ADB

Exploring Public–Private Partnership in the Irrigation and Drainage Sector in India

A SCOPING STUDY

Asian Development Bank

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Preface

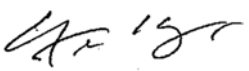
Despite large government investments in irrigation infrastructure development in India, its upkeep has not been commensurate, thus raising numerous concerns. Rising population, scarcity and inefficient use of water, and the associated low water user charges are affecting agricultural production and productivity. While the central as well as state governments have been traditionally playing the role of both developers and service providers in the irrigation sector, they now feel that decentralization of the sector's management with integrated efforts of state water resources departments, stakeholders, and collaborative private sector investments, can bring in the much desired economic and financial stability, as well as ensure transparency.

The encouraging performance of public–private partnership (PPP) in other sectors prompted the governments to explore opportunities of private investments within the irrigation and allied sectors. This intent and willingness of governments to create a conducive and enabling atmosphere to encourage PPPs led the Asian Development Bank to initiate a scoping investigative study. The study identifies the areas where private sector participation can be envisaged given the national policy framework, reviews the legal and institutional status, presence of national and international best practices, and suggests appropriate PPP models suitable for Indian conditions.

The report finds that due to a long gestation period, prolonged life cycle, and limited scope of viability gap funding, there may not be enough opportunities for involving private investments in irrigation infrastructure development. However, the report also finds that given the multidisciplinary nature of the water sector, many PPP opportunities arise within the service delivery sector. This requires various water use departments to open up and consider sharing joint infrastructure projects, review their institutional setup and frame laws that encourage private investments. The report analyzes the domestic setup in relation to the PPP framework as adopted in India, the associated risks and concerns of the private sector, and suggests suitable models that may be adopted. To conclude, there is a road map and action plan for promoting the role of the private sector participation in irrigation and drainage sector in India.

This report provides useful insights and will be of immense value to government agencies, private players, lenders, investment agencies, and other stakeholders who consider PPP in the irrigation sector as one of the possible means of realigning and paving the way for faster development of the irrigation sector in India.

I would like to thank the officials of the Department of Economic Affairs, Ministry of Finance, Government of India, officials of Water Resources Departments of the Governments of Andhra Pradesh and Maharashtra, and the Maharashtra Water Resources Regulatory Authority for their time, support, and inputs, which were critical in the preparation of this report. My appreciation is also due to the consultants and staff at ADB for putting in tremendous efforts to make this report a reality.



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Re1.00 = US$ 0.2222 and 1 US$ = Rs45

Units and Measures

BCM	–	Billion cubic meters
kl	–	Kiloliters
Kcal/cu/day	–	Kilo calories per consumer per day
km	–	Kilometer
m	–	Meter
mha	–	Million hectares
mld	–	Million liters per day
mm	–	Millimeter
MGD	–	Million gallons per day
sq km	–	Square kilometer

Abbreviations

ADB	–	Asian Development Bank
AgDSM	–	Agriculture Demand Side Model
AIBP	–	Accelerated Irrigation Benefit Program
AIC	–	Association d'Intérét Collectif (Water or Irrigation AICs)
APIDEA	–	Andhra Pradesh Infrastructure Development Enabling Act
APMR	–	Agriculture Produce Marketing Regulation
APWRRC	–	Andhra Pradesh Water Resources Regulatory Commission
BEE	–	Bureau of Energy Efficiency
BPL	–	Below Poverty Line
BOLT	–	Build Operate Lease Transfer
BOD	–	Biological Oxygen Demand
BOO	–	Build Operate Own
BOT	–	Build Operate Transfer
BOOT	–	Build Own Operate and Transfer
CACG	–	Companie d'Amenagement des Coteaux de Gascogne, France
CAD	–	Command Area Development
CADA	–	Command Area Development Authority
CAD&WM	–	Command Area Development and Water Management
CCA	–	Culturable Command Area
CED	–	Chronic Energy Deficiency
CGWA	–	Central Ground Water Authority
CGWB	–	Central Ground Water Board
CLA	–	Central Loan Assistance
CRDA	–	Commissariat Régional de Développement Agricole (Regional Office for Agriculture Development), Tunisia
CSS	–	Centrally Sponsored Schemes
CWC	–	Central Water Commission
DEA	–	Department of Economic Affairs
DFID	–	Department for International Development (British Government)
DISCOM	–	Distribution Company
DPR	–	Detailed Project Report
DVB	–	Delhi Vidyut Board
EPC	–	Engineering Procurement Construction
ERM	–	Extension, Renovation, and Modernization
ESCOs	–	Energy-saving Companies

GDP	–	Gross Domestic Product
GOAP	–	Government of Andhra Pradesh
GOMaha	–	Government of Maharashtra
GOP	–	Government of Punjab
GOUP	–	Government of Uttar Pradesh
HLC	–	High Level Committee
HYV	-	High Yield Variety
I&D	–	Irrigation and Drainage
I&CAD	–	Irrigation and Command Area Development
IDC	–	Interest During Construction
IFC	–	International Finance Corporation
IGB	–	Indo-Gangetic Basin
IL&FS	–	Infrastructure Leasing and Finance Corporation
IMF	–	International Monetary Fund
IMT	–	Irrigation Management Transfer
INR	–	Indian Rupee
IPC	–	Irrigation Potential Created
IPU	–	Irrigation Potential Utilized
IRAs	–	Infrastructure Regulatory Authorities
IRR	–	Internal Rate of Return
IT	–	Information Technology
IWRM	–	Integrated Water Resources Management
JISL	–	Jain Irrigation System Limited
JNNURM	–	Jawaharlal Nehru National Urban Renewal Mission
KPI	–	Key Performance Indicator
LIS	–	Lift Irrigation Scheme
MCA	–	Model Concession Agreement
MI	–	Minor Irrigation
MIS	–	Management Information System
MGNREGA	–	Mahatma Gandhi National Rural Employment Guarantee Act
MKVDC	–	Maharashtra Krishna Valley Development Corporation
MMI	–	Major and Medium Irrigation
MOA	–	Ministry of Agriculture
MOE&F	–	Ministry of Environment and Forests
MOF	–	Ministry of Finance
MORD	–	Ministry of Rural Development
MOU	–	Memorandum of Understanding
MOUD	–	Ministry of Urban Development
MOWR	–	Ministry of Water Resources
MPPKVVC	–	Madhya Pradesh Paschim Kshetra Vidut Vitran Company
MSP	–	Minimum Support Price
MWRI	–	Ministry of Water Resources and Irrigation (Egypt)
MWRRA	–	Maharashtra Water Resources Regulatory Authority

NABARD	–	National Bank for Agriculture and Rural Development
NAPCC	–	National Action Plan for Climate Change
NCIWRD	–	National Commission for Integrated Water Resources Development
NCPPP	–	National Council for Public–Private Partnership
NEDA	–	Non-Conventional Energy Development Agency
NGO	–	Non Governmental Organization
NGRBA	–	National Ganga River Basin Authority
NHAI	–	National Highways Authority of India
NHDP	–	National Highway Development Project
NPV	–	Net Present Value
NREGS	–	National Rural Employment Guarantee Scheme
NWM	–	National Water Mission
NWP	–	National Water Policy
NTADCL	–	New Tirupur Area Development Corporation Limited
O&M	–	Operation and Maintenance
OMM	–	Operations, Maintenance and Management
PAIC	–	Punjab Agro Industrial Corporation
PAF	–	Project Affected Family
PAP	–	Project Affected People
PIM	–	Participatory Irrigation Management
PPP	–	Public–Private Partnership
PPR	–	Preliminary Project Report
PRIs	–	Panchayati Raj Institutions
PSP	–	Private Sector Participation
R&D	–	Research and Development
RFP	–	Request for Proposal
RFQ	–	Request for Qualification
RSVY	–	Rashtriya Som Vikas Yojna
RWH	–	Rain Water Harvesting
SEZ	–	Special Economic Zone
SPK	–	Samaj Parivartan Kendra
SPML	–	Subhash Projects & Marketing Limited
SPV	–	Special Purpose Vehicle/Venture
STP	–	Sewage Treatment Plant
SWaRA	–	State Water Resources Agency
SWP	–	State Water Policy
TAC	–	Technical Advisory Committee
T&D	–	Transmission and Distribution
TLPA	–	Tirupur Local Planning Area
ULBs	–	Urban Local Bodies
UPWaMReC	–	Uttar Pradesh Water Management Regulatory Commission
USAID	–	United States Agency for International Development

VAC	–	Value Added Chain
VGF	–	Viability Gap Funding
VIWSP	–	Visakhapatnam Industrial Water Supply Project
VSP	–	Visakhapatnam Steel Plant
WDCS	–	Water Distribution Cooperative Society
WRD	–	Water Resources Department
WSS	–	Water Supply and Sanitation
WTPs	–	Water Treatment Plants
WUA	–	Water Users Association
WUC	–	Water Users Committee

Executive Summary

The Indian irrigation sector has gone through various cycles in the last century, from being a highly developed sector to one that has progressively disregarded the upkeep of the multiple (small) irrigation structures. As a result, the current efficiency levels, productivity impacts, and economic returns are all lower than expected. Various initiatives and programs have been sporadically organized with the aim of addressing these concerns, albeit with limited success. The large-scale construction of canal irrigation systems and the initiation of farmer management through Water Users Associations (WUAs) are two such measures that are geared towards improving efficiency levels. Most states have initiated the construction of canal irrigation systems and have developed WUAs, but the results of these steps have not been fully realized yet. Besides fiscal constraints, there are also issues regarding the organization and operation of the WUAs that are yet to be fully resolved. In order to augment the performance of the sector, the possibility of involving the private sector through Public–Private Partnerships (PPPs) is being explored.

India's water and other natural resources, considered abundant in 1950, are now under stress and are speedily headed towards scarcity. This is primarily because of the pressure of the growing population and allied environmental and ecological concerns. The per capita annual availability of water is stressed at around 1584 m^3 while the per capita annual utilizable water is already scarce at 952 m^3. Most rivers are expected to become water scarce in due course.

The Government of India Act of 1935 placed the administrative control of developing and managing irrigation works under the provincial governments. This arrangement was accepted by the Constituent Assembly that framed the Constitution of India. Unfortunately, however, this has ensured the loss of an all-India perspective on the subject of the development and management of irrigation systems.

At present, 78% of the available water is being utilized for raising crops, which is likely to reduce to 72% in 2025, and 65–68% in 2050, mainly due to the rising competition of demands from domestic and industrial sectors. Given that the net sown area in India is nearly exhausted, the only option to meet the growing challenge of food security appears to be that of enhancing productivity and production through intensification and the adoption of efficient management practices. Under the threat of climatic changes, increasing the production of food grains from 216 million tons at present to 380 million tons by 2050 will be a real challenge.

Approximately $776 billion (Rs34900 billion) has been directed towards the development of Major and Medium Irrigation (MMI) over the last 60 years or so, and an irrigation potential of about 42.35 mha has been created. The gap between the created and utilized irrigation potential is 18.87% for the MMI sector, and 12.6% for the Minor Irrigation (MI) sector. The central government initiative of 1996–1997 to complete last mile projects under the Accelerated Irrigation Benefit Program (AIBP) was given a boost under the 'Bharat Nirman' flagship in 2005, which proposed to create an irrigation potential of 2.5 mha during the Tenth Five-Year Plan, and 9 mha during the Eleventh Plan. However, the latter target had to be revised to 5 mha due to low allocation of funds.

The Irrigation and Drainage (I&D) sector is being plagued by numerous concerns. These include the current gap between irrigation potential created (IPC) and irrigation potential utilized (IPU), the rising trend of waterlogging, salinity and alkalinity in irrigated commands, inefficiency in the delivery of

water, problems caused due to floods and droughts, river bank erosion, surface and groundwater quality, surface and groundwater interaction, and the issues of resettlement and rehabilitation of project-affected persons.

It is widely believed among social and political circles that irrigation in India is being developed for subsistence and intensification to ensure food security, especially in the light of a vast population of small and marginal farmers as well as the Below Poverty Line (BPL) population engaged in the agricultural sector. Due to the low cost of inputs and assured water supply for irrigation, farmers tend to grow crops with high water requirement and low productivity. In many states, water rates have not been revised for more than two decades, recoveries have been low, and the revenue generated is not being ploughed back for the operation and management of irrigation infrastructure.

The numerous institutional governance issues directly affecting users include non-allocation of water rights; the inaccessibility, inadequacy and inequity of water delivery; the virtual monopoly of state governments over irrigation; inequitable distribution of domestic water supplies directly affecting the poor; the absence of WUAs and other stakeholders at all levels; and the lack of transparency and insufficiency of hydrologic information to be shared with users.

Considering the present levels of development in various subsectors, approximately $160.9 billion (Rs7,239 billion) would be required to complete the balance work under various subsectors at present day costs with a business-as-usual approach, it may take four Five-Year Plan periods to create the balance irrigation potential. The task of bridging the gap between the IPC and IPU may take even longer. While some states have initiated pilot schemes through bank funds, it would take substantial effort and resources to usher in the reforms that have been envisaged under these schemes.

The reform options being considered by the governments to restructure the water sector as a whole and the irrigation sector in particular include (i) participatory irrigation management, (ii) conservation (storage) of water in any form, (iii) sustainability through groundwater development, (iv) modernization of canal networks, and (v) efficiency of irrigation water use. It is increasingly being realized that the sustainable development and management of water resources will require the Integrated Water Resources Management (IWRM) approach, which in turn demands the integration of the efforts of all stakeholders; decentralization of management authority to ensure efficiency, accountability, best management practices, and the technical expertise of the private sector; participation of all stakeholders, particularly the beneficiaries; and economic and financial stability to account for costs of withdrawing, delivering and opportunity costs, including costs associated with economic and environmental externalities.

According to the National Water Policy (NWP), PPP should be encouraged in the I&D sector for the processes of planning, development, and management. State governments anticipate that private sector participation (PSP) will encourage innovative ideas, generate finance, bring in corporate management, and ensure accountability to users. Various states, including Maharashtra, Andhra Pradesh, and Uttar Pradesh, are exploring options for involving the private sector in the I&D sector.

Despite a number of initiatives in this direction, PSP in the sector has been negligible so far. Increased investment in irrigation and agriculture through PPP is being perceived to (i) enhance productivity of farming, particularly food grains, (ii) promote adoption of genetic agriculture, (iii) promote private investments, and (iv) introduce corporate culture. It is considered that the steadily decreasing public investments are the root cause of the diminishing private investments as one triggers the other.

A number of PPP opportunities may arise if agricultural reforms in the form of contract farming, improvements in inputs, markets, agro industries, and retail links are coupled with irrigation development and management efforts. A number of problems like effective conjunctive use, issues of waterlogging, salinity and alkalinity, Participatory Irrigation Management (PIM), effective extension services,

cold storage, marketing, and agro processing, could be easily addressed on a regional basis through coordination between energy and water sector distribution reforms.

States including Orissa, Delhi, and Madhya Pradesh have seen successful cases of PPP for transmission and distribution (T&D) in the energy sector, which shares similarities with canal water distribution. A number of initiatives in telecom, roads, water supply and sanitation (WSS) sector, and contract farming suggest that the private sector has been quite successful in bringing in technological innovations and efficient management practices.

A number of examples from all over the world suggest that if a PPP arrangement is well-structured, with an increased level of farmer participation and willingness to pay, it is possible to recover the capital as well as operation and maintenance (O&M) costs. It has been observed internationally that PPP is successful if the government or multilateral agencies contribute substantially to the capital costs, and private parties are made to undertake O&M activities so as to introduce improved technology and achieve efficiency in the operations of the developed assets. Another key lesson from international experience (Morocco and Egypt) has been that user participation and financial contribution for capital investments, and regular payment of user fees have contributed to the success of a project. There, it is essentially due to the large size of holdings by the farmers and their ability to pay for capital and O&M costs. But in India, since there are a large number of small and marginal farmers with small holdings and low income levels, governments may have to step in with payment guarantees and a suitable revenue risk sharing mechanism wherever PPPs are resorted to.

Unlike in other sectors, the role of PPP remains limited in the case of irrigation projects in India, and is largely restricted to engineering, procurement and construction (EPC) coupled with O&M contracts. In a majority of irrigation projects, PSP is still limited to item rate contracts. The only significant hope in the last decade has been that farmers' management of the system will assist the sector in managing day-to-day maintenance and distribution. Irrigation projects have a long gestation period and large life cycles. So far, hardly any project has witnessed its complete life tenure.

For a private party to make an investment decision, the factors considered to be crucial are the presence of a conducive framework and a robust revenue model.

The operating framework involves availability of credible information on the project, payment guarantees, structuring of risks related to recovery of user charges and, finally, the presence of a good business case. The other issues which may need to be addressed upfront are unreliability of water supply; inefficiencies due to poor governance; heavy dependence on groundwater; and the nexus between politicians, officials and farmers at the head reach of the canals who deprive the middle and tail reach farmers their allocated share water supplies, etc.

The current state of all these factors suggests that the I&D sector needs urgent reforms in order to clearly demonstrate value for a private party to evince interest and participate in the development of the sector. Governments therefore need to bring in policy changes for improving efficiency and bringing accountability, transparency, and willingness to promote IWRM. Regulatory measures for effective management of groundwater and periodic revision of water tariffs would go a long way in building the confidence of the private players. The Single Window concept (as opposed to multiple authorities being involved in the financial dealings within the water sector) would definitely help in building confidence of the private parties. This would cover all approvals and the authority to address related risks on account of non-availability of information, commercial risks, and willingness of the lending financial institutions to extend loans. A stable macro-economic climate with adequate commercial laws and financial services would certainly encourage the private sector to participate in the I&D sector. Possible incentives could also be provided in terms of taxes and subsidies.

The premise for initiating private sector involvement in the I&D sector seems to be the requirement of finances to complete the ongoing projects or schemes

on a financially free-standing basis. The viability assessment and scenario analysis for two projects indicate that the projects are not financially viable and are generating negative returns on a stand-alone basis.

Apart from the development of irrigation infrastructure projects, a number of specific purpose projects could also be linked to improve viability. These include (i) flood control projects, which can be linked with expressways and speedways on embankments, along with a toll for road use and cess on protected areas, and the development of tourism along embankment roads; (ii) lining canals in critical reaches, linking them with speedways on embankments, while the development of tourism, canal navigation, and toll collection could be some of the incentives; (iii) development of micro hydel schemes linked through sharing of power or revenue adjustments on that account; (iv) riverfront development projects linked through the development of Sewage Treatment Plants (STPs), citizens' participation, installation of group treatment plants for polluting industries, promoting recreation, advertising, and development of the waterfront; (v) integrated area development; (vi) development of pisciculture; (vii) groundwater harvesting projects allowing kharif oriented diversion projects on some important rivers in Himalayan alluvium belts, encouraging groundwater harvesting and reuse during dry weather; (viii) providing a boost to micro irrigation projects by linking them with all new groundwater development projects; and (xi) tube well expansion programs in areas where there is high potential for it.

The commercial components required to make the project financially viable do not seem practically feasible in every instance. Moreover, within the Indian context, in an integrated build-operate-transfer (BOT) contract model (which includes design, build, finance, operate, and transfer) does not seem possible considering the various components of a project such as dam, main canals, divisional channels, barrage, distribution system, and field channels.

The low financial viability of the projects in the I&D sector is the result of various policy interventions of the government over the years, along with the changing social, political, and governance frameworks at the farm level.

Despite these factors, the projects are expected to provide good economic returns to the nation. For instance, the economic Internal Rate of Return (IRR) for a typical irrigation project considered for analysis is estimated at 11.16%. The case for investments in the I&D sector, then, largely stems from the economic benefits and multiplier benefits across the agriculture value chain. Accordingly, the premise for private participation would be the increase in efficiencies in the sector and not financial returns. The projects which can be considered for involving private participation might need to be structured reflecting this position.

The conditions, therefore, seem most conducive for the private sector to assume the risks of 'service' and improve the sector efficiencies, with all other aspects of the project (financing, demand, etc.) being maintained at the same level. This would mean operating the projects on a service contract basis. This model could initially be experimented with in order to gain experience on the definition of the services, bringing in the innovation and efficiencies of the private sector, and clearly demonstrating the outcomes (including the measurement of the same).

The government and concerned agencies need to adopt a variety of policy changes to improve efficiency and effective service delivery to the farmers. These include promoting the concept of IWRM, setting out priorities with respect to water use, and proper implementation of the same. Reforms in the water sector must take into account the changing needs of the users, particularly in the light of social and hydrological challenges. The law and policy framework needs to be revisited, especially making users' participation more effective by strengthening the regulations related to PIM, and reducing the role of the government in irrigation. Past experience has shown that overt government control has led to the failure of several irrigation schemes, given the lack of accountability and corporate management skills, and the dependence on outdated technologies. Another important area is the recovery of the costs of operations and maintenance of the water supply schemes (if not the capital expenditure).

Understanding and managing PPP contracts would involve a significant amount of capacity on the part of the implementation agency. The role and scope of the private sector would change from that of a contractor who gets paid on finishing an assignment to that of a partner, who assumes much higher risks and responsibilities. The payment and reward structures would progress to 'performance' based mechanisms. This would require significant capacity building of the implementations agencies in the I&D sector.

Implementing an infrastructure project under a PPP framework would entail addressing some key issues and structural considerations, including the broad scope of engagement, transfer of ownership (whether or not this needs to be done), roles and responsibilities of various stakeholders, robustness of revenue model and operating framework, and the market appetite for the same.

The service requirements and service delivery measurement would need to be articulated as part of the consultation process during the structuring of the project. No large-scale project or program is sought to be launched in the near term; hence, the provisions would be project-specific. While the sectoral issues are varied and diverse, it is possible to configure projects with substantial operational flexibility over the project period.

Given the nascent stage of PPPs in the country, it is advisable to structure any PPP pilots in the I&D sector in such a way that the ownership remains with the government entities at all times. The operating framework for the PPP structure essentially sets out the roles of various stakeholders. The development of an equitable structure would involve articulating the roles of various stakeholders clearly and this would be the heart of a PPP structuring exercise. The private sector's concerns largely arise from (and their proposals are largely based on) the availability of information that is necessary for assuming the risks and the commercial framework that supports equitable risk allocation. These factors would need to be clearly laid down in any structure that is being envisaged. The concerns of the lenders also need to be duly addressed.

Since the scope for viability gap funding (VGF) is limited, areas that could potentially benefit the private sector would be cost effectiveness of water, higher recovery rates, assurance on water delivery, transparency and efficiency in services, and higher productivity. The multi-disciplinary nature of the water sector demands coordination between various line departments to ensure delivery of water for various uses. Many opportunities of incentive areas would open up if water user departments get together and consider sharing joint infrastructure projects of water supply, distribution, and delivery in the WSS and/ or power sector. Such efforts may require a review of the institutional setup, changes in the acts and laws, and drawing up of newer policies under the regulatory regime.

The rollout of PPP projects will have to be addressed at multiple levels within the bureaucratic hierarchy and across the government setup by the central, state, and/or local agencies. To operationalise PPP in the I&D setup, the central government and the relevant agencies should, with the support of some progressive states, set the tone for overall growth by initiating pilot projects in a phased manner. This would consist of short (0–2 years), medium (2–5 years), and long term (5–10 years) measures. The roadmap would thus involve institutional strengthening and capacity building, need assessment, financial management, and the rollout plan.

In order to better understand and promote PPP in the I&D setup, it is required, as a short term measure, to form national and state level councils/ committees/ boards (or review the terms of reference of existing councils/ committee/ boards). Such authorities will be responsible for conducting stakeholder consultations, strengthening the functioning of the existing regulatory institutions, and enhancing the capacity of the agencies. The scope of the existing state-level Technical Advisory and coordination committees could extend to providing clearance to projects that meet the requirements of PPP, and if possible, single window clearance as well. As a medium term measure, a specialized 'PPP cell' could be established within each Water Resources Department (WRD) or Irrigation Department, directly under the Engineer in Chief, to

act as the nodal agency for the development of PPP related policies and programmes; conceptualize all kinds of PPP projects for various purposes; advise and assist different organizations/circles/divisions on the preparation of Preliminary Project Reports (PPRs) and/or Detailed Project Reports (DPRs) for PPP projects; coordinate between various agencies within WRDs/Irrigation Departments as well as with respective line departments associated with the project; review and issue guidelines and model documents; recommend on finances, VGF of various schemes of state/central governments; review and monitor PPP projects during implementation/execution/operation and management stages; undertake stakeholder consultations as and when necessary; undertake awareness campaigns; and deal with all possible assistance required to the department and/or private partners.

Model documents prepared by the Planning Commission for the pre-qualification and selection of bidders, to be used for different types of PPP projects, could be used to devise a framework for the procurement process and contract structure for the I&D sector. The Request for Qualification (RFQ) and Request for Proposal (RFP) documents suggested by the Planning Commission are flexible enough to be tailored according to sector specific and project specific needs, including I&D and other water sector projects. Project specific conditions may be incorporated in the concession agreements as the need arises.

A Contract Management Team (CMT) could be put in place to ensure that the key elements of a contract are incorporated, which include activities related to monitoring and performance evaluation during implementation and contract operation period, in terms of developing good relationships, observing private sector performance, and monitoring and managing risks associated with the project.

Performance management is central to contract management as it forms the basis of evaluating the quality and value of services delivered, for which payments and penalties/incentives need be determined; therefore, performance management activities should be built into the clauses of the contract in terms of output specifications, performance targets, incentives for target achievements/penalties for service delivery defaults and a payment mechanism clearly outlining linkages with output specifications. For this purpose, key performance indixes (KPIs) should be evolved at the project formulation stage itself in the form of service objectives. Activity and area specific KPIs should be evolved at various stages of the life cycle—including contract formulation, implementation and performance—particularly for long duration contracts.

In order to further explore the viability of PPP in the I&D sector, as well as to gauge private interest, a few possible areas/projects need to be identified, which can be taken up for detailed pilot studies. While in some states, these projects are being envisaged in such a way that revenues can also be generated from components other than irrigation, it may not be feasible to configure them on a programmatic basis. Where circumstances do permit, however, the development of such a structure should be encouraged as it may enable a more comprehensive assessment of the PPP framework, as well as prove to be a valuable guide for the sectoral rollout. A few initiatives of this nature have been identified (in Andhra Pradesh and Maharashtra) in this scoping study for further investigation.

The government of Maharashtra (GOMaha) has shown willingness during discussions to explore various options for PPP in the I&D sector and develop a DPR for completing an ongoing project under a PPP arrangement (on pilot basis); ADB has been approached to provide support for this undertaking. The Maharashtra Krishna Valley Development Corporation (MKVDC) is presently engaged in identifying possible areas for generating additional revenue by way of involving private investors; the plan is to shortlist three or four such potential projects that could be taken up on pilot basis. One of these could be considered initially for the preparation of a DPR. This could be an ongoing project; as all projects except for those that involve irrigation components like dam, canals, distribution network, etc., can be made to include features that can generate additional revenues.

Officers in the government of Andhra Pradesh (GOAP) are of the view that there is a need for an integrated agriculture demand side model (AgDSM) through the replacement of energy inefficient pumps by efficient

ones, and the management of groundwater and cropping patterns in order to reduce the demand for groundwater; this, then, could be considered as a possible area for a pilot project.

Another area where PPP can be explored in Andhra Pradesh is the integrated development of lift irrigation schemes (LISs) to provide water for irrigation, special economic zones (SEZs) and power projects; the SEZs would have to be developed with a major emphasis on agro-based food processing, as well as exporting units and gas-based power projects, in order to meet the power requirements of the LIS and the SEZ. This is expected to create synergy among all three components of a PPP project. Such a project would require coordination among the various stakeholders.

The GOAP is also exploring the possibility of involving PPP in the modernization of command areas of its irrigation commands and bringing these under pressure systems with low or zero energy options by taking appropriate inputs from various private sector participants as well as other stakeholders in the form of a Special Purpose Vehicle (SPV), wherein the major emphasis is placed on water and energy efficiency, increased water productivity, and marketing agri-processed units. The proposal aims at net benefit savings in water and energy there by reducing subsidies in the sector.

The findings of the study were deliberated and agreed upon by the stakeholders in a workshop held in May 2011 at New Delhi.

Chapter 1
Introduction

The importance of water can hardly be overstated. It is one of the principal natural resources and imperative for the existence of any life form. India has been endowed with this precious natural resource, but its variability around the year and across the nation limits its use for different purposes. The rising standards of living, the increasing pressure of population growth and the consequential growth in demand for water use are constraining its sustainable development and management. India's present population is around 1.2 billion and is poised to cross 1.6 billion by 2050, which will result in an increase in food requirement from around 216 million tons in 2009–2010 to about 380 million tons in 2050. With the net sown area being nearly exhausted, the only solution to meeting the growing challenge of food security seems to lie in increasing the productivity and production through intensification and the adoption of efficient management practices.

The majority of irrigation projects in India are developed with long gestation periods and are being managed at a below optimum productivity level. Speedy development of the sector has led to a number of associated concerns such as the thin spread of funds, cost overruns, drainage congestion, lack of and/or delayed development of commands, inequity in distribution of water, a shift from envisaged cropping patterns to water intensive patterns in head reaches of canals, a gap between irrigation potential created and that utilized, the near absence of rotational water supply (warabandi) practices, meager on-farm development works, deficiencies in conveyance systems, waterlogging, salinity and alkalinity problems, uncontrolled conjunctive use, and endemic water quality problems associated with surface and/or groundwater. Some of the measures which are seen as major reform areas within the irrigation sector include effective water pricing, addressing the deficiencies of canal supplies, modernization of canals and canal controls, reclamation of waterlogged and saline/alkaline soils, increasing farm-water use efficiencies, and making command area development programs more effective. A number of reforms in the agriculture sector are also envisaged to enhance production, productivity, and the farmer's income and livelihood.

The irrigation sector in India has been viewed through a socialistic perspective rather than an economic one. Except for minor irrigation (for which some institutional finance is available) or groundwater development (for which some private investments are made), all programs that come under major and medium irrigation, command area development, and flood sub-sectors are government-funded. Expenditure on irrigation as a percentage of the total expenditure in the country has come down to 6.28% at the end of Tenth Five-Year Plan from 22.54% during the First Five-Year Plan. The cost of developing the irrigation sector is very high and even for O&M, subsidies or incentives are provided by the governments. The challenge of food security requires an increase in public investments in the agriculture sector, particularly for irrigation, in order to enhance production and productivity. However, the government is finding it extremely difficult to fully finance irrigation and drainage (I&D) projects and this trend is similar all over the world. Compared to other infrastructure sectors, private investment opportunities in the I&D sector are rather limited. Various strategies are being developed to involve private investments in this sector.

Till date, the central and state governments have been playing the dual role of developers and service providers, and are now looking to collaborate with

private partners as buyers and/or coordinators in the interest of greater transparency, efficiency, and effectiveness in the sector. Public and private players can work together in a number of ways in the I&D sector. On the part of the government, various ministries, public organizations, departments, and local governments dealing with water may need to decentralize their roles. On the part of the private sector; various banks, investors in agri-business, real estate, transport companies, contractors, cooperatives, non-governmental organizations, and beneficiary organizations could be persuaded to share responsibilities with the government. In order to create a conducive atmosphere for Public–Private partnerships (PPPs), a sense of mutual trust needs to be developed among partners, to facilitate easy access and accurate information, prior clearances from all departments, single-window concept, avoidance of long delays, etc. There is a large number and variety of projects in the I&D sector which will, therefore, require all kinds of partnerships, from large contractors to small companies, as well as the development of innovative financial concepts.

This report outlines a scoping study conducted to explore the prospects of PPP in the I&D sector in India. The objectives of the study were:
(i) to explore the possibility of employing PSP in the planning, development, and management of water resources in India, particularly in the I&D sector, through a review of the present status of the sector, including legal, institutional, and other associated aspects; (ii) to identify the nature of challenges and issues in the I&D sector, and factors currently hindering PSP; and (iii) to recommend suitable policy, institutional, and economic reforms which could help create an enabling environment to attract PSP in the sector. The scope of the study includes the identification of areas where PSP can be introduced; and the development of a road map and action plan for the implementation of relevant public–private models in the identified areas. The study was also aimed at identifying sub-projects or components of larger projects in one or two states in India, on pilot basis, for gauging the interest of the private sector for investment. This would include finalizing the scope and terms of reference (TOR) for such future activity.

Chapter 2 outlines the current status of water resource development and its management in India, the country's natural resources, development of the water sector in the past and present, constitutional aspects, policy framework and institutional setup, availability of surface water and groundwater, projected demand for water for different uses, and the likely impacts of climate change. Chapter 3 presents a diagnostic analysis and assessment of the factors responsible for the slow pace of investments in the I&D sector, along with providing past investment details in the water sector. It also evaluates policy and deals with the institutional, social, economic, and environmental concerns that need to be addressed in the national interest while formulating and implementing irrigation schemes in a PPP mode. Chapter 4 suggests possible reforms, initiatives, and regulatory instruments necessary to safeguard the interests of all and the need for a shift to IWRM in the long run.

Chapter 5 evaluates potential investment options, including those in the agriculture sector and water distribution systems. Chapter 6 provides a generalized treatment of I&D sectoral components, types and functions, and defines the essentials of a good PPP project as well as the roles expected of key players at various points: PPP contract formulation, successful implementation, and long term monitoring and evaluation stages. This chapter also elaborates on the success stories at the national level in the WSS sector, the international experience when it comes to PPP in the I&D sector and contract farming, and enumerates key lessons learnt from Indian and international case studies. PPP initiatives taken by some of the progressive states in India have also been summarized in this chapter.

Chapter 7 presents a financial analysis for exploring the possibility of PPP models for two irrigation projects—in a standalone manner as well as by using a combination of other options to augment revenue generation. Chapter 8 summarizes opportunities that exist in the I&D sector in India, defines key issues, risks involved, perceptions of markets, etc., and outlines how the MMI sector in India can be brought under the fold of PPP. Various opportunities for PPP

in the I&D sector in India, including possible areas and PPP models, are also discussed in Chapter 8.

Chapter 9 provides a road map and action plan for initiating PPP in the I&D sector, some preliminary steps that need to be taken in this direction, including a brief description of two pilot schemes from Maharashtra and Andhra Pradesh. The summary and recommendations of the study are presented in Chapter 10.

Chapter 2
Water Resource Development and Management in India

India has a territorial extent of 329 million hectares (mha), of which about 90% is land, inhabited by a population of nearly 1.2 billion.[1] The country's land area as a percentage of the world's land area is around 2.3%,[2] which holds 16.9% of the world's population. Estimates suggest that by 2050, India's population would have reached 1.6 billion, which would be 17.4% of the world's population. Agricultural land in India is estimated at 169.9 mha of which about 32% is irrigated. India ranks first in irrigated agriculture. Administratively, the country is divided into 28 states and 7 union territories (provinces) comprising of 626 districts, about 5,500 taluks[3] and 63,8596 villages.[4]

A. India's Natural Resources

Land resource: Physiographically, India is divided into eight zones: the Himalayan ranges in the north, the Indo-Gangetic Great Plains traversed by the Ganga, Brahmaputra, and Indus system of rivers, deserts in the north-west, central highlands acting as a divide between the Great Plains and Deccan Plateau, Peninsular Plateaus, the Eastern coast, and the Western coast. Four distinct types of soil—alluvium, black cotton, red, and laterite—can be found in varying degrees in different parts of India.

Climate: The average annual rainfall is approximately 1,100 cm; 15% of India receives rainfall greater than 1500 mm while 21% receives less than 750 mm. The climate of India is dominated by the monsoons, with high rainfall variability over the months; around 75–80% rainfall occurs in four to five spells during the wet period during July–October while the rest of the rainfall is spread over the dry period of the remaining eight months. The complex climate pattern is a direct result of cool currents from the Bay of Bengal and Indian Ocean, which cause variability of rainfall, humidity, and temperatures over eight distinct physiographic zones of India. The pulsating nature of high rainfall with gaps, associated temperatures, and humidity are of great significance for agriculture for kharif (June–October) crops; while irrigation from storage becomes essential to supplement rabi (November–March) crop growth.

According to the National Water Policy, the river basin is to be used as a hydrologic unit[5] for all

[1] Indian Population Clock. http//:www.medindia.net/patients/calculators/pop-clock.asp (accessed 20 January 2011).

[2] Government of India, Ministry of Agriculture, Department of Cooperation, Directorate of Economic & Statistics, Agricultural Statistics Division. 2009. *Agricultural Statistics at a Glance*. http://agricoop.nic.in.

[3] Generally, a Taluk or a Tehsil consists of a city or town that can possibly serve as headquarters to additional towns and a number of villages. As an entity of local government, it exercises certain fiscal and administrative powers over the villages and municipalities within its jurisdiction. It is the ultimate executive agency for land records and related administrative matters.

[4] Government of India. 2001. *Census of India*.

[5] The *Convention on the Law of Non-Navigational Uses of International Watercourses* adopted by the United Nations defines rivers as a system normally culminating into a single terminus as a single drainage basin.

planning and development of water resources. The National Commission for Integrated Water Resources Development (NCIWRD)[6] has divided the country into 24 basins comprising 14 major river basins and 10 composite basins of rivers with a catchment area of less than 2000 square kilometers (sq km).

Surface water: Out of the 1,869.37 billion cubic meters (BCM) of the available surface waters in India's rivers, the utilizable quantum of reliable withdrawal is estimated by the Central Water Commission (CWC) at 690.32 BCM, and this figure is supported by the NCIWRD. Not all waters in India are utilizable. A major portion of available waters return to the sea—either unutilized or as evaporation from soil and water bodies, and transpiration from vegetation. The estimated evaporation from land and water bodies and evapotranspiration from plants and other flora is 1,500–2,500 mm. Table 1 provides the basin-wise availability and extent of utilizable surface waters. Table 2 indicates how the flow of the Ganga-Brahmaputra-Barak and west flowing rivers is highly skewed.

Groundwater: The country's dynamic (replenishable) groundwater resource[7] has been estimated scientifically, state-wise as well as basin-wise, using base data of 2004 by the Central Ground Water Board (CGWB) as 433.69 BCM. The annual replenishable groundwater resource is constituted mainly by rainfall and other sources such as canal seepage, recharge from water bodies, artificial recharge from water conservation structures, and return flow from farms. The average ratio of rainfall and other sources as contribution to

Table 1: Surface and Groundwater Resource Potential

(BCM)

S. No.	*Basin name*	*Surface water availability*	*Surface water utilizable*	*Percent utilizable surface water*	*Replenishable groundwater*	*Total utilizable resource*
1	Indus	73.31	46.00	62.7	31.23	77.23
2	Ganga, Brahmaputra, Barak, and other Basins	1110.62	274.00	24.7	209.85	483.85
3	Godavari	110.54	76.30	69.0	37.50	113.80
4	Krishna	78.12	58.00	74.2	26.65	84.65
5	Cauvery	21.36	19.00	89.0	10.15	29.15
6	Subernarekha	12.37	6.81	55.1	5.13	11.94
7	Brahmani & Baitarani	28.48	18.30	64.3	6.70	25.00
8	Mahanadi	66.88	49.99	72.6	17.72	67.71
9	Pennar	6.32	6.86	108.5	5.10	11.96
10	Mahi	11.02	3.10	28.1	3.12	6.22
11	Sabarmati	3.81	1.93	50.7	2.98	4.91
12	Narmada	45.64	34.50	75.6	12.90	47.40
13	Tapi	14.88	14.50	97.4	7.36	21.86
14	Ten composite Basins	286.02	81.03	28.3	57.30	138.33
Total		**1869.37**	**690.32**	**36.92**	**433.69**	**1124.01**

Ten composite river basins are: 1. West flowing rivers of Kutch & Saurashtra, 2. West flowing rivers south of Tapi, 3. East Flowing rivers between Mahanadi and Godavari, 4. East flowing rivers between Godavari and Krishna, 5. East flowing rivers between Krishna and Pennar, 6. East flowing rivers between Pennar and Cauvery, 7. East flowing rivers south of Cauvery, 8. Area of north Ladakh not draining into Indus river, 9. Rivers draining into Myanmar, and 10. Andaman, Nicobar and Lakshadweep islands.

Source: NCIWRD, 1999.

[6] Government of India, National Commission for Integrated Water Resource Development. 1999. *Integrated Water Resource Development: A Plan for Action*, Volume I.

[7] It is the dynamic groundwater resources and groundwater available in shallow aquifers that get replenished due to various recharge processes and occur in the zone of fluctuations. The static groundwater resource, also known as deep water resource or the resource available below groundwater fluctuations, is generally not affected by seasonal recharge and is considered diminishable. As a policy, this resource is to be utilized as a last resort only.

Table 2: Skewed Distribution of Available and Utilizable Surface Water in River Basins in India

Basins	*Area* (%)	*Water as resource* (%)	*Utilizable surface water resource* (%)
Ganga-Brahmaputra and Barak basins	33.5	62.0	40.0
West flowing rivers south of Tapi	3.5	10.0	5.0
All other basins	63.0	28.0	55.0

Source: NCIWRD, 1999.

replenishable groundwater is estimated at 67% and 33% respectively. Table 1 also gives the basin-wise average annual replenishable groundwater resource as estimated by CGWB.

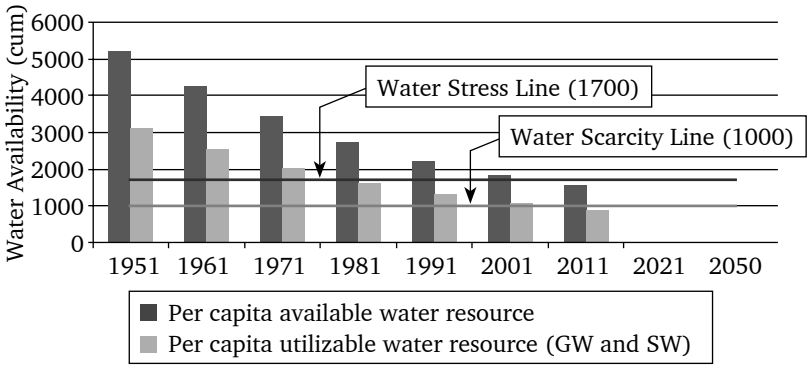
Per capita availability and utilizable water: The annual per capita water availability and utilizable water availability in the country is diminishing fast with the rising population. The country is already facing water stress and this may translate to water scarcity very soon. Figure 1 shows these diminishing trends. Rivers that are already water scarce include Krishna, Cauvery, Pennar, Mahi, Sabarmati, Tapi, Subarnarekha, east flowing rivers between Mahanadi and Pennar, east flowing rivers between Pennar and Kanayakumari, and west flowing rivers of Kutch and Saurashtra including Luni, Godavari, and Indus (up to Indian border) are water stressed at present.[8] By 2025, Ganga and Godavari are also expected to have become water scarce.

Storage: The estimated ultimate live storage capacity of dams in the country is approximately 397 BCM, out of which 225 BCM is in position, 64 BCM is in pipeline and 108 BCM is yet to be created. With a projected population of 1.18 billion in 2010, the present per capita live storage is 191 m^3, and assuming that all of the 397 BCM storage is created by 2025, the per capita live storage in 2025 and 2050 is expected to be 286 m^3 and 249 m^3 respectively.

B. Historical Perspective on Water Resources

Prior to the nineteenth century, irrigation in India was mainly confined to harvesting ponds, diverting flood waters through inundation canals, or dug wells in shallow aquifers. In the mid-nineteenth century, the then British Government decided to promote irrigation through guarantee systems. A number of famines, however, shifted the focus to developing projects that would bring in net returns. Around the end of the nineteenth century, a number of famine commissions recommended the development of

Figure 1: Per capita available and utilizable water resource in India



Source: Authors, based on census and CWC data (see footnote 8).

[8] Central Water Commission. 2010. *Water and Related Statistics*.

irrigation works to contain the famines. Accordingly, the First Irrigation Commission (1901) once again shifted the focus to irrigation as a means of protection against famine. Irrigation development remained a federal subject till 1921. The Government of India Act (1935) brought radical changes in the administration of irrigation projects when the jurisdiction of I&D development was shifted to the provincial governments, with the federal character of Irrigation to be considered only in the case of inter-state water disputes. The Constituent Assembly, while framing the Constitution of India, also accepted that the development and management of irrigation projects remain the responsibility of the state governments. Unfortunately, however, this has ensured the loss of an all-India perspective on the subject of the development and management of irrigation systems.

C. Water under the Constitution of India

Law on water: The legislative and functional jurisdiction of the development and management of water lies with the state governments; the central government is required to step in only in the case of inter-state rivers. Panchayats, local governments, and municipalities fulfill a functionary role for several aspects related to water use as and when allocated by the respective state legislatures. Matters related to inter-state disputes need to be adjudicated under the Inter-States Disputes Act (1956) through the water Dispute Tribunal when the center is of the opinion that the matter cannot be settled through negotiations. Of the 10 tribunals set up so far under the act, the final settlement under the Ravi–Beas Tribunal is still pending while the adjudication of four is currently under process. The River Boards Act (1956) enables the central government to control and regulate aspects relating to inter-state rivers. However, no Boards have been formed so far to manage the basin as a whole.

Policy on water: The Second Irrigation Commission (1972) was constituted to review the development of irrigation and recommend essential irrigation works in chronically drought prone areas of the country in order to achieve food self-sufficiency. Among other suggestions, it proposed the adoption of benefit–cost ratio as a criterion for the sanction of irrigation projects, and the raising of water rates to cover O&M and other running works costs at a reasonable rate of interest charged on the capital cost. The Commission also recommended the protection of watershed areas through afforestation, pasture development, protection of riverbanks and shorelines, a participatory approach to water management, and the promotion of a special agency for the expeditious and coordinated development of command areas.

National Water Policy: Formulated in 1987 and updated in 2002 by the Ministry of Water Resources (MOWR), the NWP recognizes water as a prime natural resource, a basic human need and a precious national asset. The policy *inter-alia* prioritizes water use, stresses the promotion of the IWRM, and emphasizes conservation and efficient use of water. The relevant section of the NWP on PSP has been given below:

> Private sector participation should be encouraged in planning, development and management of water resources projects for diverse uses, wherever feasible. Private sector participation may help in introducing innovative ideas, generating financial resources and introducing corporate management and improving service efficiency and accountability to users. Depending upon the specific situations, various combinations of private sector participation, in building, owing, operating, leasing and transferring of water resources facilities, may be considered.

