

**Public-Private Partnerships in Basic Irrigation Service
West Delta Water Conservation and Irrigation
Rehabilitation Project (Egypt)**

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Abstract

The West Nile Delta area is about 255,000 feddans (1 feddan= 0.42 ha) which provides jobs to about 250,000 people in the agriculture sector. The area has experienced noticeable agricultural growth over the past few years through exploitation of groundwater resources, but with the development there has been excessive depletion of the groundwater reserves. Groundwater depletion has an effect on overall water quality and poses a substantial threat to the farming economy in the area. The Project is the Government of Egypt's (GoE) response to resolve the problem of excess groundwater exploitation and to foster continued agricultural growth, employment, and investment in the area. The Project proposes to implement a surface water conveyance system extracting water from the Nile River to connect commercial farmers in the area. In achieving this objective, the GoE intends to introduce important reforms to the sector, particularly to charge farmers for the full cost of service through volumetric pricing. The GoE also will involve the private sector in the design, construction and operation of the new irrigation system in order to share the various risks and returns from the project.

Keywords: PPP, Irrigation, Risk Allocation, Cost recovery

Introduction

Egypt policy for expanding its agriculture land is driven by a fast growing population, limited cropped land and the need to ensure food security. Although the total area of the country is slightly over one million square kilometer, 99 percent of the population lives within the Nile Valley and Delta which constitutes less than 4 percent of the total area. Currently, Egypt population is about 76 million with annual

rate of growth of 1.9 percent. This makes the populated area of Egypt one of the most densely populated areas of the world at a rate of 1900 person per square kilometer. Such density creates huge economic pressure on the available resources with serious social consequences. Thus the need to expand the populated area to accommodate further increases of the population is a primary objective of the Egyptian government.

Population increase implies mounting demand for housing and other related domestic infrastructure. For more than a century urbanization is creeping on the Delta and Valley agricultural land. The change rate in land use from agriculture to urban from 1984 to 1990 was 5.7 percent. The total loss of agricultural land would reach up to 686,000 feddans¹ (as much as 12% of the total area of the Delta) by 2010 if the pace of rural-urban land conversion, which started 38 years ago, continues unabated (World Bank, 2005). Although agriculture forms only 13.8 percent of the country's GDP, it provides 32 percent of the labor force and home for 57 percent of the total population that form Egypt's rural community. New irrigated land is extremely important not only to compensate for the agricultural land lost to urbanization but also to provide new job opportunities for the farming community and to slow down the immigration from the rural areas to big cities.

Egypt agriculture is well known with its high agricultural productivity and diversified agricultural products. Food security in Egypt is ensured through both locally produced and imported food products. Although Egypt is a net importer of agricultural products (FAO, 2006), the country exports several agricultural products (cotton, rice, vegetables and fruits) to foreign markets particularly in Europe and the Gulf. The recent turbulence in the global food markets combined with rising food demands of an increasing population requires maintaining balance between imported and locally produced food products. Increased crop production is realized through increasing the productivity of the currently cropped land and by expanding the cropped land to the maximum possible limits allowed by the available water resources. The National Water Resources Plan of Egypt envisages expansion of the irrigated area by 3.4 million feddans by 2017 (MWRI, 2005a). New irrigated areas are located along the fringes of the Nile Delta, Nile Valley, North Sinai and Western Desert.

West Delta Agricultural Expansion

Recent activities for expanding the irrigated land base started in the mid of last century. The western fringes of the Nile Delta witnessed many of these activities. Irrigation schemes was implemented first on Nile water in the northern parts of the West Delta region after the construction of El-Nasiry Rayah (a main canal with head regulator upstream the Delta Barrages). The Nubaria canal (figure 1) was then constructed in the 1980s to irrigate an area of 190,000 feddan (8000 hectare) from El-Nasiry Rayah. The objectives of the Nubaria Scheme was to create new employment opportunities for the many university graduates residing in the congested cities, to expand cultivable land by reclaiming desert land,

¹ 1 feddan= 0.42 ha

increasing agricultural output for domestic consumption and export and the creation of new and dynamic communities.

