500 million annually to the Egypt's GDP. This irrigation scheme sought to develop a surface water irrigation system over an area of about 75,000 ha on reclaimed desert land on the West of the Egypt's Nile Delta for commercial and small farms that were threatened by groundwater depletion. The project sought to reverse the imminent collapse of a highly efficient export-oriented agricultural economy based on high value agriculture by providing a reliable source of surface water that also would promote sustainable conjunctive use of the remaining groundwater resources. The transaction essentially involves contracting a private operator to take over a concession area consisting of about 190,000 *feddans* in the southern part of the West Delta, to design, construct, and operate for 30 years a piped irrigation system. The concept included piping Nile River water to the site to provide surface water irrigation. A piped system, through more expensive than an open channel will be more efficient (due to less evaporation), and have fewer environmental and social impacts. In addition, a piped system offers many more advantages, such as reduced cost of an unutilized system, and minimal risk of water theft or cost to control against water losses.	

91 PPIAF. 2008. "A Demand-Driven Design for Irrigation in Egypt." Gridlines, 38.

Project structure (cont.)

By April 2008 the project had reached the bidding stage, with a number of international and local firms participating. The project sought to implement a monitoring and evaluation system facilitated by streamlined procurement and disbursement processes that were largely "output based" focusing on the achievement of technical milestones.

Farmer participation

The project introduced a participatory approach to project planning whereby the farmers were encouraged to drive many aspects of project design and preparation through a representative advisory group, the West Delta Water User Council. During the implementation stage the council would have been given a role in monitoring the relationships and potential conflicts between farmers on such matters as water entitlements, water use, and alternating hours of irrigation.

PPP contract

A number of innovative ideas were introduced in the PPP contract of the project. First, an institutional and regulatory framework gave de facto water rights to the operator. Second, the role of the ministry changed from provider to facilitator. Third, the PPP contract introduced a framework for tariff adjustments to ensure financial sustainability. Finally, the PPP contract established an innovative risk allocation framework and transaction structure whereby many of the potential risks associated with a privately financed and managed irrigation system were equitably shared between the operator, the farmers, and the government, and effectively mitigated.

Risks

The table below illustrates the distribution of the risks between the stakeholders.

TABLE A2.33: Risk Allocation

Type of risk	Operator	Government	Farmers
Demand			
Planning and design			
Construction			
Operational and commercial			
Water resource			
Currency			
Debt financing			
Credit			
Equity financing			
Inflation			

Project structure (cont.)

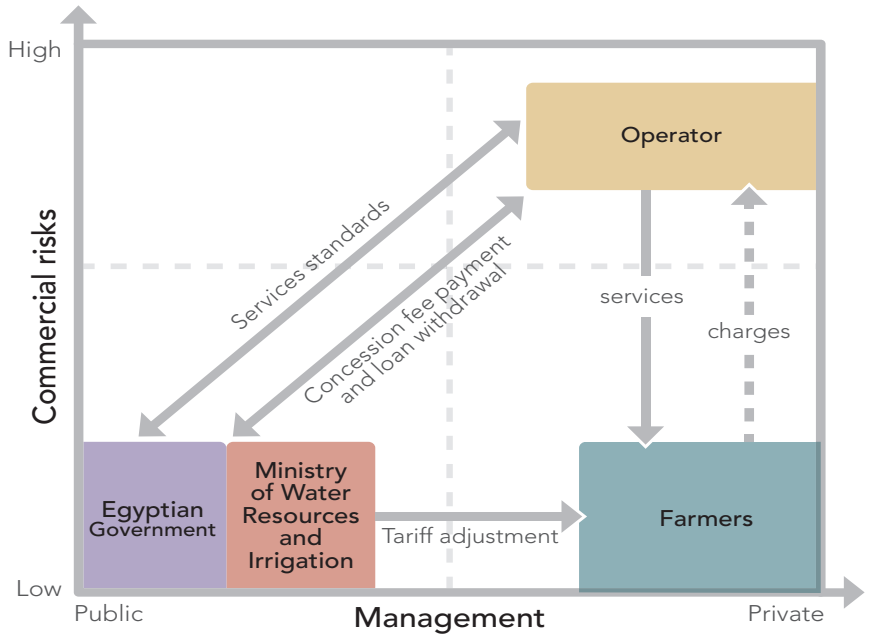
Currency risk

Under the agreement, the government assumed the currency risk for the funds it initially made available to the operator. The private operator's repayment obligation to the government is denominated in Egyptian pounds, while the government adds a premium of several percentage points to the operator's repayment obligation to cover its own currency risk exposure in repaying the dollar-denominated loan facility.