Policy formulation setup: A high political council called the National Water Resources Council (NWRC) has been set up to take all policy decisions in the country. This is headed by the Prime Minister and its members include the Chief Ministers of all states and union territories. In order to look into policy issues at an official level, a National Water Board has also been set up, which is headed by the Union Secretary of Water Resources along with the Chief Secretaries of all states and Union Territories. NGOs and other professional institutions also add to the insight as well as inputs on various policy matters with respect to development and management of water, for the consideration of the government.

D. Institutional Setup in the Water Sector

Central agencies: The MOWR is solely responsible for assessment, allocation, development, and policy issues on water while a number of ministries are responsible for water protection and water use.[9] The coordination between other ministries is nearly absent at grass root level. The CWC, a premier technical institution on surface water, deals with the planning, investigations, design, and execution aspects of water sector schemes along with a number of other activities such as irrigation, flood management, navigation, domestic and industrial supplies, hydropower development, hydrologic observations, and flood forecasting. The CWC functions in a purely advisory capacity as water is a state subject in India. The CGWB is responsible for the nation-wide assessment of groundwater as a resource. The Central Ground Water Authority (CGWA) regulates and controls groundwater development and management. The National Water Development Agency (NWDA), an autonomous society under the MOWR, prepares feasibility reports about interlinking rivers for inter-basin transfer of surplus waters to water-deficit basins.

State agencies: State governments administratively control water through a large number of state water boards, district councils, local bodies and panchayats. Irrigation Departments/WRDs or Nigams manage major and medium projects and groundwater development; State Electricity Boards look into electricity generation, transmission and distribution; Water and Land Management Institutes undertake training, professional and awareness development, action research, and participatory aspects of water in the command areas. Till date, private sector involvement in the development and management of surface water and community-based groundwater has not been attempted in India.

E. Water Demand for Different Uses

The water demand for various uses was estimated by the NCIWRD in 1999, considering low and high variants of the projected population for 2010, 2025, and 2050. Table 3 provides the demand for water in India, for various purposes. As is evident, irrigation requirements constitute 78% of the present demand and this is likely to reduce to 72% in 2025 and 65–68% in 2050. Industrial demand, on the other hand, is likely to rise from 5% at present to 8–9% during 2025 and 7–8% during 2050. Domestic demand and power demands may also rise due to rise in living standards. The trend clearly indicates the need for conservation, efficiency in irrigation systems, and low water intensive and high yielding varieties in the future.

F. Basin-wise Demand Management

Detailed basin-wise analysis for different scenarios (given in Table 3) suggests that Sabarmati, Indus, and certain inland areas of Rajasthan shall be water starved and that these basins must be managed by the recycling and reuse of return flows, watershed management techniques, minor irrigation planning, and inter-basin transfer. Estimates suggest that by 2025, additional basins like the east-flowing river basins between Mahanadi and Pennar and those between Pennar and Kanayakumari, west flowing rivers in the Kutch and Saurashtra, including Luni, will have gone dry. To meet the water deficiency in these areas, conventional methods of water conservation will have to be considered. Scenario 2050 indicates that additional basins like Mahi and Pennar are likely to become water-deficit. In addition, basins like Krishna, Cauvery, and Subernarekha will

[9] Other ministries and their respective departments along with their counterparts in the States that deal directly with water use/water protection include: Agriculture and Cooperation, Food Processing and Industries, Environment and Forests, Heavy Industries and Public Enterprise, Power, Railways, Rural Development, Urban Development, Health, Textiles, Steel, Panchayati Raj, Mines, etc.

Table 3: Water Requirement for Various Uses as Estimated by NCWIRD

S. No.	Use	Year 2010				Year 2025				Year 2050			
		Low		High		Low		High		Low		High	
		SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW
1	Irrigation	330	213	339	218	325	236	366	245	375	253	463	344
2	Domestic	23	19	24	19	30	19	36	26	48	42	65	46
3	Industries	26	11	26	11	47	20	47	20	57	24	57	24
4	Power	14	4	15	4	25	6	26	7	50	13	56	14
5	Inland Navigation	7	–	7	–	10	–	10	–	15	–	15	–
6	Flood Control	–	–	–	–	–	–	–	–	–	–	–	–
7	Environment		–		–		–		–		–		–
	Afforestation	–	–	–	–	–	–	–	–	–	–	–	–
	Ecology	5	–	5	–	10	–	10	–	20	–	20	–
	Evaporation Loss	42	–	42	–	50	–	50	–	76	–	76	–
Total		**447**	**247**	**458**	**252**	**497**	**287**	**545**	**298**	**641**	**332**	**752**	**428**
Total all Use		**694**		**710**		**784**		**843**		**973**		**1180**	

Source: Report of the NCIWRD, 1999.

be highly stressed as the percentage use of water by industry will drastically increase in these basins.

G. Impact of Climate Change on Water Resources

Cause and effect: India has taken serious note of the threat of global warming caused by the accumulation of green-house gas emissions in the atmosphere. The analysis of records of over 100 years and 125 rainfall stations all over India by the National Institute of Hydrology shows a countrywide increase of 0.42°C, 0.92°C, and 0.09°C in the annual mean temperature, mean maximum temperature, and mean minimum temperatures, respectively. However, regional trends vary. Global Circulation Models and Regional Circulation Models are being studied by the Indian Institute of Tropical Meteorology using observed and proxy data, as well as diagnoses and assessments of climatic impacts, with particular focus on Indian summer monsoon.

It has been argued that climate change can influence rainfall patterns in Himalayan, Central, and Peninsular India, and this may cause a rise in air temperatures by 3–4°C by the end of the twenty-first century. This will, in turn, result in increased potential evapotranspiration, and increased glacial melt, thereby causing the retreat of glaciers, increase in monsoon precipitation, decrease in winter rains, and extreme flood and drought cycles.

Concerns emanating from global warming that implicate water resources include the declining glacier size and receding snow line in the Himalayas, increased floods due to greater intensity of rainfall in flood-prone areas, increased droughts owing to a reduction in the number of rainy days in the rest of the country, adverse effect on groundwater quality in alluvial aquifers due to increased flood and drought events, negative impact on groundwater recharge, and increased saline water intrusion of coastal and island aquifers due to rising sea levels. The overall long-term impact of climate change may alter the distribution pattern of India's water resources and thereby threaten the livelihood pattern of its citizens.

National Water Mission: In June 2008, the National Action Plan for Climate Change[10] was inaugurated by the Hon'ble Prime Minister of India wherein eight missions, including the National Water Mission (NWM), were launched. The objective of the NWM is to conserve water in all forms, minimize wastage, and ensure equitable distribution of water

[10] The eight identified missions are: (i) National Solar Mission, (ii) National Mission for Enhanced Energy Efficiency, (iii) National Mission on Sustainable Habitat, (iv) National Water Mission, (v) National Mission for Sustainable Himalayan Eco-system, (vi) National Mission for Green India, (vii) National Mission for Sustainable Agriculture, and (viii) National Mission on Strategic Knowledge for Climate Change.

across and within states through IWRM.[11] Five distinctive steps have been identified to meet this aim (i) the formulation of a comprehensive database in the public domain and assessment of the impact of climate change on water resources; (ii) promotion of citizen and state action for water conservation, augmentation, and preservation; (iii) focused attention on over-exploited areas; (iv) increasing water use efficiency by 20%; and (v) promotion of basin-level integrated water resources management. In this direction, the NWM aims to:

- Review the NWP;
- Conduct research and studies on all aspects related to the impact of climate change;
- Expedite implementation of water resources projects (including multipurpose projects) with carryover storage;
- Promote traditional systems of water conservation;
- Intensive program for groundwater recharge in over-exploited areas;
- Incentivize recycling of water including waste water;
- Conduct water resources planning based on the principles of integrated water resources development and management;
- Ensure convergence among various water resources programs;
- Carry out intensive capacity building and awareness programs including those for Panchayati Raj Institutions, urban local bodies and youths; and
- Sensitize the elected representatives of over-exploited areas to the dimensions of the problem and to orient investment under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) towards water conservation.

The NWM has noted that since the central programs related to water resources are being dealt with by the Planning Commission and nine central ministries,[12] the measures to mitigate the impacts of climate change and other adaptive measures should be taken by the respective ministries. In order to identify the most suitable measures from a national perspective and to ensure effective implementation as well as proper coordination between all stakeholders and implementing agencies, a two-tiered (monitoring and evaluating) mechanism has been developed at the central and state levels.

Chapter summary: India has a vast potential of land and water resources; however, the nature and kind of topography, soil, climate, and spatial and temporal rainfall variability limit water availability in specific regions. Merely 36.9% of the surface water is utilizable, of which nearly 64% has already been tapped. Close to 57% of the replenishable groundwater resource has already been developed, mainly with the aid of private investments; and much of the remaining groundwater potential lies in northeastern states in the Gangetic plains, where its development is being encouraged. However, many of the basins in the country are already water-scarce and have already exhausted their surface potential and over-utilized their groundwater potential. The average per capita availability of water has decreased from 5177m^3 in 1951 to 1588m^3 in 2010 and the country's water resources are already stressed. By 2050, the country is expected to face water scarcity. The increasing pressure of population and upward trends in the standards of living, along with rising demand for better quality and quantity of food, may worsen this condition of scarcity: mainly due to the competing demands of various water sectors. The situation urgently calls for the conservation of water, its efficient use, and the need for low water intensive but high yielding varieties of crops. The threat of climate change and its impact on water cycle is real and needs to be taken seriously in all future development and management projects. All future development and management process including those attempted through PPP fold may have to consider circumstantial needs, spatial and temporal resource availability, scarcity as well as associated risks, alternate demand shifting, and revised policy on climate change.

[11] Government of India, Ministry of Water Resources. 2009. *National Water Mission under National Action Plan on Climate Change: Comprehensive Mission Document*. Volume 1.

[12] The nine ministries are: Ministry of Water Resources, Ministry of Rural Development, Ministry of Urban Development, Ministry of Commerce and Industry, Ministry of Power, Ministry of Transport, Ministry of Environment and Forests, Ministry of Agriculture and Ministry of Home Affairs.

Chapter 3
Diagnostic Assessment of Irrigation and Drainage Development in India

This chapter briefly provides a diagnostic assessment of important water use-related infrastructure development programs initiated by the Government of India, the constraints in water sector development, and related social, environmental, and economic concerns. The section concludes by underlining the urgency for initiating IWRM reforms and promoting private investments in the sector under a regulatory setup.

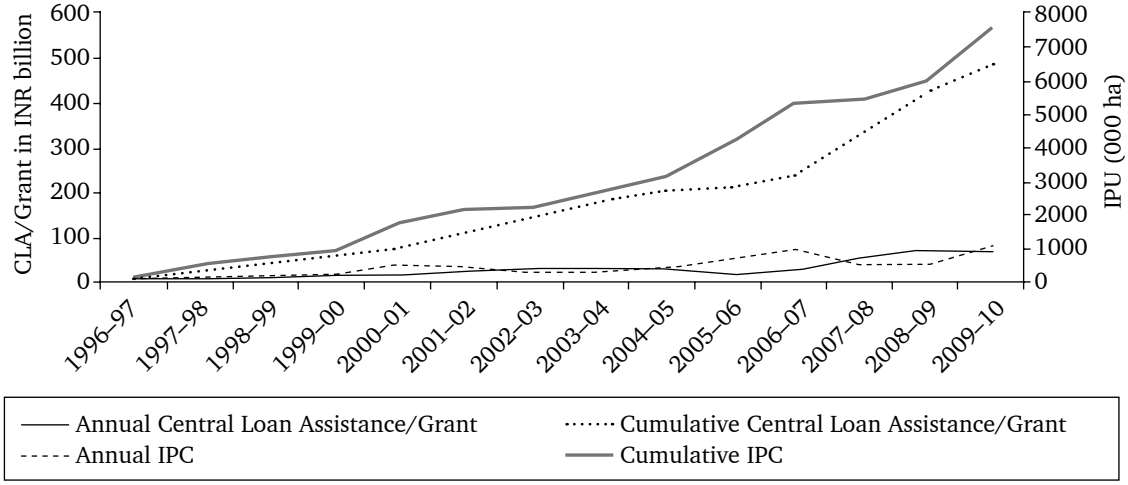
A. Planned Irrigation Development in India

At the time of India's independence, the irrigated area under the then completed 217 MMI projects and a number of minor irrigation projects was 19.4 mha, and food grain production from all sources including rain-fed agriculture was nearly 50 million tons. Planned development in irrigation started from the First Plan itself. By the end of the Tenth Plan, nearly 1,410 out of 1,887 MMI and extension, renovation, and modernization (ERM) projects had been completed, and irrigation potential of 42.35 mha had been created; food grain production of about 216 million tons had been achieved; and a total of $775.6 billion (Rs34,900 billion) had been incurred on the development of the irrigation sector. Irrigation was given topmost priority in the First Plan due to growing concerns regarding food shortages, and the total expenditure on I&D constituted close to 22.54% of the expenditure on all sectors. Gradually, the emphasis shifted to other dominant sectors and by the end of the Tenth Plan, this percentage came down to 6.28%.

Accelerated Irrigation Benefit Program: A review conducted at the end of the Eighth Plan suggests that 162 out of 240 ongoing irrigation projects needed special thrust for completion. Accordingly, the AIBP was initiated in 1996–1997 to complete last mile projects on priority basis so that additional potential for irrigation could be created. Under the program, the central government was to provide 50% assistance to the states for all projects and 90% for projects in hilly and drought-prone districts, in order to complete the projects that were already nearing completion first. The program received a boost in 2005 when it was decided to create additional 10 mha of irrigation potential under the Bharat Nirman Flagship Programme within about four years. However, the desired results could not be achieved due to various reasons. During the Eleventh Plan (2007–2012), a target of 9.0 mha was set out of which 2.46 mha had been achieved by the end of 2009–2010. Accordingly, the targets for the Eleventh Plan have been revised to 5 mha.[1] The Planning Commission has reported that ever since the inception of the AIBP scheme in 1996, about 40% of the MMI projects, and 47% (3,253 of 6,855) of the minor irrigation (MI) schemes were completed by the end of 2008. Figure 2 shows the annual and cumulative performance of the AIBP with respect to central loan assistance (CLA)/grant and IPC.

Despite the long gestation period of irrigation projects, the AIBP initiative has provided an

Figure 2: Annual and cumulative performance of Central Loan Assistance/Grant and irrigation potential created under the Accelerated Irrigation Benefit Program



Source: Authors.

opportunity to complete irrigation schemes in a time-bound manner for the creation of additional irrigation potential. The performance of the MI sector under AIBP has been satisfactory and has led to an increase in the area under irrigation, productivity, and production. The Planning Commission has reported that the inefficiency of the AIBP can be attributed to the fact that states often target the wrong sort of projects (instead of last mile projects). Other factors include cost overruns due to delays, low allocation of funds, and diversion of funds to other sectors. The monitoring of the scheme by the CWC is proforma-based and needs to be strengthened through systematic benchmarking and other reforms. The authors of this report are of the view that systematic reforms for developing infrastructure projects in the I&D sector would ease out the above constraints, if a PPP model is to be implemented in these projects.

Minor irrigation: All surface minor irrigation (MI) schemes such as canal irrigation from tanks, diversion weirs, lift, and sub-surface schemes such as dug wells, shallow and deep tube wells are planned, investigated, designed, and managed by the state governments. The center only looks into the policy setup, design and development of the MI sector as a whole. A number of ministries and departments at the central and state level are responsible for implementing the schemes. A majority of the tube wells and dug wells are privately owned, though some community based schemes are also developed through local bodies, Panchayats, and NGOs. Apart from the component under the AIBP, the MOWR is executing repair, renovation, and rehabitation (RRR) of water bodies under the MGNREGA; the Ministry of Agriculture (MOA) is executing command area development (CAD) schemes in Eastern India for the development of groundwater in irrigation through funds from the National Bank for Agriculture and Rural Development (NABARD) funds; the MOA is also executing the Million Shallow Tube Wells Programme in Bihar for the development of groundwater; the Ministry of Rural Development (MORD) is executing the Swaranjayanti Gram Swarozgar Yojna (SGGY) to provide open irrigation wells to small and marginal farmers; the MORD is also implementing the Rashtriya Som Vikas Yojna (RSVY) to rectify the regional imbalances through MI schemes through community involvement.

As per the third MI census[2] undertaken by the MOWR in 2000–2001, there are some 19.7 million MI schemes of which 94% are based on groundwater alone; the irrigation potential created under groundwater MI

[1] Government of India, Planning Commission. 2011. Mid Term Appraisal for Eleventh Five Year Plan 2007–12.
[2] Government of India, Ministry of Water Resources. 2000–01. *Third Minor Irrigation Census*. http//:www.mwr.nic.in

schemes is 62.4 mha, and that from surface water schemes is 11.9 mha. The utilization of groundwater MI potential is around 72% while the same under surface water MI is 58%. Based on the groundwater availability and net draft in 2004, the level of groundwater development is around 58%, about 8% of which is utilized for providing water supply to urban and rural areas. The ultimate MI potential from groundwater resources is assessed at 64.17 mha, of which 46.11mha was reportedly created and 40.81% utilized by the end of the Tenth Plan.

Investment potential for MI sector: The strategy adopted by the Planning Commission for the MI sector includes repair, renovation, and restoration of old tanks, including re-commissioning of their command areas, promotion of micro-irrigation in water deficit areas, and development of groundwater in untapped areas with unutilized potential. Out of an ultimate potential of 81.50 mha under the MI sector, 63.11 mha has been created so far.[3] The investment required to develop the balance potential is estimated at around $61.31 billion (Rs2,759 billion at the rate of Rs150,000 per ha). The majority of developments are expected from the groundwater sector, except in the case of some hilly regions where the scope for lift irrigation is quite prominent. Availability of sufficient power is a major prerequisite for groundwater development through private resource and community development.

Command Area Development and Water Management Initiative: Upon recommendations of the Second Irrigation Commission (1972), a centrally sponsored scheme for Command Area Development and Water Management (CAD&WM) was initiated in the country in 1974 with a view to systematically improve land, water, and crop management for sustainable optimum production and productivity of irrigated commands in the MMI sector. A number of Command Area Development Authorities (CADAs) were created for this, which consist of multidisciplinary teams from various departments, for the systematic development of commands extending over 0.1 million ha each. This includes managing on-farm works, consolidating holdings, streamlining farm inputs and providing roads, drainage, markets and other infrastructure.

Started with 60 MMI projects spread over a culturable command area (CCA) of 1.5 mha, the program has now covered 29 mha under 314 projects, out of which work on 17.06 mha is ongoing. By the end of the Tenth Plan (2002–2007) a sum of $92.3 million (Rs4.155 billion) had been spent. About 50 CADAs are now running the program, which is being monitored on proforma basis. Up to the mid-eighties, it was considered successful in achieving its objectives and showed rise in both production and productivity. Subsequently, the focus of the program shifted to the development of on-farm works, mainly field channels. The evaluation of about 50 CAD projects has indicated that though the program has been useful in bridging the gaps in CAD projects, performance has not been optimal. So far only 11.94 mha of the irrigation potential created under MMI sector has been brought under the fold of the CAD program.

Drainage as component under CAD: The adverse effects of large scale irrigation development include, among others, waterlogging, salinity, and alkalinity in many of the irrigation commands. A component on reclamation of waterlogged, saline, and alkaline areas was introduced in 1996, and since then merely 0.05 mha out of an estimated 2.45 mha has been reclaimed so far. Apart from traditional practices, bio-drainage has also been attempted as a method for reclamation. Recently, a component on the correction of system deficiencies has also been introduced under the program. To treat the balance of 2.4 mha at an average cost of $555 (Rs25,000) per ha, a sizeable sum of $1.33 billion (Rs60 billlion) would be required. The current failure in adopting preventive measures is likely to result in an increase in the area under waterlogging.

Shortcomings of the CAD&WM program: Despite its potential usefulness, the CAD&WM program has not been able to achieve its desired objectives due to various reasons. Out of 3,253

[3] The figure differs from the third MI Census. See Appendix 1.

completed or ongoing MMI projects, only about 180 have been completed under the program and another 134 are ongoing. Out of 42.35 mha of IPC under MMI, the program covers about 18.94 mha so far. The MI sector is not covered under it (except in the case of some hilly and backward states). As of date, 39.56 mha out of an ultimate potential of 58.5 mha under MMI is yet to be covered under the program. Taking approximately $778 (Rs35,000) per ha as present cost, an amount of $30.8 billion (Rs1,385 billion) would be required to cover On-Farm Development (OFD) works under the MMI irrigation sector alone. During the past 36 years, an average of $2.55 million (Rs115 million) per year has been spent on the program. Based on the expenditure of $72.2 million (Rs3.25 billion) for 2008–2009,[4] the program would require a sum of $1.23 billion (Rs55.4 billion) annually at present cost to cover the remaining CAD&WM-related works under MMI projects in the next 25 years, which would mean enhancing the present allocation to about 17 times. The program does not, however, cover the cost of increasing efficiency in conveyance systems, the promotion of participatory efforts, and costs of extension, marketing, and rural infrastructure development. Despite the expenditure on OFD works, the expected farm yields cannot reach near optimal levels unless water supply at farm gate is assured. The program thus requires pragmatic reevaluation.

Apart from the main schemes of MOWR on irrigation infrastructure development, a number of other schemes on artificial recharge to groundwater, and a host of water use programs under the MORD and Ministry of Urban Development (MOUD) also provide infrastructure development in the WSS sector.

B. Groundwater Development and Regulation Scenario

As pointed out earlier, about 58% of the replenishable groundwater in the country has already been exploited and around 62.4% of the irrigation potential is created from groundwater resources alone, mainly through tube wells and dug wells. But extraction through tube wells is causing steady depletion of the groundwater table, particularly in the alluvial belts of the states of Punjab, Haryana, Rajasthan, Uttar Pradesh, and other areas in Gujarat and Tamil Nadu. The present regulatory system permits anybody to sink a tube well in their land and the net result is overdraft or near exhaustion in these states. The current pricing of electricity as well as free power for agriculture in some of the states is also encouraging overdraft of groundwater. Table 4 provides the groundwater availability, net draft, and level of groundwater development in the above states as well as the country as a whole. The government at the center feels that there is a need for collective action to regulate this resource.

The Model Ground Water Control Bill prepared by the CGWA in 2005 does not seem to address the problem of overdraft as it does not tackle the core issue of exploitation by sealing new borings while allowing existing tube wells to remain. The model bill does not prioritize the use of groundwater for commercial and non-commercial use, nor does it encourage the conjunctive use of surface water and groundwater, despite the two being a unitary resource. According to the Planning Commission, there is a need for a more comprehensive legislation which takes into account environmental concerns and the involvement of all stakeholders on the one hand, and hydro-geologists along with environmentalists and social mobilizers on the other, who can promote collective sharing and sequential use based on a careful understanding of the storage and transmission characteristics of different aquifers in diverse hydro-geological settings.[13]

[4] Government of India, Ministry of Water Resources. 2009. *Annual Report 2008*.

Table 4: Annual Groundwater Availability, Net Draft, and Level of Development

States	*Net GW Availability* (BCM/Yr)	*Net Draft* (BCM/Yr)	*Balance GW for Future Use (2004)* (BCM/Yr)	*Level of GW Development (2004)* (%)
Punjab	21.4	31.2	(–)9.9	145
Rajasthan	10.4	13.0	(–)3.9	125
Haryana	8.6	9.5	(–)1.1	109
Tamil Nadu	20.8	17.7	3.1	85
Gujarat	15.0	11.5	3.1	76
Uttar Pradesh	70.2	48.8	19.5	70
India	**398.7**	**230.4**	**161.9**	**58**

Source: Government of India, Planning Commission. 2010. 11th Plan Midterm Appraisal Report.

C. Concerns in Water Sector Development

1. Gap between irrigation potential created and utilized

The Planning Commission has estimated the ultimate irrigation potential[5] of the country at 140 mha: 58.5 mha under MMI and 81.5 mha under MI. By the end of the Tenth Plan, 42.4 mha of irrigation potential was reported to have been created under the MMI sector and 60.4 mha under the MI sector (14.3 mha from surface water schemes and 46.1 mha from groundwater sources). In the Eleventh Plan, a target of 9.0 mha of additional irrigation potential under MMI was set, out of which 2.8 mha is reported to have been achieved by the end of 2009–2010. This target now stands revised at 5 mha. In the Eleventh Plan, a target of 7.0 mha was set for the MI sector (revised to 4.5 mha in the mid-term appraisal), out of which 2.7 mha was reportedly achieved by end of 2009–2010.

By the end of the Tenth Plan period, there was a gap of 18.87% between potential created and that utilized under the MMI sector and of 12.6% under the MI sector. Appendix 1 provides the ultimate, created and utilized figures of irrigation potential during Plan periods. Various reasons have been attributed to the gap in potential. Some of these are: (i) unreliability of data provided by revenue departments on irrigation potential utilized; (ii) incomplete coverage of CAD program in many commands; (iii) non-availability of adequate water in the system, particularly at outlets, resulting in lower supply in field channels at the tail ends; (iv) large scale deviations from design cropping pattern to water intensive crops; (v) deteriorating conveyance systems; (vi) non-enforcement of warabandi; (vii) lack of awareness among farmers and functionaries; and (ix) lack of will for participation among beneficiaries.

2. Waterlogging, salinity and alkalinity in the command area

The unscientific management of soil, water, and crops in irrigated commands and the obstruction of natural drainage systems by various natural processes or developmental activities have led to disruptions in the ecological balance of water in the root zone. This has led to waterlogging, salinity, and alkalinity in many commands of irrigation projects. There are also many manmade factors such as deforestation and poor upkeep of watersheds, and developmental activities such as the construction of roads, bridges, railway lines, and buildings, that choke the flow of natural drainage. The hydraulic pressure of water from upper irrigated areas results in seepage in low lying areas. Other problems include the introduction of irrigation without taking into account the characteristics of the

[5] According to the Planning Commission, irrigation potential is the area under irrigation that comprises of the cumulative area of seasonal and perennial crops in a year. Irrigation potential is said to have been created when the main structure and conveyance up to a portion of command have been completed and are capable of drawing water. It is said to be utilized when that area of the command actually starts drawing water. Gap in potential is estimated in the succeeding year of the one in which irrigation potential was created.

soil and sub-soils; seepage from canals, distributaries and watercourses; excess application of irrigation water, particularly in the initial years when the command is not yet fully developed; poor on-farm water management practices which result in poor water application efficiencies; unrealistic cropping patterns tilted in favor of water intensive crops; the lack of night irrigation in some commands; inadequate drainage and poor maintenance of existing drainage systems and outlets; and the lack of conjunctive use of surface water and groundwater. All these factors are cumulatively responsible for waterlogging, salinity, and alkalinity problems.

Extent: A systematic assessment of waterlogged and saline areas in the irrigated commands was made by adopting common norms, by a working group of MOWR in 1991.[6] It evaluated the extent of waterlogging, salinity, and alkalinity as 2.45 mha, 3.07 mha, and 0.24 mha respectively. The CWC initiated a program for the mapping of surface inundation and salt-affected areas in all the MMI commands of the country using satellite remote sensing through the Regional Remote Sensing Service Centre in Jodhpur, Rajasthan, which estimated a decline in surface retention and salt-affected area at 1.72 mha and 1.04 mha respectively. A state-wise assessment of the waterlogged and salt-affected area reported by these forums is given in Appendix 2. Ten states (Andhra Pradesh, Bihar, Gujarat, Haryana, Madhya Pradesh, Orissa, Punjab, Rajasthan, Uttar Pradesh and West Bengal) were found to be severely affected by waterlogging, salinity or alkalinity. The reclamation of degraded soils and/or preventive measures have been taken up in irrigated commands under the CAD&WM program of the MOWR. The MOA, MORD and MO&EF at the center and their corresponding ministries and departments in states are responsible for taking up reclamation measures in the degraded areas under their respective jurisdiction.

3. Inefficient use of irrigation water

Many of the irrigation projects have been operating below potential due to various reasons. The overall efficiency of irrigation water use in India is considered to be around 38–40% for canal irrigation and about 60% for groundwater irrigation schemes. This is mainly responsible for the unreliability of the supply of irrigation water at the farm level and the consequent reduction in water use efficiency. The reasons cited for low irrigation water use efficiencies include inequity in water distribution, poor distribution due to theft and canal cuttings, excessive seepage from canals, waterlogging, inadequate water availability, lack of maintenance of canals, and poor alignments and design, which cause low flows, and this in turn leads to weed growth and frequent siltation. So far, the policy on irrigation development has been to open up projects for irrigation as soon as their headworks and main/branch canal networks are completed. Work on the construction of distributaries/ minors as well as development of the command follow for another 10–20 years before the commands are fully developed. With abundant water availability in head reaches in the initial stages of canal development, farmers often shift to water intensive crops, thus causing an overall reduction in planned intensity of irrigation. Often faulty head regulators and canal controls allow wasteful withdrawals of water. In addition, poor communication facilities and the absence of control structures do not allow canals to adjust to large variations in demand and supply due to rainfall or crop patterns. Non-completion of on-farm works in commands is also cited as one of the reasons for poor water use. Deficiencies in the conveyance system result in the reduction in capacity of canals due to lack of maintenance, demand-supply mismatch, reduced availability of water at outlet/ farm gate, wastage of water, creation of waterlogged conditions and other related problems. One of the factors responsible for the low water use efficiency of the projects is the absence of O&M of canal systems, primarily due to inadequate funds.

At present, improvements in the efficiency of the conveyance system form part of the ERM scheme. This scheme sometimes also covers the components of main dams, barrages or headworks. Often, the lining of canals has to be accessed to address the deficiencies in the conveyance system without considering other factors such as groundwater development in the

[6] Government of India, Ministry of Water Resources. 1991. *Water Logging, Soil Salinity and Alkalinity*.

command. This requires a great deal of caution as it may affect the flow regime that might have developed between the seepage and the groundwater. Restoring design sections and installing volumetric assessment devices at control locations along with canal lining in selected reaches may be the best option in correcting the majority of conveyance system deficiencies.

Considering the irrigation potential created so far, the extent of the conveyance system under MMI and MI runs into hundreds of thousands of kilometers. While it would be difficult to congregate the country-wide extent of canal deficiencies, an estimate can be obtained. Assuming that 50% of the system created under MMI by the end of Seventh Plan (30 mha, for the system existing for more than 20 years) requires rehabilitation/restoration at an average irrigation intensity of about 120%, the CCA that requires immediate rehabilitation would be of the order of 12.5 mha. At a cost of $133 (Rs6,000)[7] per ha, the anticipated cost of correcting canal deficiencies would be approximately $1.7 billion (Rs75 billion).

D. Environmental Concerns

1. Floods

The total flood-prone area in the country has been estimated by the CWC at 45.36 mha.[8] The majority of flood-prone areas lie in the Brahmaputra and Barak Basins in the north-east, the Gangetic Plains of Uttar Pradesh, Bihar, and West Bengal, and deltaic areas of Godavari, Krishna and other east flowing rivers. These rivers often overflow. Himalayan rivers often carry a sizeable amount of silt which spreads in the Gangetic flood plains and often creates in-land deltas, causing rivers to meander and change course. Erosion of the banks of these rivers is quite common. Some other areas in the Himalayan regions are vulnerable to flash floods due to snow melt, cloudbursts, and natural barriers or landslides in the Himalayas or cyclic storms in coastal regions. The flooding of urban areas due to drainage congestion is quite frequent and causes huge losses to life and property, also causing unhygienic conditions and the spread of epidemics. Inadequate and unplanned storm water drains, and habitation in low lying areas are the main causes of drainage congestion in cities affecting poor people.

Complete control over floods is neither feasible nor economically viable; hence a two-pronged strategy constituted by structural and non-structural measures is adopted in order to provide reasonable protection from floods. Structural protection includes embankments, flood walls, dams and reservoirs, detention basins, channel improvement, and drainage improvement and diversion. Thus far, a total of 18.22 mha has been protected and about 27.14 mha is yet to be protected. At $889 (Rs40,000)[9] per ha, the total cost of protection works out to $24.1 billion (Rs1,086 billion) which would be required to complete the works at present day prices. Table 5 provides the details of protection works completed until the end of the Tenth Plan period.

The task of containing floods is extremely difficult and the most practical approach would be to work out a way to live with them. Non-structural measures, which are cost effective, include not only forewarning people, but also reducing flood damage through the regulated use of flood plains. Flood plain management through zoning, flood proofing, flood forecasting, and flood disaster management are some of the non-structural measures being actively pursued

Table 5: Flood Protection Works Completed by the End of the Tenth Plan Period

Structural Measures Taken	*Status*
Flood embankments created	33929 km
Drainage channels	388810 km
Towns protected	2458
Villages raised	4717
Area accorded protection	18.22 mha

Source: Report of the Working Group for Eleventh Plan.

[7] Component on correction of conveyance deficiency under CADWM Programme of MOWR for the Eleventh Plan.

[8] *Rashtriya Barh Ayog (*1980) has assessed the flood prone areas of the country to be 40 mha. The MOWR website (http://www.wrmin.gov.in) has calculated the value to be 33.516 mha and the *Report of the Working Group on Water Resources for the 11th Five Year Plan* puts this figure at 45.36 mha.

[9] Government of India, Ministry of Water Resources. 2006. *Report of the Working Group on Water Resources for the 11th Five Year Plan*.

in India. The flood forecasting network in India comprises of around 147 level and 25 flow forecasting stations on nine major river systems.

2. Droughts

India experiences high variability of rainfall in terms of both time and space. Deficient rainfall in many parts of India has caused meteorological droughts, which in turn trigger hydrological and consequential agricultural droughts. Besides affecting rural employment, causing migration of landless and bovine populations, degradation of surface water and groundwater, malnutrition, and regional economic downturn, droughts also affect food production and food security. The country experienced some of the severest droughts in 1877, 1899, 1918, 1965, 1972, 1979, and 1987. In a study conducted during 1975–1982, 725 taluks in 325 blocks of 99 districts, covering 108 mha, were deemed drought-prone by the CWC. At present, parts of some 182 districts are considered drought-prone.

The Government of India has initiated both short- and long-term programs to mitigate droughts. The strategy adopted to address the immediate distress of human and bovine population includes digging ponds, constructing water harvesting structures and community buildings, increasing the supply of food grains and fodder, creation of fodder banks, providing mobile drinking water facilities, immediate employment to workers, shelter for cattle, crop management, and supply of subsidized seeds, fertilizers, and fuel. Presently, the government is focusing on drought mitigation through the National Rural Employment Guarantee Scheme (NREGS),[10] which inter-alia also covers water harvesting, minor irrigation, repair, rehabilitation and renovation of traditional water bodies, drainage in waterlogged areas, afforestation, and tree plantation.

A number of long-term drought mitigation measures have been initiated by various central and state ministries, some of which are:

- **Integrated Drought Prone Area Program** for drought proofing which comprises the restoration of ecological balance, optimum use of natural resources, soil moisture balance, water harvesting, afforestation, farm forestry, development of pasture and fodder, and promotion of horticulture;
- **Desert Development Program** for control of desertification, restoration of water balance and raising regional production, income and employment, grassland development, sand dune stabilization, water harvesting structures, and shelter belt plantation;
- **Rainwater harvesting** and water shed management programs in rain-fed areas are being run successfully by a number of ministries and have helped in increasing runoff of small streams and nallahs as well as promoting rural development on a large scale. Integrated watershed development is being promoted through soil conservation, check dams, nallah bunding, contour bunds, and gully plugs. Many states have reported success stories. In urban areas, rooftop rainwater harvesting is being encouraged through regulations.

Nearly three-fourth of all agriculture is practiced in rain-fed areas in the country; the MOA lays emphasis on utilizing soil moisture through dry land farming and early maturing crops. Tank irrigation is prevalent in southern parts of India on a large scale. Replenishing groundwater through artificial recharge and water conservation measures also helps mitigate droughts in semi-arid and arid regions. Water conservation technologies such as selection of water saving cropping pattern suitable to soil and climatic conditions, deficit irrigation, use of micro (pressure) irrigation, and conjunctive use of surface water and groundwater are being promoted.

3. River bank erosion

The Ganga with its tributaries, Brahmaputra, and many other rivers are prone to silting and scouring,

[10] NREGS, under the MGNREG Act, envisages that any adult member in a rural area who is willing to do unskilled manual work, is eligible to work for as many days as he desires without exceeding 100 days in a financial year. The scheme is active throughout the country.

which causes severe damage to their banks every year. The Kosi has shifted westwards by 105 km in the last 250 years and the Gandak has shifted its course by 12 km in 80 years on both sides. Dredging in selective reaches, desilting and lining have been attempted at selective locations as measures to contain the rivers within their banks, but these have not proved cost effective.

4. Surface water quality

Nearly 75% of the domestic (and also some industrial) water supply comes back to the system as return flow, often laden with organic, chemical, and bacterial pollution. Water quality analysis of river flows since 1986 has indicated an increasing trend of contamination due to the discharge of untreated effluents from growing cities and urban centers into the rivers. Biochemical Oxygen Demand and coliform bacteria are on the rise in all major basins while the quantity of dissolved oxygen shows a falling trend. The major sources of such pollution include industries like pulp and paper, iron and steel, pharmaceutical industries, distilleries, textiles, tanneries, etc. Besides agricultural runoff, another pollutant of surface water bodies is the base flow during summer from shallow groundwater which contains vast quantities of pesticides and chemicals. The Ministry of Environment and Forests (MOEF) has initiated systematic conservation for pollution abatement plans in rivers, lakes, and other water bodies in the country.

National Ganga River Basin Authority (NGRBA): The Ganga has been accorded the status of National River and the NGRBA has been constituted as an empowered planning, financing, monitoring, and coordination authority under the Environment Protection Act, 1974. The Hon'ble Prime Minister of India is the Chairman and members include the Chief Ministers of all the states through which the river flows. Union Ministers of MOEF, MOWR, MOUD, Ministry of Shipping and Transport, and the Deputy Chairman of the Planning Commission are also members of the authority. Similar setups have been created in the states under the chairmanship of the respective Chief Ministers.

5. Groundwater quality

Hard rock regions constitute 239 mha of the country's geographical area, while the rest (90 mha) is alluvium.[11] A substantial amount of shallow groundwater resources are replenished every year due to rainfall, seepage from unlined canals, tanks, and irrigation farms. In general, groundwater in shallow aquifers is suitable for different purposes and often carries calcium bicarbonates. The deeper aquifers on the other hand, vary in quality from place to place due to various contaminations on account of geogenic factors. While a variety of chemicals are present in groundwater, the common types found in India which render groundwater unusable include inland salinity, coastal salinity, fluorides, iron, arsenic, and nitrates.

Groundwater protection measures: Fostering the management of groundwater both locally and at the national level requires regulation of groundwater development and its strict enforcement, conjunctive use of surface and groundwater, development of deeper aquifers, rainwater harvesting and artificial recharge, stress on research and development (R&D) for treatment of polluted industrial effluents, domestic and municipal sewage, regular monitoring, developing information systems, and initiating public awareness programs.

6. Surface and groundwater interaction

Surface water and groundwater are considered as a unitary source. Often there is dynamic interplay between water on and beneath the ground, either through infiltration of surface water to the rock bed beneath streams or lakes during dry periods, or the reappearance of base flow during wet periods. As a result, many rivers like Luni in Gujarat and Sai in Uttar Pradesh have gone dry during lean season. In the case of a large number of rivers, the average annual flow during lean seasons has reduced considerably; the Gomti in Lucknow now carries about 35% of its average lean season discharge in 1979 while there is no direct withdrawal from the river, except for minor domestic use. A similar trend is being observed in many tributaries of the Ganga.

[11] National Ground Water Congress, held at Vigyan Bhawan in New Delhi, 11 September 2007.

Excessive groundwater pumping in areas around streams, lakes, and other water bodies has reduced their average annual flows, thereby increasing the risk of contamination of both surface and ground flows; and many of these interactions are neither accounted for nor considered in planning processes.

E. Social Concerns

Resettlement and rehabilitation: The submergence of large tracts of land due to the creation of dams causes not only large-scale displacement of people from their homes and environment but also deprives them of their livelihoods, thus giving rise to several sociological and psychological concerns. While such displacement is often unavoidable, the lack of relevant policies in the early 1960s and 1970s enhanced the stress of project-affected families (PAFs), when almost one-third of the compensation for land acquired was meted out without any policy on resettlement or assured livelihood in the post-project period.

Taking into account the growing concerns and increasing number of court cases on R&R issues, the Ministry of Irrigation (now MOWR) issued directives to all state governments in 1982 to implement Resettlement and Rehabilitation (R&R) packages pertaining to state irrigation projects. A draft National Resettlement Policy was prepared in 1998 to overcome the existing shortcomings in the implementation of the R&R programs. Based on the principle that R&R is the joint responsibility of central and state governments and project authorities, it has been ensured that the cost of all R&R components will be included within the project cost. The broad objectives of this policy are: (i) minimum displacement by exploring and disclosing non-displacement and less-displacement options; (ii) higher income and better standard of living for project-affected people (PAP); (iii) minimizing trauma due to loss of livelihood systems, productive assets, and income sources; (iv) pre-project planning, mutual understanding between project authorities and PAP, right to information, transparency, and stakeholder meetings as part of the package.

As a consequence of the policy, there has been a marked change in the overall perspective on R&R issues. Though PAFs still face inconvenience during short periods, the provision on resettling PAP in the command areas, as per the R&R plan of the project, makes them part of the project beneficiaries and they gain both socially and economically. The provisions of this draft policy have thus ushered in an era of institutionalizing R&R plans. On the other hand, this has led to an increase in project costs, causing many private investors to shy away from developing irrigation infrastructure projects, on account of likely risks due to R&R.

F. Economic Concerns

1. Low water rates

Large scale irrigation infrastructure in India is being developed for subsistence agriculture and intensification to ensure food security for the growing population. These projects indirectly benefit a large number of small and marginal farmers when a negligible portion of the cost is allocated to the beneficiaries. The Government of India has pursued a policy of low and highly subsidized food prices for a large number of BPL families.[12] It is often cited among political circles that irrigation development in India has followed a socialistic model whereby project costs are charged to the exchequer in order to maintain a low food pricing structure, as opposed to an economic model where the project costs are directly borne by the beneficiaries. As a result, charges for irrigation water are kept low.

The competition between demands for various water uses has been escalating. A World Bank Report[13] talks about harmonizing the three economic measures of

[12] A BPL family is defined as a family (six to seven persons) with income less than US$2 (Rs90) per day. Nearly 260 million people are reportedly BPL, of which 193 million live in rural areas in 12 states, mainly from north eastern, eastern, and central India.

[13] Briscoe. 1996. Water as an Economic Good: The Idea and What it Means in Practice. Paper presented at the 16th World Congress on Irrigation and Drainage. Cairo. 15–22 September; quoted from reference under footnote.

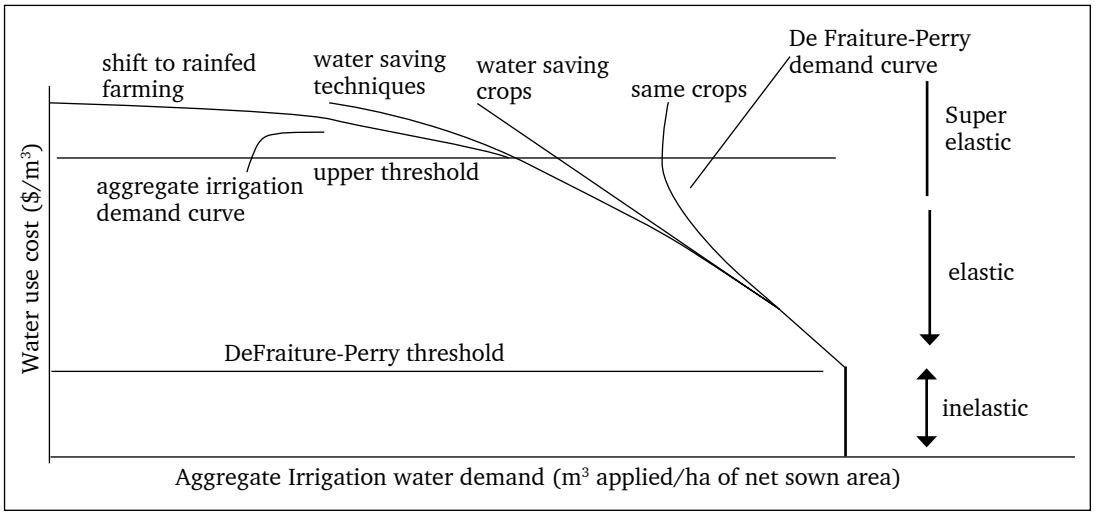
water use: (i) the use cost incurred by the user in obtaining water and its subsequent use; (ii) marginal value productivity of water in irrigation use; and (iii) the opportunity cost, i.e. the value of irrigation water when used for the next best alternative. When the water use cost is low, farmers have no incentive to improve productivity; the distortions will be more serious in cases where the use of water for other purposes is denied, while farmers use the irrigation water for high water-intensive crops which have lower productivity.

Supporters of low irrigation water charges[14] opine that the relation between the cost of and demand for water is inelastic below a threshold line beyond which farmers do not respond, irrespective of the increase in water charges. As this relation moves to the inelastic zone, farmers strive to save their crop from moisture stress and with this relation in the super-elastic zone farmers may shift to water saving crops or even move to rain fed farming. Critics, however, disagree[15] and argue that in a majority of the developing countries that follow a low food cost strategy, the water prices remain between elastic zones. Water pricing may thus be a blunt tool when it comes to influencing farmers' behavior. Figure 3 illustrates the response of agricultural water demand to rising water costs in the Indo-Gangetic Plains (IGB).

The preference given in the past to the large-scale construction of new projects over the maintenance of existing ones, coupled with the lack of O&M funds, has rendered irrigation systems inefficient and dilapidated, and this has made users reluctant to accept higher water rates given the unreliability of service delivery, thus creating a vicious circle. The lack of participation of beneficiaries in the O&M of the system has resulted in less-than-optimal utilization of water as well as a diminishing interest in a participatory approach to maintenance. In many of the states where PIM acts are in place, the reluctance of Irrigation Departments in handing over the systems to Water Users Associations (WUAs) is hindering the empowerment of WUAs.

O&M expenditure[16] constitutes one of the principal elements in the recurring costs of irrigation systems, the others being depreciation and the interest on

Figure 3: Response of agricultural water demand to the rising water use cost in the Indo-Gangetic plains



[14] C. De Fraiture and C. Perry. 2007. Why is Agricultural Water Demand Unresponsive at Low Price Ranges? In F. Molle and J. Berkoff, eds. *Irrigation Water Pricing: The Gap Between Theory and Practice.* Oxfordshire, UK: CABI Publishers. pp. 94–107.