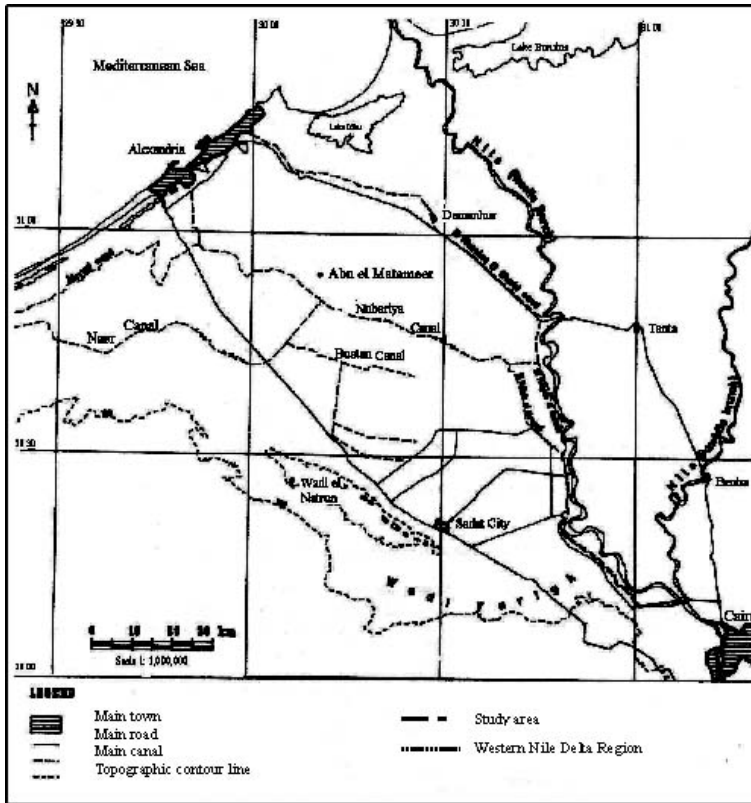


Figure 1: West Delta, a Base for Social and Economic Development

In the 1980s irrigation was extended to land more to the south using groundwater. The area along the Cairo-Alexandria desert road at about 60 kilometer north-west Cairo was the target of private commercial farmers to mainly grow horticulture and vegetable crops using up-to-date agriculture and irrigation technologies. The groundwater irrigated area estimated at 255,000 feddans became the home of about 250,000 agricultural worker with as much as this number commuting from the neighboring old rural Delta land for temporary jops in this area. Although only 47 percent of the land is cultivated (EWP, 2006), the economic value of annual agriculture products in the area was about US\$ 500 million. Farms in the area are a mixture of large, mediam, and small. The area of large farms is in the range 1000 – 10,000 feddans while small farms are less than 50 feddans in their areas (figure 2).

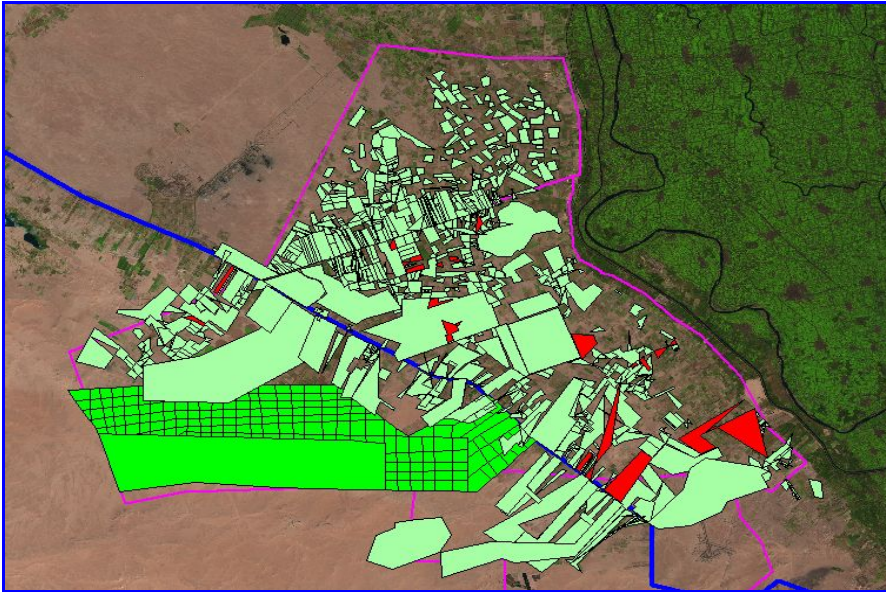


Figure 2: Distribution of farm size in the project area

The Looming Risk of Loss

With drilling more wells to irrigate new farms in the western Nile Delta signs of groundwater depletion increasingly spread out. Groundwater levels started to fall at a rate of 1-2 meters per year in several locations. The drop of groundwater levels was 10-20 meters in 15 years (figure 3). Its salinity also increased due to up-coning of deep saline groundwater. Some farmers were forced to deepen their wells to tap the falling water table at a higher cost of pumping. Others have to pull out their mature fruit trees and shift to more salt tolerant crops when their yield deteriorated due to increasing groundwater salinity.