Demand Risk

Demand risk would be a major obstacle for any private operator. To reduce that risk, and the risk of designing a system that exceeds demand, a three-month "subscription period" was built into the project design phase. During this period, farmers would sign up to be connected to the new network and pay a security deposit to secure their commitment. After enough farmers had subscribed, the operator would design the system to reach those participating. If there was insufficient demand after the initial "subscription" period, the operator could terminate the contract. The farmers who decided to subscribe at a later stage would be charged a higher flat fee rate. The subscription deposits not only served as proof of commitment, they also provided the private operator with additional capital to finance initial construction. This method of subscription also allowed the operator to expand into new territories within the concession area without over-extending infrastructure into low-density and unprofitable areas.

FIGURE A2.26: West Nile Delta Case Study Diagram



Financial arrangements

The project was divided into two phases: Phase 1 includes developing irrigation system for area of 90,000 of the total 190,000 feddans in the concession area); Phase 2 is focused on providing the irrigation system to the remaining 100,0000 feddans.

For Phase 1, government would facilitate a 20-year soft loan from the World Bank (that would include a four-year grace period) and Agence Française de Développement would cover up 85 percent of the first area project cost ($175 million) to support the financing for the initial 90,000 feddans. The private sector operator would provide at least 15 percent of the first area cost ($30 million), and could draw on the loan facility to cover up to 85 percent of the initial construction costs.

In Phase 2, the private operator would need to raise full financing. A concession fee would be paid by the private operator to the government for over 20 years to recover the part drawn from the loan, plus interest and surcharge for potential currency devaluation.

To ensure government restitution in the event of default, the private operator was required to put up a performance bond. In total, the security would equal 30 percent of the entire investment, which is typical for purely private financing. The government would be covered in case the operator walked away after construction and could re-bid the project. The expansion would be done purely as a private BOT project.

Farmers were required to pay an upfront deposit when subscribing for their water entitlement, which amounted to 8 percent of the project costs. The operator could use this funding to reduce its own contribution

Recovery of costs

The two-part tariff accrued by farmers—(i) the annual flat fee per feddan over 20 years based on the land area connected, and (ii) the volumetric fee paid monthly per cubic meter consumed—would adjust periodically for inflation. The intention was to encourage efficient use of piped water and ensure positive cash flows, especially through the critical early years. More important, the flat fee, which was mandatory for farmers, regardless of water consumption, would ensure the minimum revenue base the operator needed to meet its concession fee payments to the government and recover its fixed capital costs—and ensure coverage for the government in repaying its loan.

The government of Egypt would guarantee a fixed allocation of water to the PPP, based on an annual amount per hectare.

Lessons learned

The project preparation introduced a number of innovating ideas such as, involving private investors and the farming community in the preparation and decision making processes: a strategy to mitigate demand, commercial, and currency risks. In terms of the design, this project has offered a new approach to irrigation development by introducing a piped surface water irrigation scheme system instead of an open channel. This would offer more efficiency in use and provide greater environmental and social benefits than an open canal irrigation.

Unlike the centrally planned projects of the past, this one is demand driven. The focus is on developing an irrigation network with features that farmers want and are willing to pay for. The project's sustainability would depend on reconfiguring the water service delivery model based on conjunctive use of surface and groundwater, and by recovering costs from water users.

Already, a number of other projects in Ethiopia, Zambia, and India are adopting the demand-based, participatory approach to assessing feasibility and cost recovery policies. The West Delta would be, if implemented, be the first such project to test the newly-created framework of consultation among the Nile riparian nations, which pioneered its approach and process for sharing knowledge and experiences for mutual benefits among the Nile basin countries. There is great interest in revitalizing the project.

The World Bank Group provides assistance to governments in developing countries to improve access to infrastructure and basic services through public-private partnerships (PPP). When designed well and implemented in a balanced regulatory environment, PPPs can bring greater efficiency and sustainability to the provision of public services such as water, sanitation, energy, transport, telecommunications, healthcare and education.

The World Bank Group's support is unique in that it covers the entire PPP cycle —upstream policy and regulatory guidance, transaction structuring advice, as well as financing and guarantees to facilitate implementation.

PPIAF provides technical assistance to governments to support the creation of a sound enabling environment for the provision of basic infrastructure services by the private sector. PPIAF also supports the generation and dissemination of knowledge on emerging practices on matters relating to private sector involvement in infrastructure. The production of this toolkit was funded by PPIAF.

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