[15] T. Shah et al. 2008. Is Irrigation Water Free? A Reality Check. *World Development*. 37(2).

[16] O&M expenditure comprises of the salaries of the personnel managing canal systems and regulating the release of water through the distribution network up to outlet and the staff in control of water distribution on the field, the expenditure incurred on taking crop measurements, billing and keeping water accounts, allowable overheads, outlays on normal repairs, maintenance of the conveyance system facilities, and the costs of energy and maintenance of pumping equipment in the case of lift irrigation.

capital expenditure. Concerns have been expressed over rising interest payments and growing wages and salaries, which are regarded as major expenditure. On account of poor maintenance and continued negligence due to inadequate allocation of funds, irrigation systems have been operating at levels much below their capacity. Thus there is a need for earmarking some part of the receipts from each irrigation system towards the O&M of the system. Very little or no money is left for maintenance work as a large portion of the budget provision is spent as establishment cost.

Data on actual O&M outlays are supposed to be available in the accounts maintained by the state Public Works Department/Irrigation Departments for each major and medium project and for minor works collectively, but is seldom available in proper shape. Therefore, apart from the improvements required to ensure proper maintenance of data, there is an imperative need to ensure uniformity with respect to the classification of various categories of expenses under different heads of costs, including the treatment of overheads, assessment, and collection costs.

In India, charges are levied on irrigation water to ensure the regulated use of water within the reach of users. The Second Irrigation Commission (1972) emphasized the role, importance, and necessity of such charges and their adequacy for meeting O&M costs to achieve equitable distribution as well as efficient use. The Vaidyanathan Committee recommended that at least 10% of the Plan provision for major and medium projects be allocated for renovating the existing systems, and the recovery of accumulated arrears be earmarked towards improving the cost of deferred maintenance/special repairs of the project concerned. The adjustment in prices, taxes, and subsidies for a particular input like water should bear some relation to the changes in the prices of other inputs and of the output generated by the system. The Committee also recommended the enhancement of water rates to cover O&M costs and the interest on capital cost, along with depreciation.

Irrigation projects, in general, have become poor revenue-earners because of low water rates and still lower collections. According to the NWP:

> [The] need to ensure that the water charges for various uses should be fixed in such a way that they cover at least the Maintenance and Operation charges of providing the service initially and a part of the Capital Costs subsequently. These rates should be linked directly to the quality of service provided. The subsidy on Water Rates to the disadvantaged and poorer sections of the society should be well targeted and transparent.

The rates charged by the states have been extremely low and vary for flow and lift irrigation. Appendix 3 provides details of water rates levied by states since 1993. Nagaland, Sikkim, Meghalaya, Mizoram, Chandigarh, and Lakshadweep have not levied charges on the use of water for irrigation.

According to the MOWR, in the present economic scenario, a rationalized water rate structure is imperative. While the full recovery of recurring O&M costs and part of the capital costs need to be the main considerations in the fixing of water rates by the states, differential water rates may have to be levied according to the economic capacity of users, employing land holding size as a proxy variable. As the revision of water rates may not be possible every year, some kind of provision needs to be incorporated in order to address inflation. In addition, there is a need to evolve some kind of regulatory mechanism in the states to determine water charges and oversee their collection.

2. O&M expenditure

The Twelfth Finance Commission (2005–2010) had proposed O&M expenditure of $13.3 (Rs600) per ha (base year 2004–2005) with respect to the utilized potential under major and medium schemes, and $6.7 (Rs300) per ha for the unutilized potential under major and medium schemes as well as utilized potential under minor irrigation schemes. For hills and special category states, the O&M expenditure would have to be 30% higher. The state Irrigation Departments dealing with O&M work are heavily staffed and most of the budget provision is spent towards establishment charges with very little or no money left for maintenance work. Based on these norms, the projected O&M expenditure for the state is given in Table 6.

Table 6: Maintenance Expenditure Recommended for the MMI and Minor Irrigation Sectors

Sector	*Major & Medium*				*Minor Irrigation*			
Year	*India*	*Andhra Pradesh*	*Maharashtra*	*Uttar Pradesh*	*India*	*Andhra Pradesh*	*Maharashtra*	*Uttar Pradesh*
2005–06	2944	198	158	432	2220	88	139	544
2006–07	3100	207	166	454	2330	92	146	571
2007–08	3265	218	174	476	2447	97	154	600
2008–09	3432	229	183	500	2569	101	161	630
2009–10	3607	240	192	525	2698	106	169	662
2005–10	16348	1092	874	2387	12264	484	769	3007

Source: Government of India. 2004. Report of the 12th Finance Commission.

The Thirteenth Finance Commission (2010–2015) made the observation that an autonomous statutory institution at the state level could only address concerns related to inequity in water distribution among various water uses, low water use efficiency, the fragmented approach to the planning and development of water resources, low water user charges and meager recovery. The Commission recommended the setting up of a Water Regulatory Authority in each state and the specification of a minimum level of recovery of water charges. The functions that the proposed regulatory authority may perform include: fixing and regulation of water tariff system, and charges for surface and sub-surface water for different uses, determining and regulating the distribution of entitlements for various categories of uses as well as within each category of use, and periodically reviewing and monitoring the water sector costs and revenues.

The Commission also recommended an incentive grant of $1.1 billion (Rs50 billion) for this purpose, which could be inter-se allocated to respective share in the total expenditure under the O&M head on irrigation and their respective share in irrigation potential utilized at the end of the Tenth Plan, assigning equal weightage to both these shares. The amount is to be released in two equal installments over the four year period (2011–2015). The states have been given one year to make the necessary preparations to absorb these funds. The release of grants would be subject to the condition that all states (excluding north-eastern states except Assam) must set up a Water Regulatory Authority by 2011–2012 and notify latest by 31 March 2012.

In addition, the Commission calculated the recovery rates for irrigation, separately for special category and general category states, on the basis of actual revenue receipts of the states, and suggested state-specific normatively projected recovery rates for the period 2011–2015. States are required to achieve the projected recovery rates to become eligible for grants. Where the State Water Regulatory Authority/ Commission mandates recovery rates, those would replace the recovery rates prescribed by the Thirteenth Finance Commission for that particular state for the purpose of eligibility and release of grants. A state shall be eligible for grants if it recovers at least 50% of the water charges mandated by the Authority.

In a recent study conducted in the Jaunpur Branch of the Sharda Sahayak System in Uttar Pradesh, it was revealed that major expenses in O&M are required for operational costs, which mainly include salaries and are more or less consistent. Table 7 provides the head-wise details of such expenses.

Table 7: Head-wise Expenses for O&M at the Jaunpur Branch System in the Sharda Sahayak Canal System, Uttar Pradesh (2002–2007)

Head	*Expenses* (Rs/ha)	*Percent expenses*
Maintenance	272.00	28.5
Operation	751.60	47.2
Management	453.06	17.0
Vehicle	108.00	6.8
Others	6.71	0.5
Total	**1591.37**	**100.0**

Source: UP Water Sector Restructuring Project, Atlas for Jaunpur Branch sub-system.

Table 8: Details of Expenditure versus Revenue Generated in Canal Systems in Uttar Pradesh and Maharashtra

Year	*Annual expenditure on O&M* (Rs/ha)	*Annual revenue generated* (Rs/ha)	*Net shortfall* (Rs/ha)
Uttar Pradesh: PIM reforms not yet initiated in the state			
2000–01	1524.00	582.03	941.93
2005–06	3558.07	855.43	2702.64
2007–08	6755.89	1380.16	5575.71
Maharashtra			
1999–00 (Pre-Reform)	1566.26	623.00	943.26
2005–06 (Post-Reform)	1083.73	988.03	95.70

Source: Budget Document (2009–2010), Sinchai Vibagh (Irrigation Department), GOUP; Reform paper by S. V. Sodal.[17]

As is evident, expenses on O&M are higher when compared to the Twelfth Finance Commission allocations for the state. On the other hand, the revenue generated in the states has been much lower than the actual expenditure on O&M. Table 8 shows the actual revenue generated in the states of UP and Maharashtra during the last decade.

It is clear then that O&M expenses in India are not commensurate with the revenue generated and upward revision of water rates is inevitable[18] if PPP is to be encouraged with revenue generation as a basis. It is beyond doubt that PPP involvement in irrigation water development and management must ensure specific and consistent cost recovery, and incentives to farmers/WUAs for reducing consumption, attaining farm efficiencies and increasing production/ productivity within the overall objective of enhancing livelihoods.

G. Agriculture and Allied Concerns

1. Food insecurity

Present levels of food production worldwide are considered sufficient to provide for all of humanity despite the fact that more than 800 million people living in developing nations lack sufficient and secure access to nutritious food and clean drinking water.[19] India, though considered as a food surplus state, has the largest number of undernourished people who have limited access to a balanced diet and clean water necessary for basic food requirements. Despite high economic growth India's food security concerns are rising, especially given the crisis in the rural economy with the decreasing purchasing power of people that inhabit rural areas as far as the three components of food security (availability of food in the markets and mandis (local markets), access to food through adequate purchasing power, and nutritional level of food) are concerned.

According to the report on the status of food security in rural India,[20] indicators directly affecting the food security and nutritional status of a person are: the percentage of population consuming less than 1,890 kilo calories per consumer per day (Kcal/cu/day), households not having access to safe drinking water and access to toilets within the premises, ever-married women in the age group of 15–49 years who are anemic and suffer from chronic energy deficiency, and children in the age group of 6–35 months who are anemic and stunted. Figure 4 provides the composite food insecurity index: among the states, Jharkhand and Chhattisgarh are the most insecure, followed by

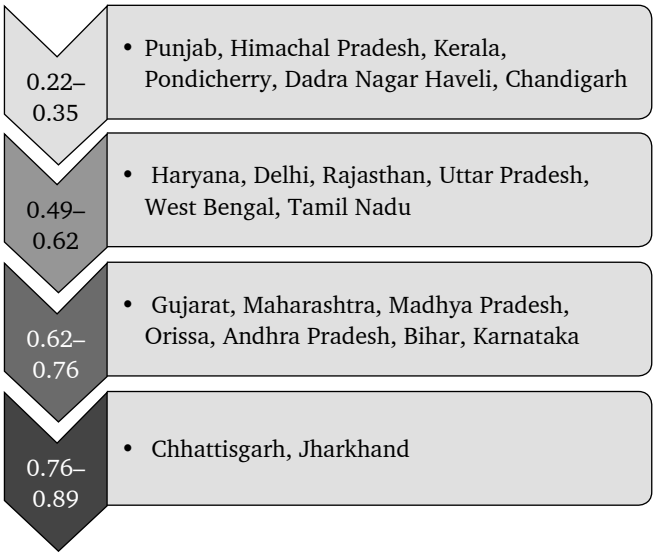
[17] S. V. Sodal. 2007. Reforms Initiatives in Water Resources Sector in Maharashtra State. Maharashtra Water Resources Regulatory Authority, Mumbai.

[18] Reforms in the states of Andhra Pradesh and Maharashtra have demonstrated that revenue recovery rates actually increased after assurance on water, IMT, and revision of water rates.

[19] M. S. Swaminathan. 1998. *Uncommon Opportunities: An Agenda for Peace and Equitable Development*. Report of the International Commission on Peace and Food. London.

[20] http://home.wfp.org/stellent.groups/public/documents/newsroom/wfp197348.pdf

Figure 4: Composite food insecurity index in states and Union Territories covered under the study



Madhya Pradesh and Bihar. Surprisingly, even highly developed states like Maharashtra, Andhra Pradesh, Gujarat, and Karnataka suffer from low levels of food security. Higher levels of food security can be found in the states of Punjab, Kerala, and Himachal Pradesh.

According to the report,[19] the interventions needed to deal with food insecurity include: (i) a revolution in agricultural productivity through the adoption of quality inputs such as advanced cultivation practices, (ii) increasing productivity of water, (iii) access to credit, (iv) infrastructure for storage, (v) producer-oriented marketing of food processing industries, besides adequate levels of intensification and mechanization. The other areas that need attention are information empowerment, awareness campaigns, crop diversification, water conservation, and safety nets (food for work and mid-day-meals). All these areas are being given appropriate attention by the Government of India.

2. Food security versus water as an economic good

Political exigencies compel water rates to be kept low for ensuring food security and low food prices. Research worldwide on this issue indicates that water should be considered an economic good which demands water prices to be commensurate with at least the prevailing O&M costs, even if full capital recovery is not aimed at; subsidies for water supply should be withdrawn. Another opinion[15] on the matter is that not only should water be treated as an economic good, but water for irrigation should be perceived outside the scope of gravity irrigation as well. A wider approach needs to be adopted which is suited to present day developments as it is often the case that gravity irrigation sources are utilized for lift irrigation on a large scale, even in MMI commands.

The alluvial plains of the Indus, Ganga and Brahmaputra (IGB) in India, Pakistan, Nepal, and Bangladesh contain a population of 747 million, of which about 30% live below poverty line on an income of less than $1 (Rs45) per family per day; 75% live on an income of within $2 (Rs90) per family per day. A study conducted in the region indicates that groundwater is the dominant source of irrigation and the cost per hectare to grow paddy and wheat far exceeds the water prices fixed for gravity irrigation. 75% of all farm area in Punjab depends on wells and tube wells. There has been a 36% reduction of canal irrigation in Punjab, 40% in Uttar Pradesh, 11% in Andhra Pradesh, and 46% in Gujarat. According to the study, even after having spent $25 billion (Rs1,125 billion) on AIBP, India's gravity systems have declined by 2.8 mha. On the other hand, the net irrigated area from groundwater resources rose from 28% in 1950–1951 to 61% in 2000. A survey conducted in 2003 in 6,770 villages by the National Sample Survey Organization revealed that 69% of irrigation depended on groundwater during Kharif (wet season) and 76% during Rabi (dry season). According to the MI census, the net irrigated area of the IGB states in 1993–1994 was 15.63 mha, which fell to 11.04 mha in 2000–2001, i.e. by 29.4%. On the other hand, the net irrigated area served by groundwater in IGB states rose by 25% from 17.41 mha in 1993–1994 to 21.76 mha in 2000–2001.

The argument that in canal commands, it is seeped canal water that is being pumped by farmers, does not find favor in terms of low water charges, since the total cost of water borne by the farmer is high, given that it includes irrigation water charges together with groundwater pumping costs (cost of pumps, electricity, and/or diesel). The use cost of irrigation

systems varies from $0.0025 to $0.02 (Rs0.1 to Rs0.9) per m^3 in the case of tank and canal systems, to about $0.15–0.25 (Rs6.8–11.3) per m^3 in the case of electric pump systems—a variation of almost 100%, which definitely falls in the super elastic zone as illustrated in Figure 3. Interviews with farmers in Deoria, Uttar Pradesh, further revealed that water prices and the overall economy of the produce depend upon the rise in diesel and pump irrigation prices, relative to farm prices of wheat and rice. Thus, water as an economic good needs an altogether new debate. Table 9 shows the rise in costs of diesel and pump irrigation relative to farm prices of wheat and rice in Deoria.

Assured groundwater-based irrigation even at a higher water use cost helps survive water stress, but given the soaring cost of groundwater, there is a need for subsidies and further development to ensure sustainability. As for canal water as an economic good, the factors that demand attention are water quotas, water actually supplied, and the efficiency and reliability of the canal delivery and distribution system.

H. Key Governance Issues

The key issues[21] affecting institutional governance in the I&D sector in India are: (i) inaccessibility and inadequacy of safe drinking water for all, particularly the rural poor; (ii) improper balance between the service providers and users of all kinds, particularly the middle and tail reach farmers in the case of canal irrigation; (iii) a virtual monopoly of the state governments over irrigation supplies—water is either not provided to the poor, or, when provided, is of inferior quality and insufficient quantity. The absence of adequate water rights and entitlements, as well as the lack of enforcement of the existing ones have resulted in inefficiency, corruption, financial crisis, and conflicts; (iv) inequitable and uncontrolled allocation of water to users at all levels, be they farmers, domestic users, bulk users and/or states, thereby giving rise to water conflicts; (v) absence of stakeholders, particularly the PAP; and (vi) inadequate transparency—the inability of the users to get hydrologic data systems.

I. Gap in Investments

Considering the present level of development, a considerable balance of work on AIBP, MI, CAD, drainage, and flood protection remains to be done. Based on present costs per ha, Table 10 enlists this balance of work and associated requirements of funds in each sub-sector. At the present levels of allocation of funds, anywhere between 15 and 91 years may be required to complete sub-sector-wise potential works.

Table 9: Deoria, eastern UP: Rise in Diesel and Pump Irrigation Prices Relative to Farm Price of Wheat and Rice

Year	*Kg of wheat to buy 1 liter of diesel*	*Kg of wheat to pay 1 hour of pump irrigation*	*Kg of rice to buy 1 liter of diesel*	*Kg of rice to buy 1 hour of pump irrigation*
	Pumps and generator owned by farmers	*Rented pumping*	*Pumps and generator owned by farmers*	*Rented pumping*
1990	1.24	3.14	1.45	3.67
1995	1.61	4.04	2.17	5.43
2000	3.71	8.00	5.30	11.43
2005	5.63	10.00	6.75	12.00
2007	3.39*	6.86*	6.29	12.73

* 2007 saw increase in wheat and rice prices.
Source: See footnote 15.

[21] ADB. *Water Resources Development in India: Critical Issues and Strategic Options*. http://www.adb.org/Documents/Assessments/Water/IND/water-assessment.pdf

Table 10: Balance of Works and Associated Costs at Present Level of Prices

Sub-sector	*Total work* (mha)	*Works completed* (mha)	*Balance of work* (mha)	*Present cost* (Rs/ha)	*Funds required to complete works*		*Expenditure (Tenth Plan)* (Rs billion)	*No. of years required to complete works*
					Rs (Billion)	$ (Billion)		
MMI (mha)	58.50	48.20	10.30	200,000	2,060	45.80	712.13	15
MI (mha)	81.50	63.11	18.39	150,000	2,759	61.31	245.21	86
CAD&WM (mha)	58.50	18.94	39.56*	35,000	1,385	30.8		
Reclaiming water-logged areas in irrigated commands (mha)	2.45	0.05	2.40	Varies between 25,000 and 60,000	108	2.40		
Flood Protection Works (mha)	45.36	18.22	27.14	40000	1086	24.1	59.60	91
Total					**7398**	**164.41**		

*Assuming balance of CAD&WM to cover existing MMI sector alone.

Chapter summary: Given the expenditure of $775.6 billion (Rs34,900 billion) on the irrigation sector in the last 60 years or so, India's efforts towards developing the sector are laudable and have been recognized the world over, though the performance of many schemes related to infrastructure development is subject to dispute. Following the business-as-usual approach, India still needs $164.41 billion (Rs7,398 billion) over the next three or four Plans, just to achieve its irrigation potential target under MI and MMI; and this does not include irrigation schemes in the states. Much work remains to be completed, particularly under the CAD&WM and flood control sectors, where the present setup needs to be completely reconceptualized.

Despite infrastructure development, the concerns regarding the water sector, food insecurity, and growing food demands are hindering the developmental objectives and need to be addressed in a timely manner. Low water rates and inadequate recoveries are often cited as reasons for the poor upkeep and O&M of conveyance systems. At the same time, supportive groundwater is treated as a boon for increased production/productivity despite the exorbitant input cost involved. Considering the reforms approach being followed in some states towards restructuring the water sector through pilot projects, considerable efforts are yet to be initiated. The only option available with the governments is to generate private interest and mobilize PSP.

Chapter 4
Available Options and Reform Initiatives

To address the growing concerns that have been outlined in the previous chapter, India has initiated certain admissible reform processes. In some states, pilot efforts are being made through water sector restructuring projects. However, much remains to be done. This chapter elaborates upon the reform initiatives recognized by the country and concludes with the observation that sustainable development and management in the water sector are possible only through an IWRM approach.

A. Participatory Irrigation Management

PIM is now a worldwide phenomenon. Many countries have successfully dovetailed PIM with irrigation management. The Government of India also considers the participation of farmers' associations indispensible to enhancing agricultural productivity, the management and upkeep of irrigation systems, ensuring periodic maintenance, bringing efficiency in water use, addressing environmental degradation, etc. With the aim of fostering a feeling of ownership among farmers, the MOWR has been inspiring their participation in irrigation management since 1985. This extends to the maintenance of tertiary canal systems, promotion of conservation and management of water for optimum scientific crop management, ensuring equitable distribution, improving service deliveries, and taking responsibility to collect water charges which are then deposited with the government exchequer (revenue Irrigation Department). Necessary guidelines and a model PIM act were also released by the MOWR for the subsequent formulation of PIM acts in the states. The NWP also advocates the formation of WUAs and suggests:

> Efforts should be made to involve farmers progressively in various aspects of management of irrigation systems, particularly in water distribution and collection of water rates. Assistance of voluntary agencies should be enlisted in educating the farmers in efficient water-use and water management.

Fourteen states have enacted PIM acts or have modified Irrigation acts to encourage PIM.[1] About 61,000 WUAs covering 12.55 mha have reportedly been formed in these states.

The legal framework for PIM requires the formation of a WUA with an administratively viable delineated command area delineated on hydraulic basis, as

[1] These states are: Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu and Uttar Pradesh. Chhattisgarh follows the erstwhile Madhya Pradesh State PIM Act. Manipur has agreed in principle to formulate PIM Acts in due course. Indus Basin states like Punjab, Haryana, and Himachal Pradesh manage warabandi (rotational water supply system for irrigation) effectively in their respective projects and consider outlet level committees as sufficient to distribute water judiciously below outlets. Barring Jharkhand, which is undecided, the rest of the hill and the remaining six north eastern states do not have major or medium systems to attract PIM acts at this stage.

[2] Generally, a command area of a group of outlets or a minor canal at its head is considered as a viable jurisdiction of a WUA from many angles. This size is viewed as appropriate from an administrative point of view, and convenient for bulk supplies to WUAs for distribution among farmers, as per their area based allocations. A distributary committee may comprise of five or more WUAs. The presidents of WUAs together

well as distributary- and project-level committees (federations).[2] The Associations at different levels are expected to be actively involved in the maintenance of the irrigation system within their area of operation, as well as in the distribution of irrigation water to the beneficiary farmers as per the irrigation (warabandi/osrabandi) schedule, and assisting the Irrigation Department. Considering the number and the significant contribution of women to the agriculture sector, women could play an important role in the WUAs. Many states have rightfully ensured representation of women in their PIM acts. Despite awareness, however, their representation in WUAs is marginal.

In spite of government support, farmers as well as officials of Irrigation Departments in the states are finding it difficult to implement PIM in irrigation commands, not only due to lack of financial support but also because of the vastness of the command area. The size of the area also aggravates problems of fiscal availability, O&M costs and recovery of irrigation charges. Other challenges include: system deterioration and deficiencies that require one-time repair; the lack of legal back-up and policy changes; the unreliability of water supply; reservations about financial viability; lack of the requisite technical knowledge leadership, awareness, publicity, and training; the demographic diversity;[3] the mega irrigation projects; rifts between the jurisdiction of WUAs and Panchayats; difficulties in capacity-building on a large scale; and the inadequate number and undefined roles of NGOs. It has been observed that in general, small-scale systems where informal farmers groups and system management are already in place, provide a more conducive environment for PIM.

It has been realized that regardless of difficulties in implementation, the active participation of beneficiaries is critical to the efficient management of irrigation systems. Experience shows that wherever farmers have been actively engaged, the overall management of the irrigation system and water use efficiency has significantly improved. Success stories suggest remarkable improvement in water delivery and distribution, and increase in production, productivity, as well as revenue collections. In Maharashtra for instance, the Ozar group of WUAs in the tail end of the right bank canal (RBC) of the Waghad dam command area is an example of the conjunctive use of surface water and groundwater at the WUA level.

To ensure smooth implementation of PIM in the states, the Planning Commission has suggested the following:

- For the CAD&WM program to be effective farmers need to participate as stakeholders in the process right from the planning and implementation stages to monitoring and maintenance. WUAs need to be set up within the Panchayati Raj Institutions (PRI) and provided autonomy. The process of WUA institutional strengthening as well as building of WUA federations may require investment in terms of time and money.
- Irrigation Department officials must undertake the task of capacity building in partnership with PRIs and civil society organizations with experience in PIM.
- The entire profile of Irrigation Department officials also needs to be broadened to include not only engineers (who provide technical inputs) but also social mobilizers (social workers and anthropologists) who understand the social dynamics of farmer stakeholders and their motivational structure.
- All these changes further require a new institutional legal and regulatory framework that draws lessons from both the strengths and weaknesses (especially) of the Maharashtra Water Resources Regulatory Authority.

Cost of implementing PIM in irrigation commands: Creating an institutional setup in the

constitute the general body of the distributary committee. An apex (project) committee that consists of irrigation officials and presidents of the of distributary committees shall constitute the general body of this committee. These committees are responsible for the preparation of water demand, collection of water charges, resolving disputes among the members of WUA, monitoring flow of water in the irrigation system, etc.

[3] A majority of the farmers in irrigation commands have land holdings that are less than 2 ha.

Box 1: Successful Implementation of Conjunctive Use in the Waghad Dam Command

Three WUAs, namely the Banganga Water Distribution Co-operative Society (WDCS), Mahatma Phule WDCS and Jay Yogeshwar WDCS, formed in a village called Ozar (and are commonly known as Ozar WUAs) near Nasik, in the tail end of the RBC of the Waghad dam, operate in a CCA of about 1,151 ha. Samaj Parivartan Kendra (SPK), an NGO that operates in the area, took the initiative of convincing the government to construct 18 check dams to harvest rainfall and collect water losses from distribution through seepage. The three WUAs also contributed their allocated shares from the dam towards these storages. These check dams helped in the recharging of wells within the command area. Thereafter, the WUAs switched to irrigation by rotation—partly from canals on volumetric basis and the remaining from wells. This helped the farmers switch to the cultivation of vegetables and grapes, which require light and frequent irrigation. They were thus enabled to irrigate at their own will.

Thanks to another initiative of the SPK, a record is now made of the water level in wells, and these records are maintained by the WUAs, which have in turn developed reliable techniques of estimating the recharge for each well. The nearby wells are also used in rotation to avoid unnecessary drawdown. In the process, the WUAs also collect water charges for irrigation from wells, on a per hour basis; the fee is half of that charged for canal water. The jurisdiction of the command for each well is also defined on the basis of well recharge characteristics. This initiative of the SPK has not only improved water use efficiency, but has also enhanced the dependability of water while ensuring flexibility in supply. The sustainability of conjunctive use in the command is clear from the water table, which is within safe limits. These efforts have encouraged other farmers in the command, while also helping the project authorities to hand over the management of the system to the respective project, federation and WUA.

changed scenario would entail providing the requisite infrastructure for the WUAs, modernizing conveyance systems, imparting awareness and training the farmers. Considering the unit cost of $778/ha (Rs35,000/ha),[4] covering 140 mha of irrigation commands by 2025 would require a substantial expenditure to the tune of $108.9 billion (Rs4,900 billion). It is believed that a healthy combination of PPP involvement in the service sector (maintenance and distribution) coupled with contract farming can help WUAs boost production, productivity, and livelihoods.

B. Need for Conservation

The conservation of water is the need of the hour, irrespective of the form of storage—natural or manmade—be it surface water, stored in the soil moisture zone of crops or underground (shallow or deep). This includes reducing evaporation losses as well as avoiding wasteful use. Farmers need to be encouraged towards deficit planning through equitable and rationed supplies for deficit tolerance capacity. Measures towards this may include: shifting to sprinkler and drip irrigation to save water, the conjunctive use of surface water and groundwater to improve the efficiency of water use, reduction in conveyance loss by lining the critical reaches of the canal system, renovation of tanks, groundwater harvesting through percolation tanks, reducing evaporation from reservoir surfaces (spraying chemicals) and soil surfaces (mulching), desalination, priority use of groundwater wherever feasible, deficit irrigation, and choosing crops in conformation with water availability, soils, and agro-climatic conditions.

C. Sustainability through Groundwater Management

Given its advantages in terms of high dependability and uniform quality, being relatively pollutant free, minimal loss to evaporation, and security it provides against droughts, groundwater plays an important role in the development of drinking water and irrigation, especially when compared to other sources. The growing demand for water owing to the rise in population, urbanization, and

[4] An estimate; the cost of similar work being carried out under the restructured programs of the World Bank/ADB is nearly $2,222 (Rs0.1 million) per ha.

industrialization, has often entailed degradation as well as inadequately regulated pumping in many parts of the country, which have disastrous, if not irreversible consequences. A number of factors hinder the sustainability of groundwater. The sound scientific management of the resource is thus imperative, for which some strategies are: the scientific development of groundwater, ensuring controlled use for agriculture, artificial recharge, increased regulation and contamination checks.

Several other strategies that could be considered have either failed or been found inadequate; some of the reasons for this are: (i) the absence of a pricing mechanism and strict regulation, (ii) indiscriminate abstraction, (iii) wasteful utilization, (iv) inadequate research on groundwater use specific to the socio-economic context, (v) fragmented hydro-geological research, and (vi) climate change. Also necessary is the proper estimation of the resource, while considering 'high-value' use near urban centers or prime agricultural areas. The management of groundwater requires an interdisciplinary and holistic approach, while also involving all the stakeholders. An effective policy framework needs to be devised, taking into consideration all issues related to scarcity and over-exploitation, including proper legislative measures towards making rainwater harvesting mandatory in over-exploited, dark, and grey areas.

D. Modernization through Canal Automation

Traditionally in India, canal systems have been operated through controlled gates, which fall into disrepair over time and are often miscontrolled. Besides, these gates cannot be operated during rainfall in the commands or emergency closure of the canals, which results in wastage of water. To prevent this, wireless devices and telephones have been employed in many of the systems, but these too are not impervious to human error. Canal automation is being introduced in some of the restructuring projects where automated observations on groundwater levels, soil moisture, and agro-climatic parameters are sensed and transmitted to data centers in order to assess canal flow requirements on real time basis during the growing period of crops; the flow can then be regulated according to the actual water requirement of crops within the commands.

E. Efficiency in Irrigation Water Use

The efficiency of irrigation systems from an engineering perspective is considered a performance indicator for better water delivery for crop use. Irrigation water, whether diverted from storage reservoirs and transported to farms through the canal distribution network (main, branch, distributaries, minors, water course and field channels), or pumped (single or multiple) and supplied through farm channels at the time of application to enhance root zone storage, often gets partially lost during the process. Depending upon the various sub-processes within canal water transposition (lined, partially lined or unlined) or water utilization by crops (evaporation or seepage from surface water channels, or furrows, leaks from sprinkler/drip pipelines, drift from sprinklers, percolation beneath root zone or runoff from fields), irrigation efficiency can be evaluated crudely or more efficiently.

The overall irrigation efficiency is greater in the case of lined canals (65–75%) than unlined canals (50–60%); with respect to field applications, this may vary between 60–80%.

Strategies suggested by the MOWR[5] for improving irrigation project efficiencies include:
(i) standardization of the definition of irrigation efficiencies—irrigation project efficiencies including basin efficiencies should be evaluated as a regular practice; (ii) conjunctive use of surface water and groundwater should be given highest priority;
(iii) the MOU of WUAs should include a standard clause on effective conjunctive use; (iv) small tanks,

[5] Government of India, Ministry of Water Resources. 2006. *Report of the Working Group on Water Resources for the 11th Five Year Plan*.

ponds, and other MI projects within the commands of large projects should be treated as part of major projects and the efficiencies of these projects should be determined accordingly, as such projects allow diversion of surplus canal waters for storage and also promote groundwater harvesting; (v) water budgeting of all water that is accrued, stored or used should be a regular practice for all irrigation projects; and (vi) drip/sprinkler use should be promoted for horticulture/vegetable crops (and also sugarcane) in all existing and upcoming irrigation projects. The Ministry accepts that actual improvements have fallen short of expectations since very little effort has gone into improving the performance of ongoing projects.

F. The Need of the Hour: Integrated Water Resources Management

It has become evident that past water management practices in India have proven inadequate; sustainable sectoral development of water resources under the present institutional setup would be a long-drawn process unless there is a paradigm shift in its development and management in a coordinated and integrated manner. The excess of water supply over demand management has led to inefficient irrigation projects, caused negative externalities and raised opportunity costs to unsustainable levels. Inefficient and low quality operations and the consequent financial unsustainability have created a vicious cycle—users refuse to pay the tariff and this delimits infrastructure maintenance efforts. Poor services have exacerbated low productivity, depletion of water, and pollution of water bodies. Given the shortcomings of the present WRM setup, IWRM has emerged as a means to address water-related issues, thus pointing towards sustainable water management in the future.[6]

Global Water Partnership[7] defines IWRM as a 'process that promises the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems'. The United States Agency for International Development (USAID) has proposed a more functional definition of IWRM as 'a participatory planning and implementation process, based on sound science, which brings together stakeholders to determine how to meet society's long-term needs for water and coastal resources while maintaining essential ecological services and economic benefits'. IWRM should thus be seen as a tool to help protect the environment, foster economic growth and sustainable agricultural development, promote democratic participation in governance, and improve human health.

For the sustainable development of infrastructure through PPP, the IWRM framework would need to rely on a sound basin-based water policy, an updated scientific database, basin-based entities with sound financial resources, and strong political will to support broad-based reforms. The implementation of IWRM in such a scenario would initially face several potential retardants such as opposition from various interest groups, difficulties that arise out of large-scale changes, water scarcity, natural disasters, water quality/pollution crisis, and dissatisfied water users. However, the private sector may ultimately be able to convince the stakeholders of the benefits of the reforms, based on concrete data and sound analysis. Executing the IWRM under a PPP arrangement is thus going to be a slow but steady process and seems to be the only way forward in developing and managing the I&D sector in the future.

G. Regulatory Framework in PPP Setup

The regulation of a public utility in general can be broadly considered as an effort of the state to address the social risk, market failure or equity concerns

[6] World Bank Institute. 2006. Integrated Water Resources Management: Introduction to Principles and Practices. Paper for the Africa Regional Workshop on IWRM. http://www.pacificwater.org/userfiles/file/IWRM/Toolboxes/introduction%20to%20 IWRM%20introduction.pdf

[7] An international organization dedicated to the promotion of sustainable management of water resources.

[8] Government of India, Planning Commission, Secretariat for the Committee on Infrastructure. 2008. Approach to Regulation of Infrastructure. http://www.infrastructure.gov.in/pdf/approach_to_infrastructure.pdf

through rule-based direction of social and individual action.[8] In terms of the economic regulatory process, the states have identified certain objectives which include ascertaining the effective functioning of the competitive market outcome, setting optimum tariffs, establishing service standards, addressing subsidies and cross-subsidies in the pricing of infrastructure services, ensuring universal and equitable access, consumer protection, and maintaining health and safety standards. Clearly, the role that the regulatory institutions are required to perform depends on specific concerns of the central/state governments with respect to infrastructure development and/or management process, and the provisions of the respective acts that clearly outline the jurisdictions of these institutions.

Regulatory framework in infrastructure sector: In general, the regulatory framework in the infrastructure sector in India has developed more or less autonomously. Regulatory Authority or Commission Acts have been passed at the center and in a number of states, and agencies are set up when it comes to oil and gas, airports, ports, power, broadcasting, cable TV, and the telecom and internet sectors; with respect to other sectors like transport, roads, railways, energy, coal, communication, etc., where major PPP initiatives have already taken place, the respective departments at the center or in states act as operators.[9] In the case of groundwater, the CGWA under the Water (Prevention and Control of Pollution) Act, 1974, is responsible for the regulation and control of groundwater development, with powers to control pollution and protect the environment.

Regulatory framework in the I&D sector: Considering the fact that water is a multi-disciplinary sector as well as a state subject, the constitution of regulatory Authorities/Commissions for infrastructure growth in the I&D sector as well as the development and management of assets are not only expected to adhere to the above referred principles of infrastructure development but are also expected to lead to conservation and efficient use of surface water and groundwater resources, determine allocations, and ensure equitable distribution of entitlements of different categories of water use as per standard performance criteria and parameters laid down for the purpose, register and monitor bulk entitlements, review and revise water tariff/charges periodically for water use, and fix O&M and administration charges under the provisions of the act. They should also have the authority to modify, revise or withdraw such water entitlements, review, enforce, and monitor volumetric assessments and actual supplies to stakeholders, ensure preservation of water quality, and impose penalties on defaulters and those who misuse the provisions of the act.

As a general policy, regulatory Authorities/Commissions are required to ensure the implementation of the state water policy through different water-related departments/agencies, monitor water quality and quantity, and ensure coordination between different water user agencies. While the overall power remains with the state governments, the Commissions are expected to devise rules and guidelines, publish related data and reports and ensure better performance on equitable, safe and efficient use of water for various purposes. The Authorities/Commissions are also expected to have the adjudicatory powers of a civil court and are accountable to the legislature through submission of annual reports and accounts to the state legislature as prescribed under the act. The jurisdiction of the regulatory institutions promoted for the I&D sector should not merely cover standalone institutions that protect the interests of irrigation departments and related stakeholders, but also extend to ensuring proper coordination among all water-related departments/agencies. Apart from the promotion of reforms and the development and management of the water sector, there are various issues that need to be addressed. The objectives and approach need to be clearly defined; the setup, functions, jurisdictions, multi-sectoral coordination, and monitoring mechanisms need to be taken care of.

[9] See footnote 5. This report lists details of sectors where regulatory authorities are formulated or central/state agencies/departments which look after their respective sectors as operators.

Other concerns include transparency, participatory coordination of stakeholders as well as adjudicatory mechanisms. The Government of India is considering setting up sector-specific regulators (water supply and sanitation, agriculture, irrigation, power, etc.) to ensure better coordination. Such mechanisms need to be technically supported by an independent agency for multi-disciplinary water resources development, management, as well as monitoring and evaluation.

H. Regulatory Framework in States

Under the stipulated provisions of the state water policies, so far Maharashtra, and Uttar Pradesh have enacted water resources regulatory Authority/ Commission acts in order to: (i) regulate water as a resource (both surface water and groundwater); (ii) facilitate and ensure judicious, equitable and sustainable management; (iii) allocate and optimize utilization of water resources for the environmentally and economically sustainable development of the state; (iv) fix the rates for water use for agriculture, industrial, drinking, power and other purposes including flood protection and drainage works; and (v) address matters connected therewith or incidental thereto. Some states (Andhra Pradesh, Orissa, Gujarat, and Rajasthan) are in the process of finalizing their respective Bills/enactment process for the purpose.

Existing regulatory institutions have evolved as part of a longer process of water sector reforms initiated by the Government of India in the states, with the assistance of the World Bank. Efforts towards restructuring the water sector are meant to promote initiatives by the states in the form of PIM acts, and are not necessarily oriented towards the issues, concerns, and associated risks related to promoting PPPs in the I&D sector. Even with respect to sectors that provide I&D-related services like water distribution through canals, distributaries, minors, water courses, and field channels, these acts would need to be amended.

1. Maharashtra Water Resources Regulatory Authority Act, 2005

Promulgated in 2005, the Maharashtra Water Resources Regulatory Authority (MWRRA) Act aims to 'regulate water resources within the state to facilitate and ensure judicious, equitable and sustainable management, allocation and utilization of water for agriculture, industrial, drinking and other purposes and to deal with matters connected therewith or incidental thereto'. The Authority constituted under the act comprises of a Chairperson and two members with relevant experience in the fields of water resources engineering and water resources economy; they are appointed for a period of three years by a selection committee outlined in the act and can be reappointed for up to two consecutive terms. The act also provides for five special invitees with experience in the fields of engineering, agriculture, drinking water, industry, law, economics, commerce, finance, or management for assisting the Authority in taking policy decisions. The Authority is assisted by a full-time secretariat with adequate staff under the control of the Chairperson.

As a general policy, the Authority needs to work within the framework of the state water policy, implement a comprehensive hydro-meteorological data system to promote sound water conservation and management practices within the state, and work on the principle of 'polluter pays'. It must also empower river basin agencies to fix quota at basin, sub-basin or project level to ensure equitable distribution of water among all land owners within the command area of a project, decide and ensure uniform percent reduction in the quota in the years of water distress, along with limiting the supply of water at least for one acre to each land owner; supply water from tail to head and abide by the provisions of the Maharashtra Ground Water Regulation (Drinking Water Purposes) Act,

[10] Agriculture, industry and domestic users.

1993. The Authority also, inter-alia, has provisions for dispute resolutions. It has the powers to prepare its financial budget, maintain accounts and get them audited by the Accountant General, and is required to present a copy of the annual report before the State Legislature.

On the issue of fixing the tariffs for bulk consumers,[10] the act provides that these should be reviewed and revised once every three years after taking into account the views of the beneficiaries. The charges must be sufficient to recover the O&M costs, and not the capital costs. The act also states that the government must address the need for cross-subsidy amongst the various categories of users to ensure that the cost of O&M is met. As a result of this, the Authority is empowered under the law to charge higher tariffs from bulk consumers and the rich Urban Local Bodies (ULBs) in comparison to the Gram Panchayats and WUAs, based on affordability, accessibility, quantity, and timeliness of supply. For instance, in districts where farmers traditionally hold small parcels of land (less than 2 ha), the tariff could be lowered. Water tariff can serve as one of the useful tools, besides better management practices, for improving water use efficiency and quality of service.

2. Uttar Pradesh Water Management Regulatory Commission Act, 2008

The Uttar Pradesh Water Management Regulatory Commission (UPWaMReC) Act, enacted in 2008, includes all the provisions of the MWRRA Act, but has a wider scope in terms of enhancing and promoting the judicious, equitable, and sustainable management of water; ensuring the allocation and optimal utilization of water resources in an environmentally and economically sustainable manner; fixing water rates for agriculture, industrial use, drinking, power, and other purposes; levying a cess on lands that have benefitted from flood protection and drainage works, and on the owners of lands that have gained from appropriate regulatory instruments according to the state water policy, and matters connected therewith and incidental thereto. The act differs from the MWRRA Act in that it provides for four members with experience in the fields of water resources, water resources economy, drinking water and waste water management, and agriculture/land management. The tenure of the Chairperson as well as members is five years, and they can be reappointed for up to two consecutive terms. The Commission is formally constituted as soon as its Chairperson is appointed. Its general policies include sound water conservation and management practices throughout the state, in accordance with and within the framework of the state water policy, and supporting the enhancement and preservation of water quality within the state in close coordination with the relevant state-level agencies.

The functions and powers of the Commission, apart from those similar to the MWWRA Act, include approving Integrated State Water Plan/Basin Plans developed by the State Water Resources Agency (SWaRA) of Uttar Pradesh. While the Chairman of the Commission has been appointed and the Commission is in existence, the members are still in the process of being appointed at the time of writing this report.

The act also provides for fixing and regulation of tariff based on O&M expenses incurred,[11] which could be reviewed and revised periodically. The Commission is required to work within the framework of the state water policy, which it is required to approve. The state water policy envisages that the water projects be self-sustaining, a factor that would be taken into account when the Tariff Regulatory Body fixes the tariff.

3. Andhra Pradesh Water Resources Regulatory Commission Bill

The provisions of the Andhra Pradesh Water Resources Regulatory Commission (APWRRC) Bill are devised precisely to promote PIM in irrigated commands under the Andhra Pradesh Farmers Management of Irrigation Systems Act, 1997. The provisions regarding the formulation of the

[11] Section 12(n) of the act.

Commission have been taken from both MWRRA and UPWaMReC. The general mandate of the Commission is to work in accordance with the framework of the state water policy and other existing laws of the state.

I. Long-term Implications of Regulatory Institutions in India

Wagle and Warghade[12] have assessed the provisions of three independent regulatory authorities (IRAs) with respect to the structure, processes and functioning of these institutions. In order to analyze the likely impact of new IRA laws on the governance system and on the interests of 'non-dominant' stakeholders, they have identified five main aspects, which are: (i) formulation of laws, (ii) selection procedure for members, (iii) compositions of IRAs, (iv) functioning of IRAs with respect to procedural matters, and (v) functioning of the IRAs with respect to substantive matters. Their conclusions are as follows:

- None of the three states have carried out investigations with respect to (i) the suitability of IRAs as a solution to local problems, (ii) the suitability of other options for the resolution of such problems, or (iii) the possibility of improvising upon the design suggested by the World Bank and borrowed from the electricity sector. While formulating new IRA laws, the three state governments did not feel the necessity to consult other stakeholders. As a result, there has been a great deal of suspicion about the intentions of the state governments, and this alienation has eroded the credibility of the IRAs. There is an understanding that such IRAs are being created under pressure from the World Bank;
- The selection process is monopolistic; the top-level bureaucracy exercises considerable power in recommending names to the government and the process is not free from 'political interference'. There is complete dominance of engineers and economists while stakeholder representation is absent;
- Functional characteristics of the IRAs indicate that the IRAs, in their present form, are structurally and functionally biased against non-dominant sections of society;
- In terms of substantive matters, IRA laws create 'private', tradable, and near-perpetual rights to give permanence to the existing distribution system which is unjust and inequitable.

These IRAs will lose credibility unless the pro-market approach (as in the telecom and electricity sectors) is rejected and the principles of 'full cost recovery' and 'tradable elements' are seriously reconsidered.

J. Importance of a Regulatory Framework for the Promotion of PPP in the I&D Setup

There are certain reservations about private sector involvement in the I&D sector which necessitate the regulation of infrastructure development and service delivery. It is anticipated that the private sector will not be able to provide services to the people in a competitive manner and/or the required levels and quality of service may not be made available, which is also likely to result in increased costs to the consumers. Regulation is also essential where the benefit of contracting is not likely to be achieved by both parties (government agency as well as the private service provider under the contract) and where the government is of the view that the nature of public services needs to be regulated in the interest of the people. To ensure effective regulation, what is required is an adjudicatory system strengthened by a sound legal framework (laws, rules, and contractual boundaries) and an administrative mechanism for the identified sectors with clear function guidelines.

Besides proper guidelines and procedural formalities, a clear legal regulation would also help those responsible in taking considered decisions so as to

[12] Subodh Wagle and Sachin Warghade. New Laws Establishing Independent Regulatory Agencies in the Indian Water Sector. *SAWAS*. 2(1). www.sawasjournal.org.

safeguard public money and protect the interests of the people. An independent regulator who is detached from service providers and who is vested with sufficient legislative powers to ensure a competitive environment can secure the trust of stakeholders and beneficiaries of the infrastructure service. The implementation of commitments shall largely depend on the Regulatory Act provisions. The powers and functions of the regulatory institutions dealing with the water sector, which are designed to address the PIM initiatives in India alone, not only need to be re-evolved to address the issues relevant to the effective implementation of PPP models, but also ensure that PPP efforts include all kinds of reforms necessary in the national interest and in the interests of sustainability of the development and management initiatives.