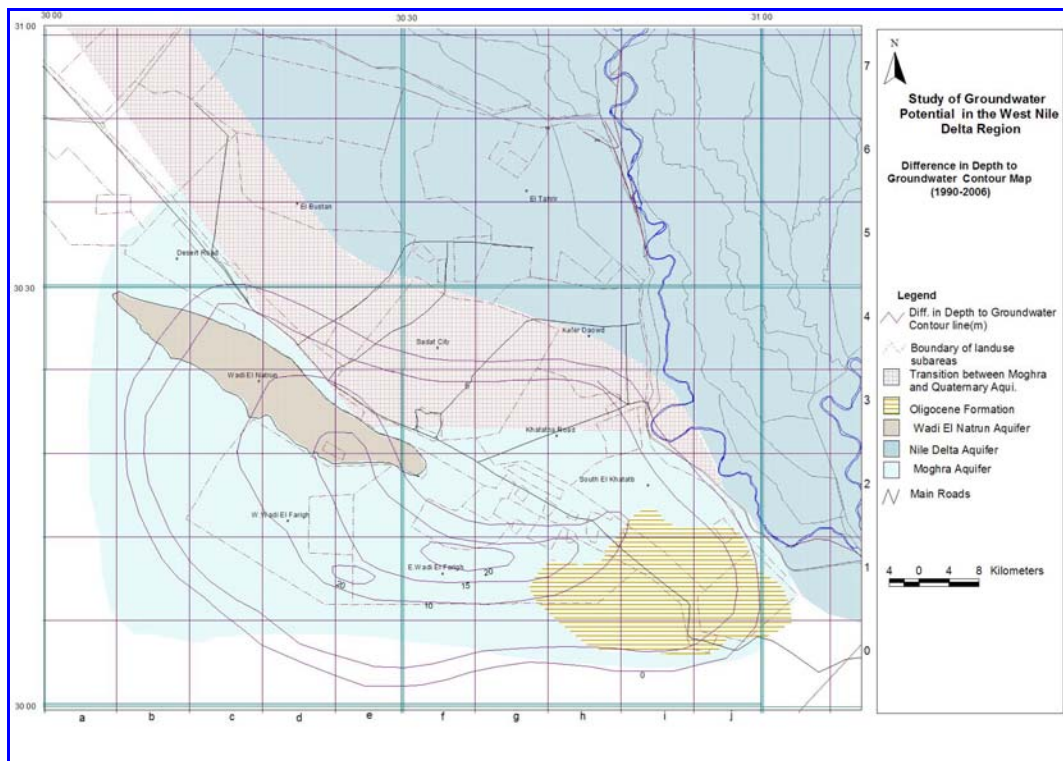


Figure 3: Drop in groundwater levels (1990 – 2006)
Source: RIGW, 2007

Recent groundwater studies (RIGW, 2007) showed that aquifers in the area are rechargeable, but the extraction rates are well above the recharge rates. Water extraction by the year 2000 reached 870 million m³ annually, a 36.2% increase in just over a decade. The more than one billion US dollars worth investment in groundwater irrigated crops became at great risk of unavoidable losses. Investors who are facing dramatic losses became concerned and asked for government help to secure a new sustainable source for irrigation which can be secured only from the Nile water to survive these looming crises.

The Way for Sustainability

The government responded positively by including this area in its plans to allocate water resources for expanding the agricultural land by additional 3.4 million feddans. The guiding principles to implement a surface water delivery project were water conservation and financial sustainability. The goal of the proposed project was to minimize if not totally halt the depletion of the groundwater resource. The overall project objectives are to sustain economic growth and achieve poverty alleviation. The approach was to introduce important reforms in the sector which allow engaging the private sector in developing and operating the irrigation scheme and to charge for irrigation services on volumetric basis. The

West Delta Water Conservation and Irrigation Rehabilitation Project² (WDWCIRP) was proposed to provide critical infrastructure to increase production of export oriented crops in the West Delta, as well as spillover effects in the agribusiness services (packing, market information, technical advice, logistics, etc), and input industries (irrigation equipment, locally produced fertilizers, etc). The project area will have major direct and indirect generation of employment opportunities for an estimated half a million persons (World Bank, 2007).

Studies were carried out by national and international experts with support from the World Bank to examine technical options; develop conceptual framework and transaction model; and define risks and risk allocation. The following main tasks have been performed in order to develop a Public-Private Partnership (PPP) transaction model:

- Development of a number of technical options to bring surface water for irrigation to the study area along with preliminary cost estimates that can be presented for decision-making by growers and policy makers.
- Consultations with growers and identification of the most feasible technical solution, taking into account the growers willingness to connect at given tariffs levels and an agreed set of underlying guidelines and legal agreement.
- Development of a framework for the tariff setting process based on volumetric rates and recovery of the investment cost, based on the reality that some growers may continue using existing groundwater sources.
- Development of financial and management options to exploit viable funding sources, whether public or private, and to ensure the efficient management and maintenance of the new investments.
- Development of a workable PPP model that will align financial incentives and that will allocate risks fairly among the different parties, including the private sector/operator, the Government of Egypt, and the farmer community (WDWCIRP, 2005).

The first phase of the project is set to design, build and operate a piped-irrigation system by a private operator in 90,000 feddans within a concession area of 190,000 feddans. The irrigation service is to be provided on demand basis until the full concession area is covered. The second phase will extend the project to the rest of the 255,000 feddans currently under groundwater irrigation.

The Underlying Political Economy

There are a number of complexities in achieving the projects goals and objectives. For example, realistically the growers cannot be forced to connect to a new surface water system, particularly if they are expected to pay for the cost of service. Consistent with recently approved policies, it is GOE's intent to fully recover the cost of the system and to introduce volumetric tariffs to ensure correct incentives to conserve and utilize water more efficiently. Moreover, beyond its

² See Project website at www.mwri.gov.eg/wdip

objective to achieve full cost recovery, GOE also wishes to identify practical ways of involving the private sector in the design, operation and even financing of the surface water system. While GOE fully endorses the project, it is also keen to transfer as much of the related risks and to assign maximum responsibilities of the operations, maintenance to a private operator. In the Same time the Government wishes to introduce volumetric charges to promote water conservation and maximize returns to farmers of per cubic meter of water utilized. It is the Government's intent to assign maximum responsibilities of the related operations, maintenance and loan amortization to a private operator, who would be selected through a competitive bidding process (WDWCIRP, 2005).

The above initiatives to solve the West Delta irrigation water problems are consistent with the recently published National Water Resources Plan (MWRI, 2005a). The NWRP promotes Integrated Water Resources Management (IWRM) that includes actions oriented at gradually establishing holistic principles for sustainable water resources management. The implementation of cost recovery based on economic principles is included in the IWRM plan; specifically, cost recovery of Operation and Maintenance (O&M) in old lands and full cost recovery in new lands are proposed to be implemented as actions. Equally important are the proposed actions in the IWRM Plan related to the use of Public-Private Partnerships (PPP) to enhance efficiency and sustainability of IWRM (MWRI, 2005b).

Proposed Transaction Model

Involving the private sector in the West Delta poses a significant challenge. Private participation in providing irrigation services is new compared to the traditional infrastructure projects in the power, telecommunication, transport and water supply sectors. The large dominant international operators are playing a much lesser role in direct financial placements. Their preferred choice of PPP options are those that transfer financing and demand risk to the public partner (as in management contracts and leases) and it is not certain whether these investors can be led back to assume financing risks, regardless of how these are allocated (WDWCIRP, 2005; World Bank 2007).

Preparation of the proposed project focused on identifying a number of different public-private models with different risk allocations between public and private parties for implementation. The choice of PPP model was largely governed by a number of considerations including: (i) transferring the various risks associated with the project to the extent possible from public to private operator;; (ii) realize GOE's objective for cost recovery and for the project to sustain itself financially throughout its project life; (iii) the ability to mobilize long-term financing in order to render tariffs affordable; (iv) ensure the maximum possible mitigation of demand risk by linking the planning and construction scheduling to actual operation; and (v) ensure an appropriate balance of risk and return, at the same time being mindful that the absolute level of financial commitment may deter private sponsors and lenders.