K. PPP Initiatives in the I&D Sector

The issue of PPP initiatives in the I&D sector in India is not new. The Planning Commission and MOWR have set up various committees to look into matters related to private sector involvement since 1995. The NWP, 2002, as well as water policies of different states have favored PSP at all levels. As observed in the NWP, 2002:

> Private sector participation should be encouraged in planning, development and management of water resources projects for diverse uses, wherever feasible. Private sector participation may help in introducing innovative ideas, generating financial resources and introducing corporate management and improving service efficiency and accountability to users. Depending upon the specific situations, various combinations of private sector participation, in building, owning, operating, leasing and transferring of water resources facilities, may be considered.

The MOWR constituted a High Level Committee (HLC) in 1995 under the Chairmanship of Mr P. V. Rangaiah Naidu, the then Union Minister of Water Resources, to examine the feasibility of PSP in irrigation and multi-purpose projects. The committee recommended piloting PPP initiatives in certain projects. Putting forth the recommendations of the HLC, the NCIWRD, 1999, felt that adequate private sector involvement could be accomplished only when the private sector is confident about getting sufficient returns from water users; it also expressed that the private sector can be usefully engaged in groundwater development and supplies to urban and industrial sector. The Working Group on Private Sector and Beneficiaries Participation Programme for the Tenth Plan set up by the Planning Commission in 2001 suggested the identification of pilot projects for the involvement of the private sector through PPP and formulating criteria for their selection. A group of experts constituted by the MOWR in 2003 to examine various issues relating to PPP in water resources management proposed guidelines for the implementation of water resources projects through PPP initiatives, identified areas for implementation, suggested likely incentives, clearances required, and the procedure for clearance of projects to be taken up by the private sector. Appendix 4 inter-alia quotes recommendations of the group. The Department of Economic Affairs (DEA), Ministry of Finance (MOF), has aimed at clubbing infrastructural development and management in all sectors including I&D and created a centralized portal;[13] respective state governments have also created PPP cells for infrastructural development initiatives.

Despite such initiatives, there has been virtually negligible involvement of private entrepreneurship in the I&D sector. So far, MMI has been sought to be brought under the portfolio of PPP. In his address[14] at Stanford University in 2006, P. Chidambaram, the then Finance Minister of India, pointed out:

> The challenges in agriculture sector are to increase public investment in agriculture, especially irrigation; to enhance productivity of farming, especially paddy, wheat, pulses and oilseeds; to adopt genetic sciences to the needs of Indian agriculture; and to promote private

[13] http://www.pppinindia.com
[14] Address of Finance Minister of India at Stanford University. 2006.
[15] Address of Hon'ble Prime Minister of India. October 2006.

> investments, including investments by the corporate sector, in pre-farming and post-harvest activities in a manner that will not affect the sacred relationship between the tiller and the land.

According to the address of the Hon'ble Prime Minister of India in 2006,[15] there are four areas of deficit that affect the agriculture sector: (i) investment deficit (both public and private); (ii) infra-structure deficit (roads, irrigation facilities, warehousing, cold-storage chains, and agro-processing industries), (iii) credit deficit (lack of access to bank loans), and (iv) lack of technical know-how (appropriate technology to keep pace with world productivity standards). The steady decrease in public investment in the sector is the root cause of the diminishing private investments as one triggers the other.

Chapter 5
Potential Areas for New Investments

A. Potential Investment Decisions

In a privately managed infrastructure utility, the choice of whether or not to invest depends on who owns the assets, and all decisions are purely financial, based on the expected returns. So far, investments in the development and management of infrastructure for irrigation (except farmer-owned groundwater investments), drainage, and flood sub-sectors have been made in the form of grants under several government programs, and the decision to invest, finance, design, and implement these have been made by various government institutions. The onus of implementation, regulation, and control of water, including allocation and distribution, lies with the irrigation departments/WRDs. Due to several reasons including lack of funds, the water services, system maintenance, and distribution functions have suffered, and given the inherent inefficiencies of the system components, this has resulted in sub-optimal agricultural production. Adequate attention has not been paid to the value-added chain within agriculture and allied sectors (of which I&D is a small link). This is indeed unfortunate considering that more than 60% of the population is dependent on this chain. Moreover, given the high level of subsidies in the sector, it has been contributing the highest to the economy's GDP.

Irrigation infrastructure projects, when developed and managed in a standalone manner, require heavy investment, but offer limited scope for revenue generation which is not even sufficient to meet the O&M costs. Private sector investments in the I&D sector are hardly profitable and do not provide opportunities for the BOT model of development. Same is the case with flood management projects where elements of revenue generation are missing given that beneficiaries are not taxed or charged a drainage relief cess. Under the present constitutional setup, there is hardly any scope for sharing water rights with private partners, as opposed to power projects, where there is some hope in the form of sharing electricity rights or the cost of electricity generated.

Pure private investment options in the I&D sector are thus ruled out. Under such conditions, the only avenues available to attract private sector involvement in the I&D sector would be: (i) a provision for viable gap funding (VGF) by the government, (ii) provision of incentives for execution of projects by private investors, and (iii) a healthy mix of the above two options. It goes without saying that the potential benefits of private sector involvement include cost effectiveness, higher productivity, speedy delivery, efficiency in services, customer-oriented focus, transparency, and recovery of service charges in harmony with the local conditions. Factors such as prioritized commitment towards developing other sectors and the limited resources with the government may not permit the private players' involvement with 100% VGF, except in the case of small social sector projects which require efficient and accelerated service delivery (as in the case of the health and education sectors). To attract private investment, it would thus be essential to explore areas where certain regulated incentives could be provided in lieu of the development and management of infrastructure in the I&D sector, without jeopardizing the reforms

proposed for the sector, compromising environmental and social concerns, or transferring or sharing the water rights as enshrined in the PIM acts of the states.

The multidisciplinary nature of the water sector demands coordination between various water user departments and the I&D sector in order to ensure efficient water delivery wherever required. Even though there is ample scope for PPP in a majority of the infrastructure development and management projects, these are currently being undertaken in a standalone manner. Many opportunities may emerge if different water user departments consider the possibility of joint infrastructure projects of water supply, distribution, and delivery in the WSS or power sectors. Agro-parks and integrated area development are now becoming a reality. Incentives outside the water and agriculture sectors such as tourism and fisheries can also provide much wider opportunities.

Such options may require amendments in the irrigation acts as well as in the rules and guidelines being followed by different agencies dealing with water. In this regard, certain policies of the state governments may need to be reconsidered as well. The scope of existing regulatory provisions may also require enhancement and generic risks need to be identified and evaluated before inviting PSP. Given that irrigation is a small but important input link in a value added chain (VAC) within the agriculture sector, a number of possibilities of infrastructure development in the I&D sector can emerge through the VAC itself.[1] In the energy distribution system, which shares a first-order similarity with the water distribution system, PPP models under regulatory control have been implemented with a great deal of success. It would thus be essential to understand the relationship between the VAC and energy transmission with the irrigation water distribution sector.

1. Agriculture sector reforms

During the Eleventh Plan period (2007–2010), an average growth rate of 4% was projected to maintain food security.[2] The average growth rate of the Indian economy during the first three years of the Eleventh Plan was of the order of 7.7%, while the corresponding growth rate in the agriculture sector was 2.2%, which constituted about 24% of the Indian economy, 63% of its population, and shares 67% of employment.[3] With a net sown area of 140.3 mha, net irrigated area of 60.9 mha, and abundant sunshine, India has made strides in agriculture research and extension, coverage under high yielding varieties (HYV), agri-inputs and establishment of mandis, which have led to large scale intensification of agriculture and a higher order of production. The productivity rates, however, are low when compared to other similarly placed countries. The policy focus on agricultural development has been on the rice-wheat cycle, with a minimum support price (MSP) fixed by the government. Currently, more than 40% of farmers all over India are willing to quit agriculture because of the dismally low income and the consequent debt trap, which have also led to a large number of farmer suicides. The rising population, land degradation, lowering of the groundwater table, and the fragmented land holdings, coupled with the rising costs of cultivation, the lack of crop insurance facilities, and frequent droughts are cited as the main reasons for the unattractiveness of the agriculture sector. Some of the measures being taken to address the situation include the consolidation of holdings, mechanization, shifting to crops that yield higher returns, a policy shift from MSP to market-driven prices, crop diversification, and support through allied sectors such as fisheries, animal husbandry, and food processing. The agriculture sector needs heavy investments including those from sources other than the government. The net sown area has already stagnated at 140 mha; there has been a decline in water security for agricultural growth.[4] Given these

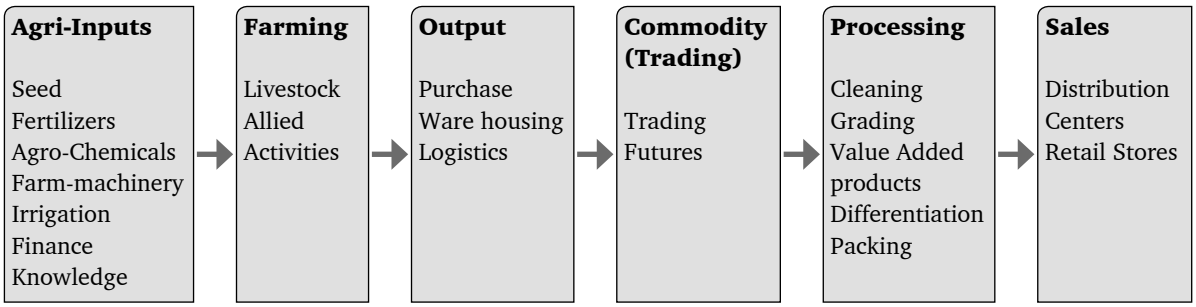
[1] R. D. Singh. 2007. *Transforming Agriculture for Rural Prosperity, Public–Private Partnership, Issues and Strategies: A Lucknow Management Association Publication*. New Delhi: Excel Books Private Limited.

[2] Food security can be defined as physical and economic access to food by all the households at all times to ensure a healthy and active life. Another definition of food security is the absence of hunger and a pre-determined number of calories at household level.

[3] Government of India, Planning Commission. 2010. *Mid-Term Appraisal for Eleventh Five Year Plan 2007–2010*.

[4] Water security could be defined as existing and potential supplies of water in relation to its present and future demands.

Figure 5: Value added chain in the agriculture sector



Source: R. D. Singh (see footnote 1).

factors, the only way to increase production is by nurturing the soil to healthy levels, intensification and increasing the productivity levels.

In order to understand and address the concerns of the sector, it is essential to be aware of every link in the VAC shown in Figure 5.[5] It may be noticed that irrigation is a very important but small link in the chain. A number of inefficiencies exist at the pre-harvest, post-harvest and marketing levels, which need to be addressed adequately. The inefficiencies at the pre-harvest stage include higher consumption of low-cost and poor quality agri-inputs, absence of mechanized tilling and uninformed purchase decisions, lack of awareness among farmers about the adoption of scientific farm practices, inferior quality of seeds, low seed replacement rates, absence/non-availability of timely credits, and poor water use efficiencies. Inefficiencies at the post-harvest stage include lack of marketing facilities, high wastage, absence of transparency, malpractices, lack of infrastructure for storage, processing and grading, absence of regulatory controls, and near-vacuum of large players. At the marketing end, inefficiencies account for absence or bad quality of roads, expensive transportation, fragmented retailing, and lack of market intelligence.

Corrective measures could include making quality inputs available, systematic and scientific farm practices, farm mechanization, organizing and creating awareness among farmers, development and dissemination of post-harvesting technology, infrastructure creation, improved market access, and efficient transport means. Modernizing the irrigation systems and making them efficient will not help until each link in the VAC is strengthened. Reforms in the sub-sectors of agriculture require large-scale corporate interventions along with appropriate government initiatives. To begin with, awareness programs, and capacity-building of farmers in these sub-sectors should be ensured through farmers' associations, federations, and NGOs. PPP through contract farming could also help bring about value additions. In many states, agricultural reforms are already underway. The problem lies not in any dearth of technology in the country, but in the gap in implementation through extension and marketing. The issues of resource deficit, water use efficiency and credit and risk management need to be tackled through PPPs and this is going to be a challenging undertaking.

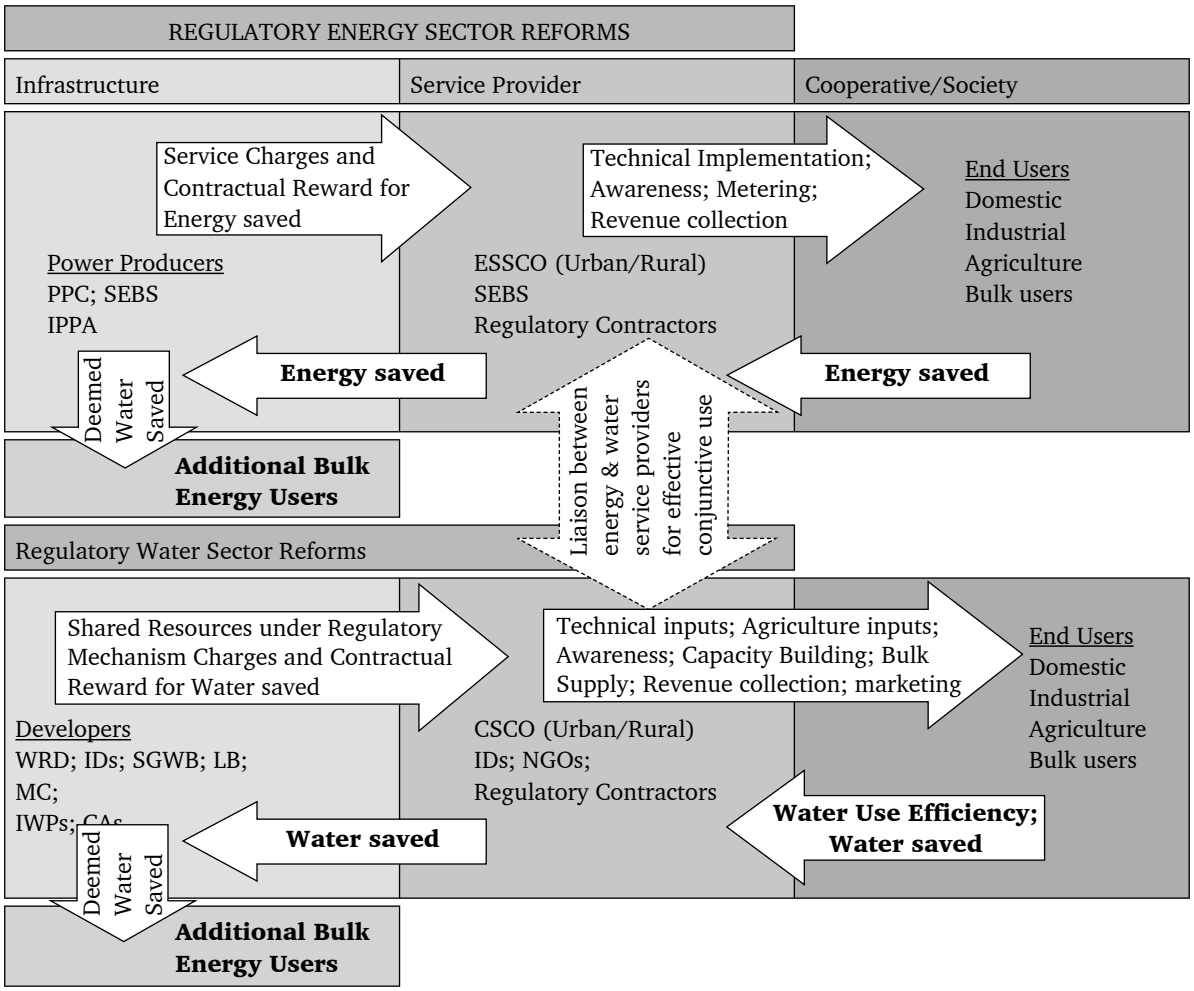
2. Systemic similarities between the I&D sector and the energy distribution sector

There is a close resemblance between the energy sector and irrigation (and WSS) setup when it comes to the structure of the generation, distribution and delivery systems of concerned departments, as well as issues related to transmission and distribution loss. These similarities extend to the reform options available in the two sectors as well as the provisions under the regulatory acts of both.[6] Figure 6 illustrates all of these.

[5] Lucknow Management Association. 2006. *PPP: Issues and Strategies*. New Delhi: Excel Books Pvt. Ltd.

Critics argue that reforms through PPP have become possible due to revenue generation opportunities available in the metered[6] energy sector which are absent in the irrigation sector, particularly because of the socialistic bent of the I&D sector. There are, however, vast incentive opportunities in the irrigation and allied sectors which may sometimes even exceed those in the energy sector. These opportunities have been discussed in the next section. In fact, deemed water savings through water conservation and efficient use can help generate higher levels of agricultural productivity along with creating much wider scope for cooperation with WUAs at minors and down below. The regulated operation of distribution in the two sectors coupled with coordination of WUAs can help promote contract farming as well as conjunctive use, which will in turn help in arresting groundwater degradation as well as reducing energy wastage in the agriculture sector in a major way.

Figure 6: Probable structure of energy and water sector reform through PPP



PPC – Power Producer Companies; SEBs – State Electricity Boards; IPPA – Independent Power Producers Associations; ESCO – Energy Saving Service Company; WRD – Water Resources Department; IDs – Irrigation Departments; SGWB – State Ground Water Board; LB Local Bodies; MC – Municipal Corporations; IWPs – Independent Water Provider Contractors; CAs – Community Associations; CSCO – Contractual Service Company; NGOs – Non Government Organizations.

[6] The urban energy sector is metered; so is the urban water supply sector. On the contrary, canal irrigation is not metered in many of the commands; and agricultural energy supply in many states is either not metered or agriculture energy charges are too low to be effective in generating attractive revenue.

Chapter 6
PPP Experience in the Water Sector

A. Infrastructure Development under the PPP Framework in India

In the wake of liberalization and the economic reforms in India, initial attempts to involve the private sector as an instrument of government policy in infrastructure service provision were made in the early 1990s. Since then, India has had mixed experiences with PSP in various sectors, predominantly in energy, telecom and transport. The initial focus of energy reforms was on privatizing generation, which eventually turned out to be lesser of an issue when compared to the issues plaguing transmission and distribution (T&D). One of the fundamental structural problems with the power sector was the prevalence of high T&D losses,[1] which were largely unaccounted. The structural separation of generation from T&D was, in hindsight, not conducive to successful PSP in the sector.

The privatization of telecom services was relatively successful, but not without its share of problems. PSP contracts were initially awarded on the basis of license fees, payable for pre-defined areas of operations which were known as 'circles'. The initial wave of telecom privatization attracted significant international participation, backed by tremendous optimism in the Indian markets, with the result that the license fee bids for almost all the circles were much higher than what the market could actually bear. This prompted mid-course correction in the privatization process, from a fixed bid license fee based contract to a revenue-share contract. This measure, along with other policy initiatives including the institutionalization of regulation, enabled progressive structural readjustment in the sector. Today the telecom industry is characterized by a number of large domestic players and is one of the fastest growing sectors. It is cited as one of the most successful examples of PSP in the delivery of infrastructure in India.

At an estimated value of $12 billion (Rs540 billion), road development in India has also undergone a quiet revolution with the launch and implementation of one of the largest highway development programs in the world. A major portion of the funds is expected to come through private financing initiatives and a large number of private sector contracts have already been awarded to the private sector by the National Highways Authority of India (NHAI). These projects are at various stages of implementation. The success of road sector privatization can be attributed to structured project development which has incentivized private players to participate in the process. This has also enabled the standardization of road sector contracts, thus facilitating faster implementation.

[1] http://www.teriin.org/upfiles//pub/papers/ft33.pdf. In India, the average T&D losses have been officially indicated as 23% of the electricity generated. However, as per sample studies carried out by independent agencies including The Energy and Resources Institute, these losses have been estimated to be as high as 50% in some states. In a study carried out by State Bank of India Capital Markets for the Delhi Vidyut Board, the T&D losses have been estimated at 58%.

The following section deals with a historical perspective on the I&D sector. This is followed by a brief discussion on the components and functions of the I&D sector, risks involved in the sector and essentials of PPP contracts. Further, the current status of private participation in the I&D sector is discussed along with examples of a few important case experiences, both at the national and international level, which concludes with the lessons learnt from these and suggestions given. Appendix 5 discusses India's experience with private participation in the road and energy sectors and also provides details of a few PPP case studies in the water sector (irrigation and drinking water) in India and abroad.

B. I&D Sector: History and Trends

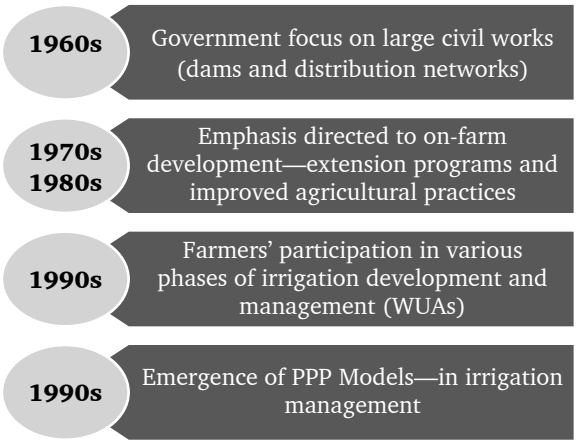
In the post-independence period, the Indian I&D sector has witnessed substantial changes as the central as well as several state governments have taken several initiatives for the development of the sector. Beginning in the 1950s and 1960s, there has been substantial investment in irrigation infrastructure, with a primary focus on large civil works (dams and main distribution networks); funding and management have chiefly been taken care of by the governments. This process, largely set into motion after the green revolution, took place mostly in Asia. As a result, the irrigation potential in the country has seen a steady increase from 22.6 mha in 1950–1951 to 93.95 mha in 2002–2007. With the increased production levels, India is now self-reliant in food and has been able to meet the needs of the increasing population over the decades.[2]

In the second phase, during the 1970s and 1980s, considerable investment was still being directed towards the construction of irrigation assets, but the emphasis was increasingly on on-farm development, extension programs and improved agricultural practices. However, these programs did little to improve the overall irrigation performance, mainly because the quality of service provided by the management agencies was not satisfactory. During the late 1990s, a movement towards PIM that envisaged the involvement of the farmer community began to gather momentum. Substantial efforts were made to increase farmers' participation in various phases of irrigation development and management, primarily through the organization of WUAs.

Figure 7 charts out the progressive efforts made by the government during the last four decades, which have culminated in the search for private investments in the sector.

On the other hand, the desire of the government to reduce the fiscal and administrative burden, coupled with the belief that if given ownership of the land, the users would be able to maintain and utilize the developed assets and irrigation systems properly and more effectively, led to the preparation of specific programs for irrigation management transfer (IMT). It was also felt that users are more likely to pay for the O&M of assets over which they have some measure of control. Since many transferred systems were very large indeed, a system of split transfers was often employed whereby the irrigation service provider would keep the head-works and main system while delegating the responsibility for the secondary or tertiary level systems to the farmers. The first decade of the twenty-first century saw the emergence of PPP in I&D in a modest way, with implications on different

Figure 7: Progressive efforts by the government during the past decades



[2] Madaswamy Moni. 2004. Paper presented at the National Conference on Climate Change and its Impact on Water Resources in India, Madurai Kamaraj University. Madurai. 15–17 December.

existing non-governmental organizational models for managing irrigation systems.

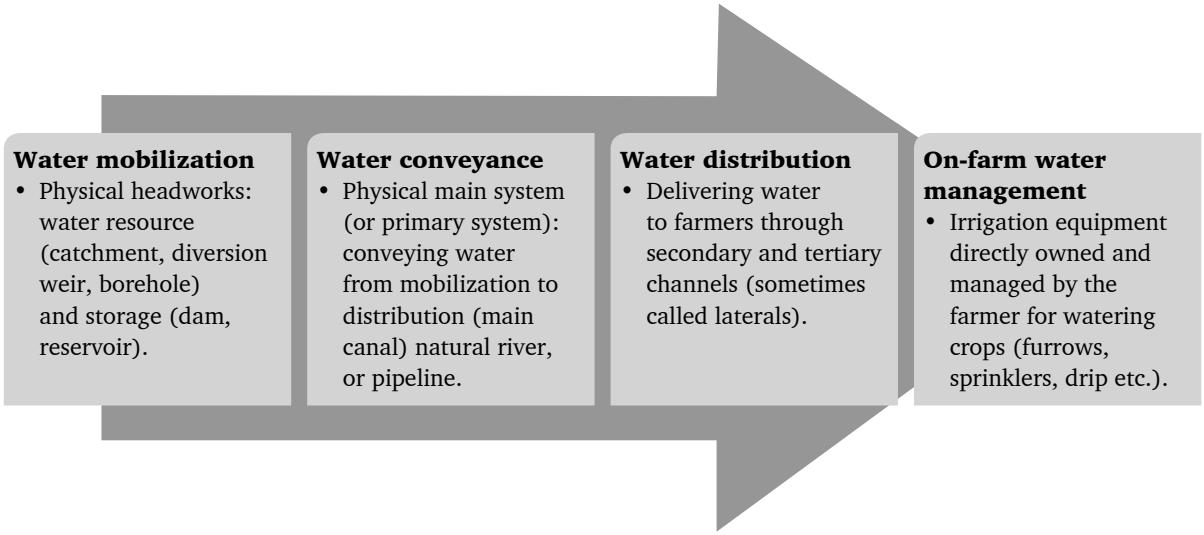
C. Components, Functions and Risks of the I&D System

System classification: In order to appreciate the available opportunities for PPP and associated risks in the I&D sector, a World Bank report[3] broadly categorized I&D projects based on type, components, and functions. 'Type' was further divided depending on who is responsible for the management of projects (individuals or collective formations); the scale of the projects; the source of water being utilized (surface, ground or conjunctive use); whether the project is based on the farming of cash crops or subsistence crops; and the source of funds (private or public) for the development and management of the projects. The category of 'components' has been subdivided depending on projects meant for water mobilization (headwork, diversion, storage, borehole); those based on water conveyance or distribution system (canals—primary, secondary or tertiary systems); and water delivery system for distribution of water to farmers. 'Function' includes investment functions (decision to invest, project financing, design, and implementation); governance functions (allocation, monitoring, supervision, regulation, and control); O&M function (water allocation, service, and system maintenance); and agriculture production function (water to create value). There could thus be thousands of permutations and combinations of types, components or functions, which suggests the diverse nature of each I&D project for which PPP opportunities would be equally diverse. The report also suggests that I&D projects all over the world are largely being managed collectively and publically in an integrated manner; and they mainly require improvements in efficiencies. This does, however, pose several risks when it comes to PPP, which could restrict its role in improving efficiencies within the sector.

I&D system: The I&D system comprises of four successive components, as shown in Figure 8.

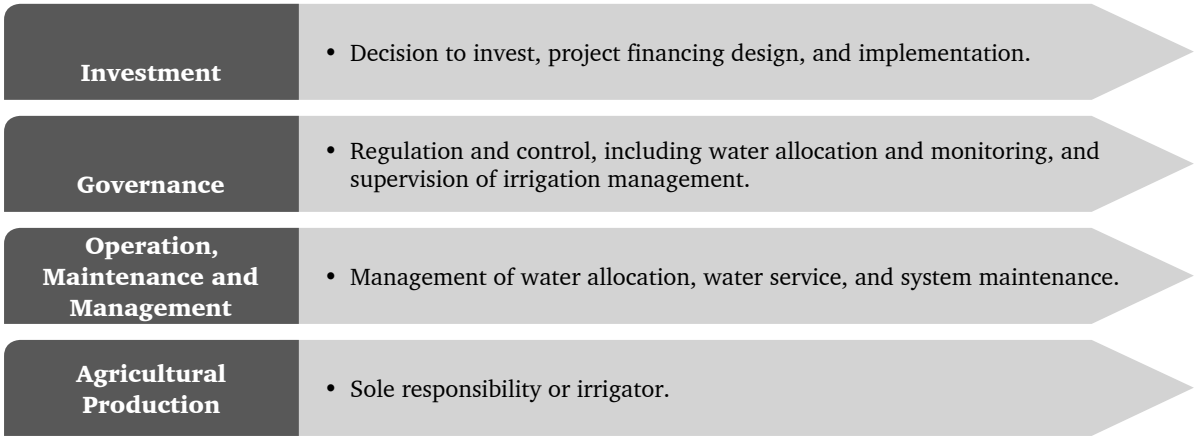
I&D functions: The functions of an I&D system are given in Figure 9.

Figure 8: Components of an irrigation system



[3] World Bank Group. 2007. Emerging Public-Private Partnership in Irrigation Development and Management. Water Sector Board Discussion Paper Series Paper No. 10.

Figure 9: Functions of an I&D project



Risks: The principal risks involved in the sector along with the recommended mitigation mechanisms are explained below:

- The serious political and social implications associated with water, food, and agricultural production make for high country risks while devaluation and export market risks are also relevant. Possible mitigation mechanisms include government risk guarantees, the involvement of international financial institutions, matching currencies, and third-party partial risk guarantees.
- Commercial risks include the failure to recover the (usually high) user fees from farmers, while business risks refer to the insufficiency of farm produce. In order to mitigate these risks, steps could be taken during the tariff indexation and resets, or at the commencement of the contract, by granting a grace or transition period. Other possible mechanisms include government guarantees, and financial third-party partial risk guarantees.
- Climatic conditions or competing demands from domestic or industrial sectors may reduce water availability during the contract period. The recommended protection here would be to have suitable clauses on tariff indexation and resets, government guarantees and termination payments.

D. Essentials of a PPP Contract

1. Defining PPP

There are several national and international definitions suggested by various agencies that have engaged with the concept of PPP:

- DEA defines PPP as an arrangement between the government, statutory entity or government-owned entity on one side; and a private sector entity on the other, for the provision of public assets and/or related services for public benefit, through investments being made by and/or management undertaken by the private sector entity for a specified period of time, where there is a substantial risk sharing with the private sector; and the private sector receives performance linked payments that conform (or are benchmarked) to specified, pre-determined, and measurable performance standards.
- The guidelines for the VGF scheme issued by the MOF define PPP as a project based on a contract or concession agreement, between a government or statutory entity on the one side and a private sector company on the other, for delivering an infrastructure service on payment of user charges.
- The *Scheme and Guidelines for the India Infrastructure Project Development Fund* released by the MOF describes PPP as a partnership between a public sector entity (sponsoring

authority) and a private sector entity (a legal entity in which 51% or more of equity is with the private partner/s) for the creation and/or management of infrastructure for public purposes for a specified period of time (concession period) on commercial terms, where the private partner has been selected through a transparent and open procurement system.

- The Andhra Pradesh Infrastructure Development Enabling Act (APIDEA), 2001, defines PPP as an investment by a private sector participant in an infrastructure project of the government agency or the local authority in the state. According to the act, the concessionaire may or may not charge a user fee, depending on the type of contract and the terms of the specific concession.
- The National Council for Public–Private Partnerships, USA, describes PPP as a contractual agreement between a public agency (federal, state or local) and a private sector entity. Through this agreement, the skills and assets of each sector (public and private) are shared in delivering a service or facility for the use of the general public. In addition to the sharing of resources, each party shares in the risks and rewards potential in the delivery of the service and/or facility.
- The International Monetary Fund identifies PPPs, Government Guarantees and Fiscal Risks as arrangements under which the private sector supplies infrastructure assets and infrastructure-based services that have traditionally been provided by the government.
- The Australian National Public–Private Partnership Policy and Guidelines, 2008, define PPP as a long-term contract between the public and private sectors where the government pays the private sector to deliver infrastructure and related services on behalf or in support of the broader service responsibilities of the government.
- According to the World Bank (2003):

> [T]he term PPP has taken on a very broad meaning, the key element, however, is the existence of a 'partnership' style approach to the provision of infrastructure as opposed to an arm's length 'supplier' relationship…. Either each party takes responsibility for an element of the total enterprise and work together, or both parties take joint responsibility for each element…. A PPP involves a sharing of risk, responsibility and reward, and is undertaken in those circumstances when there is value for money benefit to the taxpayers.

- ADB suggests that PPPs broadly refer to long term, contractual partnerships between public and private agencies, specifically targeted towards financing, designing, implementing and operating infrastructure facilities that were traditionally provided by the public sector.[4]

2. Characteristics of PPP

The broad characteristics of a PPP include a long-term contractual arrangement, optimal risk allocation, focus on output specifications, performance-linked payments, whole life cycle costing, and financing. Figure 10 further elucidates these.

3. Role of the government

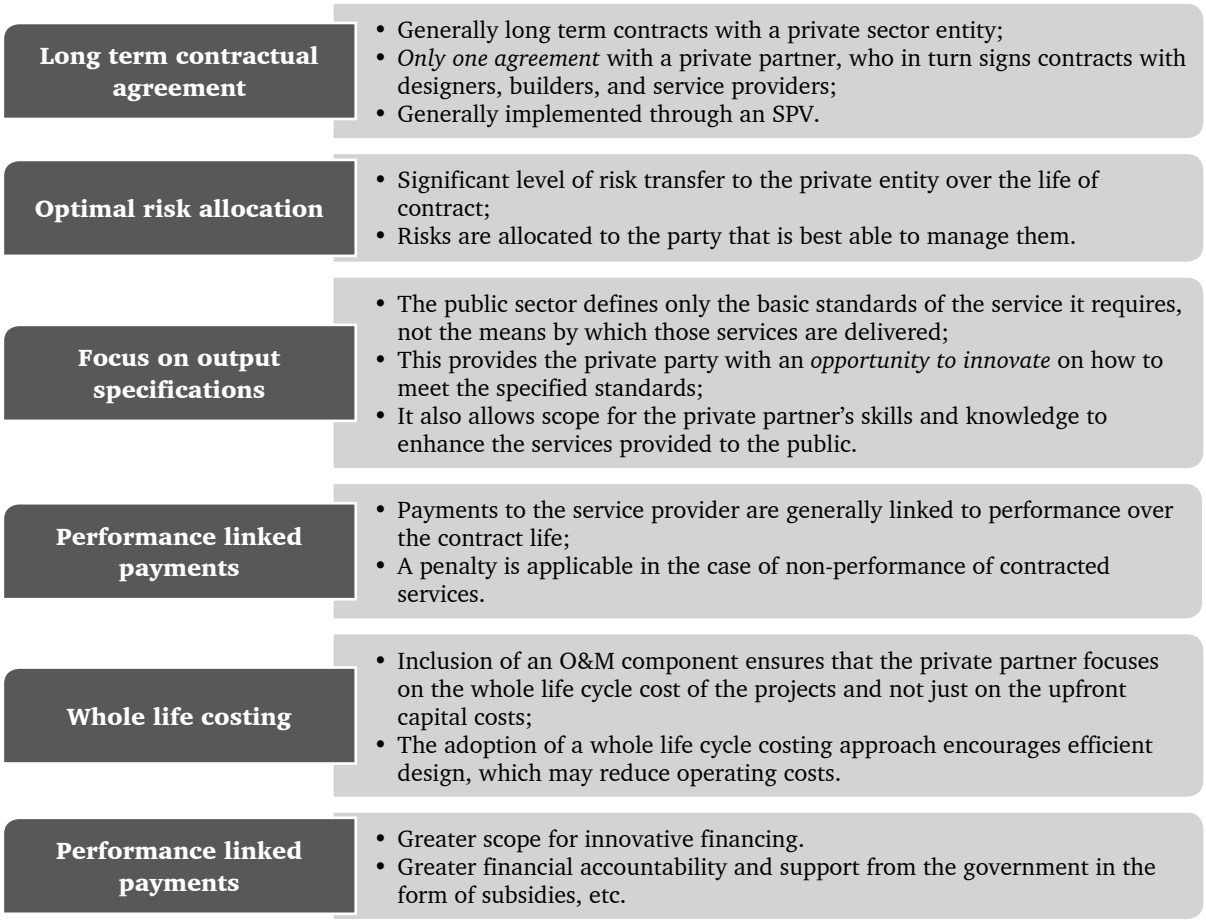
In a traditional public procurement, the government's role is that of an infrastructure and services provider, whereas in a PPP the government assumes the role of a facilitator and enabler for the provision of infrastructure and services. The primary interests of the government in a PPP are harnessing private sector efficiencies (including on-time, on-budget delivery, access to latest technology), augmenting government resources, ensuring value for money and continuity in service delivery (welfare motive), and ensuring compliance of laws (including environment protection, fair tariff setting).

4. Role of the regulators

At present, unlike sectors such as electricity, telecommunications, and national highways which have their own regulatory authorities (Electricity Regulatory Commissions, Telecom Regulatory Authority of India, and the NHAI respectively—though the NHAI additionally performs the role of

[4] ADB. 2000. *Developing Best Practices for Promoting Private Sector Investment in Infrastructure*. Manila. p. 16.

Figure 10: Characteristics of a well articulated PPP model



developer), there are no such authorities (except for state governments when directives are issued to local governments to ensure services, fix tariff, etc.) for water supply, municipal waste management systems, and urban roads. In the absence of an effective regulatory mechanism, a number of difficulties arise in the matters of tariff fixation, quality checks at the service delivery levels, and ensuring equitable distribution amongst the people, especially in the case of water supply, which is currently being looked after by the municipalities to some extent. Therefore, the role of a regulatory authority becomes increasingly critical.

5. Role of the private partner

The private partner takes on the responsibility for the design, construction and long-term O&M. It may also contribute financially through debt and equity issuances. Risks are allocated to parties which can manage them most efficiently. The private partner manages the overall project, and payments, if any, are made to the private player over a long period of time which culminates in the delivery of services and achievement of outcomes under the contract. The interests of the private sector are feasible projects—visibility of profits, fair distribution of risk between government and private entity, transparent laws and regulations, and a stable political and economic environment.

6. Constituents of a PPP structure

The components of a model PPP structure are: (i) scope, in terms of defined tasks and responsibilities, (ii) mode, in terms of variants (alternatives) that are possible under associated risks, (iii) a financing mechanism for investments (public and/or private) as

well as a cost recovery mechanism, and (iv) contract duration for completion of project as well as cost recovery. The key challenge in the composition of a PPP project would be to define a structure that provides adequate economic justification and value for money and is viable from the private as well as public sector perspective.

Scope: The scope of the PPP structure is defined in terms of tasks and responsibilities allocated to the private entity and is related to the respective assets that are to be designed, built, financed, maintained, and/or operated. The scope of the PPP does not have to be same as that of the project identified for the purpose of meeting a specific public objective. The PPP could have a more limited scope, i.e. by excluding certain tasks and responsibilities, thereby making it more attractive or more achievable—in other words, splitting up the project. Alternatively, its scope can be wider than that of the project, i.e. by adding certain tasks and responsibilities that make it more attractive or achievable, for example land development rights or advertisement rights.

Mode: Mode refers to the manner in which PPP will define the nature of the risk allocation (though not in detail) with regard to: (i) demand risks, (ii) construction risks, (iii) performance risks, and (iv) residual value of the risk (relating to ownership issues). The main PPP modes that can be identified are management contracts, lease contracts, and BOT/ concessions and its variants.

Financing and cost recovery mechanism: A vital constituent of the PPP structure, the financing and cost recovery mechanism must address the following key concerns:

- The willingness and ability of the beneficiaries to pay back the fees;
- The dependability (or uncertainty) of the demand for an alternative cost recovery scheme or guarantee;
- Sufficient cost sustainability (through demand) in order to generate revenue for recovering the capital, or the need for VGF;
- The need for regulations in the event of the private collaborator mishandling possible monopolistic characteristics of the project to generate excessive profits; the sharing of profits if they exceed the amount estimated as part of the contract;
- Investment options (both public and private); in case of viability funding, creating a mechanism for government support through guarantees, annuity payments, shadow toll, etc.

Duration: PPPs are typically characterized as long-term arrangements to allow for 'Life Cycle Cost' optimization, i.e. higher construction costs leading to lower maintenance costs and sufficient revenue streams to ensure adequate returns to the capital providers. The duration of the contract is to be typically aligned with the economic life of the asset. Analysis is required to determine the most suitable duration, though alternatively, the duration could be defined as a bidding parameter. It has been observed that this time period can vary. Typically in India, a period of 30 years is taken as sufficient to ensure that the private developer's investment is recovered and that it has also made a reasonable profit from the project. Sometimes the period of concession is regulated by means of a statute, as is the case in Andhra Pradesh, where the APIDEA, 2001, has prescribed a maximum period of concession which is 33 years from the issuing of the land grant to the private party.[5] Model Concession Agreements (MCAs) suggested by the Planning Commission and MOF also provide some guidance in this regard though the exact number of years has to be defined upfront, based on technical factors and financial implications.

Types of PPP contracts: Contracts (typically used for Water and Sewerage Services) are generally for services, management, affermage, concession or cooperative arrangements. The nature of these contracts is outlined in Appendix 6.

[5] Section 2(rr) Schedule V [Clause II(i)(a)] of the act.

E. Private Sector Participation in the I&D Sector: Current Scenario

In the Indian context there have been virtually no examples of PSP in the I&D sector for the provision of services on a long-term basis. Though private contractors have for long been actively involved in the construction of irrigation facilities throughout the country, private sector investment in irrigation and the management of the irrigation system (distribution system) in a project area has not yet been attempted except for the involvement of WUAs in the management of distribution systems, below minor irrigation, which can be considered as limited participation of the private sector. Of late, both central and state governments have been considering an alternate model of service provision so as to enable more efficient and reliable irrigation services to the users. A successful PPP arrangement can be achieved when projects are structured in a manner that attracts private players to invest and manage irrigation projects on a long-term basis. This can be made possible by ensuring the optimum distribution of risks and responsibilities between the government and the private operator. The contract conditions must be structured suitably to not only improve performance but also maintain the profit-based motivation of the private sector.

In a recent study conducted by the World Bank,[3] 21 examples (15 existing and six projected) of PPPs in I&D were analyzed in terms of demand, offer, content, contracts, and risks, followed by four main findings. It was concluded that the demand for private participation in the sector is mostly a government initiative, which means that the department concerned intends to reduce recurrent public subsidies in the management of the I&D system. It has been observed that PPPs offer advantages over public service provision when it comes to project design and procurement. The cost of a project is reduced when it is made open to competitive bidding as private operators are more motivated to accurately assess the costs involved, as compared to planners in the public sector. Another result of this is that the public sector's expenditure over the life of the project is reduced since the onus of designing, building, and operating the facility is on the private operators, who in turn are incentivized to arrive at an optimal balance in the project design and cost of construction, and also ensure timely completion.

Service providers are especially reactive to the needs of users when a project involves private capital infusion in I&D investment. Private operators not only manage to complete construction on time and within the budgeted limits, but are also equipped to deliver more reliable services when compared with their counterparts in the public sector. In a public sector undertaking, all project risks are mainly borne by the government and users of the facility, while in PPPs, some project related risks are transferred to the private operator.

Private operators are sensitive to invest mainly because their risk appetite depends on various factors. These include country risk (devaluation and political environment) and recovery of user fees from farmers. Essentially, therefore, they prefer service or management contracts with special financial allocation arrangements made by the public sector.

1. PPP initiatives in the I&D sector in India

There have been virtually no successful cases of PSP in the I&D sector in India till date, though some states have made attempts in this direction. So far, state governments have led the expansion of large-scale irrigation, but performance has not been as expected and the reforms that have been introduced towards improving efficiency of water service delivery have proved inadequate. The problems of low water use efficiency, high reliance on government financing, and poor standards of management and maintenance still plague the sector.

The NWP, along with several committees, commissions and working groups formed by the MOWR, has encouraged PSP in the I&D sector. Efforts have been made in the states towards the setting up of state-level water regulatory Authorities/Commissions; government orders suggesting the formulation of schemes/projects under a PPP framework indicate a positive role for PPP in the I&D sector in the near

future. So far, though, these are still suggestions and are yet to be taken forward by any state government.

One option that has been tested over the last two decades is PIM involving WUAs in the financing and management of schemes. The logical conclusion of this step lies in irrigation management transfer, by way of handing over the responsibility of scheme operation and maintenance to farmers and their organizations. Although PIM has made impressive strides mainly in Andhra Pradesh, Gujarat, Maharashtra, Madhya Pradesh, and Karnataka, water use efficiency has risen only marginally; there are many areas where O&M is beyond the farmer's capacity. A few of the initiatives taken by the states of Maharashtra, Andhra Pradesh, and Karnataka in promoting private participation in the I&D sector are described in the following section.

Maharashtra: By the end of financial year 2008–2009, there were about 1,050 ongoing MMI projects in Maharashtra,[6] with an estimated balance of cost of approximately $12 billion (Rs543 billion) for creating an additional irrigation potential of about 3.6 mha. The government of Maharashtra (GOMaha) is now facing severe financial constraints that threaten the completion of these projects, and various options, including PPP, are being explored to arrange for the requisite funds. In this regard, the GOMaha issued directions for involving the private sector through a Government Order of 2003.[7] However, these efforts have proved futile given the reluctance of private players to get involved. Reasons include the low returns from water charges alone, while the recovery of costs is restricted to meeting O&M expenses, with no recovery towards any capital cost. The revision of the 2003 Order is under active consideration by the state government.

In 2008, the International Finance Corporation (IFC) was involved in providing advisory services to GOMaha for initiating PPP. A preliminary investigation report on strategic options was prepared, which identified two potential projects for completion through PPP mode. The IFC also undertook a preliminary financial analysis in order to assess whether the project could sustain itself without support from stakeholders. The broad features of the contract would be a design-build-operate framework with support activities for a period of 30 years.[8] According to IFC estimates, the project would not be able to sustain itself and would require considerable support from stakeholders. Due to the ongoing trend of low user charges, and the nature of the customers (users), IFC configured the project as an annuity model. An assessment was also made of the annuity payments. The estimated annuity amount for the two projects as a percentage of the project cost is of the order of 10.5% and 15% respectively. This amount was considered high by the stakeholders. In addition, the resolution of the GOMaha, as stated above, does not provide for the recovery of capital expenses from the water users. In the annuity structure, the recovery of the capital expenses and the other O&M expenditure were intertwined and could not be easily separated. GOMaha has decided not to proceed with this model as it felt that further assessment was required and more alternatives needed to be explored.

GOMaha decided to explore other PPP options being developed by the irrigation departments and corporations. The MKVDC is presently engaged in identifying possible areas for generating additional revenue through the involvement of private investors, and is shortlisting potential projects that could be taken up under a PPP arrangement. It also intends to develop a DPR for the implementation of an

[6] The ultimate irrigation potential of the state from surface water resources has been assessed as 8.11 mha [state sector schemes of WRD (area more than 250 ha)-6.16 mha and local schemes (area <250 ha)-1.95 mha] and irrigation potential created up to March 2009 is 5.99 mha (state sector schemes-4.63 mha and local schemes-1.36 mha).

[7] Government of Maharashtra resolution no. 702/(425/02)/MP-1, dated 15 July 2003, regarding the completion of various irrigation projects through private entrepreneur(s)/contractor(s) on BOT basis.

[8] Some other features of the PPP model include depositing the revenue generated in a dedicated escrow fund for the purpose of long term O&M; to tap the rise in land taxes caused by the irrigation of the land; to generate additional revenues from other associated activities such as recreation, fishing rights, etc.; getting the government to agree to an annuity payment and such O&M subsidies as would be defined in the contract; to secure annuity by an underlying guarantee fund established through multilateral financing mechanisms; to explore the potential for obtaining VGF from the Government; and to guarantee the rights to construct and provide irrigation equipment, technical assistance, and marketing rights to private consortium partners.

ongoing project on pilot basis. An analysis of one of the projects has been carried out by the authors in order to assess the potential sources of revenue which could be included to make the project viable for implementation through PPP mode. The same is elaborated in Chapter VIII.

As part of the reform process, the MWRRA is in the process of finalizing the water entitlements of users, which can be traded like other commodities; it is also proposing to set up trading houses for the trading of these water entitlements among farmers as well as other users such as industries. It also anticipates investments from private players towards the setting up of such trading houses that can collect brokerage charges from the users in return.

Other possible areas where PPP is being opted for include: (i) assessment and improvement of water use efficiencies, (ii) promotion of cost effective water saving technologies for recycling and reuse of domestic and industrial effluents, and (iii) installation of solar panels all along irrigation canals for generating electricity which could be directly used by the farmers of the command area.

Andhra Pradesh: The Irrigation and Command Area Development (I&CAD) Department, GOAP, has taken up a massive program for the development of its allocated share of water resources through about 86 MMI, ERM, and flood protection schemes. An estimated cost of about $40 billion (Rs1,800 billion) is required for creating an additional irrigation potential of about 4.4 mha, out of which $12 billion (Rs540 billion) has been spent so far. Huge financial constraints now threaten the completion of the remaining work and the GOAP is exploring various options for generating the requisite funds to complete the ongoing projects.

These projects have been taken up under an EPC contract for their expeditious completion so that the targeted goals are achieved in a time-bound manner.[9] One of the features of the contract is the inclusion of the O&M of the project for a period of two years when it comes to the gravity canal systems and 5–15 years with respect to LISs.

The I&CAD Department is planning to undertake a project for developing a 320 MW hydropower component, for which a BOT-based annuity model is being considered, along with O&M for 15 years under an EPC contract, for the operation of the LIS.

As part of the water sector reform process, the I&CAD Department has made significant efforts towards setting up the APWRRC as well as creating farmers' organizations at minor distributaries and at the project level. It has taken initiatives for empowering the farmers' organizations to provide inputs (supply of seeds, fertilizers, pesticides, etc.) and output services (processing, storing, transportation of produce, etc.), and also seeks the involvement of stakeholders in the O&M of the irrigation system. In addition, the state government is exploring various other options for PSP in the sector.

The I&CAD Department has conceptualized a model for implementing a number of LISs, whereby private irrigation service providers would demonstrate improvement in existing (low) water use efficiencies through various measures such as canal lining in selected critical reaches, improved agricultural practices, and providing a micro-irrigation system[10] in a selected command area of the LIS. This would cost approximately $2.7 billion (Rs120 billion)[11] and would involve activities such as power generation, development of agri-business value chain, provision of micro-irrigation system, etc., through the participation

[9] The agency (contractor) was made responsible for carrying out all the related surveys and investigations and preparing the hydraulic design of canals and other structures; preparing land plan schedules required for acquisition; procurement of machinery, material and men and completion of construction activities as per agreed milestones, while duly maintaining quality standards in accordance with the Bureau of Indian Standards (BIS) and other guidelines. The package size ranges between $0.45 and $1.1 billion (Rs20–50 billion).

[10] A drip and sprinkler irrigation system with zero or low energy requirements is under consideration, with the involvement of private partners. Initially, four pilot projects have been planned by the Jain Irrigation Systems Limited and Netafim Irrigation India Private Limited on an area of about 80–100 ha each. Micro-irrigation will help save costs of lifting water as well as water which can be used for the second crop. It seems that the project has not been completed due to insufficient resources and other constraints.

[11] The LIS is expected to irrigate 0.26 million ha by utilising 22.25 BCM of water. The power required for these LISs is 8494 MW, which will put tremendous pressure on not only the existing power capacity (12,427 MW) but also on future expansion. Hence it was recommended to have

of private players as well as farmers' organizations at the distributary level. The revenue model considered for this project is based on various forms of subsidies from the government and the returns to the private players are to be linked with the improvement in the efficiency of the system. If this option is found viable, it could potentially be replicated in other similar schemes in the future. The success of this project can only be determined once it has been fully conceptualized, studied in detail, and subsequently implemented.

Another option is the replacement of the existing inefficient pumps in the LIS with more efficient pumps that are currently available. A study undertaken by the USAID, Department of International Development (Government of Britain), and the Bureau of Energy Efficiency (BEE) (Government of India) has revealed that the investment cost for replacing old pumps can be recovered in about three years through energy saving measures. The requisite proposal for this replacement operation is under consideration by the state government. The scheme is proposed to be implemented through private partners who will be paid a fixed amount based on certain norms to be fixed by the government. The energy saved from irrigation can be sold by the energy distribution company to industrial or other consumers. While it remains to be seen how successful this project could be, it may still be possible for the private sector to recover the cost of energy efficient pumps in installments with the active participation of WUAs. It would be harder to recover costs by increasing the water rates as those are anyway seldom paid by farmers in many states.

Karnataka: The state of Karnataka has completed 52 MMI projects, while 45 are either ongoing or in the pipeline. Another 4,491 MI projects are currently using surface water; these consist of minor irrigation tanks, bhandaras (ponds), barrages, and lift irrigation systems using water from rivers and streams and groundwater from dug wells and bore wells. These projects are mainly taken up as construction contracts where the methodology for selection and procurement is as per the Karnataka Transparency in Public Procurement Act, 1999. The main issues faced in the implementation of projects in Karnataka include belated construction due to delays in land acquisition (leading to cost and time overruns), incessant or unpredictable rains, late payments to contractors, and poor monitoring during and after construction.

A considerable amount of work has been undertaken towards implementing the IWRM in Karnataka, notably in developing the State Water Policy (SWP) and other reforms such as promoting and supporting PIM, strengthening the Water and Land Management Institute, and the setting up of WUAs. Barring some cases in the Belgaum district, WUAs have not been very successful in the state, mainly due to disparities between the tail and head reaches of a canal, water losses, improper drainage, waterlogging and salinity, absence of water audits, non-payment of electricity charges in lift irrigation projects, and changes in stipulated cropping patterns.

The employment of PPP in the I&D sector has not been attempted in the state due to lack of private interest given the low cost recovery from water charges alone. The WRD is of the opinion that PPP is not a feasible option in the I&D sector as users perceive water as a social good and a gift of nature, not a commodity. This perception needs to be changed. The state is gradually considering the involvement of private players (mainly NGOs) in the areas of Operations, Maintenance and Management (OMM), initially without any profit motive, and slowly progressing towards partial/full cost recovery models. Through IWRM, the government of Karnataka is contemplating whether the Nigams, which function as commercial entities, can be privatized, fully modernized, and thereby be made an option for PPPs themselves.

Uttar Pradesh: The government of Uttar Pradesh has planned to develop eight-lane expressways along the river Ganga and the embankments of the Upper

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a separate power project based on gas to serve the LIS and SEZs exclusively. Also being contemplated is the setting up of a multiproduct SEZ with agri-based focus, to use the raw produce from the agricultural land irrigated by the LIS, which will help avoid wastage of food produce, and also save on storage costs. The SEZ will use the power generated from the power project situated next to it. The SEZs will also provide employment opportunities to both unskilled and semi-skilled local public.

and Middle Ganga Canals, and is also considering generating hydropower on the Upper Ganga Canal at seven locations through PPP initiatives.[12]

As mentioned earlier, most Indian states have not yet made any substantive efforts towards garnering private sector support for the management and improvement of the I&D sector. The few that have attempted it have concentrated more on user participation[13] rather than inviting private investments, efficient management practices and technological improvements. A few countries including Egypt, Morocco, Brazil, and Ethiopia have successfully experimented with active participation of the private sector and the involvement of users in the development of the I&D sector. After a study of some of the PPP initiatives in India and abroad in the area of industrial water supply, urban water supply, abstraction of bulk water, contract farming, and irrigation projects, certain lessons have been identified which could lead to better structuring of successful PPP projects in the I&D sector in India.

2. Experience with PPP in the water supply sector in India

The participation of private players in areas such as the urban drinking water sector has been a low-key affair, as opposed to other infrastructure services such as roads and telecommunication. Though there have been several attempts by the respective state governments in the cities of Hyderabad, Goa, Pune, Cochin, and Tirupur among others, to involve the private sector by means of build-own-operate-transfer (BOOT) contracts,[14] these have met with limited success. The main reasons attributed to this are: (i) lack of adequate project development; (ii) projects not being bankable; (iii) most of the projects were operator-led rather than government/ULB-led, which, in the absence of adequate project development, caused protracted negotiations, further resulting in difficulties during project implementation; (iv) procurement issues—most of the projects are based on negotiated contracts and are not processed through competitive bidding procedures; (v) concerns regarding the assurance of payments to the private operator; (v) low tariff regime; (vi) lack of credible information about the existing assets; and (vii) lack of government support and political will.

The **Vishakhapatnam Industrial Water Supply** (VIWSP) (2003–2004)[15] is an innovative initiative for the development of infrastructure in industrial, domestic, and irrigation water supply taken by the Andhra Pradesh Industrial Infrastructure Corporation Limited in partnership with Infrastructure Leasing and Financial Services.[16] The overall cost of the project was $88.9 million (Rs4,000 million).

This is the second mega project in the water sector and the first of its kind in India to have been commissioned under a PPP arrangement on commercial basis. Its overall impact has been an increase in efficiency in the use of water for different purposes including agriculture. The augmented canal capacity was used to supply irrigation en route. What is commendable about the project is the participation of stakeholders including beneficiaries throughout its life. The achievements of the projects include: (i) motivated and dedicated team efforts by technical, managerial, financial and legal experts, (ii) detailed program implementation process featured on detailed project life cycle, (iii) timely completion, and (iv) effective integration to meet regional requirements, and innovative financial packaging including risk mitigation. The specific socio-economic benefits were: (a) to address the waterlogging problems caused by seepage from the canal and intensification through multi-cropping,

[12] 2010. *Dainik Jagaran* (Hindi) (Lucknow Edition). 8 August.

[13] The involvement of WUAs under water sector restructuring projects initiated by the World Bank has been the main agenda for water sector reforms in these states.

[14] Delegated management contracts.

[15] http://www.ilfsindia.com/downloads/bus_rep/visakh_industrial_rep.pdf

[16] Under VIWSP, 520 million liters per day (mld) bulk water is supplied to a combination of green fields, developing industrial and economic zones in Visakhapatnam; these include SEZs, Pharma city, Gangavaram port, and additionally meeting the requirements (to the tune of 206 mld) of existing bulk consumers like Visakhapatnam Steel Plant, Simhadri Power Plant of National Thermal Power Corporation and Visakhapatnam Municipal Corporation (VMC) from the Yeleru left bank canal system.

(b) rehabilitation of the canal resulting into enhanced capacity of the canal for irrigation and other uses, and (c) meeting long term shortfall of 182 mld for the city of Visakhapatnam, which is likely to be the second IT hub in Andhra Pradesh.

24x7 demonstration projects in north Karnataka (Urban water supply): The Karnataka Urban Water Supply Improvement Programme (KUWASIP), funded by the World Bank, was initiated in 2003 in order to improve the existing water distribution systems in a few demonstration zones in the cities of Belgaum, Gulbarga, and the twin cities of Hubli and Dharwar. Under this program, a private operator (Veolia) was selected, and on 7 March 2005, Karnataka Urban Infrastructure Development Finance Corporation, Karnataka Urban Water Supply and Drainage Board, and three ULBs entered into a management contract. According to the contract, the operator was delegated the responsibility of improving the existing distribution system in the pilot zones and manage the O&M of the system. The contract period was three and a half years, with a performance-based fee model for the operator. While the capital investments were made by the government agency, the work was carried out by the operator under the supervision of a Technical Auditor, who was present during the entire duration of the contract. The project has been considered a success as the operator managed to bring about technological improvements in the system and increase the billing and collection efficiency, all of which have resulted in improved revenues to the ULBs, and a substantial reduction in losses (from 50% to about 3%); consumers who were earlier supplied water once a week now enjoyed 24x7 water supply, and due to the improved pressure, they no longer need to pump water to their overhead tanks. The operator has also benefited from the performance-based fee model and had to assume only technical risks in the project.

Experience in Kerala (Abstraction of bulk water): There have been a few failed attempts with private sector players. The state government allowed a private company to draw water up to 200 mld from the river Periyar, treat the same and distribute it to industries, commercial establishments, and bulk consumers in the Greater Cochin Area. The company was to be granted exclusive rights at an estimated cost of $73.3 million (Rs3.3 billion) for a period of 20 years. Similar projects were announced by the government in the Palakkad district in the industrial areas of Kanjikode and Pudusseri. However, all of these projects as well as similar ones in Guruvayoor, Kumarkom, and Kovalam, were later abandoned by the government due to local resistance against events taking place elsewhere in the state. In 2002, the multinational soft drink manufacturing company Coca-Cola was allowed to utilize groundwater for factory. The people of Plachimada in the district of Palakkad rose in opposition as this deprived them of water supply. Another reason was that the environment around the factory was being polluted. Due to excessive mining, the groundwater had been contaminated with disproportionate amounts of calcium and magnesium from the dissolution of underground limestone deposits. About 100 people suffered from repeated stomach aches due to consumption of polluted water. While the local body supported the people and laid stringent conditions on the company, the state government initially favored the company. The venture entered into a difficult legal hurdle. The government of Kerala passed a bill for the establishment of a Special Tribunal for the expeditious adjudication of disputes and recovery of compensation for the victims from the Coca-Cola unit in February 2011. In November 2011, the Kerala government notified the land on which Coca-Cola unit was located, which implies that the unit will now have to seek additional clearances in order to draw groundwater under the Kerala Groundwater (Control and Regulation) Act, 2002. In light of the existing water scarcity in the area, it seems unlikely that Coca-Cola will be granted permission to use groundwater.

3. Experience of contract farming in India

Contract farming[17] is fast emerging as a refined marketing alternative to the present mandi system followed in many Indian states. It has the

[17] Contract Farming could be defined as an agreement between farmers and a sponsor, who could be an exporter, processor, and/or a marketing firm.

advantage of combining the efficiency of the small farmer, utilizing corporate management skills, providing assured markets, and reducing input costs. This approach has been quite successful in crop diversification, arresting the depletion of groundwater, saving energy, saving agro-inputs, conservation of scarce water, introducing improved technology, providing easy credit to farmers, and assured purchase of produce by the company.[18] The services rendered by the private partners generally range from providing inputs like fertilizers, seeds, pesticides, and extension services, to quality monitoring and the assurance of buying the produce from farmers. The system has definitely led to an increase in production, productivity and the area under cultivation, improved the quality of produce, enhanced participation of farmers, etc. Two models of contract farming, one in the private sector and the other in PPP mode, are described below:

Onion Dehydration Project, Maharashtra: India is the second-largest producer of onions in the world, with the production of 5.46 million tons per year, covering 0.48 million ha. Maharashtra alone produces nearly 25% of the onions in India. The majority are grown for fresh markets. The variability of the climate often causes large-scale damage to the crops, resulting in the escalation of prices. Horticulture producers in general and onion producers in particular require optimal sustainability in production control in terms of inputs and marketing prices.

PepsiCo–Tropicana Project in Punjab: In order to encourage crop diversification and thereby break the vicious wheat–rice cycle which is responsible for lowering the groundwater table beyond critical levels, the Council for Citrus and Agri Juicing in Punjab of the Punjab Agro Industries Corporation (PAIC) conceived a program for the Tropicana fruit juice project of PepsiCo, USA and Punjab.[19] The alternative under consideration was that of more economical horticulture development, with improved varieties of Kinnoo and other fruits. Since the government of Punjab (GOP) did not have enough processing units or the requisite varieties of fruits, the PPP mode was adopted in order to invite Tropicana (part of Pepsi Foods) to bring in new varieties. In 2002 an agreement was signed with Tropicana under which the cultivation of citrus fruits was to be increased from 50,000 ha to 200,000 ha. Tropicana brought in the best varieties of citrus from Spain, USA, and South Africa. PepsiCo and PAIC have also jointly set up a greenhouse at the Agriculture Research and Development Centre (ARDC) in Jalandhar to

Box 2: Onion and Fruit Contract Farming, Maharashtra

Jain Irrigation System Limited (JISL) has established an onion dehydration and fruit processing plant in Jalgaon, Maharashtra. It is a 100% 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 (Gram Sewaks) 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% 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 the most modern processing facilities to produce the finest quality of 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.

[18] R. C. Jain. *Regulation and Dispute Settlement in Contract Farming in India*. http://www.ncap.res.in/Contract_%20farming/Resources/16.5%.20.RCAJain.pdf

[19] http://www.punjabagro.co.in/councils.html

encourage and commercialize citrus cultivation. The experiment involves setting up greenhouses, R&D, experimentation with numerous combinations of field trials, and includes capital expenditure. Given the need to protect the interests of thousands of farmers involved, this could certainly not have been a purely private venture. As a result of the joint efforts of Pepsico, GOP and the farmers, multi-processing plants are already coming up. This is one of the successful examples of a PPP where the capital investment in land, and infrastructure was offered by the state while the private sector contributed in terms of O&M and other technical support including international experts. In turn, all three partners gained from the project. The project also helped arrest groundwater depletion.[20]

4. International experience with PPP in the I&D sector

A few case studies on international experience with irrigation PPPs[21] are given below:

Pontal Project, Brazil (Faster social and economic development): In order to hasten the process of development in the Sao Francisco Valley, the Government of Brazil decided to invite private participation in the agriculture sector in June 2009. The private parties were granted the right to manage agricultural lands belonging to the farmers and to provide appropriate logistic support for the movement of agricultural produce in a more efficient manner. Before this, the public irrigation projects in Brazil had not been self-sustaining; a significant portion of the land in the country had been idle; the operations and maintenance of the irrigation systems were ineffective and intermittent. Due to all these factors, small farmers frequently faced insolvency.

The Pontal Irrigation Project is located in the city of Petrolina, a semi-arid region in the state of Pernambuco in northeastern Brazil. Expertise was sought from the private sector for the implementation (construction and operations) of the irrigation infrastructure that would be necessary to develop the land. In turn, the project was expected to provide two business opportunities for the private partners—first, the development of agriculture, whereby the sale of agricultural products translates into revenue earnings and second, the development of infrastructure, which gives them the right to sell water to the users. The government contributes by way of providing access to the existing irrigation infrastructure, land and annual payments. The private party is to incur expenditure on agriculture investments, provide water, and invest in operations for common irrigation infrastructure. The area covered under the Pontal project is more than 180,000 ha.

Codevasf is the development company under the auspices of the Federal Ministry of National Integration that is responsible for selecting the private party through a competitive bidding process. Codevasf is to transfer the operation of 33,526 ha of land—out of which 7,717 ha is to be considered as irrigable land—to the private sector for 25 years. Crop selection is the prerogative of the farmers with a few agricultural restrictions, though without any governmental intervention. The responsibilities of the private operator include managing the occupation of the land, taking care of agriculture production, completing the construction of the main channel, and operating and maintaining the same according to specified performance standards, for a period of 25 years. The main canal has been partially built by Codevasf and a number of pumping stations are operational. According to the main contract, the tariff is to be set and charged by the concessionaire to the land users. The government has set the roof tariff, which is to remain fixed (land) at R$785/ha/year while the variable (water) is R$2,200/1000 m^3. The maximum payment by the government to the private partner has been fixed at R$202 million throughout the 25-year contract. There is also a price adjustment clause in the contract with annual tariffs and government contribution in accordance with the Brazilian Consumer Price Index (CPI). Land is to be transferred to the private party at no cost. The highlights of the project include a short-term payback

[20] SWaRA. 2009. *Public and Private Partnership in I&D Sector in Uttar Pradesh: A First Concept Paper*. Lucknow.

[21] The context of South Asia differs given the higher percentage of share choppers, mono culture of paddy rice or low value crops, and unautomated and unmeasured irrigation supplies, resulting in vastly contrasting conditions.

period and a highly attractive IRR; Banco do Nordeste have offered to provide the financing.

Megech–Seraba Irrigation and Drainage Scheme, Ethiopia (Supervision of construction and O&M contract): This is a performance based management contract with a term of up to 8–10 years. It envisages the provision of services for the supervision of the construction of the Megech–Seraba irrigation scheme, post-construction O&M for the primary and secondary irrigation infrastructure, and support for establishing an irrigation WUA to operate the tertiary systems. The overall objective of the government is to increase the agricultural output and productivity in the Megech–Serba and Ribb Project areas, in a sustainable manner. The Megech–Serba irrigation scheme involves the construction of a surface water conveyance system that extracts water from Lake Tana and distributes it to farmers in the Serba area of about 4,000 ha of West Megech River.

The government is supposed to finance the project, including the procurement of infrastructure and related equipment from the pumping station through main, secondary, and tertiary canals to field level. The financing and construction of irrigation works at quaternary field level are the responsibility of the farmers, but it is expected that some direction and support will be given by the regional government. WUAs are also being formed. It is expected that cost sharing will be achieved through collection of user fees, although this is expected to be tapered in as the benefits of the system are reaped by the farmers. Bidders for the Megech PSP project will be required to indicate the minimum fee levels they will need for their various tasks and responsibilities, against milestones and key performance indicators. This fee system will be performance based. This will form an important part of the bid evaluation criteria. The project, which is a subproject of the Ethiopian Nile Irrigation and Drainage Project (ENIDP), funded by the World Bank, is at the bid stage (as of 4 December 2010[22]), whereby the bidders have been asked to demonstrate that they meet the mandatory qualification criteria which will be assessed on a pass/fail basis.

The West Delta Project, Egypt (Conservation of groundwater): In the West Delta region in Egypt, the incipient PPP scheme in irrigation is based on the full cost recovery approach by way of levying tariffs on users. This reflects both the scale and commercial orientation of the farmers, as well as the PPP objective of financial sustainability. The area consists of about 107,000 ha of 'reclaimed' desert land that was rapidly developed for agricultural use over 15–20 years. There are about 960 farmers and the average farm size is 112 ha. However, there is wide variation in farm sizes with the largest of the 30 farms occupying almost 50% of the land area. These farms are unevenly distributed geographically, with large holdings mainly situated towards the south. The main crops are high-value fruits and vegetables, which are largely meant for export purposes. The agricultural income is estimated at US $300–500 million (Rs13.5–22.5 billion) per year, which comes to an average of $0.5 million (Rs22.5 million) per farm.

The primary objective of the PPP arrangement in the West Delta region was to stop the rapid depletion of groundwater in a financially sustainable manner. Therefore, a Design-Build-Operate (DBO) contractual framework was adopted on full cost recovery basis. The concession contract covers an area of around 80,000 ha in the southern part of the West Delta area. The concession period is spread over a period of 30 years. The main features of the PPP scheme are as follows:

- Private operators have been invited to design, construct, and operate a closed conduit system in the project area.
- The investment and operating cost requirement for the initial project area was estimated at $200 million (Rs9 billion), 15% of which is required as equity from the private operator. The remaining 85% is to be made available through on-lent donor support, largely comprising of a loan of $145 million (Rs6.525 billion) by the International Bank for Reconstruction & Development (World Bank).
- Since willingness to pay was concentrated among the larger farms, the system was reconceived

[22] 2010. *The Ethiopian Herald*. 4 December.

on a phased basis, with an initial development area of around 40,000 ha. The highest-demand areas and farmers would therefore be connected first, thereby mitigating the demand risk. Rules were laid down for how other farmers could subsequently join the irrigation scheme.

- The O&M costs of the West Delta Project are to be recovered from connection and service charges as well as from the land development near Sadat City.
- Payment by farmers is based on a two-part tariff, with fixed and variable components designed to fully cover investment and operating costs respectively.
- An additional $8 million (Rs360 million) by way of World Bank funding has been approved for institutional development and farmer capacity building.

While an open-channel irrigation system is generally considered to be the most desirable and cost-effective choice, the World Bank study found that a number of important considerations about construction cost led to a reevaluation of the conventional logic. Besides the fact that the difference between the costs of an open-channel and piped system was less than previously thought, a piped system was found better suited to the service needs of the farmers in the area.

Bidders from the People's Republic of China and Egyptian/European consortia participated in the pre-qualification processes, and were then invited to prepare financial proposals. The bid parameter was the lowest average tariff that could be charged from the users.

The funding for the project was provided by the World Bank in the form of a loan to the Ministry of Water Resources and Irrigation (MWRI). The government party to the PPP contract was required to set up a holding company that would own the assets, take the liability for long-term debts, and also carry the currency risk. The structure of the project was such that the government was to lease the final design, construction, and operation to a private operator who would assume both demand and commercial risks. The private operator was to provide the equity capital. The government would charge a lease fee equal to its debt service in addition to a premium for the currency risks. The MWRI would act as a regulator and take responsibility for water allocation and the enforcement of farmers' rights and service standards. The risks of the project were fairly distributed between the stakeholders, as shown in Table 11.

Table 11: Types of Risks and Risk Allocation

Type of risk	*Operator*	*Government*	*Farmer*
Demand	✓		
Planning and design	✓		
Construction	✓		
Operational and commercial	✓		
Water resource			✓
Foreign currency		✓	
Debt financing		✓	
Credit		✓	
Equity financing	✓		✓
Inflation			✓

Source: World Bank. 2007. Water Sector Discussion Paper 10.

A project management unit is responsible for the contract design, procurement, and management. A regulatory office within the MWRI has been made responsible for contract monitoring and enforcement of the relevant provisions of the contract. The unit is supported by an independent panel of experts whenever necessary. The commitments of the MWRI under the contract include the provision of a fixed water resource allocation.

A Water User Council (WUC) has been established as an independent farmers' organization by a Ministerial decree, pending the appointment of a more permanent user group once the participating farmers have been identified and can hold elections. The WUC has been involved in project preparation and is to play an informal role in contract monitoring.

Guerdane Irrigation Project, Morocco (Efficiency improvement with active participation of users): Farmers in the Guerdane area in Morocco operate on a smaller scale, and affordability of the irrigation service is a major concern. The PPP arrangement in Guerdane includes a public subsidy which covers approximately 25%

of the total project cost, with the remaining cost of investment and operations to be recouped through user fees.

The Guerdane area spans 10,000 ha in the arid Sous-Massa region in southwestern Morocco. The 670 farms, with an average holding size of 15 ha, largely comprise citrus groves. The produce is meant for the domestic market as well as export. Over-exploitation of groundwater through private wells has led to rapid diminishing of the groundwater level and, as a result, some of the wells and farms are drying up entirely. The cost of pumping water has also dramatically increased. The primary objective of the government in seeking PSP is to make surface water accessible and affordable to the largest number of farmers.

A Design-Build-Transfer-Operate scheme based on a 30-year concession contract was designed, with the following characteristics:

- The private operators are responsible for the construction and are to substantially finance the project. Upon completion of construction, it was decided that the infrastructure was to be transferred back to the state and the private operator would be responsible for the operations and maintenance of the developed assets.
- The total estimated project cost is $105 million (Rs4.73 billion); the government subsidy is about 24% of the cost. The private operator has access to a further $25 million (Rs1.13 billion) of government funds by way of soft loans and is responsible for mobilizing the balance of the investments.
- User payments comprise an upfront subscription plus a variable component, designed to minimize the risk of non-payment.
- Farmers are expected to make advance subscriptions, so as to mitigate the demand risk. This cost has been worked out at approximately $840 (Rs37,800)/ha. Construction would not need to begin until 80% of contribution is subscribed/paid for by the users, which would raise an expected revenue of $8 million (Rs360 million).
- Since reliability of water supply is considered a major project risk in this drought-prone area, contract provisions ensure that this risk is shared between the parties. The revenue deficit of the private party due to water shortages is limited to 15% of normal volumes. The remaining potential loss is borne by the water users, through tariff surcharges of up to a maximum of 10% and beyond this, by the government.

Representing the government is the Regional Rural Development Agency of Souss–Massa (Office Regional de Mise en Valeur Agricole du Souss–Massa or ORMVA–SM). This agency works under the Ministry of Agriculture and Rural Development. The contract commitment of the government to provide a minimum allocation of water is supported by an intra-government contract between the contracting authority, ORMVA, and the regional water authority.

By means of competitive bidding, an international conglomerate led by the Moroccan group Omnium Nord-African was selected in 2005. Based on the total project cost it was worked out that the water unit price was 20% lower than the expected cost and the competing bid. Contracts were signed between the government and the private operator in 2005. User subscriptions commenced in 2006, and elicited a strong positive response. Nearly 95% of the farmers had subscribed before construction began in 2007.

F. Lessons Learnt

The important lessons learnt from the successful Indian case studies are:

- Governments have been increasingly looking at private participation in the distribution sector rather than at the bulk level, barring a few cases such as the desalination project in Tamil Nadu and the recent Naya Raipur capital city project. The pattern seems to be of expecting private operators to make improvements in the existing systems through technological innovations and efficient management while the capital risk is borne entirely by the state/local governments.
- Typically, there are only a few private operators in India who are involved in the water sector. These operators tend to bid for several projects, often in

collaboration with international operators. They also seem to be sensitive to the commercial risks and are relatively more comfortable with bearing the collection risk. Where Indian operators are involved, there seems to be lesser political interference and NGO activism is less vocal.

- The PPP initiative has higher chances of success if the government continues to provide financial support for a longer period, especially by way of capital investment. For instance, projects like those in Salt Lake and Mysore have been successful because of initial funding from the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) scheme and multilateral funding in the case of four towns in Karnataka and Latur in Maharashtra. Experience shows that having a volumetric tariff policy, financing water and energy audits, and undertaking adequate technical studies prior to operator selection are crucial for the success of a project.
- Contract structures should involve a balanced risk-sharing mechanism, as was done in the Salt Lake, Latur, and Karnataka projects. To summarize, as has been demonstrated in the (successful and not-so-successful) projects discussed above, public consultation, preparatory work, and attention to detail are crucial. Experience has proved that the presence of these factors is a sure-shot marker of success, and therefore it is important that the combination be replicated in other projects as well.
- Though there seems to be stark similarity between the energy T&D sector and irrigation conveyance and distribution sector, the key lessons could be: involving the private sector in electronic metering of all consumers including regularization of unauthorized agricultural connections, conducting energy audits after census of agricultural pump sets, preparation of databases, and collection of arrears.
- The shortcoming of the contract farming system at present is that almost all agreements are based on mutual trust, without legal obligation, and lack of regulatory control. In the absence of the security of land use, many of the sponsors felt discouraged from investing larger amounts or entering into long-term contracts. While companies prefer large and medium farmers in areas where water is readily available in bulk, this deprives the small and marginal farmers who constitute nearly 80% of the farmers in India. Besides, Corporates are often reluctant to lift low-quality produce as they do not cover the production-risk of the farmers. Agriculture Produce Marketing Regulation (APMR) Acts in many of the states still do not allow processors/manufacturers to be in direct contact with the farmers.
- APMR acts in many states recommend that all contract farming sponsors should be registered with Market Committees. While contract farming could be a viable PPP model, in the present situation it cannot be considered workable unless (i) investment failure risks[23] are addressed, (ii) a dispute resolution mechanism is introduced, (iii) crop insurance is strengthened, (iv) a farmer-sponsor link mechanism is redefined, (v) participatory processes are empowered, and (v) incentive measures are provided to sponsoring companies.

Lessons from the international case studies include the need for appropriate structuring and assessment of needs. The key issues are as follows:

- In view of the increased levels of farmers' incomes and the levels of tariffs that they are willing to pay, the impact and degree of risk that can be transferred to the private sector can now be assessed. The West Delta and New Zealand irrigation schemes serve large-scale commercial farmers with relatively high incomes. Tariffs that farmers pay willingly are enough for the private operator to recover all costs associated with developing the scheme, including capital costs. This is one reason that private operators have been ready to bear the demand, payment, and some financing risk. In the Guerdane irrigation scheme, tariffs charged to farmers will allow the private operator to recover O&M costs in addition to some capital costs, and the latter is therefore

[23] Investment failure risks may include natural calamities, pest epidemics, market collapse, price fluctuations, and poor crop management.

prepared to bear part of the financing risk. Most Indian farmers work with small or marginal holdings and are even less willing to pay, which means that the government may have to bear a greater degree of risk to find a private operator to encourage PPP.

- Irrigation projects require massive investment in fixed assets, so it makes sense to consult farmers and ensure that they will use the systems that are built. A survey to ensure the willingness of farmers to connect with the system, and pay the requisite water use charges would be useful for a better understanding of the expected demand for the project, and to tailor the project design accordingly. However, it is difficult for farmers who are not using irrigation to quantify the value that irrigation could bring.
- Greenfield irrigation projects generally involve charging farmers for a service that they have not paid for in the past. The risk of non-payment is a significant concern for the private operators.
- The introduction of private sector management principles through PPP or other approaches such as the New Zealand irrigation reform has significant potential to improve irrigation service delivery.
- PSP in one or more of the investment functions is an important feature of two-thirds of the cases studied, while private participation in one or more of the OMM functions can be found in 90% of the contracts. Typically, OMM functions become quite crucial for the sector as the absence of timely repairs and proper maintenance of the irrigation assets lead to high levels of losses. For instance, the Ministry of Agriculture and the Oromia Irrigation Development Agency, Ethiopia, has assessed that the irrigation systems built to serve smallholders have shown losses between 50% and 75%. It was felt that once the private sector gets involved in the O&M of irrigation schemes, the losses will decrease as the private sector is in a position to introduce the best practices in these areas.

To conclude, the emerging picture of PPP in the I&D sector is not one of a typical concession/BOT type of arrangement for new projects, or about the empowerment of WUAs through IMT of existing systems; it has more to do with raising the level of professionalism in the systems considered. What is required is not so much an ‘absolutely private’ partner, but a professional ‘third party’ between the farmers and the government, be it public (e.g., a reformed and financially autonomous government agency) or private (e.g., a private service provider looking for business or a WUA turning into a private corporation).

Chapter 7
Financial Analysis for the Development of Irrigation Projects under PPP

A. Appraisal Method

The financial analysis presented in this section is based on the summary of the technical study on the Nira Deoghar irrigation project in Maharashtra, and a DPR of another major irrigation project. These technical studies are largely based on the present CWC guidelines for the preparation of project estimates for major irrigation and multipurpose projects. Details of project costs, command area details, and water rates have been drawn from the technical reports of these projects and projections have been made of the revenue and O&M costs for the project. The financial analysis includes viability assessment and scenario analysis.

B. Asset Creation/Rehabilitation Model

The asset creation/rehabilitation (MMI/ERM) model is generally applicable to a major irrigation project with one or more of the following components:

- Dam/barrage/weir and canal diversion headworks on a river;
- Main and branch canals, and other divisional channels—generally constructed on one or both sides of the dam;
- Distribution channels, which draw water from main, branch and/or distributaries to minors, water courses, and field channels; and
- On-farm development works, which help draw water from distribution channels and provide it directly to the farm-gate for efficient farm management.

The asset creation/rehabilitation model has been explained below with respect to the Nira Deoghar irrigation project in Maharashtra. This project is being supervised by the Maharashtra Krishna Valley Development Corporation (MKVDC), an entity created by the GoMaha for the promotion of irrigation and generation of hydroelectric energy in the Krishna basin.

C. Financial Analysis of the Nira Deoghar Project

Description: This is an ongoing project which envisages the construction of an earthen dam, a gated masonry spillway, with lined right and left bank canals as well as canals for lift irrigation. The project is expected to provide annual irrigation to an area (CCA) of 43,050 ha. The salient features of the project components are given in Table 12.

1. Capital cost of the project

The cost estimates are based on a study conducted by the MKVDC and data made available by them. The project cost was last reviewed in 2007–2008. Based on this estimation, the project cost and viability under

Table 12: Salient Features of the Nira Deoghar Irrigation Project, Maharashtra

Item	*Particulars*
Earthen dam	Length: 2330 m; maximum height: 58.525 m; length of masonry gated spillway: 70 m; two sides concrete non-overflow portions: 60 m
Canals	Left bank canal: 21 km; right bank canal: 208 km; CCA: 22,410 ha
Lift irrigation canals	Length: 135 km; CCA: 20640 ha.

PPP have been analyzed. The key assumptions for the financial assessment are provided in Table 13.

The capital costs have been broadly categorized based on the components of the irrigation system. The cost assessment is based on the assumption that a private developer is implementing the project. The estimated costs of the project components are provided in the Table 14.

The total project cost is estimated at $431.0 million (Rs19.396 billion). The interest during construction (IDC) contributes to around 18% of the project cost. This indicates that the expenditure towards the interest payments for the projects in the irrigation sector is considerably high.

Table 14: Estimated Costs of Project Components

S. No.	*Components*	*Total cost* (Rs million)
1	Dam	3,755.6
2	Left bank canal	347.9
3	Right bank canal	6,205.1
4	Lift irrigation	3,169.3
5	Establishments	1,154.5
6	Tools and equipments	134.5
7	Receipts and recoveries	–13.0
8	Indirect charges	157.5
A	Total cost of Part A	14,911.3
B	Technical studies and master planning	149.1
C	Pre-operative expenses	74.6
D	Contingencies	447.3
	Total project cost without financing charges and interest during construction (IDC)	15,582.3
E	Financing charges	298.2
F	IDC	3,515.1
	Total project cost	**19,395.7**

2. Project financing

The project is estimated to be financed with a debt to equity ratio of 70:30 by the private developer, as worked out in Table 15. No grant has been assumed for the project.

Table 13: Features of the Nira Deoghar Irrigation Project

Parameter	*Assumption*	*Description*
First year of the model	2011	The financial year ending in March 2011 has been taken as the first year for the financial model.
Construction period	7 years	The time period is based on the identification and quantification of major activities, assuming mechanized construction and two-shift operation.
Time horizon for assessment	55 years	The project is expected to provide benefits for around 100 years, but since the initial years would have major impact on the financials, 55 years have been considered for analysis.
Inflation rate	5%	The assumption is based on the average inflation rates of the last few years and the estimated future inflation rates in the next few years.
Pre-operative expenses	0.5% of capital cost	Includes cost of obtaining necessary clearances, land related costs, audit and account charges, etc.
Contingencies	3% of capital cost	As there have been detailed estimations of the project cost, only 3% of the capital cost has been taken as technical contingency.
Receipts and recoveries	13 million	The revenues would come from recovery on account of resale or transfer of temporary building and re-sale of special tools and plants. The total estimated value is expected to be Rs13 million.

Table 15: Proportion of Debt and Equity for the Project

Parameters	*Value in* (Rs million)
Total project cost	19,395.7
Debt (@ 70% of the project cost)	13,466.7
Equity (@ 30% of the project cost)	5,771.4

Considering a project life of 100 years and a high level of capital investment requirement, it is assumed that the loan tenure will be 30 years, and the interest rate is 14%.

3. O&M expenses

Maintenance of the dam and canals: The annual O&M costs are assumed at 1% of the capital cost for the dam and canals. The annual escalation in the O&M costs is estimated at 3%.

O&M costs for CAD: As per estimates by the concerned government agency, the average O&M expense for CAD works would be Rs1,000[1] per ha. The same rate has been considered for the analysis.

Costs of research, training, surveys, and improvements: These costs are considered for activities like technical tests, research, training, surveys and improvements, etc. These are estimated at 0.1% of the capital cost.

Direction and administration costs: The average direction and administration costs for all the irrigation projects are approximately 20% of the total O&M costs. The same assumption has been used to estimate this component.

The summary of the annual O&M costs is provided in the Table 16.

Table 16: O&M Costs Involved in the Project

S. No.	*Components*	*Total cost* (Rs million)
1	O&M costs for CAD	43.1
2	Maintenance of dam, canals, and LIS	134.8
3	Research, training, surveys and improvements, etc.	14.9
4	Direction and administration	48.2
	Total O&M costs in first year of operation	**240.9**

4. Revenues

Revenues are assumed from the following components:

- User charges/water rates,
- Revenues from fishing related activities,
- Sale of surplus available water, and
- Tourism related activities.

Water rates/User charges: For the purpose of analysis, the water rates (or user charges) have been considered at Rs1,100 per ha.[2] This is the average water charge that has been proposed for various crops. The collection efficiency is assumed at 40% in the initial year, gradually increasing to 75% in the fifth year of operation. It is assumed to stay constant after that. The escalation in user charges is assumed at 10% every three years.

Revenues from fishing related activities: As per the report that was made available, the total area expected to be utilized for fishing is 792.5 ha. Fish farming is expected to yield revenues to the tune of Rs8,682 per ha. The same is assumed in line with the other major irrigation project that was studied. It is assumed that 50% of this revenue would be shared with the private developer.

[1] This has been assumed in line with O&M costs estimated by the Uttar Pradesh Water Sector Restructuring Project (UPWSRP) for the Jaunpur Branch System in the Sharda Sahayak Canal System.

[2] This is the weighted average of the user charges set by the concerned government agency for various crops for this particular project. The charges vary considerably across states.

Table 17: Summary of Estimated Annual Revenues in the Initial Years of the Project

(Amount in Rs million)

Operation Years	*Year 8*	*Year 9*	*Year 10*	*Year 11*
User charges/Water rates	18.9	23.7	31.3	36.5
Revenues from fisheries	3.40	3.50	3.60	3.8
Sale of surplus available water	20.0	20.9	21.9	22.9
Tourism	39.5	40.7	41.9	43.2
Total Revenue–Operations	**81.9**	**88.8**	**98.7**	**106.3**

Revenues from the sale of surplus water for drinking use: As per the study, 3.03 MCM of drinking water would be available to the private developer for sale, which can be sold by the developer at the rate of Rs6.6/cum.[3]

Revenues from tourism related activities: These refer to revenues earned from the sale of boating rights as well as entry charges for visitors. A summary of the estimated annual revenues in the initial years of operation is provided in the Table 17.

5. Viability assessment

The viability of the project is assessed in terms of the IRR and Net Present Value (NPV). The estimated values of the same are provided in the Table 18.

Table 18: Internal Rate of Return and Net Present Value of the Project

Years	*Project NPV* (Rs billion)	*Project IRR*
20	(10.3)	Negative IRR
25	(10.3)	Negative IRR
30	(10.4)	Negative IRR
40	(10.4)	Negative IRR
50	(10.4)	Negative IRR
55	(10.4)	Negative IRR

As shown in the table, the project is not financially viable since the expectation of the private developer in terms of the IRR would be around 15%. Also, the estimations of the yearly cash-flows indicate that the revenues are not sufficient to make the interest payments and debt repayments. Equity infusion is required during the intermediate years. The equity IRR for the project is even less than the project IRR provided above.

6. Scenario analysis

Various scenarios have been considered to assess the viability of the project, which has been analyzed in two ways (i) changing the values of the key variable to make the project viable, and (ii) introducing new revenue streams for the project.

Keeping other estimates as constants, the VGF (as % of capital costs) and user fees/water charges were calculated to achieve the desired return of 15% from the project, and the findings of the analysis are provided in Table 19.

The above levels of VGF, water charges or annuity[4] are not realistic and cannot practically be achieved. However, the water rates could be increased from the current level and then fixed, keeping in view the demand in the region and the users' ability to pay.

[3] The sale rate of surplus water varies across states. The rate has been assumed in line with estimates of a government agency for a major irrigation project.

[4] The annuity approach essentially involves a specified payment made by the authority/government at stated intervals for a predetermined period to compensate the developer for the capital costs and operating expenses and returns thereon in relation to the construction and O&M of a project facility. This model does not operate on the 'user-pays-principle', therefore there is no incentive for the private entity to maximize user-base. From the bidders' perspective, the focus would be on cost reduction rather than revenue maximization. The financial strength of the government entity promising to make payments would come under critical review and the continued credit worthiness of the entity would be the cornerstone of any financing for such projects. It would be necessary to put in place a properly ring-fenced fund with earmarked sources to provide the necessary comfort to lenders and investors as more projects are developed using this method.

Table 19: Viability Gap Funding, User Fee, and Annuity Estimates

S. No.	*Parameter*	*Current Value*	*Value at which desired return from the project is achieved keeping the other variables as constant*	*Remarks*
1	Viability Gap Funding	0% of the project Cost	more than 95% of the capital cost	This is not a practical option. It is equivalent to awarding an EPC and an O&M contract.
2	User Fees	Rs1,100 per ha	Rs1,50,000 per ha	To increase the user charges to such a high level is not practical as the farmers would not be able to (or willing to) pay the same.
3	Annuity support	No annuity support assumed	Rs4,150 million/annum	Not practical
4	Rate of sale of extra water	Rs6.6/cum	Rs1,209.8/cum	The average sale value of water in India is about Rs5/cum and for tank water, it is Rs80/cum. However, it varies between Rs0.58/cum and Rs1,900/cum. In view of the same, the rate used for analysis in the study seems low. However, Rs1,209.8/cum is very high.

Some commercial activities could be included in the project to make it financially more viable. Examples of such activities are:

- Providing land for commercial development,
- Building toll roads along the canal, and
- Allowing tourism related activities (like Water Parks) near the irrigation area.

Usually, the government decides which land can be used for commercial activity. In many of the irrigation projects, the irrigation departments act as promoters and land is generally available either with the department (such as defunct irrigation/canal land within cities and surplus land around running canals) or with the farmers within the command area which could include land that has lost fertility due to deterioration, waterlogging, alkalinity, and salinity and is therefore chosen for other uses. The Government can transfer such land, if available, or acquire land from farmers in exchange for compensation, which is to be borne by the developer, and transfer the land to the developer at market costs if it is to be developed within a city. Governments can negotiate with developers and decide which land should be given to the developer after paying adequate compensation to the land owners. A summary of the financials for the Nira Deoghar project has been provided in Appendix 7.