In this context, expected Project Related Risks have been identified as: 1) Demand Risk, 2) System Design & Planning Risk, 3) Operation and Commercial Risk 4) Devaluation/Currency Risks, 5) Regulatory Risks, 6) Financing Risk, 7) Construction Risk, 8) Credit Risk, and 9) Other Risks. Based on understanding of expected risks and its allocations, verities of PPP-models with different risk allocations between public and private parties have been studied. Four options were considered for the project implementation: a) Public Company Option, b) Private Concession/BOT Option, c) Performance Management Contract Option (PMC), and d) Design-Build-Operate Option.

The choice of PPP model was largely governed by many considerations including: risk allocation, balance of risk, cost recovery and project suitability. Based on these considerations, the Design-Build-Operate (DBO) option was considered as the preferred transaction model for the West Delta. The DBO attempts to divide risks between the public and private parties, but more to an extent than performance management contracts and less so than a full concession. The scheme essentially contracts a private operator to design, construct and assume the full responsibilities of operating the system including, the associated demand and commercial risks. The public sector would in turn assume the ownership of the assets and undertake the financing responsibilities and related risks including, the currency risk which would arise from potential devaluation of the local currency against the currency of foreign finance. The Design-Build-Operate model offers a more balanced risk allocation framework than a full concession and was proposed to be the more suitable model to pursue for the West Delta (WDWCIRP, 2005; World Bank, 2007).

The project will be bid out to a private operator for a 30-year concession through a Design-Build-Operate (DBO) contract where the operator will assume most responsibilities with the project, including design, construction and operation of the surface water irrigation system within the concession area. Following a contract award, there will be an initial 3-month "subscription period" in which farmers may sign up for connection from the private operator. If there is insufficient demand following the initial "subscription period," the operator may terminate the contract. The subscription would be backed by the execution of legal connection agreements and the submission of a security deposit for connection to the system. Farmers who decide to connect at a later stage will be subject to a higher flat fee rate.

Upon completion of construction, the private operator will be guaranteed concession rights of the project assets from the government along with a concession to operate the system for the entire concession area for which it pays a concession fee through the life of the contract. The concession fee would correspond to the debt service obligation of the public sector. In the proposed DBO scheme, the private operator would also be required to raise the equity financing. This contribution is channeled through a special purpose company so as not to intermingle the funds of the various parties. The equity would be repaid along with returns over the life of the contract in either graduated or equal installments.

Design Consideration

The conceptual design was based on a “demand-driven approach to planning” where the growers’ willingness to pay for connection guided the technical design options with commensurate tariffs. In addition, a piped system was chosen as the preferred option given its advantages over open channel systems, particularly with regard to efficient water resource use and lower environmental and social safeguards risks. Final design will be completed by the private operator contracted to construct and operate the system on a long term basis. A fixed allocation of water resource will be made available by GOE to the project area based on the estimated gross annual requirement of 5200 m³ per year per feddan. The surface water system would meet most of the water resource needs of the farms that will be connecting, allowing the aquifers to recharge and to benefit farmers in adjacent areas.

The technical options adopted for the West Delta Project were based on a number of design criteria involving, technical considerations as well as the farmers’ needs and a service they would be willing to pay for. This approach yielded: (i) the most feasible conceptual plan for open canal irrigation networks that covers the whole project area; (ii) cost estimates for each proposed open canal network and determination of the minimum cost option; and (iii) an improved closed conduit network configuration. Technical parameters of the most feasible conceptual plan were then used by the financial assessment work in order to derive the total revenue requirements and tariffs to meet the Government’s objectives for cost recovery (WDWCIRP, 2005; EWP, 2006; WDWCIRP, 2006b).

The pipeline option has been included as the baseline estimate given its preferred characteristics over the open channel system. The system will include construction of culverts, a lift/pumping station, transit storage capacity, conveyance a main distribution system, roads and energy sources and other related civil works (figure 4) to serve an initial 90,000 feddans in the southern part of the West Delta Area. This area was selected during project preparation given its relatively higher declining groundwater table’s area and the commensurate greater willingness by farmers to pay for surface water irrigation. The implementation of the proposed project in this area will serve as model for development of the other areas in the West Delta as well as other agricultural lands in Egypt (WDWCIRP, 2006b).