A sensitivity analysis has been carried out to determine the values of the key parameters of the above mentioned commercial activities. The summary of this analysis is provided in Table 20.

The detailed assumptions of the above commercial activities are also provided in Appendix 7.

The viability of the project was assessed for a combination of various possible commercial activities and VGF levels. The summary of the same is presented in Table 21.

D. Assessment of a Typical Major Irrigation Project

Besides the Nira Deoghar project, one other sample irrigation project was analyzed, the details of which are provided in Appendix 8. The summary of the key financials are given in Table 22.

For the above analysis, the set of assumptions that were made for implementation under the PPP framework are the same as those for the Nira Deoghar project.

It was deduced from the analysis of the project revenues that in irrigation projects, the user rates

Table 20: Summary of the Sensitivity Analysis of Various Commercial Activities

S. No.	*Activity*	*Key parameters*	*Value at which desired return from the project is achieved keeping the other variables as constant*	*Remarks*
1	Providing free land for commercial development to the developer	Extent of land	With expected average value of lease rental to be between Rs135,900 to 185,250 per ha, the private developer needs to be provided with about 30500 to 22300 ha of land for the development for 55 years.	This does not seem to be a practical solution as (i) social issues may come up while acquiring such a huge parcel of land and land acquisition may take few years, (ii) lack of demand for such a large extent of land.
2	Toll Road Development	Length of toll road, traffic	A 2-lane toll road would be built at a cost of Rs25 million per km length and would require around 10,000 PCUs to breakeven. Any traffic above this level would generate positive effects on the project returns.	The possibility of providing toll road along with the irrigation project is highly project specific.
3	Tourism Related Activities – water parks at 2 locations	No. of visitors	The number of visitors to the amusement park that would make the project viable is 6 million/year	Not practical. This is more than the capacity of amusement park/water park. However, with practical assumption of 0.2 million visitors/year, the viability of the project would increase marginally.

Table 21: Summary of the Sensitivity Analysis of Combinations of Commercial Activities

Key parameters	*Maximum expected values that can be practically achieved*	*Viability of the project*
Providing free land for commercial development to the developer	It is assumed that the concerned Government Agency may provide maximum of 1,000 ha of land for commercial development for 55 years. Lease rentals are assumed to be Rs180,000 per ha, which is on the higher side of the market range of Rs135,900–185,250 per ha.	With all these factors, the viability of the project improves marginally and the project still generates negative returns. However, it is to be noted that the revenues generated are sufficient to recover O&M expenses of the project.
Sale of surplus water available	It is assumed that the surplus water could be sold at Rs11/cum.	
User rates	The user rates fixed for the project (Rs1,100 per ha) is higher when compared to other projects implemented in India. However, it is assumed that the user rates could go up to Rs1,500 per ha.	
VGF	The maximum possible VGF for any project in India is 40%. The same is assumed for the project.	

Table 22: Summary of the Project Cost

S. No.	*Particulars*	*Value*
1	Project Cost (Rs billion)	15.0
2	Debt to Equity Ratio	70:30
3	O&M costs in the first operational year (Rs billion)	0.20
4	Revenues in the first operational year (Rs billion)	0.19
5	Project IRR for 55 years	Negative
6	Project NPV for 55 years (Rs billion)	(7.5)

fixed by government agencies are not even sufficient for covering the O&M expenses of the project. Revenues from related activities like the sale of water, fish farming, tourism, etc., are required to cover the O&M expenses and generate profits in the operational years. However, the profits will not be enough to repay the interest and principal payments of the loan for many years. The profits are considerably small compared to the capital cost and would not generate positive returns.

The viability assessment and scenario analysis for this project was carried out and details of the same are provided in Appendix 8. Like the Nira Deoghar project, this project too is not financially viable and is generating negative returns. The commercial

components that are required to make it viable are not practical to achieve.

E. Analyzing Financial Viability of an O&M Contract under PPP

The possibility of awarding a PPP contract for the O&M of the Nira Deoghar project for a period of 25 years has been analyzed. The summary of the analysis is provided in the table below.

It may be noted that the IRR would not be useful to the assessment of the viability of an O&M contract since there is no capital expenditure expected from the private sector. Viability would then need to be assessed in terms of NPV. For the purpose of this analysis, it has been assumed that the private operator's expected returns from the project would be 15% on project investments, which is in line with the infrastructure sector. The expected returns would be calculated on the expenditure (in NPV terms) by the private player on O&M activities. As shown in Table 23, it is difficult to develop a financially viable PPP project for the O&M of any major irrigation project. However, in case the project has the following characteristics, a viable PPP project for O&M could be structured in a case-specific manner.

- The O&M requirement under the project is very low.
- It is possible to substantially raise the user charges with fairly high collection efficiency.
- Land with fairly good commercial potential is available in urban areas.
- It is possible to reduce the annuity requirement to acceptable levels by providing a combination of several revenue streams.

F. Issues, Constraints, and Options of the Suggested Model

The key issues and constraints for the private sector in the I&D sector have been summarized below:

- Insufficient scope for the private sector to generate revenues and recover its expenses;
- Non-availability of avenues to augment revenue—land (for associated/commercial use), tourism potential, rights of way for other utilities, etc.;
- Low level of collection efficiency of user charges (irrigation water charges);
- Lack of political will to increase the water rates and enforce payment; and

Table 23: Summary of the Financial Analysis for an O&M Contract

S. No.	*Scenario*	*Summary of viability assessment (Value of key parameter to make the project viable)*	*Remarks*
1.	Considering the project on standalone basis without any other revenue generating stream	Annuity payment of Rs193 million required	The revenues are not sufficient to recover O&M expenses. If the user charges are not increased from the present low levels, the annuity payment to the tune of around 80% of the expected O&M costs would be required to be paid under a PPP project. The same is calculated considering the expected return of 15% on the investments.
2.	Land provided for commercial development under the project	Assuming lease rentals of Rs180,000 per ha, around 1,100 ha of land required	It is difficult to get 1,100 ha of land in urban/sub-urban area which could be utilized as commercial land.
3.	Allowing sale of surplus water for industrial usage along with the project	Need to realize Rs66/cum for the surplus water of 3.03 million cum available under the project.	Considering the present sale rate of Rs11/cum, achieving Rs66/cum seems optimistic. Moreover, the present regulatory and institutional framework needs to be changed to allow for the sale of surplus water to the industry and to have a surplus water purchase, guarantee mechanism.

- With the high level of capital investments and limited sources of revenues, the risk borne by the private developer in the I&D sector remains very high, especially that of social resistance, demand risk for the sale of any surplus water and risks associated with financial recovery.

The estimated IRR for both projects considered for evaluation in this section is not deemed sufficient for attracting private participation. However, the projects are expected to provide good economic returns to the nation. For instance, the economic IRR for a typical irrigation project considered here is estimated at 11.16%. As the economic benefits would not matter to a financial investor, that particular aspect has not been considered for the analysis in this section.

The low financial viability of projects in the I&D sector is a consequence of various policy interventions of the government over the years, along with the changing socio-political conditions and governance frameworks at the farm level. Water/water delivery is heavily subsidized in India and, as a result, projects in this sector produce no financial returns. The case for investments in the I&D sector, then, largely stems from the economic benefits and multiplier benefits across the chain. Accordingly, the premise for private participation would be to augment efficiency in the sector and not financial returns. Projects where private participation is being considered would need to be structured accordingly.

To promote PPP in the I&D sector, an enabling environment will have to be created, with sufficient scope for generating revenues. A stable macro-economic climate, and adequate commercial laws and financial services are some factors that will increase the confidence of the private sector to get involved in the I&D sector. Incentives with respect to taxes and subsidies could also be considered. Further and more detailed research would be required to explore different combinations of various possible options for each project, to generate additional revenues and thereby make PPP a technically and economically viable proposition.

Despite being aware of the inadequacy of the revenue models for PPPs, the state governments/implementing agencies still feel that the support provided to the projects should be minimal. When projects are not found financially self-sustaining, they still prefer taking recourse to grants from various central or state governments, or other sources, rather than structuring direct financial support. While analysis indicates that considerable financial support is required (given the low user charges), it would be useful to explore other means of revenues to minimize the outflows of the implementing agencies. These would have to be examined on a case-to-case basis; such an exercise would be useful for the pilot projects under consideration.

Chapter 8
Opportunities for PPP in the I&D Sector in India

A. Issues in the I&D Sector

It is common perception that the government is solely responsible for providing adequate, equitable, and timely water to the farmers in order to ultimately achieve food security in the country. In order to design an appropriate irrigation scheme, it is important for the government to have information on past cropping patterns, availability of adequate water at the source and area that would need to be covered for irrigation purposes. This becomes even more crucial when the government intends to seek private investment and participation in the development and management of I&D assets. Experience shows that various state governments and public sector agencies have attempted to involve the private sector in water services (especially urban water), with limited success, under various contractual structures such as BOOT, delegated management contracts, and so on. The failure to achieve the desired level of services can be primarily attributed to one or more of the following reasons (in no particular order):

- Lack of adequate project development;
- Projects not being bankable enough to evince private sector interest;
- Most of the projects were operator-led rather than government/implementing agency-led. Hence, inadequate project development led to protracted negotiations and stifled successful project implementation;
- Procurement issues: most projects were based on negotiated contracts and not on a competitive bidding process;
- Lack of security of payments to private operator;
- Low tariff regime;
- Lack of credible information to the private operator; and
- Lack of government support and political will.

The main issues from the perspective of the private sector when it comes to investing in a government project are associated with the availability of credible information, the presence of a business case for the project (risk on user charges or otherwise), appropriate contracting framework and payment guarantee structure. It is also important for the government to have adequate capacity for handling such contracts. These and some other related issues have been discussed in this chapter.

The I&D sector in the country is characterized by low efficiencies, as elaborated in Chapter 3 of this report. There is a growing imbalance between the demand and supply of water; the rainfall pattern has shifted perceptibly, forcing changes in cropping practices; and the groundwater levels have depleted. All these lead to increased reliance on surface water. However, the I&D infrastructure assets have yielded sub-optimal returns on investments, and are in poor condition due to delays in or lack of maintenance. Unreliable measurement of water use, along with higher cost of service delivery and low recovery of user charges are issues that plague the I&D sector.

A variety of policy changes need to be adopted by the government and concerned agencies to improve the efficiencies and ensure effective service delivery

to the farmers. These include promoting the concept of IWRM, setting out priorities in water use, and ensuring the implementation of the same. Measures like offering incentives for appropriate water usage, regulating groundwater usage, and the logical revision of user charges in a timely manner would go a long way in developing a sound operating framework for the sector. Multiple initiatives would be required and involving the private sector may be one of the options to achieve these ends.

The prospect of promoting PPP in the development of standalone infrastructure in the I&D sector seems limited without coordination with other water use sectors. However, there may be some hope in managing irrigation water through private and participatory efforts under regulated control. For this purpose, existing acts, programs, and policies of the central and state governments need to be reviewed. Annuity studies of certain pilot projects are necessary to prove the effectiveness of sample PPP models that involve coordinated efforts by the I&D sector and allied water use sectors.

The Indian experience with PPPs varies from sector to sector and is almost non-existent in the I&D sector. A host of issues including policy, law and capacity need to be addressed in addition to developing a business framework for private participation in the sector as there are currently no central or state level policies or laws that pertain exclusively to private participation in the sector (though some states do have infrastructure acts and policies).

B. Policy, Legal, and Capacity Building Requirements

It is important to use legal and policy changes as part of the strategy for the effective implementation of reforms in the water and I&D sectors in order to seek effective PSP in the future. In legal terms, water is seen as belonging to the owner of the land since the term 'land' is taken to include water resources. The judicial view has been that the right to dig bore wells to draw groundwater can be restricted or regulated only by an act of the legislature and not by way of mere executive or departmental restrictions which have no statutory basis. There is an urgent need to build suitable safeguards to stop indiscriminate withdrawal of groundwater. Such legislation is needed to empower the state to regulate its use and could also be made to include punitive restrictions on misuse of groundwater. To make projects viable on a standalone basis, the primary requisite from the private sector perspective would be to regulate the use of groundwater. For instance, when a private entity is allowed to supply water to the farmers with the right to recover O&M charges from the users, it may lose its expected revenues from the project if the government does not control groundwater abstraction by users. The rampant and increasing exploitation of groundwater for irrigation and other uses has led to the rapid lowering of the water table in many parts of the country.

The central government has formulated a model bill pertaining to groundwater and has set up a Central Groundwater Authority under Section 3(3) of the Environment Protection Act. This was notified on 14 January 1997 and is aimed at regulating and controlling the development and management of groundwater resources in the country. A few states like Kerala, Andhra Pradesh, and Goa have introduced specific legislations in this regard.[1] The main features of these include the setting up of a groundwater authority under the direct control of the government. This authority has been given the right to notify areas where it is deemed necessary to regulate the use of groundwater; the final decision is taken by the respective state governments. In all notified areas, every user of groundwater must apply for a permit from the authority except in the case of hand-pumps or wells from which water is drawn manually. The decision of the authority in granting permits is based on a number of factors, including technical factors such as the availability of groundwater, the quantity and quality of water to be drawn, and the spacing between groundwater structures. The authority is also mandated to take into account the purpose for which water is to be drawn. Among other provisions, all

[1] Kerala Ground Water (Control and Regulation) Act, 2002; Goa Ground Water Regulation Act, 2002.

wells, including those in non-notified areas, are to be registered.

It may be noted that while the model bill and legislations can provide a framework for asserting government control over the use of groundwater by seeking the registration of all groundwater infrastructure and introducing permits for groundwater extraction in regions where the resource is being over-exploited, such legal mechanisms will not be effective when it comes to areas where over-use has already led to water scarcity. Be that as it may, these will nonetheless provide a basis for ensuring that future use is more sustainable.

The NWP focuses on developing a databank, estimating the amount of water available, prioritizing water use (with the highest priority accorded to drinking water), developing groundwater for meeting drinking water needs, developing irrigation facilities, encouraging the participation of stakeholders in water management, monitoring water quality, promoting conservation, developing a flood control and management system, using cost-effective measures to minimize erosion, maintenance and modernization of waterworks, ensuring the safety of structures built on water bodies, the development of science and technology relevant to water management, and training of personnel. The policy is also geared towards improving the performance of the institutions operating in the field of planning development and management of water resources, the promotion of rehabilitation schemes for the displaced, enhancing participation of private parties in water management, creating an effective monitoring system, and ensuring that states share the water of a river, wherever required.

Reforms in the water sector must take into account the changing needs of the users, particularly considering the social and hydrological challenges. The law and policy framework needs to be revisited, especially to make users' participation more effective by strengthening regulations related to PIM, and reducing the role of the government in irrigation. Overt government control has, in the past, led to the failure of several irrigation schemes, given the lack of accountability and corporate management skills, and dependence on outdated technologies.

Another priority is the recovery of O&M costs (if not the capital expenditure) involved in water supply schemes. The rationale for financial sustainability flows from historical experience dating back to the colonial and pre-independence period when the water charges would fully cover O&M costs. Also important is the need to create and extensively spread awareness among people to conserve water and promote its judicious use.

The governance and administrative framework is attuned to regular contracts, i.e. item rate contracts and EPC contracts. Understanding and managing PPP contracts would require significant capacity on the part of the implementation agency. The role and scope of the private operator would change from that of a contractor who is paid on the completion of a certain amount of work, to that of a partner, who assumes much higher risks and responsibilities. The payment and reward structure would progress to a performance based mechanism. The treatment meted out to a partner would have to differ from that meted out to conventional contractors.

Through the Department of Economic Affairs, the Indian Government is currently undertaking a national capacity building program with respect to most of the urban and state level agencies, primarily oriented towards sectors that are witnessing implementation within PPP frameworks. The I&D sector will also need such capacity building exercises.

C. Determinants of PPP

Implementing an infrastructure project within a PPP framework would entail addressing certain key issues and structural considerations. Some of these are as follows:

- What would be the broad scope of the engagement? For instance, would it involve the building of new assets, providing the services through the rehabilitation of existing assets or carrying out of operations and maintenance activities only?
- Is there any transfer of ownership envisaged through the engagement?

- What are the roles of various stakeholders and how are the risks allocated?
- How robust are the revenue model and support mechanism of sponsors for the project?
- Is the commercial framework commensurate with the project components?
- Is there a market appetite for such a framework?

The service requirements and delivery measurement need to be articulated as part of the consultation process during the structuring of the project. There is no plan for a very large scale project or program to be launched in the near future; hence the specifications would have to be project specific. While the sectoral issues are varied and diverse, it is possible to configure projects with substantial operational flexibility over the project period. Obviously, a mechanism for periodic reviews of costs and performance would need to be incorporated in such contracts, given the nature of the sector.

The administration and management of various WUAs, especially with relation to the proper and timely conduct of elections and the interface between the office bearers of the association, government employees, water users, and other relevant stakeholders, will also set the content for improved governance.

The transfer of ownership of infrastructure assets, particularly rights related to the water sector, has been a contentious issue in the past. While constitutional and state laws provide in some cases, for implementing projects with private participation, the responsibility of making this provision remains with the government entities. The retention of ownership would also indicate the ongoing commitment of the entities involved and would encourage better governance structures. Given that the concept of PPP is still nascent in India, it is preferable to structure PPP pilots in the I&D sector in such a way that ownership remains with the government entities at all times.

The operating framework or the PPP structure is essentially meant for the allocation of roles to various stakeholders. The development of an equitable structure would entail articulating these roles clearly and this would be the core of a PPP structuring exercise. This practice is expected to be followed in all PPP projects, including the pilots.

While preliminary financial analysis does not indicate a favorable situation for financially free-standing projects, a comprehensive structure needs to be put in place to create a support mechanism. The same needs to be studied and elaborated during the structuring phase of PPP implementation in the I&D sector.

D. Market Perception

It is also important to understand the mindset of the private investor when considering PPPs in the sector. These include the risks associated with the availability of adequate and proper information as well as the commercial risk associated with the collection of user charges, bidding arrangements, freedom of sub-letting the works, etc., including investment requirements in the sector, all of which need to be addressed. Although financial analysis is based on an IRR of 15%, private operators expect a reasonable absolute quantum of return, which is a result of project size and estimated returns. A key aspect of private sector participation in infrastructure projects, especially in cases where financial risks are borne by the private operator and are to be recouped in the long run, is the establishment of a suitable payment guarantee mechanism. This structure varies with the capability of the agency concerned and the accruals from various sources, including devolutions from the state government. Typical structures expected by the private sector would include escrow mechanisms of any significant and consistent revenue line (state government devolutions, letter of credit based payment structure, and so on), revolving bank guarantees, etc. The capability of the implementing agency in managing the agreement with the private developer is also of significant importance and hence deserves due consideration.

To summarize the above, it may be stated that the capacity of the Indian Government to handle long-term PPP contracts is still lacking. Capacities need to improve and support at the state level needs to be

augmented. Based on the feedback received during various interactions throughout the study, it may be concluded that the relevant knowledge base regarding PPPs and the various modes of implementation is yet to be developed in the I&D sector, as compared to more evolved sectors such as roads and power. The market perception of PPP in the I&D sector is also briefly summarized in Appendix 9.

1. Risks related to non-availability of information

Detailed information on the state of the existing assets and sites is crucial and is often not available. The expected information includes a complete inventory of assets available—both above and below ground, their condition, the nature of material, age, and repair history. These records become even more critical in the case of contracts where the private operator is to assume the financial risk.

It must also be specified whether or not the project requires additional land for the creation of new facilities. If so, the private operators need to know whether the government authority has the necessary rights to the land. The failure to deliver the land (with the necessary access rights over it) in PPP projects in India is one of the most common when it comes to the authorities, and is also one of the hardest to cure. It is absolutely essential that the issue be addressed upfront.

Another important aspect related to the site is the grant of a right-of-way to the private operator in a timely manner. A delay in the completion of the land acquisition process is a significant risk to the project. Once the agreement has been signed, a considerable delay within the project timetable can potentially jeopardize the ultimate success of the project, and also expose the authority to significant claims from the operator for time and cost relief. Equally, private operators may be reluctant to commit to a project in which key parts of the project sites have not yet been acquired. They would need to know the extent of their rights over the buildings, machinery, plant, equipment, fixtures, materials, land, etc., and whether they can grant the security rights of some of these to the lenders. They also need to be informed of the extent of their authority in terms of subcontracting works to the contractors of their choice rather than needing to consult the authority on the same.

For effective surface water management by the private sector, data and analysis relating to inter-basin/interstate/international treaties and agreements for transfer of water and the utilization of available surface storages become crucial in the assessment of water availability.

The implementing agencies need to prepare and maintain an updated database of the ownership of properties within their jurisdiction, including details on utility lines in use and their condition, especially those that are underground. This would help in providing comprehensive information to the private developers, thereby minimizing the need for multiple visits to various departments for details of the locations of underground pipelines/cables, before beginning construction work.

While most implementing agencies do provide DPRs, the information furnished to the private operators must also include the name of the consultant who prepared the detailed project report so that they can assess the quality of the output. Further, the private operators may also be interested in knowing whether field surveys were carried out recently or otherwise. This would help them make informed decisions.

2. Commercial risks

The primary risk perceived by the private sector today is related to the security of project returns, which in turn is linked to the increase in user charges and adequate one-time/connection charges. Given that most implementing agencies do not have the adequate financial resources to meet the required expenditure for the projects, it is important to ensure timely payments to the operator. A suitable payment guarantee mechanism thus needs to be created before the contract is finalized. This mechanism may involve escrowing of user charges and other revenues, devolutions from the state government, a letter-of-credit based structure, etc.

If the viability of a project solely depends upon the increase of user charges in the future, the case for generating interest in PSP will be weak. There need to be mechanisms, depending on the business case, to offset the complete tariff risk through payments of annuity and/or performance based structures. If a contract envisages that an implementing agency will provide financial support in the form of minimum revenue guarantees, payout during construction period or other guarantees like minimum water consumption or purchase guarantees, the private operator would be interested in knowing the source of funds to meet this expenditure. The implementing agency may need to provide for an adequate legal and administrative mechanism to provide additional support and assurances to the creditors that the government will comply with the guarantees given by the implementing agency. If the collection risk is borne by the operator, it needs to be ensured that there are adequate covenants ensuring that the money is properly collected and either deposited or appropriated in the relevant accounts, as the case may be.

Payments made to the private operator must be subject to escalation over the period of the contract and can not be fixed. In international PPP projects it is common for the contractor payment to be subject to indexation in order to account for the effects of inflation over the long contract period. The absence of an indexation mechanism may lead to private operators factoring inflation into their pricing, which will not ensure value for money.

With the growth in acreage and an increase in the number of categories of farmers, there is a need for lumpy investments within the duration of the PPP contract. There should be a mechanism to address this, in the form of shared or individual investments.

The state specific legal framework for delegating the powers to charge, collect, and appropriate user charges in specific states need to be studied prior to designing a PPP arrangement.

The private operator may wish to know whether the implementing agency will provide a guarantee for a minimum amount of new work (extension of service coverage area and the resultant increase in revenue thereof) in a pre-estimated timely manner as well as any financial support (capital investments) for undertaking such additional works during the contract period. The obligations cast upon the operator to pay penalties for non-compliance to environmental regulations in the event of deterioration in the quality of water supplied, would need to be clearly spelt out.

The operator may seek information from the government/implementing agency related to the number of farmers using groundwater in order to make a realistic assessment of the surface water to be earmarked for the project. Developers would need to be protected against loss of revenues on account of defaulting farmers. For this, the contract must provide for a possible recourse to the implementing agency to make recoveries from the defaulting consumers or, alternatively, a back-to-back agreement for the payment of such dues by the implementing agency directly. Regarding illegal use and unauthorized withdrawals, the contract needs to clearly set out the administrative support that would be provided to the operator. Incentives for the operator may be considered for detecting illegal and unauthorized use of water. Possible escalation in power charges in the future should also be adequately addressed, either by means of passing through or carrying out periodic energy audits in order to reduce power consumption.

Generally, tenders floated by implementing agencies for PPP arrangements do not allow private operators the option of marking or otherwise submitting their comments on the draft contract, except during pre-bid meetings and some suggested changes related to the transfer of certain risks to the authority are often not accepted. A process of negotiations with the successful private operator prior to the execution of the concession agreement is also not envisaged. In international PPP projects it is common for the tender process to allow for negotiations on key contract conditions. This allows the private operators to suggest alternative arrangements for risk allocation, which could result in a more competitive bid price. It may also contribute in terms of refinement of practical issues in the agreement, with implications on the whole process. The complexity of a PPP project usually demands a bilateral approach. Non-negotiable contract documentation is generally suitable for

simpler projects. Given the complexities involved and the fact that the Indian I&D sector is still at a nascent stage, it may be useful to develop contracts based on extensive consultations with all the stakeholders, including the private sector.

Normally, in water-related PPPs, especially short-term contracts, it is expected that the employees of the department will be able to acquaint themselves with the technological and operational improvements made by the private operators during the contract period, and that this learning can subsequently be put to use in the post-contract period. To enable this, the contracts provide for the deputation of employees of the implementing agency with the private operator. It may need to be verified whether or not the legal and policy framework of the state government allows for such an arrangement. Typically, a financier to a PPP project would carry out the activities shown in Figure 11 prior to extending debt assistance to an infrastructure project.

Given that there is no history of PPP projects in the I&D sector where the private investors have needed to take a loan, banks and other financial institutions do not possess the necessary expertise to assess the viability of a project. Therefore it may take a long time for the bank to study the business model (revenues, capital expenses, O&M expenses, etc.) and assess the financial feasibility and bankability of the project. Financial institutions also need to deal with developers and operators working at varying scales. This is due to the fact that the project sizes may not be large and attractive enough for larger developers in terms of expected returns, which are much higher in other bigger infrastructure projects that involve similar effort. The systems and procedures of smaller developers are not evolved, and often lead to delays in the appraisal process.

Due to the lack of knowledge among the financing institutions about the business models in this sector, it is difficult to procure financing based on the cash flows of the project alone. Also, many contracts in the sector do not allow for the assets of the project to be used as collateral for debt. Therefore, the company's assets are used as security against the debt. It is relatively easy to get loans for projects in which (i) contracts allow for the assets (equipments, project facility, etc.) to be used as security against the debt; and (ii) there are fixed payments to be received from the government agencies.

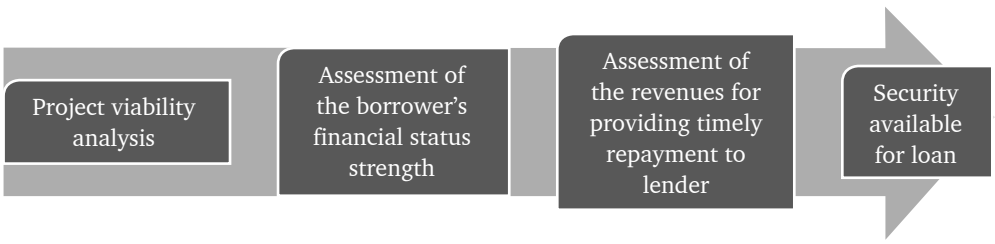
E. Potential Areas for PPP in the I&D Sector in India

A number of potential areas exist where PPP could be encouraged. Some of these are indicated below.

1. New and existing irrigation projects that require infrastructure development

A number of irrigation projects are at different stages of planning, investigation, design, and/or require mandatory clearance; some of the cleared projects either await sanctions or have been sanctioned but are waiting to take off for want of funds. Then there are projects where head works have been completed or are at an advanced stage of construction, but the distribution system has either not taken off or has been suspended midway for want of funds or other reasons beyond control. There are yet other projects where part of conveyance system has been completed but its irrigation potential cannot be utilized in the

Figure 11: The procedure before extending debt assistance



absence of adequate development of command areas, agro-power facility, roads or market facilities.

A majority of these projects cannot be funded through private participation alone. The possibility of VGF could be explored or, alternatively, incentives could be made available to the private partners in the form of development rights for wastelands/permanently waterlogged lands/infertile lands within the command of the project. The cost of acquiring the land would have to be borne by the developer at market cost. Also worth considering as incentives are social projects that involve increasing production/productivity, socially uplifting the command population, education oriented programs, animal husbandry programs, agro-based industrial projects clubbed with contract farming and/or agro-parks which generate employment among the local population. Other options that could help generate private interest are: (i) sharing of unallocated water or allocation of deemed water saved due to conservation/efficient measures adopted by the private partner, and allowing commercial use of such water; (ii) fishing rights in reservoirs, canals, local water bodies, (iii) hydro-electric power generation or cost adjustments on that account; (iv) allowing construction of high speed roads on both sides of canals; (v) navigation rights for transporting goods through canals, and (vi) development of sports or amusement parks. The approval of regulatory institutions on environmental safeguards and water allocation rights would be mandatory.

2. Completed projects

Completed projects that require O&M work, suffer from conveyance deficiencies and await correction, are plagued by inequity in distribution, or are fraught with environmental and ecological concerns, fall into the category of service contracts. Unlike distribution companies (DISCOMs) or energy saving companies (ESCOs) which have brought about reforms in the energy distribution sector, and where incentives commensurate with the revenue generated and energy saved, the delivery of water is not considered attractive due to the low levels of revenue generation, high O&M costs, and non-assurance of delivery. In many canals, sharing of water and/or allocation of rights on deemed water saved for commercial use are presently not feasible. Service delivery contracts in completed projects could be a viable option when clubbed with PIM reforms in micro-level command systems, in the interest of bringing about efficiency and sustainability in the systems, ensuring supplies and generating revenue.

Large agro-based companies that have an established industrial setup, and the capacity to introduce contract farming may be interested if provided with adequate facilities. These would include long term land rights for research farms, storage facilities, cold storage rights, and agro-based industrial plots. Such arrangements would require deep thinking, policy changes, and major stakeholder consultations. Generally, agro-industrialists prefer diversifications to horticulture, oilseeds, and/or cash crops. Obviously, such arrangements are not feasible in the case of food grain crops. In such cases, corporations should play the role of agro-industrialists and guarantee to ensure inputs and to lift produce. Contract farming, as a component of a service delivery model in completed projects, could be an additional incentive to the private sector partner.

F. Possible PPP Models in the I&D Sector

When developing a suitable arrangement for PPPs in any infrastructure sector, there is no single method of structuring a project, but a hybrid of possible and implementable options that need to be configured. Same is the case with PPP projects in the I&D sector. As the involvement of the private sector in the I&D sector in India is largely restricted to item rate contracts, upgrading to a PPP arrangement requires a paradigm shift as it involves assuming a substantial share of one or more risks relating to financing, design, construction, and O&M. This would mean that all concerns are addressed comprehensively and in an equitable manner prior to offering a project for private participation.

Therefore, the primary consideration for the PPP framework would pertain to the orientation of the needs and viability. Assuming that a project is warranted, the mode of implementation would

depend on financial viability and cost effectiveness. Financial viability would include addressing the mechanism of cost recovery, need for public sector support and user charges levied, as well as the existing regulatory framework. For a PPP project to be sustainable, its value to the public sector needs to be clearly demonstrated.

The absence of prior experience with PPPs in the I&D sector also implies that there is no evidence that the private sector is capable of delivering the required outcomes, though one could argue that the situation was similar in other infrastructure sectors like road, telecom, and power that did resort to PPPs. While the appetite in the current situation is not much, the private sector has expressed the intention to review the projects at hand in a balanced manner. It would be an experiment for both the private sector and the government stakeholders for rolling PPP projects in sector. The past experiences of other infrastructure sectors in the country indicate that a well defined operating and commercial framework would generate adequate business intent.

Financial analysis indicates that a conclusive case for PSP cannot rest on a standalone basis, but attempts could be made with pilot projects which would set the tone for a long-term PPP program in the I&D sector.

A well configured PPP project usually involves effective and conscious risk allocation. The provisions in a PPP contract which need to be configured for the I&D sector, especially those aimed at efficiency improvements, should involve significant transfer of risks. With government projects, there is a tendency towards delays and considerable cost overruns. As the ability of the private sector in tying up the finances is reportedly better, PPPs in the I&D sector are expected to achieve better management of time and cost overruns, and usher in innovations after due diligence of the costs involved.

Drawing from the experiences of the case studies, a series of models of the successive stages of PPP processes in the I&D sector are being proposed internationally. These models move along a consortium of reducing government involvement and increasing participation by user associations and private sector service providers. Although there are many types of I&D sector schemes, the models have been based on large public systems that represent half of the irrigated areas and also reflect the most serious problems.

The World Bank[59] has analyzed five successive models from the perspectives of the government and the farmers. The five models are:

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

Appendix 10 provides a detailed discussion of these models.

The Indian context requires a different approach, and it may take time for PPP projects to be configured and offered to the market. The suitability of PPPs is gauged according to two distinct parameters—qualitative and quantitative. Qualitative parameters for assessing a PPP option relate to whether it is desirable, viable, and achievable. The desirability of a project is determined by answering the following questions: Is the PPP likely to involve better risk management, significant risk transfer and better incentives for cost-effective and timely delivery? Is the PPP likely to involve greater innovation? Viability is associated with the following concerns: Can the service requirements be stated in clear output based terms and can the effectiveness of service delivery be measured and monitored? Can operational flexibility be maintained over the lifetime of the contract at an acceptable cost? Achievability is addressed by the questions: Is there evidence that the private sector is capable of delivering the required outcome? Is there likely to be sufficient market demand for the project? Is there/will there be sufficient client-side capability to manage the procurement process and appraise the on-going performance against agreed

outputs? It is only after addressing all these concerns and establishing the qualitative parameters of the technical aspects of the sector that the implementing agency can go ahead and assess the quantitative parameters.

1. Model for new infrastructure development for MMI

The development of new infrastructure for an MMI project entails activities ranging from designing (including surveys and investigations), engineering, financing, construction, and O&M. It is necessary to assess the various PPP components viz., scope, mode, financing, and commercial aspects, before analyzing available options and arriving at possible modes for implementation.

There are various kinds of PPP contracts (as outlined in Appendix 6), ranging from service contracts to full concession contracts. The risks and roles for the private sector progressively increase along these types of contracts. The benefits and experience of implementing the PPPs in I&D sector could be appreciated better if the adoption of the models is also progressive along the type of PPP contracts. This would enable better understanding of the risks involved, a clearer picture of the project development activities as well as the measurement of outcomes. The progressively linear adoption of models would also provide an opportunity for any mid-course correction required during the implementation of the projects. Several possible PPP model variants are given in Table 24.

In a PPP arrangement that involves a service contract, the aim is to derive the benefits of private sector efficiencies, while the risks of financing and demand are retained by the government stakeholders. The current context of the I&D sector does not seem to provide for a wholesale transfer of the financing and demand risks to the private sector, and the government stakeholder is expected to provide financial support for the sustainability of the projects. Moreover, efficiency is sub-optimal when it comes to the public sector, and thus needs major improvements. The most suitable arrangement, then, seems to be for the private sector to assume the risks of "service" and improve the sector efficiencies, while all other aspects of the project (financing, demand, etc.) are maintained at the same level. This would mean operating the projects on a service contract basis. This model could be experimented with—services could be redefined, the private sector could introduce innovations and improve efficiencies—and the outcomes would be clearly demonstrated and assessed.

After significant experience has been gained, and the capacity of the private sector has been augmented, it could then progressively be allocated with more risks and responsibilities. These would include the components of design, engineering, finance and demand risks, among others. It is also essential that a sustainable co-operative arrangement be arrived at between the developers and the farmers (water users), and the scope/details of the arrangement could be best studied under a service arrangement without being clouded by the financial implications of PPP structures where the private partner shares both investment as well as demand risks.

The primary issue is the identification of a stakeholder who takes responsibility for interface risks. Given the social sensitivities involved, the task of interfacing with all the stakeholders would remain with the government.

Table 24: Model Variants

Project Components	*Tasks*	*Design*	*Build*	*Finance*	*Maintain*	*Operate*
Dam		×	×	×	×	×
Main canals		×	×	×	✓	✓
Divisional channels		×	×	✓	✓	✓
Barrage		✓	✓	✓	✓	✓
Distribution channel		✓	✓	✓	✓	✓
Field channel		✓	✓	✓	✓	✓

The state of Andhra Pradesh has recently taken up irrigation infrastructure development works in the EPC mode. This has been seen as a major step away from the conventional item-rate contracts that had been adopted so far. The documents specify the broad scope of work, key features[2] of the project, outputs envisaged, and other contractual conditions (based on templates developed by the Federation Internationale Des Ingenieurs-Conseils) associated with the roles and responsibilities of all the parties involved. Issues relating to the comprehensive description of scope, variations and modes of action, the estimation of work involved, and evaluation of tenders (technical and financial bids) have not been completely resolved, and are being developed with experience. These contracts cover a significant portion of the PPP modalities, while excluding the demand, revenue, and operational risks. While most of the leading civil contractors in the country do enter into conventional item-rate contracts, the EPC contracts in the I&D sector have been viewed as pilots. The graduation to the EPC mode, in itself, is perceived as a key development and the private sector appetite to absorb finance and demand risk has not been proven yet.

Financing of an MMI scheme: The financial aspects of an MMI scheme, based on the interactions during the study, are given in Table 25.

Parameters such as duration of contract, payment mechanisms, changes in scope, instances of default and its consequences, would essentially flow from the operating framework and the revenue model. Typically, PPP contracts are aligned with the economic life and design capacity of the asset, and the extent of risk borne by the private sector. A typical structure for a new MMI infrastructure development project, if adopted, is outlined in Figure 12.

2. Model for O&M of existing MMI projects

Details of the scope of work and mode of implementation in an existing MMI project are provided in Table 26. The other parameters discussed in the earlier section would be similar for all I&D sector infrastructure projects. An indicative model for the project is given in Figure 13.

3. Cooperative model for distribution system of MMI schemes

Water, albeit a key input, is one of the many required in the agriculture/horticulture sector. The gains from the timely and adequate quantum of water supply can make a substantial difference to the farmers' commercial standing and hence, they would like to have a say in the I&D sector. This is currently facilitated by WUAs at various levels (zonal, district levels, distributary and project level committees, etc.). When an MMI or MI project is configured, the immediate stakeholders will be impacted and may not have recourse to a redressal mechanism under the conventional provisions of WUAs. Those directly participating in the project may give the farmers concerned a better appreciation and also derive benefits directly. This may also considerably improve project sustainability. Towards this end, a co-operative model could be configured, such as the one illustrated in Figure 14.

4. Micro-irrigation

A model micro-irrigation project envisages the financing of micro-irrigation systems like sprinkler irrigation and a drip/micro-sprinkler irrigation system in the state, with emphasis on rain shadow areas where suitable cropping patterns are being adopted and groundwater development is high. Drip irrigation

[2] The key features of the project include water availability, elevations of project components, tentative route of the canal network, extent of command area to be covered, etc. The initial estimation of the project cost for the EPC contract is carried out by the irrigation department based on the available feasibility report or DPR on pro-rata basis. The EPC agency is responsible for carrying out all the related surveys and investigations, updating the DPR, including detailed designs and drawings of canals and other structures, cost estimates and financial analysis; preparing land plan schedules required for acquisition; procurement of machinery, material and men; execution of the project as per the approved DPR and agreed milestones, while duly maintaining quality standards and O&M of the project as per the conditions of the contract (2–5 years for schemes involving gravity flow and 15 years for LISs). The package size ranges between $0.4 billion and $1.1 billion (Rs20–50 billion).

Table 25: Financial Aspects of an MMI Project

User willingness & ability to pay	The traditional user payments have been below optimal. The tariffs have been set to recover O&M costs, with the efficiencies being witnessed; even this is not being met. However, there are opinions that given good quality service, users wouldn't mind paying higher charges as the benefits of the I&D sector are far-ranging.
Stability of demand	The demand for services in I&D schemes would depend on the scheme and the cropping pattern envisaged. For the defined period, a reasonably accurate assessment of the demand could be established.
Adequacy of demand	A major issue associated with project returns (which is a product of user charges and the water consumed) is how the charges have been set, along with the provisions for its recovery. Detailed financial analysis has been carried out in Chapter 8. The water charges are not enough to recover the capital costs and barely meet the O&M expenses.
Monopolistic nature	The water conveyance system of an MMI scheme could be termed as a "monopoly" and appropriate precautions would need to be taken to prevent misuse of rights granted under a PPP framework.
Credit enhancement measures	Significant government support/credit enhancement structures for the MMI schemes are required for sustainable private sector participation. Some means of increasing revenues—providing additional land, permitting tourism related activities, constructing toll-roads on the banks of irrigation canals, developing a hydropower plant, etc., can be considered. The project specific details would need to be assessed prior to arriving at any conclusion on the "revenue-augmenting" support requirements for the project.

Figure 12: Typical MMI infrastructure development project

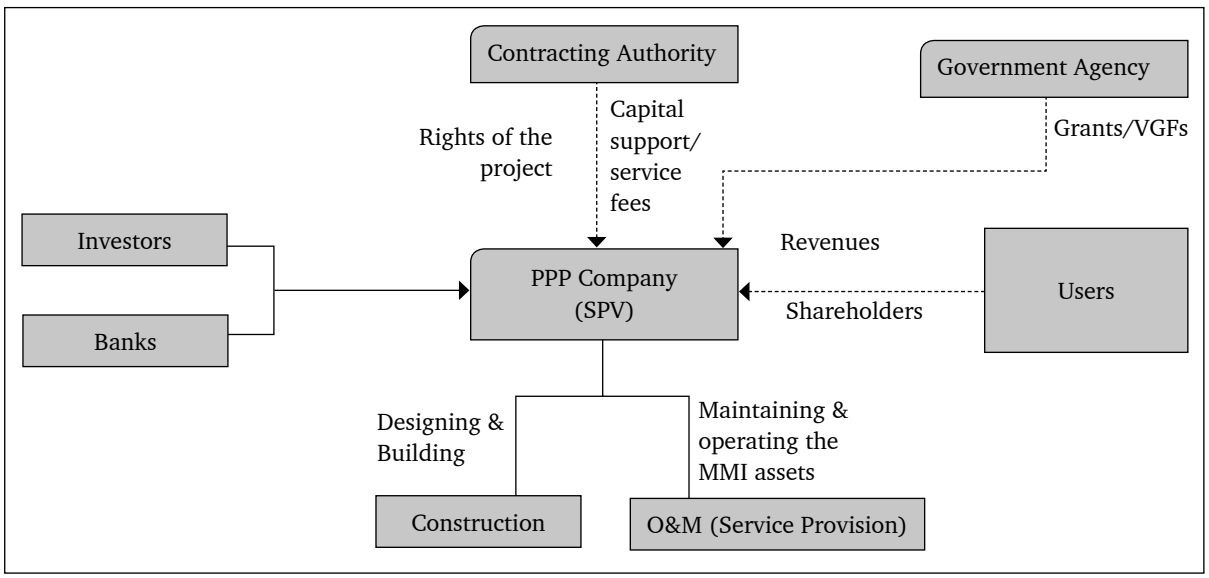


Table 26: Scope of Work and Mode of Implementation for an Existing MMI Project

Project Components	*Tasks:*	*Design*	*Build*	*Finance*	*Billing & Collection*	*Maintain*	*Operate*
Dam		×	×	×	×	×	×
Main canals		×	×	×	×	✓	✓
Divisional channels		×	×	×	✓	✓	✓
Barrage		×	×	×	×	✓	✓
Distribution channel		×	×	×	×	✓	✓
Field channel		×	×	×	✓	✓	✓

Figure 13: Model for existing infrastructure service project

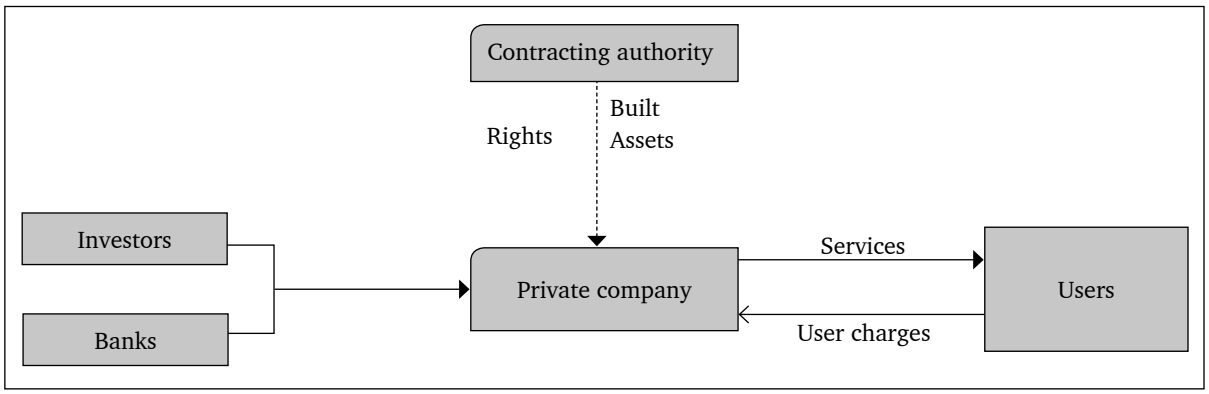
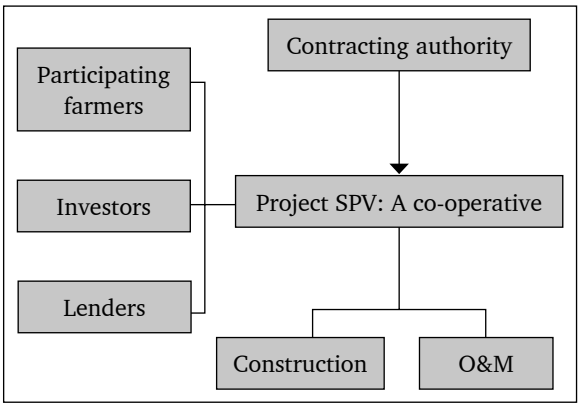


Figure 14: Cooperative model for distribution system



and micro-sprinkler systems are installed to irrigate horticulture crops and vegetables, whereas sprinkler irrigation systems are used to irrigate field crops like wheat, gram, soybean, cotton, sunflowers, etc. The advantages of these systems are mainly saving water, more effective use of fertilizers, and less labor and energy cost.