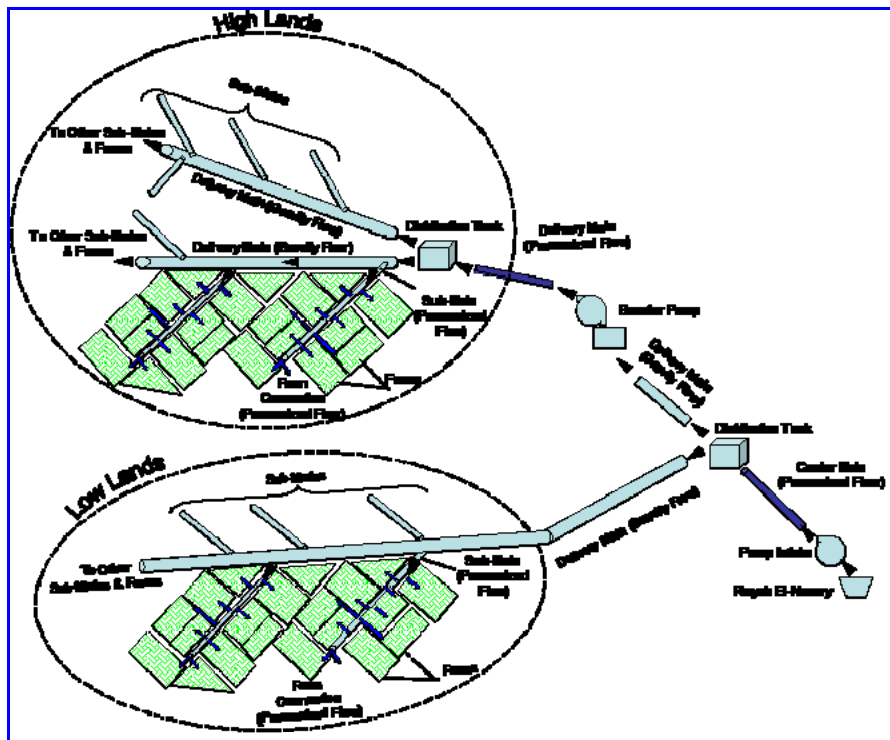


Figure 4: Conceptual Layout of the Surface Closed (pipel) Irrigation Conduit

Water will be delivered to connected farmers at their farm-gate through one outlet per 100 feddans. Each outlet will be provided by a valve and meter. Small farms of area less than 100 feddans (e.g. 5-50 feddans) can share one outlet. They should establish among themselves a water user association to distribute irrigation water in rotation. However, owners of small farms that are willing to have their own meters are allowed to do so at their own discretion provided that they pay additional cost. Water pressure at the outlet will be 3 bars which is sufficient to operate drip irrigation systems. The establishment and operation of on-farm irrigation systems is the responsibility of the farmers.

Financing

The financing plan for the surface conveyance system in an initial area of 90,000 feddans, assumes that 85% of the infrastructure cost will be financed from a loan from each of the World Bank and Agence Française de Développement (AfD) proceeds, leaving the remainder 15% to be financed from equity contributions from the private operator and security deposits from the participating farmers. After the funds have been fully utilized the operator is responsible for sourcing on his own any additional funds needed for expansion of coverage to the rest of the concession area.

Through connect agreements; the private operator will be able to utilize security deposit that will be paid by participating farmers as part of its financing requirements. Such deposits are to be retained as a liability on the accounts of the

private operator and repaid in the event they choose to withdraw from the system. The initial capitalization by the private operator will be accomplished with the setting up of the Special Purpose Vehicle as a pre-requisite of the execution of the DBO contract. As operation is expected to begin in year two, the private operator will generate internal cash flow in those years to offset some of the total investment requirements.

Tariff Structure

The project financial analysis focused on: (i) determining the average tariff level and appropriate tariff structure that will recover all costs through the duration of the project and ensure a sustainable cash flow to the operation; and (ii) determining an appropriate capital structuring and financing plan maximizing the mix of public and private financing, including contributions from farmers; and (iii) the development of long-term financial projections in order to assess financial sustainability of the project under different financial and management assumptions.

Payments by commercial farmers for irrigation services will be based on a two-part tariff structure to include: (i) a fixed charge to be paid on a per feddan basis to recoup investment costs over 20 years. This charge will be paid regardless of actual amount of water usage and should deter farmers from continuing to exploit the groundwater resources after they have been connected to the surface water system; and (ii) a volumetric charge per unit volume of water to recover O&M expenses related to the actual usage of water for irrigation. Tariffs will be finalized through competitive bidding (WDWCIRP, 2005; World Bank, 2007; BDO-Zarouk Khalid, 2008).