In Lohardaga district, Jharkhand, one can find a successful case of active community participation contributing to the success of an LIS project. This was made possible under the RSVY scheme; check dams were constructed by the community on its own, in order to prevent the flow of water, by lifting water with the help of five to eight high-pressure diesel engines. After its implementation, the members are expected to pay the tariff fixed by the WUA. Out of 107 sanctioned units, 74 were completed at a total project cost of $0.54 million (Rs24.492 million), out of which the subsidy (under the RSVY scheme) amount came to $0.485 million (Rs21.84 million) and beneficiary contribution to $0.06 million (Rs2.654 million)[3]. Of the 1250 ha of land under the scheme, about 700 ha has been utilized which has helped 1,600 families with an increased profit of $329.47 (Rs14,826) per ha. There are other similar examples of successful community participation in LIS in Rajasthan and Uttar Pradesh.[4]

5. Cooperative farming setup

Co-operative farming is a practice whereby small plots of land are pooled together and managed jointly. One of its greatest advantages is that the size of the unit of cultivation can be readily increased, while, at the same time, deriving all the benefits of large scale farming. For instance, the farmer would be able to strengthen the source of credit, purchase and use costly modern machinery and farm implements, ensure effective division of labor, provide irrigation, undertake measures for the permanent development of land, and finally sell his produce advantageously, which would otherwise be beyond the capacity

[3] Success Story of Micro Irrigation System under RSVY. Lohardaga.nic.in/Irrigation/Micro/Irrigation (accessed 26 June 2011).

[4] Research and Development Initiatives. 2003. Sharing Practices in Rural Development: Case Studies of Few Success Stories in Rajasthan and UP. New Delhi. Report submitted to the Planning Commission.

of an ordinary individual farmer. The cultivator derives these benefits by becoming a member of a co-operative farming society without losing his individuality, initiative, and ownership.

Considering these obvious benefits, the question of developing cooperative farming in the state of Maharashtra was given serious consideration in the post-independence period and a special officer was appointed to investigate and suggest the suitability of adopting co-operative, collective, joint or better farming societies, along with model schemes for each type of society.

Cooperation in the field of farming began in India in 1958–1959, with the establishment of a joint co-operative farming society at Sahur, Maharashtra. By 1964–1965, 19 societies had been set up (17 Joint Farming Co-operative Societies and two Collective Farming Societies) with a total membership of 242 and a share capital of $1,440 (Rs64,700). The government contribution to the share capital amounted to $1,000 (Rs44,700) and the reserve and other funds stood at $400 (Rs18,599) during the same year. Together these societies commanded an area of 780 ha of which about 9 ha was under irrigation. In 1964–1965, the value of agricultural produce stood at $4,950 (Rs222,808). Of the total number of societies, 13 made a net profit of $850 (Rs38,018) while three incurred a loss to the tune of $60 (Rs2,726). Two of the remaining three just managed to balance the expenditure and income, while one had just been registered. A Co-operative Farming Societies Federation has been set up to supervise their activities.

6. Contract farming setup

Contract farming refers to the production and supply of agricultural produce under an advance contract, which is essentially a commitment on the part of the farmer to provide the agricultural commodity of a certain kind, at an agreed time and price, and in the quantity required by a known buyer. It basically involves four factors: pre-agreed price, quality, quantity or acreage (minimum/maximum), and time.

Reliance Life Sciences, ITC (agri-business division), Jain Irrigation, and PepsiCo are some of the prominent companies that have either already started contract farming projects or are actively discussing them with governments.

The contracts come under three categories:

- Procurement contracts, under which only sale and purchase conditions are specified;
- Partial contracts, where only some of the inputs are supplied by the contracting firm and the produce is bought at a pre-agreed price; and
- Total contract, under which the contracting firm supplies and manages all inputs, and the farmer becomes the supplier of the land and labor.

7. Private groundwater development

Private groundwater development refers to tube well irrigation through modern water extraction mechanisms. It has been vital to food security and sustainable livelihoods in India due to its relatively high reliability and efficiency as compared to canal irrigation. India started with big publicly owned surface irrigation systems. However, over the last two to three decades, there has been major expansion in irrigation capacity in terms of private groundwater irrigation and this has been the lifeline for agriculture, especially during this period. Certain policy decisions are needed with regard to the exploitation of groundwater resources, which not only prescribe limits on its utilization, but also define the manner in which these resources should be shared on an equitable basis among the farmers in the area.

8. Water delivery model including micro-irrigation

Under this model, an artificial waterway is to be constructed for the movement of water for purposes including navigation, transportation, irrigation, water supply or drainage. The (canal) water delivery model can be used for flood control by diverting water from threatened areas into storage basins or to other outlets. In some cases, the models are used to generate electricity.

9. Specific purpose PPP models

PSP in the I&D sector cannot be restricted to irrigation infrastructure or service delivery projects alone. There are a number of other areas where specific purpose projects can generate revenue through PPP efforts, which could be utilized for the development of other irrigation-based infrastructure elsewhere. At present, the policy of many of the state governments is to transfer the revenue generated to revenue departments and irrigation departments/WRDs that are maintained through budget grants approved by the state legislatures. Ample opportunities for revenue generation exist within the I&D setup of states. A paradigm shift in policies is required if the revenue generated by I&D is to be used within the sector, as in the case of railways or defense. Some of the areas that need the immediate attention of state governments and where PPP initiatives could be viable are:

Flood control projects: As mentioned in Chapter 3, efforts towards flood protection through embankments can be coordinated with the transport sector to develop expressways/high-speed roads on embankments. The revenue collected as toll and cess on protected areas could be shared. An example is the Badaun–Ballia Ganga Expressway project in UP, which is currently in the pipeline.

Box 3: Expressway on Embankments

In the present day context, embankments not only provide flood protection but can also be utilized as means of communication, road-side development, and serve as sites for river front leisure activities. These offer ample scope for private investments. The government of Uttar Pradesh considers[5] that at a cost of $5.55 million (Rs250 million) per km of embankment length, the total cost of developing expressways on 4,700 km would be around $26.67 billion (Rs1,200 billion). An expressway project connecting Budaun to Ballia along the river Ganga is already under construction under a PPP arrangement, at a cost of $8.94 billion (Rs400 billion).

Canal lining projects: Seepage from canals is a major cause for the loss of water and thereby a loss of potential created in irrigation canals. The lining of existing channels in critical reaches is often necessary, but ignored for want of funds. The government of Uttar Pradesh (GOUP) alone has estimated an investment of $13.3 billion (Rs600 billion) for lining critical reaches of main and branch canals of all major systems in the state. Such projects offer certain advantages like low gestation period, no need for acquisition of additional land and rehabilitation of people, no adverse environmental impacts, and ease of construction. Waterlogged and marshy lands areas along canals could be identified where private developers could be allowed to develop the land as ponds, lakes, etc. The GOUP is also exploring the use of silt taken out of canals for making bricks and pavement blocks.

The construction of high speed roads on the banks in important reaches of canals, laying of telecom and other service lines along roads, the development of tourism and industry along canals, and even permitting navigation within select reach of canals could be treated as incentives for lining and maintaining canals in the long term.

Multi-purpose hydropower generation: It is estimated that India has a hydropower potential of 84,000 MW at 60% load factor, out of which only about 20% has been developed so far.[6] Though the government has itself introduced various policy initiatives, it has also permitted 100% Foreign Direct Investment in the hydropower sector. Recently, the government of Mizoram approved the setting up of hydropower projects under a PPP framework. The Tuivai Hydro Electric Project is to be built with an installed capacity of 210 MW, at an estimated cost of Rs17.5 billion. It is expected that nearly 30% of its cost (Rs5.1 billion) will come as VGF from the central government.[7] Multi-purpose projects incorporating hydropower generation can be easily brought under the PPP fold.

Micro-hydel projects on canals: Several main/branch canals offer the opportunity for the harnessing of waterfalls for the development of micro-hydel

[5] SWaRA. 2009. *Public and Private Partnership in I&D Sector in Uttar Pradesh: A First Concept Paper*. Lucknow.
[6] ADB. 2007. *Hydropower Development in India: A Sector Assessment*. Manila.
[7] 2011. *Financial Express*. 14 May.

energy. The Micro Hydel Corporation and the Non-conventional Energy Development Agency are already exploring such options. This could potentially act as an incentive for PSP to develop other I&D sector projects.

Riverfront development projects: A large number of urban centers discharge their industrial and domestic waste in rivers. As already discussed, a majority of the rivers have already been polluted beyond their self-cleansing capacity. A dip in flow pattern during lean season has been observed in many rivers due to the reduction in base-flows as a result of excessive pumping in nearby areas for agriculture, domestic and industrial use, and also given the boost in building activities. River bank encroachments cause a further increase in the accumulation of solid waste. The Yamuna near Delhi, Mathura, and Agra, the Gomti at Lucknow, and the Ganga near Kanpur and Varanasi are typical examples. The GOUP has recently taken some preventive measures with respect to the Gomti at Lucknow, where a number of industries in the upstream catchment have been banned and STPs are promptly being installed. Despite efforts, however, local bodies express difficulty in maintaining a minimum flow for ecological considerations, reducing Biological Oxygen Demand (BOD), and improving Dissolved Oxygen. Flood Plain Zoning is being attempted for want of regulation along the river bank line.

With citizens' participation as well as certain minimum efforts at the government level, PSP can help in constructing STPs, diverting sewerage, installing group treatment plants for industries, and developing and maintaining the riverfront. Investments for such projects can be raised from a cess on water-supply for sanitation activities, by coordinating with industries, and through the promotion of recreation along riverfront, advertising, etc. Even if VGF is necessary to an extent, it would be worth the effort if flood plain zones are maintained, which is absolutely essential in the present circumstances. Regulation and charging for the pumping of groundwater in river-groundwater hydraulic inter-action zones for building, agriculture, and industrial activity can certainly improve the minimum flow of the rivers.

Integrated area development projects: Integrated area development activity through coordination between various departments is now becoming a reality in various parts of the world. In the case of urban and suburban areas, opportunities like housing, development of amusement parks, recreation, lakes, water front, agro-parks for horticulture, floriculture, and fisheries on unused lands under the irrigation departments, could be developed as incentive to private investors in lieu of work being done elsewhere. In rural areas, agro-parks could be an ideal setup for developing agricultural activities or animal husbandry and dairying.

Irrigation land in the vicinity of reservoirs could be developed for agro-parks, tourism, recreation, water sports, and/or allied industries. Ample opportunities exist around and near reservoirs where opportunities for sharing revenues with private investors could be considered for providing works elsewhere.

Development of pisciculture: In a number of states, the fisheries departments manage pisciculture in reservoirs, wetland, canals, and other water bodies, on a cost-sharing basis, with a small percent allowed as royalty to the irrigation departments, which treat this as revenue. The yield per ha from ponds in India is nowhere near international standards; increasing the productivity of fish in the economic sense is likely to boost water productivity in a broader sense. The development of pisciculture through PPP initiatives could be an added incentive for PSP in the irrigation sector.

Some states are encouraging the development of pisciculture at micro-level through a group of farmers, WUAs/SHGs using micro-financing. These groups manage a small pond in a village or develop a farm pond. Such activity not only helps in harvesting groundwater, but also assists the farmers in maintaining adequate soil moisture for raising rabi crops. A national level committee constituted for mitigating droughts in the Bundelkhand region has strongly advocated the construction of farm ponds. Such activities need supportive action on a large scale for providing good quality fish, feed, cold storage, and marketing facilities. In several countries, fisheries are being developed, managed and marketed in the form

of cooperatives, like Amul in the milk sector in India. The promotion of fisheries through PPP efforts as part of contract farming is a possibility that needs to be explored and studied.

Groundwater harvesting projects: In the case of several rivers in the Himalayan belt, excessive flood flows cannot be utilized due to the want of storage sites, which mostly lie in the neighboring countries like Nepal and Bhutan. The majority of flood flows drain to the sea as the current policy of the central government does not permit the development of irrigation infrastructure for kharif crops alone. The Ghaghra, Gandak, and Kosi are three such rivers in the Ganga basin where sufficient potential for kharif irrigation in commands adjoining the rivers can be developed from low diversion or lift irrigation schemes for use in the kharif season. This will in turn help in the harvesting of groundwater and improve the prospects of rabi crops as well. Since such flood waters have not been allocated as yet, the sharing of water rights could be easy if such schemes are conceived through PPP efforts. As an incentive, agro-based industrial and research plots could be provided to the private sector for the setting up of supporting agriculture activities in the region by way of contract farming or cooperative efforts of WUAs. Such activity should take place away from the city centers at sites that can be developed as hubs for meeting the basic horticulture/poultry/dairy needs of the people living in urban areas. There is ample scope for initiating PPP efforts in this area.

Micro-irrigation projects: A centrally sponsored 'Micro-Irrigation Drip and Sprinkler' scheme provides subsidies to individual farmers through the coordinated efforts of developers, banks, and state agriculture departments. The scheme also includes partial loan assistance, installation, training for three to four years, and back-up services. Several state governments also provide assistance for micro-irrigation out of the state funds. As a result, subsidies under the scheme are directly disbursed to farmers.

Micro-irrigation could essentially be linked to all new groundwater development projects, particularly in the areas where contract farming is to be encouraged. Many agro-based companies and manufacturers of micro-irrigation equipment as well as land developers would be interested in this activity.

Navigation on canals: The navigation potential of many of the large canals and some select reaches of the rivers allow for one/two-way traffic. The GOUP has already initiated action in identifying the potential for developing navigation on the Upper Ganga Canal to connect the sugarcane fields with the sugar complexes within Uttar Pradesh, which will provide much relief to road transport in the region. Suitable tracts need be identified.

Tube well expansion: The groundwater potential has not yet been fully utilized in many areas such as eastern Uttar Pradesh, Bihar, Jharkhand, West Bengal, Orissa, Chhattisgarh, and states in the north-east. This water has not yet been allocated for any purpose. In order to promote PPP in the I&D sector, rights could be transferred to private developers for bulk use (in a regulated manner) for commercial or any other purposes, in safe zones equipped with the appropriate rain water harvesting measures.

Chapter 9
Road Map and Detailed Action Plan

The conventional method of developing irrigation systems in India has involved the states managing the construction of large canals, with O&M work being carried out when required. Around the year 2000, PIM gained prominence and the dominant view in the sector now is that farmer management through WUAs will help improve efficiencies. This approach has been partially successful and the operating framework needs to be significantly altered in order to develop the sector. If and when private participation increases, it is expected to bring in more efficient practices and (hopefully) finance to the sector. However, this can happen only after there is a systemic change which includes organizational initiatives. This chapter discusses the role of various organizations and formulates an indicative road map and plan of action for the involvement of the private sector in I&D projects.

A. Road Map for PPP in the I&D Sector

The implementation of infrastructure projects under a PPP framework (in any sector) is a new phenomenon in India, and the country is yet to witness a complete project life cycle—very few projects have completed their 'designated' contract periods. Different sectors have progressed at varying stages: highways, telecom, and power are amongst the infrastructure sectors that have witnessed better PSP, while water supply/ sewerage have gained lower private sector interest. The evaluation of each sector differs in terms of compliance, complaints and risk sharing. For example, in the case of the highway sector, PPPs were initially implemented under a toll-based structure, which was subsequently transformed into an annuity-based structure and proved to be a success; now the toll-based models are being adopted again. In contrast, the water sector has very few PPP contracts and these are largely restricted to management contracts and EPC plus O&M contracts. Hardly any construction contracts have been taken up in the PPP mode.

Private sector involvement in the I&D sector is currently limited mainly to item-rate contracts, while some projects are being conceptualized, none of the major ones are being actively developed yet. The substantial sectoral issues in the current scenario—the lack of demonstrated need at both public and private levels, acceptability by beneficiaries and stakeholders, and sustainability of a suitable revenue model—do not appear to be conducive for a rollout of PPP projects on a large scale. At present, substantial need-assessment, project development and promotional actions are required for soliciting private participation in I&D sector.

The rollout for PPP in the I&D sector would need to be addressed at various levels of the government; central and state level authorities as well as implementing agencies need to be allocated certain duties and responsibilities. A road map, in that sense, does not specifically constitute an "Operations Plan" for any particular agency, but is aimed at concerted efforts across various agencies and bodies in the government. A broad understanding among different agencies is the need of the hour and precedents in other infrastructure sectors have proved that such an approach is possible. Directions provided by the

central agencies and the efforts of a few states (in the first mover category) can set the tone for the overall growth of the sector.

The broad parameters identified for developing PPP in the sector include: an institutional setup, appreciation of the need (for specific projects and programs), a robust financial and revenue framework, and project specific development activities.

The relevant short, medium, and long term activities are set out in Table 27.

B. Institutional Strengthening

Institutional strengthening and capacity building activities are expected to play a major role in the transformation of the sector. Their benefits are twofold: to prepare the agencies for private participation if and when required, and importantly, to educate the agencies on the intricacies of commercial operations within the framework.

The institutional framework needs to be multi-tiered, with state and national level councils, technical

Table 27: Road Map to Operationalize Elements for Private Sector Participation in the I&D Sector

Category	*Short-term* (0–2 years)	*Medium-term* (2–5 years)	*Long-term* (5–10 years)
Institutional Strengthening	• Formation of national and state level councils • Stakeholder consultations • Considering and reviewing the need for PPP cells at state level in WRD • Strengthening the functions of Regulatory Commissions/Authorities from PPP angle	• Setting up of PPP cells specifically for Irrigation Departments/WRDs, where warranted • Communication program & stakeholder consultation • Development of templates for transactions	• Standardizing various models for implementation • Monitoring and improving the process, wherever required • Stakeholder consultation
Need Assessment	• Review of current status of I&D schemes & requirements • Indicative plan for completion/development of projects • Role of PSP and modes of participation	• Examine details of the pilots and study their impact • Plan for the integration of learning for rollout	• Develop templates for continuous need assessment and how these needs are met • Incorporate lessons learnt in the long term program
Financial Management	• Preparation of Financial Plan for the completion of existing projects • Development, based on need, of the revenue models for PPP projects	• Shortlist of revenue models for pilot projects • Test out various schemes/ models in pilots[1]	• Crystallize options for structuring of PPP projects • Develop guidelines for rollout
Project Development & Rollout	• Broad listing of projects for further evaluation • Templates/consultation for short- listing of projects • Pre-feasibility (technical, financial, legal, social, environment aspects) of a few projects	• Detailed project preparation • Transaction process for pilot projects • O&M and Service Contracts could be taken up	• Assimilation of learning from pilots • Rollout, after incorporating these lessons

[1] In the short and medium term, simpler revenue model scan be developed (for instance, for O&M service contracts without revenue collection) and pilot projects can be implemented to establish a viable PPP for the O&M phase of the scheme. These can then be gradually scaled up based on the experience gained, once an effective service delivery mechanism has been established;this along with a focus on more promising schemes (e.g., with higher WUA participation, higher revenue, higher share of industrial water, etc.), possibly establishing models of surplus revenue generation by the private players (or third party public company) with their involvement in billing and revenue collection. In the long term,opportunities of developing a more advanced model of PPP as well as the investment phase could be explored, with an improved policy framework to establish the norms for capital cost recovery (linked with water entitlements, etc.).

advisory and coordination committees and PPP cells, and must be developed in the states where PPPs are to be implemented. The indicative roles of such agencies are laid out below:

1. Scope of national and state level councils, committees, and/or boards to include promotion of PPP in the I&D sector

As a first step, the national and/or state level councils, committees, and boards can assess the challenges involved in encouraging PPP in their respective domains. Thereafter, the base framework for the I&D sector can either be developed by existing state level councils with modified TOR, or altogether new bodies can be set up, sufficiently independent from the policy making apparatus of state governments. The broad charter for such councils could include:

- Setting out the diagnostic status of the sector;
- Carrying out a review of the guidelines/ procedures for decisions related to investments and service provision, including a comprehensive assessment of the technical, social, financial, and environmental aspects;
- To propose and assist stakeholder consultations;
- Prescribing guidelines/templates/formats for assessing the feasibility of pilot PPP projects; and
- Advising the policy-making bodies on the outcomes of deliberations over the implementation of PPP projects in the I&D sector.

2. Broad scope of existing technical advisory and coordination committees in WR/I&D departments for clearance of all PPP projects

The MOWR and CWC have stipulated certain guidelines for preparing project reports of irrigation/ multi-purpose water resources infrastructure development projects. According to these, the role of the state Technical Advisory Committee (TAC) is to review the PPR and/or DPR prepared for the irrigation/multi-purpose water sector projects by the state irrigation departments/WRDs, before submitting it to the CWC and departments of other Ministries for appraisal and approval. The TAC is also supposed to ensure that reports follow the guidelines with respect to: surveys and investigation; hydrological concerns; irrigation planning; environmental, social, economic, and financial studies; civil, electrical and hydro-mechanical designs; and cost estimates. Alongside these roles, TAC is also responsible for the interface between the private entity and the PPP cell within the WRD. The guidelines could be reviewed in the light of a PPP arrangement. The broad scope and procedure for the clearance of project reports for PPP has been elaborated below:

- TACs need to prepare templates for project reports such as the PPR and DPR for projects to be implemented through PPP. Though the templates/ guidelines for project reports are currently available with the CWC, these may need to be modified to better suit the requirements of the private developers.
- The PPR is to be prepared by technical consultants appointed by the respective PPP cells through a competitive and transparent bidding process. The selection process and bidding documents are to be based on the guidelines prepared by the Planning Commission.
- The PPR should first be reviewed by the relevant agencies in the states/Union Territories and also approved by the respective regulatory authorities within the state governments for feasibility analysis, allocations on water issues, and for deliberations with stakeholders. If necessary, central agencies should be invited for the stakeholders meetings.
- The TAC is supposed to review the PPR, which should, as per the CWC and other ministries' requirements, cover surveys and investigations including geological, seismic and foundation investigations, construction, material survey, hydrological and meteorological investigations; international/inter-state aspects; hydrological studies; drinking water requirements; irrigation planning; planning for other intended benefits; brief environmental and ecological aspects; social concerns, financial analysis, cost estimates, etc. This is necessary to establish the techno-economic

viability of the basic planning of the project proposal. All the requisite clearances should be in place before the submission of papers to the TAC.

- The PPR must contain all such information on the proposed project based on which an interested party can prepare a bid. In cases where it is necessary to issue a DPR to the bidders, the same needs to be taken care of by the TAC.
- Upon review by the TAC, the PPR is to be submitted to the CWC, if required, for 'in-principle' approval. The CWC then scrutinizes the PPR and conveys 'in Principle' consent for the preparation of a DPR once the prerequisite of satisfactory compliance to CWC observations has been incorporated by the state government in the report.
- The PPR forms part of the documents that are issued to interested bidders. The selected bidder then prepares the DPR using the most up-to-date data, detailed surveys, investigations and the required studies and cost estimates as per the latest schedule of rates, CWC guidelines, and the relevant Bureau of Indian Standards (BIS) codes, while complying with the comments and observations of the CWC, if any.
- The bidder simultaneously processes and obtains the necessary clearances from the Ministry of Environment and Forests with respect to the Environment Impact Assessment (EIA), Environmental Management Plan (EMP) and diversion of forest land, the Ministry of Tribal Affairs (in case tribal population is affected), and other concerned ministries. The submission and clearance of EIA and EMP, R&R Plans, etc. and forest clearance will be governed by the prevailing norms and regulations of the relevant ministries.
- The TAC and PPP cells are to ensure that all necessary clearances are received from these ministries well in time after due appraisal; the DPR is submitted along with these clearances to the CWC for appraisal; and that the approval of the TAC of MOWR is duly procured.
- On the basis of recommendations made by the TAC, the Advisory Committee of the MOWR takes a decision on the techno-economic viability of the project proposal.

3. Creation of PPP cells in Irrigation Departments/WRDs

It is recommended that a specialized PPP cell comprising of qualified professionals be established within the Irrigation Departments/WRDs, directly under the Engineer-in-Chief (EIC),to provide all kinds of legal and technical assistance on various major, medium, and ERM irrigation/multipurpose projects or any other water-related specific purpose projects undertaken by the department, which follow a PPP model. Where independent civil and mechanical departments co-exist for the development of surface water and groundwater (respectively), separate cells may be created in each EIC office. These cells should coordinate with each other in the case of conjunctive use. The expertise of the PPP cell may be utilized for the following purposes:

- to act as a nodal agency to the department for the development of PPP policies and programs, and make suitable recommendations to the department for due consideration and subsequent adoption;
- to conceptualize and identify any kind of PPP project in the I&D sector in consultation with Divisional, Circles and Organizational offices within irrigation departments/WRDs under the guidance of the EIC;
- to advise irrigation departments/WRDs on the formulation of the PPRs/DPRs of projects and offer recommendations or suggestions;
- to encourage the participation of private entities in the financing, construction, maintenance, and operation of projects;
- to co-ordinate between the concerned departments/agencies involved;
- to prioritize projects to be taken up by the department and prepare an inventory of PPP projects to be implemented;
- to issue guidelines and develop model documents/agreements for the irrigation/multi-purpose sector and issue standardized documents in order to harmonize EOI/tender procedures relating to PPP projects;
- to recommend projects for grant of VGF under the relevant scheme(s) of the state/central government;

- to review and monitor PPP projects during implementation, execution, operation, and management;
- to develop and promulgate procedures and standardize best practices for PPP;
- to render and review opinions regarding the viability of PPP projects;
- to disseminate information regarding PPP programs and individual projects;
- to undertake public education campaigns on PPP for stakeholders;
- to call stakeholders meetings;
- to prepare and disseminate information and directives about PPP projects;
- to submit proposals to the irrigation department/ WRD for strengthening legislative, regulatory, institutional, and policy frameworks for PPP;
- to provide technical assistance for project implementing agencies;
- to scrutinize project proposals, tenders and contracts, and systems of governance of contractual structures prepared by various implementing agencies; and
- to monitor and issue opinions on the level of compliance of implementing agencies and the service providers to the terms and conditions of the agreements effected with respect to any PPP projects.

C. Financial Management and Project Development

Most states require substantial fiscal resources to complete the iron going projects, and the budget allocations do not seem adequate. On the other hand, the I&D projects do not seem to be financially free-standing. Implementation agencies need to prepare comprehensive financial plans in order to complete the existing projects. In addition, sub-plans should be developed to incorporate a PPP arrangement. The experience gained through a few pilot projects could help ascertain the direction of the required revenue models.

The development of the projects under consideration, subsequent to the preparation of plans, is crucial for effective implementation. Typical project development activities include technical assessment (engineering feasibilities and investigations), acquisition of land and management of utilities, getting the required clearances for the commencement and implementation of projects, and following the procurement process (of the private partner). Subsequent activities include monitoring and evaluating the project implementation process. Typically, the technical assessment would culminate in the preparation of a DPR which sets out the basis for the project. During that process, the project structure will need to be discussed and configured, prior to the procurement process. The procurement and monitoring processes have been discussed in the subsequent sections.

D. Procurement Process and Contract Structures

Considering the variation between the principles and practices followed in different sectors for the selection of bidders for PPP projects, the Planning Commission has prepared certain model documents to be used by various ministries, state governments, and other project authorities for the pre-qualification and selection processes. The guidelines are broad and generic in nature and are aimed at providing predictability to the entire process, allowing decisions to be made objectively and expeditiously. The documents address the critical minimum requirements that are to be observed in conducting the selection process and do not necessarily pertain to the concerns of the water sector in particular. If necessary, the MOWR/state governments could rework these guidelines to better suit the I&D sector.

The selection process under the model documents is typically divided into two stages. In the first stage, which is referred to as RFQ, Expression of Interest (EOI) or qualification stage, the eligible bidders are shortlisted. The objective of this stage is to identify credible bidders meeting the requisite technical and financial capacity for undertaking the project. The

second and final stage, known as the RFP stage or Bid stage, is when financial bids of the shortlisted bidders are invited. At this point, technical proposals may also be sought from the bidders, depending on the scale and nature of the project in question.

The technical capacity of the bidders is calculated based on their experience and capacity for building infrastructure projects. This is determined either from the construction work previously undertaken or commissioned, from the revenues generated from PPP projects (BOT/BOLT/BOO), or both of these, within five years preceding the application date. Eligibility conditions could also include relevant experience in the field of O&M. For the bidders to be pre-qualified, they must also have undertaken projects with weighted capital cost/revenues equal to twice the Estimated Project Cost.[2]

The financial capacity and strength of the bidders are measured through their respective net worth. To qualify as per the model document, the bidder is required to have a minimum net worth equivalent to 25% of the estimated capital cost of the project for which the bids are invited.

In the case of exceptionally complex projects where the project authority determines that the bidders must submit their technical proposals/plans, the requirement thereof should be specified in detail and such proposals/plans should be invited at the qualification stage, either along with the applications or at an intermediate stage preceding the bid stage.

The objective of the bid or RFP stage is to bring in financial offers from the bidders pre-qualified at the RFQ stage. Information sought in the RFP is restricted to financial offers only. The bidding parameters at this stage are to be decided keeping in view the nature of the project and its revenue streams. The financial offer constitutes the sole criteria for the selection of a bidder and the project is to be awarded to the bidder who quotes the lowest grant or highest premium.

Detailed terms of the project have to be specified in the concession agreement that forms an integral part of the bidding document which is to be provided to the bidders along with the RFP document. The contents of the concession agreement constitute the bid conditions and are, therefore, binding. As such, much effort and expertise is required to draft it. A feasibility report is also to be provided to the bidders, though that is only for their assistance and its contents are not binding.

The RFQ and the RFP documents provided by the Planning Commission provide sufficient flexibility for meeting sector specific as well as project specific needs including the water supply and irrigation sector. Certain provisions in the documents, usually encased in square parenthesis, can be modified by project authorities to suit their respective requirements. The project authorities can also add project specific conditions in their respective RFQ and RFP documents. However, the Planning Commission has finalized the concession agreement for only certain select infrastructure sectors like Highways, Airports, Ports, Railways, etc., and the efforts are on to prepare concession agreements for other sectors.

E. Monitoring and Evaluation

Efficient contract management during the implementation phase is critical to ensure that the project meets the desired objectives and proves cost effective. A number of PPP projects fail on account of limited and ineffective contract management. Inefficient contract management has a significant negative impact in terms of a) the social impact of disruption in service delivery; b) the financial impact of time and cost overruns; and c) reputational impact on the public sector due to disputes that may arise with the private party.

The process of contract management goes beyond purely administering the contract. It involves (i) defining the processes and procedures required for meeting contractual obligations; (ii) developing good working relationships; (iii) monitoring the private operator's performance to ensure that project objectives are met in a cost effective manner; and

[2] The B. K. Chaturvedi Committee recommends diluting this component in order to 'equal the Estimated Project Cost'.

(iv) monitoring and managing risks associated with the project.

Water, albeit a key input, is one of the many required in the agriculture/horticulture sector. The gains from the timely and adequate quantum of water supply can make a substantial difference to the farmers' commercial standing and hence, they would like to have a say in the I&D sector. This is currently facilitated by WUAs at various levels (zonal, district levels, distributary and project level committees, etc,). When an MMI or MI project is configured, the immediate stakeholders will be impacted and may not have recourse to a redressal mechanism under the conventional provisions of WUAs. Those directly participating in the project may give the farmers concerned a better appreciation and also derive benefits directly. This may also considerably improve project sustainability.Towards this end, a cooperative model could be configured, such as the one illustrated in Figure 14.

Between the issuing of the letter of award and the end of the contract term, there are a number of specific activities to be performed by the contract authority. The contract management team is responsible for these and a detailed contract management plan is to be drawn up to define the key processes, procedures, roles and responsibilities, and escalation procedures for the contract management process. The plan is a compendium of individual plans such as service delivery, contract administration, and relationship management plans which work together to assist the public sector in ensuring that the private party performs its obligations as per contractual terms, while ensuring value for money.

The nature of activities to be taken up by the contracting authority varies across the project stages, as indicated in Figure 15.

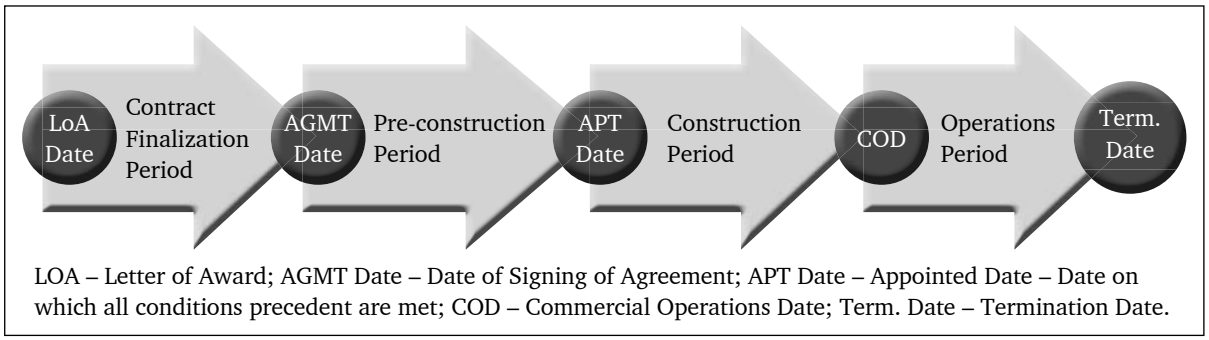
1. Contract management team

The primary responsibility of the contract management team is to monitor and review the PPP project in order to ensure that the performance of the private party satisfies the contractual terms. Given the resource constraints faced by most public sector project authorities, the Planning Commission has recommended a two-tier PPP project monitoring and reporting structure, which is given in Figure 16.

At Tier 1, it recommends the establishment of a PPP project monitoring unit (PMU) which should be established at the project authority level. A single PMU can be responsible for the monitoring of two to three projects where the aggregate value of projects managed is less than $555 million (Rs25 billion). The PMU should be manned by at least three officers, of whom at least one should have experience in the discipline of finance. It should be headed by an officer with a rank of at least Director/Deputy Secretary/ Superintendent Engineer. The other two personnel could be either officers or consultants. Monthly reports need to be created by the PMU on key project parameters in the required format. These reports are to be submitted to the next tier.

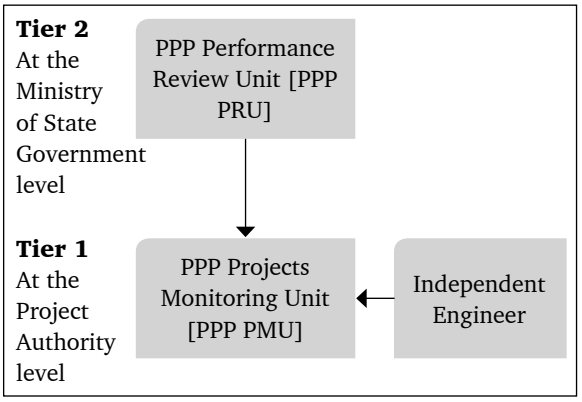
Tier 2 of the monitoring of PPPs is at the level of the central ministry or state government, through the PPP Performance Review Unit (PRU). The PPP PRU should be headed by an officer not below the rank of Joint

Figure 15: Nature of activities to be performed by the contract authority



LOA – Letter of Award; AGMT Date – Date of Signing of Agreement; APT Date – Appointed Date – Date on which all conditions precedent are met; COD – Commercial Operations Date; Term. Date – Termination Date.

Figure 16: Monitoring mechanism in a two-tier project



Secretary at the level of the central ministry/state government/statutory entity to review the monitoring of all PPP projects within its jurisdiction. In case a PPP cell exists in the respective ministry/department, it could be suitably strengthened for serving as a PRU. In the case of multiple PPP projects under a single PPP PRU, it should preferably have a dedicated team with no other functions. Additional consultants may be hired if necessary. The PRU is also required to submit a quarterly report on the status of the PPP projects based on the monthly reports submitted by the relevant PMUs.

Given the dynamic nature of the business environment in which PPP projects operate, the monitoring mechanisms should be suitably developed to ensure that project delivery is not impacted as a consequence of frequent changes in the environment. Thus the contract management function to be performed by the PPP PMU must be both efficient and cost effective for the project authority.

2. Performance management

The performance management system is fundamental to the contract management process since it forms the basis of all payments made to service providers; any penalties or incentives are also estimated through this process, based on the terms of the contract.

- Output specification should include the performance targets aimed at incentivizing the service provider to deliver the service;
- Performance monitoring mechanisms are developed and agreed to at the signing of the contract, and should ideally reflect the service delivery requirement of the government or contracting party; and
- A payment mechanism is also developed and agreed to at the procurement stage, to specify how payments are to be made and penalties imposed. It must also lay down the interlinkages with the output specifications.

The first step in developing performance indicators is to have a clear understanding of the performance requirements at each stage of the project lifecycle. The next is to define the performance measurement framework in terms of key performance indicators (KPIs).

KPIs are metrics to track the progress or performance of a project 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.

The process of developing KPIs begins in the procurement stage of the PPP project lifecycle. At this point, the contract manager/team provides support to the procurement team in developing the KPIs. At the tendering and contracting stage, the performance requirements are identified and defined. Thereafter, the KPIs are developed and elaborated. At the next level, area-specific KPIs are defined. The reporting requirements for the KPIs are also detailed at this stage.

During the implementation and monitoring stage, a reporting and monitoring framework is developed and put into practice. At the same time, the identified KPIs are closely monitored. During the process of implementation, the target KPIs may also be periodically redefined and updated. This is especially relevant for contracts with a longer duration wherein the business environment is likely to change over a period of time.

F. Pilot PPP Projects in the I&D Sector

In order to further explore the possibility and viability of PPP in the I&D sector, it is necessary to conduct detailed studies by initiating a few projects on pilot basis. Discussions were held to this effect between the officers of irrigation department/WRD in the states of Maharashtra and Andhra Pradesh with the MWRRA, to identify possible areas or some of the components of certain identified sub-projects which could be considered for a PPP arrangement by gauging the interest levels of the private sector. Based on discussions, the following proposals were suggested for consideration of further detailed studies on pilot basis:

Maharashtra: More than 1,000 ongoing irrigation projects stand incomplete due to the lack of funds. The GOMaha issued guidelines in 2003 for involving the private sector in the completion of these projects on BOT basis. The state government also identified a pilot project in Krishna basin for completion through PPP mode on pilot basis. The guidelines are under revision.

In 2008, GOMaha requested IFC to provide advisory services on PPP and its views were sought on a few projects. In its preliminary report, IFC identified two potential projects that could be taken up with PSP. The proposed model suggested very high payouts to the private investor by the government and therefore these projects were not pursued further. GOMaha felt that the PPP model would either need revenue streams from sources other than the state budget or VGF from the government. It was concluded that it was not possible to develop a generic PPP model applicable to all projects and project-specific solutions would have to be evolved. The MKVDC is presently engaged in identifying possible areas for generating additional incentives/revenue through the involvement of private investors; subsequently, potential projects to be taken up on pilot basis will be shortlisted.

Shortlisted projects could include ongoing projects which, besides those involving irrigation components such as dam, canals, distribution network, etc., do offer the possibility of including components that can generate additional revenues. A number of alternative revenue streams are possible and these can be made available to the investor by the state government to make the project attractive. Some of these could be (i) hydropower through micro stations; (ii) tourism around the water body of the reservoir; (iii) fishing rights over project reservoirs; (iv) agro processing industry with backward linkages with farmers in the command; (v) agro service centers for providing assured inputs with extension activity in the command; (vi) project based market yards for agri products; (vii) setting up exchanges for trading in water rights between user groups and at specified user fee/brokerage; (viii) commercial development by provision of additional land; and (ix) toll roads along the canal. In Maharashtra, the sale of surplus water is also considered as a source of revenue.

GOMaha has shown willingness during discussions to explore various options for PPP in the I&D sector and to develop a DPR for three or four ongoing projects that could be completed under a PPP arrangement, on pilot basis. The scope of work and TOR of the consultants can be found in Appendix 11.

Andhra Pradesh: The unrestricted proliferation of private investment in groundwater extracting devices for irrigation has led to enormous pressure on groundwater and energy resources. Analysis of data pertaining to Andhra Pradesh indicates an almost 14 times increase in the number of pumps for irrigation between 1970–1971 and 2006–2007(from 0.185 million to 2.5 million), associated with an almost 38-fold increase in electricity consumption (from 0.394 BU to more than 15 BU); and power consumed to irrigate 1 ha has increased about 10-fold (560 units to 5,431 units), which is the real and most immediate cause of concern. The main reasons for this trend may include: poor efficiency of pumps; extraction from deeper aquifers on account of unabated use of groundwater, sometimes beyond sustainable levels; and the adoption of water intensive crops.

Officers in the GOAP feel that there is a need for an integrated agriculture demand side model (AgDSM) through the replacement of energy inefficient pumps by efficient ones, and the management of groundwater and cropping patterns, in order to reduce the demand for groundwater. This could be

considered as a possible area for a pilot project. The benefits of implementing AgDSM include savings in energy consumption, power purchases, reduction in the state subsidy for agricultural power consumption and earnings through carbon credits.

The various sources that could be considered for financing the implementation include the following:

- Farmers, individually or through a collective organization, to replace the pumps.
- DISCOM/s, which would borrow directly to fund the project.
- Bulk industrial users who could sponsor the projects and borrow to fund them in exchange for a contractual right to purchase a portion of the saved energy at a discounted price.
- An ESCO could finance and implement pump replacement and benefits from energy saving under a contract with the DISCOM.

However, the state has already considered involving the three primary stakeholders, the state government, the farmers, and the pump manufacturers through the formation of a Special Purpose Vehicle (SPV) as a viable option for AgDSM. The financing procedure to be adopted for the project is such that the project funds are to be made available to the SPV by the state government as per an annual action plan. The SPV is to identify and determine the quantum of pumps to be replaced by the manufacturer/s through an agreed selection criteria and procurement procedure. The identified manufacturers are to request the SPV for a loan on a prefixed formula and enter into an agreement with the government, which is represented by the SPV. The cost of the pumps is to be recovered over a period of time to balance the gains with increasing demands. This cost is to be loaned to the manufacturer, to be converted into a final payment on the successful completion of the contractual obligations that include efficient performance of the pump over the agreed period of time. The SPV and manufacturer are responsible for monitoring the performance as per certain predetermined criteria and indicators. The manufacturer then enters into an O&M agreement with the farmer to replace the underperforming pumps and provide an extended warranty of maintenance for upto three years. The involvement of nationalized banks as a fourth partner to the SPV can also be explored. This arrangement would be a form of PPP and could be tested initially on pilot basis.

Another area where PPP can be explored in Andhra Pradesh is the integrated development of LISs[3] to provide water for irrigation, SEZs, and power projects. The SEZs would have to be developed with major emphasis on agro-based food processing as well as exporting units and gas-based power projects in order to meet the power requirements of the LIS and the SEZ. This is expected to create synergy among all three components of the PPP project.

There is also scope for PPPs in the modernizing of irrigation commands, using the zero or low energy micro-irrigation concept by taking appropriate inputs from various stakeholders through SPV, with added emphasis on water energy efficiency, increasing water productivity, and developing agri-based food processing and exporting units. Such a scheme could help save water and energy consumption, thereby reducing the need for subsidies in the sector.

Appendix 11 provides a brief description of the scope of work and required manpower, a time schedule, and associated costs for the studies and TOR for experts to carry out studies and prepare a project report for the implementation.

The anticipated costs involved in the two projects in Maharashtra and Andhra Pradesh are approximately $63,000 (Rs2.84 million), and $58,000 (Rs2.61 million) respectively, not including the contributions from the respective state governments.

G. Workshop to Discuss Findings

A workshop was organized by the India Resident Mission of ADB at New Delhi on 31 May 2011 to discuss the findings of the study. Its objective was to share the experiences of some of the prospering

[3] Thirty-one LISs have been proposed in the state, with an estimated cost of $26.5 billion (Rs1192 billion), to irrigate 2.6 mha, utilising 22.2 BCM of water, which would require 8494 MW of power.

states like Andhra Pradesh, Maharashtra, Orissa, and Uttar Pradesh, to discuss the outcomes of the study with central/state government officials, officers from leading agencies in the public and private sectors and other stakeholders with interest in the subject, and to seek their valuable suggestions.

The approach followed by the MWRRA for implementing PPP in the I&D sector in the state was presented by a representative.

Given below are the gist of discussions on the findings of the report as well as the suggestions received.

- A representative for MOWR indicated towards the necessity to pre-fix the water charges for different uses in order to make the project viable under PPP.
- The ADB representative described a recently completed capacity development technical assistance (TA) (BAN-7260) on "Developing Innovative Approaches to Management of Major Irrigation Systems" for which a loan project is scheduled for 2013. Under the loan, an independent authority will be responsible for management and irrigation service charge collection of major irrigation system.[4] The model developed is built on experiences gained from the Barind Multipurpose Development Authority, Bangladesh, which collects upfront user fees for tube well irrigation using a prepaid card system to operate tube wells. The Authority was established by the Government of Bangladesh but became financially self-sustaining after about 10 years and has also diversified to include other activities such as agricultural extension support. The need for supportive and adaptive PIM strategies for large-scale mono-culture irrigation systems was also highlighted.
- The Uttar Pradesh representative stressed the need for the creation of a fully functional PPP cell in the irrigation department; the functions of regulatory authorities should be modified to incorporate the promotion of PPP as one of their functions.
- The representative from Andhra Pradesh opined that the long-term implications of involving PPP in the I&D sector, areas where PPP can be introduced and areas from which additional revenues could be generated should be studied in advance.
- The CWC representative mentioned that there is no paucity of funds and that for various reasons, states are not being able to utilize even the allocated funds.
- A representative from ICID stressed that the PIM concept has to be underlined and interwoven in the PPP setup and that PPP programs have to be implemented in a package project mode.
- There was complete consensus on the following:
  - Large-scale irrigation projects involving dam/head works cannot, as of now, be taken up through PPP on a stand-alone basis; government support is required, in the form of a grant. All development obligations pertaining to head works/dam should always rest with the government, at least for a certain period of time. However, other components like canals, distribution network, etc., can be taken up as PPP projects.
  - The development of other allied facilities not related to irrigation[5] can be made part of an irrigation project, though with careful analysis, in order to make the project attractive to a private player, as long as efforts are directed to meet the ultimate objective of achieving food production goals;
  - PPP cells in the state government departments should be strengthened and their roles properly defined; and
  - The tenure/term of the agreement with the private partner should be at least 12 years, so that it overlaps with at least two political cycles, to enable successful and smooth implementation of the project.

[4] A pilot will be conducted at the Muhuri Irrigation Project (command area of 22,000 ha) on the Feni River.