Institutional Structure

The project will be implemented by MWRI. The day to day management will be the responsibility of a Project Management Unit (PMU) with staff seconded from within MWRI. The line department of MWRI entrusted to overview the project and assist in its preparation and facilitates its implementation is the Horizontal Expansion Projects Sector (HEPS). Since the project will be implemented using a DBO contract with the private sector, the establishment of a Regulatory Office (RO) will be necessary. Both the PMU and the RO will be under the jurisdiction of MWRI. In addition, an Independent Panel of Expert (IPE) will be set up as needed to serve as an intermediate mechanism for handling disputes and conflict resolution (WDWCIRP, 2006a).

A Water User Council (WUC) has also been established as an independent farmers' organization to take active part in the project preparation and ultimately govern water users associations that will be formed once actual beneficiaries of the project are subscribed. During implementation, the WUC will monitor the relationships and potential conflicts between farmers on such matters as water entitlements, usage, alternating hours of irrigation in the case of small farmers sharing one outlet, etc. The WUC will also monitor groundwater pumping in the area, along with the more formal program that will be implemented by the Groundwater Sector (GWS) within MWRI.

The PMU will be responsible for: (i) monitoring and making sure the project activities are being implemented as designed; (ii) ensuring compliance with contract clauses vis-à-vis GOE by the private operator; and (iii) ensuring adequate implementation of the Technical Assistance (TA) for strengthening the contract administration, the RO, and WUC as well as the initiatives directed towards assisting small farmers; and (iv) co-ordination, oversight and monitoring of the Environmental and Social Management Plan (WDWCIRP, 2007).

The RO will provide traditional economic regulatory functions for tariff adjustments and will oversee the contractual commitments of the operator with regard to the prescribed service standards. Specialists would be recruited when warranted to serve in the IPE to resolve specific disputes prior to formal arbitration in case conflicts arise between the private operator and farmers, or between the private operator and GOE (WDWCIRP, 2005, 2006a, 2007).

Risk and Risk Management

As explained above, the project poses a number of risks. The main risk in the selected DBO model is demand risk to the private operator, whereby connecting farmers may choose to use underground water for irrigation rather than surface water. Demand risk is mitigated through the flat portion (fixed tariff) of the two-part tariff which would recover most or all of the fixed cost of the investment regardless of consumption. The subscription period also mitigates demand risk by verifying an exact figure for service demand prior to construction. Charging higher tariff for late subscriber will also reduce the demand risk. To mitigate commercial risk, farmers will make a down payment equivalent to one third of the annual fixed cost in order to secure their connection. To further mitigate commercial risk the operator will have the right to disconnect non-paying farmers and sequester the security deposit, thereby taking away the farmer's water right as the operator may connect a new subscriber. The Government would bear currency risk from the World Bank and AfD co-financing and would mitigate the risk by charging a premium to the private operator. The design and construction risk will be managed through extending the system to modules (area zones) depending on securing at least 85 percent of the area subscribed for the service.

Conclusions

The proposed surface water system is expected to accommodate the water resources needs of the agricultural community. The West Delta Water Conservation and Irrigation Rehabilitation Project will directly address the two important objectives related to sustainability: (i) cost recovery; and (ii) water conservation and greater efficiency in irrigation. Both will be mainstreamed in the project using a PPP with clear contractual responsibilities between MWRI and the private operator, and between the private operator and the beneficiaries. In this context, MWRI will make financing available to the project through the proposed loan from international donor agencies. The private operator will pay a concession

fee to MWRI equal or in excess of GOE's debt service commitment to the lending agencies. The beneficiaries will pay an irrigation service fee to the private operator in order to operate and maintain the surface (pipelined) irrigation system and to repay the capital investments made by it and GOE. Through the proposed tariff structure that is based on a minimum flat fee, there are few incentives for additional groundwater usage among the participating farms. Groundwater degradation should diminish substantially in the project area. Full cost volumetric pricing will provide additional incentives for farmers to utilize the water resources efficiently as it will impact the cost competitiveness of the end crops [2, 4]. The farmer community is expected to participate during the O&M phase through the WUC.

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