[5] Other activities could include: provision of fishing rights, development of solar/hydel power plants, tourism related activities, sale of water to WUAs, industrial estates in the command area, STPs in urban areas, etc. It is important to view the project within the overall agriculture/allied sector framework and develop other components accordingly. Agro-related facilities could include: agro-service centers, market yards for agro-products, agro-processing industries, etc.

Chapter 10
Summary and Recommendations

This section provides a summary of the report along with the associated recommendations.

A. Water Resources Development in India: Present Status

India's water resources and other natural resources, though considered abundant in 1950, are now under stress and speedily headed towards scarcity. This is primarily due to the pressure of its growing population and allied environmental and ecological concerns. The per capita annual availability of water is stressed at around 1584 m^3, while the per capita annual utilizable water is already scarce at 952 m^3. Rivers considered water scarce include the Cauvery, Pennar, Mahi, Sabarmati, Tapi, east-flowing rivers between Mahanadi and Pennar, east-flowing rivers between Pennar and Kanayakumari, and the west-flowing rivers of Kutch and Saurashtra, including Luni. By the year 2025, the Ganga, Krishna, and Subarnarekha are also expected to suffer the same fate; by 2050, they will have been joined by the Godavari.

The Government of India Act of 1935 placed the administrative control of developing and managing irrigation works under the provincial governments, and this was accepted by the Constituent Assembly that framed the Constitution of India. Unfortunately, however, this ensured the loss of an all-India perspective on the subject of the development and management of irrigation systems.

At present, 78% of the water in India is being utilized for crops, and this is likely to reduce to 72% in 2025, and 65–68% in 2050, mainly due to competing demands in the domestic and industrial sectors. Given that the net sown area in India is nearly exhausted, the only option to meet the growing challenge of food security appears to lie in increasing productivity as well as production through intensification and the adoption of efficient management practices. Under the threat of climatic changes, the task of increasing the production of food grains from 216 million tons at present to 380 million tons by 2050 is challenging, if not formidable.

B. Planned Development of I&D in India

By the end of the Tenth Five-Year Plan, about 1,410 MMI projects had been completed and another 477 were under execution. Approximately $776 billion (Rs34,900 billion) has been pumped into the development of MMI over the last 60 years or so and irrigation potential of about 42.35 mha has been created. As reported by the Third Irrigation Census, close to 19.7 million MI schemes have been developed, out of which about 94% have depended on groundwater alone; an additional irrigation potential of 62.4 mha has been created under the MI sector. Under the MMI sector, irrigation potential of about 16.15 mha is yet to be developed, while under MI, this figure is 21.08 mha. The gap between the created and utilized irrigation potential in the MMI and MI sectors is 18.87% and 12.6%, respectively. The central government initiative of 1996–1997 to

complete last mile projects under the AIBP received a boost under the Bharat Nirman flagship in 2005, which proposed to create irrigation potential of 2.5 mha during the Tenth Plan Period and 9 mha during the Eleventh Plan Period. However, the Eleventh Plan target had to be reduced to 5 mha due to the low allocation of funds. On the other hand, a number of schemes handled by various ministries have been providing funds for the development and management of MI schemes through grants and loans offered under the MGNREGA and the NABARD.

Towards bridging the gap between the IPC and IPU, on-farm development of irrigation potential of 11.94 mha developed under MMI could be covered under the CAD scheme of 1974 while work on 17.06 mha is ongoing. Greater emphasis being laid on the creation of field channels and field drains. However, with the near absence of other on-farm activities required for enhancing the efficiency of on-farm management practices, the net results of rise in production and productivity have been sub-optimal.

The Model Bill on the regulation and control of groundwater, prepared by the CGWA, has not elicited adequate response from various states, largely because it merely addresses the core issue of limiting the number of borings without prioritizing the allocation of groundwater for commercial as well as non-commercial purposes. A more scientifically based, comprehensive, and region-specific legislation is required, which also takes into account the prioritization of uses, while also keeping in mind environmental and other concerns.

At present, there are numerous issues that plague the water sector in India. Some of these are the gap between IPC and IPU, the rising trend of waterlogging, salinity and alkalinity in irrigated commands, inefficiency in the delivery of water at the minor head, outlet and farm gate, problems associated with floods and droughts, river bank erosion, the quality of surface water, and groundwater, the interaction between surface water and groundwater, and the issue of the resettlement and rehabilitation of PAP.

It is widely believed among social and political circles that irrigation in India is being developed for subsistence and intensification to ensure food security, especially in the light of a vast population of small and marginal farmers and BPL population engaged in agricultural sector. Due to high costs of inputs, low costs of canal water and low minimum support prices, farmers tend to grow less productive and high water intensive crops. O&M expenses in India are not commensurate with the revenue generated and an upward revision of water rates is inevitable if PPP is to be encouraged with revenue generation as a basis. Water rates have not been revised in several states in the last two or more decades; rates of recovery are low; the revenue generated from water charges is deposited with state treasuries and not pumped back for the O&M of irrigation infrastructure. The Thirteenth Finance Commission has recommended the formation of a Regulatory Authority within each state to determine and regulate water entitlements, and decide on reasonable water rates and recovery processes, and even proposed for a central grant to encourage the realization of specified recovery rates.

The water rate structure needs to be rationalized, and can also be linked to the price index, with the aim of adequately recovering the recurring O&M costs and, if feasible, some part of the capital cost, while also keeping in mind the paying capacity of the customers. Accordingly, differential water rates can be levied, using holding size as a proxy variable for the economic capacity of the payers.

A study based on a survey in Deoria, Uttar Pradesh, reveals that farmers already incur much higher input costs for supplying assured groundwater and there is no rationale behind keeping the canal water rates low. It is the assurance of water supply that matters as already a major portion of irrigation potential created from surface water has shifted to groundwater, despite the high input costs associated with groundwater development.

The main issues concerning institutional governance that directly affect users include non-allocation of water rights; inaccessibility, inadequacy and inequity of water delivery; a virtual monopoly of state governments on irrigation; inequitable domestic and industrial supplies which affects the poor; absence of WUAs and other stakeholders at all levels; and lack of transparency and inadequacy of hydrologic information to be shared with users.

Considering the level of development in various subsectors, the balance of costs are estimated at $164.41 billion (Rs7,398 billion) at present day costs to push on business-as-usual approach; and it may take at least four Five-Year Plan periods to create the balance irrigation potential. The tasks of bridging the gap between IPC and IPU may take even longer. The execution of the reforms envisaged under pilot schemes which have been initiated through bank funds in some states require considerable efforts in terms of restructuring the irrigation sector itself.

C. Reform Options

The reform options being considered by the governments to restructure the water sector as a whole and the irrigation sector in particular include (i) participatory irrigation management, (ii) need for conservation (storage) of water in any form, (iii) sustainability through groundwater development, (iv) modernization of canal networks, and (v) efficiency of irrigation water use. It is increasingly being realized that the IWRM approach is indispensible to the sustainable development and management of water resources. This can be realized through an integration of the efforts of all stakeholders; decentralization of management authority to ensure efficiency, accountability, and garnering the best management practices and technical expertise of the private sector; participation of all stakeholders, particularly beneficiaries, and economic and financial stability to account for costs of withdrawing, delivering and opportunity costs, including costs associated with economic and environmental externalities, etc.

Maharashtra and Uttar Pradesh have already enacted Water Resources Regulatory Authority/Commission Acts, with the purpose of regulating water as a resource, assuring judicious, equitable and sustainable management, allocating and optimal utilization of water for environmental, agriculture, industrial, power, flood protection, and drinking purposes. Some other states are in the process of formulating such acts. The regulatory institutions are formulated as a process of reforms initiated by the Government of India under the assistance of the World Bank in order to promote PIM efforts in states; however, they have not adequately addressed concerns and associated risks in promoting PPP in the I&D sector. The regulation of infrastructure development and service delivery is essential to ensure that the private sector provides services to the people in a competitive manner, at the required levels of quality even in the case of rising costs. In the interest of people, regulation is also essential in situations where the benefit of contracting is not likely to be achieved by both parties as stipulated under the contract. Suitable amendments need to extend the functions and powers of these institutions to promote PPP.

According to the NWP, PPP needs to be encouraged in the I&D sector for its various benefits in planning, development, and management. governments anticipate that PSP will encourage innovative ideas, generate finance, bring in corporate management, and increase accountability to users. Despite a number of initiatives, PSP in the I&D sector has been negligible. Investment in irrigation and agriculture is sought to be increased under PPP arrangements without affecting the sacred relationship between the tiller and land. This is supposed to achieve the following: (i) enhance the productivity of farming, particularly food grains, (ii) adaptation of genetic agriculture, (iii) promote private investments, and (iv) bring in corporate culture. It is felt that steadily decreasing public investments are the root cause of diminishing private investments as one triggers the other.

D. Investment Options

Irrigation is a small but important link in the value added chain of agriculture; and a number of PPP opportunities may arise if agricultural reforms (contract framing, improving inputs, markets, agro industries and retail links) are coupled with irrigation development and management efforts. A number of problems like effective conjunctive use, problems of waterlogging, salinity and alkalinity, PIM, effective extension services, cold storage, marketing, and agro processing could be easily addressed on a regional basis through coordinated efforts towards distribution reforms between the energy and water sectors.

E. Experience of PPP in the I&D Sector

A reliable PPP model must define the tasks of both the government as well as the private party. The PPP contract must also include a well balanced risk sharing mechanism. The focus must be on output requirements, performance based payments, whole life-cycle costing, and aspects of financing. The primary concerns of the private sector include political and social issues, commercial risks, and competing facilities. Given the various types of contractual arrangements that are available, the most suitable one needs to be adopted depending on the project requirements.

There is a strong similarity between the PPP concept as applicable in the T&D in the energy sector and in canal water distribution. The former has been tried quite successfully in Orissa, Delhi, Madhya Pradesh, and elsewhere. A number of initiatives in the telecom sector, roads, WSS sector, and contract farming suggest that the private sector's success in ushering in technology innovations and efficient management practices.

There is no evidence of PPP involvement in India in the irrigation sector. However, a number of examples from the world over suggest that if a PPP arrangement is well structured, with high levels of farmer participation and the willingness to pay, it is possible to recover capital and O&M costs. It has been observed internationally that PPP is successful if the government or multilateral agencies contribute substantially to the capital costs, and private parties are made responsible for O&M activities in order to introduce improved technology and achieve efficiency in the operations of the developed assets. Another key lesson from international experience (Morocco and Egypt) has been that user participation and financial contribution for capital investments, and regular payment of user fees have contributed to the success of a project. There, it is essentially due to the large size of holdings by the farmers and their ability to pay for capital and O&M costs. But in India, since there are a large number of small and marginal farmers with small holdings and low income levels, governments may have to step in with payment guarantees and a suitable revenue risk sharing mechanism wherever PPPs are resorted to.

GOMaha has proposed private participation in creating the balance irrigation potential of 3.6 mha at a cost of $12 billion (Rs543 billion). It also intends to improve irrigation efficiencies, encourage recycling and reuse of domestic and industrial effluents, and install solar panels along irrigation canals for energy generation for farmers. Andhra Pradesh is looking at the possibility of implementing a number of LISs for hydropower generation, development of agri-business, and the replacement of inefficient pumps with energy efficient ones under PPP frameworks. GOUP is pursuing road projects on both sides of Upper Ganga canal as well as on embankments of river Ganga with PSP.

Some of the crucial elements involved in making an investment decision include: availability of credible information on the project, payment guarantees, structuring of risks related to recovery of user charges, and finally, a good business case. The other issues which may need to be addressed upfront are unreliability of water supply, inefficiencies due to poor governance, heavy dependence on groundwater, and the nexus between politicians, officials, and farmers at the head reach of the canals who deprive the middle and tail reach farmers their allocated share water supplies, etc. All these factors suggest that the I&D sector needs urgent reforms in order to attract private operators to participate in the development of the sector. Governments, therefore, need to bring in policy changes to improve efficiencies and encourage accountability, transparency, and willingness to promote IWRM. Regulatory measures geared towards effective management of groundwater and periodic revision of water tariffs would go a long way towards eliciting interest in the private sector. Other steps include: single window concept for all approvals (instead of multiple authorities according approvals and entering into financial dealings within the water sector) and the authority to address related risks on account of non-availability of information, commercial risks, and willingness of the lending financial institutions to extend loans.

F. Economic Assessment of a PPP-Oriented I&D Project

Based on the CWC guidelines for the preparation of a DPR of a major irrigation project as well as a recent study conducted by IFC on the behest of GOMaha for the Nira Deoghar Irrigation Project through PPP, a financial analysis was conducted in order to assess the viability of ongoing I&D projects on a financially free standing basis. The viability assessment and scenario analysis for standalone irrigation projects indicated that the projects are not financially viable and are generating negative returns. An attempt was made to add commercial components to increase the viability, though they were not found practical to achieve in every instance.

The projects are, however, expected to provide good economic returns to the nation. For instance, the economic IRR for a typical irrigation project considered for analysis in this section is estimated at 10.4%. The low financial viability of projects in the I&D sector is a result of various policy interventions of the government over the years, along with the changing social, political and governance frameworks at the farm level. Water/water delivery is heavily subsidized in India and consequently, projects in the sector yield no financial returns. The case for investments in the I&D sector then, largely stems from the economic benefits and multiplier benefits across the chain. Accordingly, the premise for private participation would be the improvement of efficiencies in the sector and not financial returns. Projects that involve private participation might need to be structured to reflect this position.

To promote PPP in the I&D sector, an enabling environment will need to be created, with sufficient scope for generating revenues. A stable macro-economic climate and adequate commercial laws and financial services are some factors that will increase the confidence of the private sector to get involved in the I&D sector. Incentives with respect to taxes and subsidies could also be considered. Further and more detailed research would be required to explore different combinations of various possible options for each project, to generate additional revenues, and thereby make PPP a technically and economically viable proposition.

G. Prospects for PPP in the I&D Sector

In the long run, a gamut of policy changes need to be adopted by the governments and its agencies concerned to improve the efficiencies and effective service delivery to the farmers. These include promotion of the concept of IWRM, setting out priorities in water use and proper implementation of the same. Reforms in the water sector must to take into account the changing needs of the users, particularly considering the social and hydrological challenges. The law and policy framework needs to be re-visited especially making more effective users' participation by strengthening the regulations related to PIM, reducing the role of government in irrigation since past experience shows that overt government control has caused failure of several irrigation schemes because of lack of accountability, corporate management skills, and dependence on outdated technologies. Another important area is recovery of costs of operations and maintenance of the water supply schemes (if not the capital expenditure).

Understanding and managing PPP contracts would involve significant capacities at the implementation agency. The role and scope of private sector would change from that of a contractor who gets paid on finishing some work to that of a partner, who assumes much higher risks and responsibilities. The payment and reward structures would progress to "performance" based mechanisms. I&D Sector would need significant implementing agency capacity building.

Implementing an infrastructure project under a PPP framework would entail addressing some key issues and structural considerations including the broad scope of engagement, transfer of ownership (or lack of the same), roles and responsibilities of various stakeholders, robustness of revenue model and operating framework, and the market appetite for the same.

The service requirements and delivery measurement need to be articulated as part of the consultation process during the structuring of the project. There is no plan for a very large scale project or program to be launched in the near future; hence the specifications would have to be project specific. While the sectoral issues are varied and diverse, it is possible to configure projects with substantial operational flexibility over the project period.

Given that the concept of PPP is still nascent in India, it is preferable to structure PPP pilots in the I&D sector in such a way that ownership remains with the government entities at all times. The operating framework or the PPP structure is essentially meant for the allocation of roles to various stakeholders. The development of an equitable structure would entail articulating these roles clearly and this would be the core of a PPP structuring exercise. This practice is expected to be followed in all PPP projects, including the pilots. While preliminary financial analysis does not indicate a favorable situation for financially free-standing projects, a comprehensive structure needs to be put in place to create a support mechanism.

Private sector concerns largely issue from (and their proposals are largely based on) the availability of information about financial risk and the commercial framework that supports equitable risk allocation. These need to be clearly articulated and captured in any structure that is being envisaged. The concerns of lenders also need to be addressed appropriately.

The World Bank has suggested a suitable PPP model in the I&D sector to improve service delivery to farmers associations. However, within the Indian context, an integrated BOT contract model which encompasses the tasks of designing, building, finance, operation, and transfer, especially considering the various components of a project such as dam, main canals, divisional channels, barrage, distribution system, and field channels does not seem to be possible.

Besides the heavy investments involved and the long gestation periods, standalone irrigation development projects also offer limited scope for revenue generation, not even sufficient to cover O&M costs. Unlike power projects where there is some hope in terms of sharing electricity rights, there is hardly any scope for sharing water rights with private developers in the case of I&D projects. Purely private investments are not feasible. The options available for encouraging PPP would then be to consider VGF in some form or the other, incentives for execution and management of projects, and/or a healthy and economically feasible mix of the two.

Apart from development of irrigation infrastructure projects, a number of specific purpose projects could also be successfully linked with incentive projects; for instance: (i) flood control projects linked with expressways and speedways on embankments, collecting toll for road use, and cess for protected area, development of tourism along embankment roads; (ii) lining canals in critical reaches, and linking them with speedways on embankments, development of tourism, canal navigation, toll collection; (iii) development of micro hydel schemes linked through sharing of power or revenue adjustments on that account; (iv) riverfront development projects linked through the development of STPs, citizen's participation, installation of group treatment plants for polluting industries, promoting recreation, advertising, and development of waterfront; (v) integrated area development, development of pisciculture; (vi) groundwater harvesting projects that allow kharif oriented diversion projects on some important rivers in Himalayan alluvium belts, encouraging groundwater harvesting and reuse during dry weather; (vii) encouraging micro-irrigation projects and linking them with all new groundwater development projects; and (vii) tube well expansion programs in areas where there is extensive potential for such development.

Potential benefits of private sector involvement include cost effectiveness, higher productivity, speedy delivery, efficiency in services, customer-oriented focus, transparency, and recovery of service charges in harmony with the local conditions. The multidisciplinary nature of the water sector demands coordination between various water user departments and the I&D sector in order to ensure efficient water delivery wherever required. Many opportunities may emerge if different water user departments consider the possibility of joint infrastructure projects of water supply, distribution, and delivery in the WSS or

power sectors. Such options may require a review of the institutional setup, as well as amendments in the acts and laws while drawing newer policies under the regulatory regime.

H. Way Forward

Unlike in other sectors, the role of PPP remains limited in the case of irrigation projects in India, and is largely restricted to EPC coupled with O&M contracts. In a majority of irrigation projects, PSP is still limited to item rate contracts. The only significant hope in the last decade has been that farmers' management of the system will assist the sector in managing day-to-day maintenance and distribution. Irrigation projects have a long gestation period and large life cycles. So far, hardly any project has witnessed its complete life tenure. The roadmap presented in the report is indicative and thus may be suitably reviewed as per specific considerations and concerns within each state/Union Territory.

There are certain concerns in the sector which need to be addressed before PPP can be implemented in the I&D setup. These include lack of demonstrated need at public and private level, acceptability of users and stakeholders, and sustainability of a suitable revenue model. What is required is significant need assessment for project development and promotional actions for soliciting PSP. The rollout for PPP will have to be addressed at multiple levels within (bureaucratic hierarchy) and across the (various departments of) the government setup by the central, state and/or local agencies, so that a broad understanding of issues can be arrived at. To operationalize PPP in the I&D sector, the central government/agencies, along with the support of certain progressive states, must set the tone for overall growth through select pilot projects in a phased manner, with short (0–2 yrs), medium (2–5 yrs), and long term (5–10 yrs) measures. The road map would thus involve institutional strengthening and capacity building, need assessment, financial management, and project development rollout.

Institutional strengthening: Short term measures towards understanding and promoting PPP in the I&D setup would include the formation of national and state level councils/committees/boards (or reviewing the TOR of existing councils/committee/boards), conducting stakeholder consultations, strengthening the functions of existing regulatory institutions, and capacity building of the agencies. The broad charter should include: (i) arriving at a diagnostic assessment of the sector; (ii) a review of guidelines/procedures for investment and service provision decisions; (iii) involving stakeholders through consultations; (iv) prescribing templates/guidelines to address the feasibility of PPP projects; and (v) advise policy-making bodies on the outcomes of deliberations/ exercises for implementing PPP projects.

The broad scope of existing state level technical advisory and coordination committees should include the clearance of projects from the PPP angle, if possible from a single window perspective. The TAC should prepare templates for the PPR and DPR to be implemented through PPP by suitably modifying existing templates. State TACs should act as interface between the PPP cell within the government and private partners. The project documents (PPR/DPR) prepared by the PPP Cell (or through consultants) within the states should be thoroughly investigated and approved by respective clearance agencies and regulatory institutions for feasibility, allocation, transparency, and stakeholder involvement.

As a medium term measure, a specialized PPP cell needs to be established within each WRD/Irrigation Department, directly under the Engineer in Chief, to act as nodal agency for the development of PPP related policies and programs, conceptualize all kinds of PPP projects for various purposes, advising and assisting different organizations/circles/divisions on the preparation of PPP project PPRs and/or DPRs, coordinate between various agencies within WRDs/ irrigation departments as well as with respective line departments associated with the project, review and issue guidelines and model documents, provide recommendations on finances, VGF of various schemes of state/central governments, review and monitor PPP projects during implementation/execution/operation and management stages, undertake stakeholder consultations as and when necessary, undertake awareness campaigns, and deal with all possible

assistance required by the department and/or private partners.

Need assessment: To begin with, the current status of the projects needs to be reviewed; an indicative plan needs to be developed to further the efforts of development and the role of key players needs to be defined, particularly in the light of PSP. As a medium term measure, some pilots should be taken up in order to gain experience in PPP. Thereafter, long term templates can be developed for continuous efforts in irrigation development, O&M and distribution plans while involving various agencies/line departments.

Financial management: The PPP cell within the WRD/Irrigation Department, in consultation with the state Planning Commissions, should prepare a comprehensive plan for the generation of resources required to complete ongoing and new projects as well as for OMM, monitoring, and evaluation. Pilots taken up on a smaller scale could provide some inputs.

Procurement process and contract structures: The Planning Commission has prepared model documents to guide the pre-qualification and selection process of the bidders for different types of PPP projects. These documents could also be used to devise a framework for the procurement process and contract structure for the I&D sector. The RFQ and RFP documents suggested by the Planning Commission are flexible enough to be tailored to sector specific and project specific needs, including I&D and other water sector projects. Project specific conditions may be incorporated in the concession agreements as and when the need arises.

Monitoring during contract implementation: A Contract Management Team (CMT) could be put in place to ensure that the key elements of a contract are incorporated, which include activities related to monitoring and performance evaluation during the implementation and contract operation period, in terms of developing good relationships, observing private sector performance, and monitoring and managing risks associated with the project.

Performance management is central to contract management as it forms the basis of evaluating the quality and value of services delivered for which payments and penalties/incentives are to be decided; therefore, performance management activities should be built into the clauses of the contract in terms of output specifications, performance targets, incentives for target achievements/penalties for service delivery defaults, and related payment mechanisms clearly outlining linkages with output specifications. For this purpose, KPIs should be evolved at the project formulation stage itself in terms of service objectives. Activity and area specific KPIs should be evolved at the contract formulation, implementation as well as performance stages during the life cycle, particularly for long duration contracts.

I. Pilot Projects for PPP

In order to explore further possibilities and the viability of PPP in I&D and to gauge private interest, a few possible areas/projects need to be identified which can be taken up as detailed pilot studies in the states of Maharashtra and Andhra Pradesh. For this, detailed discussions were held with the officials of GOMaha, MWRRA, and GOAP.

PPP pilot study in Maharashtra: GOMaha has shown willingness during discussions to explore various options for PPP in the I&D sector and to develop a DPR for three or four ongoing projects that could be completed under a PPP arrangement, on pilot basis, and approached ADB for support. Evidently, three or four projects were shortlisted, which were to be considered for the preparation of a PPP DPR. One such project can be considered for detailed study on pilot basis. The MKVDC is presently engaged in identifying possible areas for generating additional revenue through the involvement of private investors and is shortlisting three to four potential projects to be taken up on pilot basis. One such project can be considered initially for the preparation of the PPP DPR. Shortlisted projects could include ongoing projects which, besides those involving irrigation components such as dam, canals, distribution network, etc., do offer the possibility of including components that can generate additional revenues.

PPP pilot study in Andhra Pradesh: Officers in the GOAP feel that there is a need for an integrated AgDSM through the replacement of energy inefficient pumps by efficient ones, and the management of groundwater and cropping patterns, in order to reduce the demand for groundwater. This could be considered as a possible area for a pilot project.

Another area where PPP can be explored in Andhra Pradesh is the integrated development of LISs to provide water for irrigation, SEZs, and power projects. The SEZs would have to be developed with major emphasis on agro-based food processing as well as exporting units and gas-based power projects in order to meet the power requirements of the LIS and the SEZ. This is expected to create synergy among all three components of the PPP project.

Other areas being actively contemplated by the GOAP include: modernization of command areas and bringing these under pressure systems with low or zero energy options, efficient farm practices, improving agricultural chain links, and encouraging active participation of the private sector and other stakeholders. The overall objective of the schemes is not only to introduce efficient irrigation and agricultural practices but also to enhance livelihood options while reducing subsidies in the sector as well.

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APPENDIX 1
Ultimate and Plan-wise Irrigation Potential Created and Utilized by the End of the Tenth Plan

(All figures in mha)

Plan		*MMI*	*MI*			*Total*	*MMI*	*MI*			*Total*
			SW	*GW*	*Total*			*SW*	*GW*	*Total*	
Ultimate Irrigation Potential (UIP)		58.5	17.33	64.17	81.5	140.0					
		Irrigation Potential Created (IPC)					*Irrigation Potential Utilized (IPU)*				
Pre-Plan		9.70	6.40	6.50	12.9	22.60	9.70	6.40	6.50	12.90	22.60
I Plan (1951–56)		2.50	0.03	1.13	1.16	3.66	1.28	0.03	1.13	1.16	2.44
II Plan (1956–61)		2.13	0.02	0.67	0.69	2.82	2.07	0.02	0.67	0.69	2.76
III Plan (1961–66)		2.24	0.03	2.22	2.25	4.49	2.12	0.03	2.22	2.25	4.37
Annual Plan (1966–69)		1.53	0.02	1.98	2.00	3.53	1.58	0.02	1.98	2.00	3.58
IV Plan (1969–74)		2.60	0.50	4.00	4.50	7.10	1.64	0.50	4.00	4.50	6.14
V Plan (1974–78)		4.02	0.50	3.30	3.80	7.82	2.70	0.50	3.30	3.80	6.50
Annual Plan (1978–80)		1.89	0.50	2.20	2.70	4.59	1.48	0.50	2.20	2.70	4.18
VI Plan (1980–85)		1.09	1.70	5.82	7.52	8.61	0.93	1.01	4.24	5.25	6.18
VII Plan (1985–90)		2.22	1.29	7.80	9.09	11.31	1.90	0.96	6.91	7.87	9.77
Annual Plan (1990–92)		0.82	0.47	3.27	3.74	4.56	0.85	0.32	3.10	3.42	4.27
VIII Plan (1992–97)		2.21	1.05	1.91	2.96	5.17	2.13	0.78	1.45	2.23	4.36
IX Plan (1997–2002)		4.10	1.09	2.50	3.59	7.69	2.57	0.37	0.85	1.22	3.79
X Plan (2002–07)		5.30	0.71	2.81	3.52	8.82	3.41	0.56	2.26	2.82	6.23
Total up to X Plan		42.35	14.31	46.11	60.42	102.77	34.36	12.00	40.81	52.81	87.17
Eleventh Plan Targets: MMI – 9 mha; MI – 7mha; Total 16 mha	2007–08	0.84	0.89*		0.89	1.73	–	–	–	–	–
	2008–09	1.02	0.90*		0.90	1.92	–	–	–	–	–
	2009–10	0.90	0.90*		0.90	1.80	–	–	–	–	–
Total up to end of 2009–10		45.11	63.11		63.11	108.22	–	–	–	–	–
Gap in Potential up to end of Tenth Plan							7.99	2.31	5.30	7.61	15.6
Gap in Potential as percent of Potential created up to end of Tenth Plan							18.87	16.14	11.49	12.60	15.2

* Separate figures for SW and GW not available. Utilizations for Eleventh Plan not yet compiled.
MI –Minor Irrigation
MMI –Major and Medium Irrigation Projects

Appendix 2
Extent of Waterlogging, Salinity, and Alkalinity in India Estimated by Various Forums since 1972

(All area in '000 ha)

State	*National Commission on Irrigation (1972)**	*National Commission on Agriculture (1976)**	*Ministry of Agriculture (1984–85)**	*Working Group of Ministry of Water Resources (MoWR) (1991)***	*Remote Sensing Study (RRSC–Jodhpur 2005)*	
					Surface inundated waterlogged area	*Salt affected area*
Andhra Pradesh	NR	339.00	339.00	266.40	28.27	12.93
Assam	NR	–	450.00	–	–	–
Bihar	117.00	117.00	707.00	619.70	627.88	156.89
Gujarat	NR	484.00	484.00	172.59	265.26	307.32
Haryana	650.00	620.00	620.00	249.00	16.46	19.39
Himachal Pradesh	–	–	–	–	0.26	–
Karnataka	7.00	10.00	10.00	24.54	–	5.78
Kerala	NR	61.00	61.00	0.12	12.33	4.00
Madhya Pradesh***	57.00	57.00	57.00	73.12	0.54	4.41
Maharashtra	28.00	111.00	111.00	15.35	426.40	34.54
Orissa	NR	60.00	60.00	196.26	85.99	34.78
Punjab	1090.00	1090.00	1090.00	200.00	34.97	132.00
Rajasthan	348.00	348.00	348.00	179.50	8.41	2.05
Tamil Nadu	NR	18.00	18.00	16.19	32.52	30.70
Uttar Pradesh	810.00	810.00	1980.00	430.00	126.68	283.156
Uttarakhand	***	***	***	***	0.23	0.01
West Bengal	1850.00	1850.00	2180.00	–	46.40	6.47
Delhi		1.00	1.00	–	–	
Total	**4840.00**	**5976.00**	**8516.00**	**2450.00**	**1719.30**	**1034.54**

*Area under irrigated and un-irrigated soils; ** Area under irrigated soils; *** Included in erstwhile state; NR – Not Recorded Reclamation of Water logged, Saline and Alkaline Agriculture Lands.

Appendix 3
Irrigation Water Rates for Select States

S. No.	*State/UT*	*Flow irrigation*		*Lift irrigation*	
1	Andhra Pradesh	148.20 to 1235.00	0 1-07-96	#	
2	Assam	150.00 to 751.00	30-03-00	1 50.00 to 751.00	30-03-00
3	Bihar	74.10 to 370.50	Nov. 1995/2001	#	
4	Chhattisgarh	123.50 to 741.00	15-06-99	#	
5	Delhi	22.23 to 71 1 . 36	1951/1979	33.35 to 1067.04	1951/1979
6	Goa	60.00 to 300.00	11-02-88	120.00 to 600.00	11-02-88
7	Gujarat	70.00 to 2750.00*	16-02-01	23.33 to 1375.00*	16-02-01
8	Haryana	86.45 to 197.60	27-07-00	43.23 to 98. 80	27-07-00
9	Himachal Pradesh	6.87 to 76.03	1977/1981	13.96 to 82.15	1977/1981
10	Jharkhand	74.10 to 370.50	26-11-01	#	
11	Karnataka	37.05 to 988.45	13-07-00	#	
12	Kerala	37.00 to 99.00	18-09-74	17.00 to 148.50	18-09-74
13	Madhya Pradesh	123.50 to 741.00	15-06-99	123.50 to 741.00	15-06-99
14	Maharashtra	180.00 to 4763.00**	01-09-01	20.00 to 495.00**	01-09-01
15	Manipur	22.50 to 75.00	1977–78	22.50 to 75.00	1977-78
16	Meghalaya	No water rates	–	No water rates	
17	Mizoram	No water rates	–	No water rates	
18	Nagaland	No water rates	–	No water rates	
19	Orissa	28.00 to 930.00	05-04-02	129.21 to 4990.63	Jul-97
20	Punjab	Abolished	14-02-97	Abolished	14-02-97
21	Rajasthan	29.64 to 607.62	24-05-99	74.10 to 1215.24	24-05-99
22	Sikkim	No water rates	–	No water rates	
23	Tamil Nadu	2.77 to 61.78	01-07-62	#	
24	Tripura	312.50	Yet to start	312.50	Yet to start
25	Uttaranchal	49.00 to 143.00	18-09-95	99.00 to 287.00	18-09-95
26	Uttar Pradesh	30.00 to 474.00	18-09-95	15. 00 to 237.00	18-09-95
27	West Bengal	37.05 to 123.50	06-04-77	#	
28	A&N Islands	No water rates	–	No water rates	
29	Chandigarh	No water rates	–	No water rates	
30	Dadra & Nagar Haveli	110.00 to 830. 00	29-01-96	75.00 to 275.00	***
31	Daman & Diu	200.00	1980	200.00	1980
32	Lakshadweep	No water rates	-	No water rates	
33	Pondicherry	12.50 to 37.50	31-03-79	10.00 to 30.00	31-03-79

* Subject to increase @ 15% to 25% per annum; ** Subject to increase @ 15% per annum; *** Depending upon the type of Minor Irrigation schemes, the date of enforcement varied from 1/12/1970 to 13/11/1973; # No separate rate for lift irrigation has been reported.

Appendix 4
Recommendations of the Working Group of the Planning Commission on Water Resources for The Eleventh Plan on PPP in Water Resources Management

A group of experts headed by the Additional Secretary, Ministry of Water Resources (MOWR), was constituted in November 2003 to examine the various issues related to Public–Private Partnership in Water Resources Management. After deliberating on several concerns, they made the following recommendations:

A. Guidelines for Implementation of Water Resources Projects by Public–Private Partnership

(a) A State Water Regulatory Authority (SWaRA) should be established in those states where Public–Private Partnership (P-3) is to be taken up. The SWaRA should be a statutory/ quasi-judicial authority, headed by a retired judge of the Supreme Court/High Court and should include representatives of all concerned government organizations dealing with water resources and stakeholders including those from the Water Users Association (WUA)/Local Body/ Gram Panchayat to ensure transparency.

(b) The contract document for a P-3 venture should be approved by SWaRA before it is awarded. Since SWaRA will have representative stakeholder/ WUA, prior approval will also ensure transparency and acceptability of the P-3 ideologies.

(c) Component-wise P-3 should initially be attempted in canal/water conductor and distribution system. The head work, where the private sector operator (PSO) gains control of water at the source, may be kept outside the purview of P-3 for time being, till some experience is gained on regulatory mechanisms for P-3 ventures.

(d) To begin with, management contracts may be considered as the preferred option; lease contracts as the second preference and BOT as the third preference. The various P-3 options and their features and implications are given in Enclosure-I and Enclosure-II, respectively. Wherever feasible, the participation of the WUA/Local Body/Gram Panchayat may also be considered.

(e) Before a project is posed for P-3, the primary objective (finance or technology or management) should be clearly identified. All further decisions would flow from this primary objective.

(f) The most beneficial P-3 option should be identified to achieve the stated objectives and further planning should be done accordingly. Obtaining benefits from the P-3 depends on identifying the strengths and weaknesses of each of the P-3 options and matching those with project requirements.

B. Areas/Projects for the Implementation of Public–Private Partnership

A Working Group on private sector and beneficiaries participation constituted for the Tenth Five Year plan divided the projects into three categories, based

on the investment involved: (i) investment ranging between Rs50–200 crore; (ii) investment ranging between Rs200–500 crore; and (iii) investment more than Rs500 crore. Private sector participation in projects under category-(iii) is unlikely to materialize and therefore may not be worth contemplating at this stage. However, it would be desirable to introduce the concept of pilots for select category-(iii) projects that will not face problems related to inter-state issues, security, etc. It is recommended that category-(i) projects be taken up for private sector participation. In the case of category-(ii), private investment could be invited for the following distinct components of the projects for which separate schemes would need to be formulated.

These could be schemes for:

- Participation in the construction and O&M of main and secondary canals or the conveyance system.
- Participation in the construction and maintenance of the distribution system below the minor distributaries of designated capacity.
- Participation in the remodeling and renovation of existing projects.
- Participation in the development of tourism and pisciculture.

Participation in construction and O&M of head works is not recommended at this stage.

- Since the Command Area Development (CAD) program is in operation, along with the government's efforts through WUAs on the principle of Participatory Irrigation Management (PIM), the responsibility of the private investor may end at the bulk supply of water to the WUA while the latter can take up further work.
- At the time when the project is awarded for private sector participation, there is a need for detailed interaction between the government, private entrepreneurs, and other stakeholders, in order to pay due consideration to the overall development of water resource plans and ensure the safety of structures. Based on such interactions, Memorandums of Understanding (MOUs) should be signed between the government and the private entrepreneurs.

C. Incentives for Private Sector Participation

- Some incentives will have to be provided to the private sector. These could be in the form of tax holidays, floating tax-free revenue bonds/loans at concessional rates including moratorium on repayment, etc.
- Offering incentives to private investors—for the development of pisciculture, limited use of water of the reservoir for development of horticulture, floriculture and so on by the investor, water sports, navigation in reservoir areas and development of tourism—should be considered to attract private sector participation. However, SWaRA will ensure that water allocation for different uses is not disturbed due to over-withdrawal of water earmarked as concession and the primary objective of the project is not jeopardized.

The primary and secondary benefits of projects need to be identified. There should be a clear allocation of benefits between the state government departments and the private investors.

D. Major Clearances Required (Statutory and Non-Statutory) and Clearing Authorities

Considering the multi-dimensional nature of water resources projects, all existing statutory and non-statutory clearances will be strictly adhered to. The list of statutory and non-statutory clearances is given in Enclosure-III.

E. Procedures for the Clearances

Stepwise procedures for the clearance of projects received from the state governments that are to be taken up by the private sector are as follows:

(a) At the initial stage, the concerned state government will submit a Preliminary Project Report (PPR) to the Central Water Commission (CWC). The PPR will cover surveys and investigations including geological, seismic and foundation investigation, construction material survey, hydrological and meteorological investigations, etc.; international/inter-state aspects, hydrology, drinking water requirements, irrigation planning, planning for other intended benefits, brief environmental and ecological aspects, social concerns, intended benefits, etc. All theses are required to establish the soundness of the basic planning of the Project Proposal. The requisite check-list shall also be attached to ensure that all the desired information is in place.

(b) The PPR shall be quickly scrutinized and clarifications/compliance of observations shall be attended to promptly by the state government. Once the report is found acceptable, the CWC shall convey 'In Principle' consent for the preparation of Detailed Project Report (DPR).

(c) Thereafter, the developer shall prepare the DPR with up-to-date costs as per CWC guidelines and relevant BIS codes in compliance with CWC comments/observations, if any, during the PPR stage. It must be ensured that the DPR has been prepared after detailed surveys and investigations and it contains the duly completed check-list, salient features and all relevant details as well as maps, appendixes, and comprehensive up-to-date estimates as per CWC guidelines.

(d) Simultaneously, they will also process and obtain the necessary clearances of the Ministry of Environment and Forests with respect to the Environment Impact Assessment (EIA) and Environmental Management Plan (EMP) and the forest area being diverted, the Ministry of Tribal Affairs (in case tribal population is to be relocated), and other concerned Ministries as required. The submission and clearance of EIA and EMP, R&R Plans, etc., and forest clearance shall be governed by the prevailing norms and regulations of the related ministries.

(e) The state government shall ensure that all necessary actions are taken to obtain clearances from the above mentioned ministries well in time after the due appraisal and DPR have been submitted along with these clearances.

(f) The 'In Principle' consent of the CWC for the DPR preparation of a project shall have a validity period of three years failing which the 'In Principle' consent will suo-moto lapse.

(g) The DPR thus prepared will be examined by the CWC in consultation with other central agencies, if required. During techno-economic appraisal, the compliance to observations will need to be submitted by a responsible and a professionally qualified person authorized by the developer.

(h) All projects in the Ganga, Brahmaputra, and Indus Basins will also be examined from the international angle by the MOWR.

(i) The final estimate shall be based on finalized designs and details of civil and hydraulic structures, and economic analysis will be carried out by the developer in consultation with the state government and CWC by adopting standard/accepted procedures in line with the recommendations of the Nitin Desai Report.

(j) Once the techno-economic viability of the project proposal has been established by the CWC, a comprehensive note and check-list, duly finalized by the Project Appraisal Organization (PAO), CWC will be circulated among the Members of the Advisory Committee of MOWR for consideration and clearance of such project proposals.

(k) On the basis of recommendations in Technical Advisory Committee (TAC) note, the Advisory Committee of MOWR will take a decision on the techno-economic viability of the Project Proposal.

F. Structure and Collection of Water Charges

(a) As recommended under para A.a, SWaRA will also (i) regulate the water rates and suggest the

optimal water structure which is adequate to cover up for recurring O&M costs and interest on capital, (ii) maintain a balance and uniformity in the water rates fixed in the neighboring states, and
(iii) monitor the revenue realization.

(b) The water rates should be so fixed as to ensure full recovery of recurring O&M costs initially and a part of the capital cost subsequently. Nevertheless, the paying capacity of the payers can not be ignored altogether. Differential water rates may, therefore, be adopted as per the holding size of the cultivator.

(c) The revision of the water rates to achieve full cost recovery may be done in a phased manner, providing for a full O&M cost recovery in a period of five years and recovery of a part of the capital cost thereafter.

(d) The water rates should be assessed and revised periodically at least once in a five year period coinciding with the first year of each Five Year Plan.

(e) While fixing water rates, SWaRA should take into consideration the prevailing water rates in neighboring states, crop water requirement and seasonal availability of water from rains and agricultural support price.

(f) At present, the government is involved in collecting water charges directly from the users. However, in view of the PIM approach being advocated (and gradually adopted), and given the formation of WUAs, it may be desirable to involve WUAs in water distribution and collection of water charges.

Enclosure-I to Appendix 4

Different PPP Options and their Features

PPP option	*Service contract*	*Management contract*	*Lease contract*	*Greenfield (i.e. BOT) contract*	*Concession contract*	*Full divestiture*
Financing investments	Public sector	Public sector	Public sector	Private sector	Private sector	Private sector
Financing working capital	Public sector	Public sector	Private sector	Private sector	Private sector	Private sector
Contractual relation with retail customers	Public sector	Private sector (on behalf of the public sector)	Private sector	Public sector	Private sector	Private sector
Private sector responsibility and autonomy	Low	Low	Low	Medium to High	High	High
Need for private capital	Low	Low	Low to Medium	High	High	High
Financial risk for private sector	Low	Low	Low	High	High	High
Duration of contract/ license (years)	1–2	3–5	5–10	20–30	20–30	License indefinite, provision to withdraw or revoke
Ownership	Public sector	Public sector	Public sector	Private then public sector	Private then public sector	Private sector
Management	Mainly public sector	Private sector	Private sector	Private sector	Private sector	Private sector
Setting tariffs	Public sector	Public sector	Contract and regulator	Public sector	Contract and regulator	Regulator
Collecting tariffs	Public sector	Private sector	Private sector	Public sector	Private sector	Private sector
Main objectives of private sector participation	Improve operating efficiency	Improve technical efficiency	Improve technical efficiency	Mobilize private capital and/or expertise	Mobilize private capital and expertise	Mobilize private capital and expertise

Enclosure-II to Appendix 4

Implications of PPP Options

Service contract	Promotes competition in area of contract. If the contract fails, risk is relatively low. Contracts of short duration—if contract runs into problems, can easily re-tender. Easy/simple contractual form. Potential starting point for private sector participation. Can increase utility's focus on core business. Potential for efficiency gains in the area covered by contract.
Management contract	Can improve service. Reduced risks to government and contractor. Potential first step to concession contract. Potential for setting performance standards with incentives to achieve standards. Scope to introduce private sector management skills. Limited commercial risks. Can revert to in-house management or contract may be re-tendered if problems arise. Potential for utility to bring in competition.
Lease contract	Can increase efficiency of asset management. Reduced government risk of not collecting adequate tariffs. Proportion of management responsibility and commercial risk transferred. Incentives for contractor to minimize costs, provide reliable services, and maximize revenue collection.
BOT. Also called Greenfield contract	Takes over management of operations from the government. Relieves government of need to fund investments. Full responsibility for operations, capital raising, and investment goes to private sector. Potentially large improvements in operating efficiency. Full private sector incentives across utility. Attractive to private financial institutions.
Concession contract	A fast option for improving system assets. Full responsibility for operations, capital raising, and investment goes to private sector. Potentially large improvements in operating efficiency of system assets. Full private sector incentives. Attractive to private financial institutions. Mobilizes private finance for new investments. Addresses funding shortfall.
Full divestiture	A fast option for improving system assets. Full responsibility for operations, capital raising, and investment goes to private sector. Potentially large improvements in operating efficiency. Full private sector incentives. Attractive to private financial institutions. Mobilizes private finance for new investments. Addresses any funding shortfall. Could be successful where there is good track record of private sector ownership. Private water company would have clear incentives to achieve full cost recovery.

Enclosure-III to Appendix 4

Required Clearances

Statutory clearances:		
i.	Water availability for interaction between state governments (SGs), Irrigation Departments, and CWC in the case of inter-state rivers.	SGs, CWC
ii	inter-state matters (inter-state rivers)	CWC
iii	international aspects (international rivers)	MOWR, CWC
iv	SEB clearances (multipurpose projects, where hydro power generation is involved)	SEB, SGs
v	Forest clearance (coordination with State Forest departments and MO&EF under Forest Conservation Act)	SGs, MOE&F
vi	Environmental clearance (coordination with State Forest departments and MO&EF under Environment Protection Act)	SGs, MOE&F
vii	Rehabilitation and resettlement of displaced families by land acquisition	SGs, MOTA, MOD, and MOCoal (if required)
viii	Administrative/State finance department concurrence	SGs
ix	Registration of Company (under Indian Companies Act)	Registrar of Companies.
x	Techno-economic clearance/concurrence by Advisory Committee of MOWR on Irrigation, Flood Control & Multipurpose projects after examination by CWC/CEA/GSI in respect of (a) design aspects (safety aspects, adherence to BIS codes and Government of India guidelines), (b) reasonableness of the scheme, (c) site location for optimum harnessing/utilization of water, (d) cost estimates & financial forecast, (e) geological investigations. (Applicable for inter-state river projects under guidelines for submission, appraisal, and clearance of Irrigation and Multipurpose Projects-2002).	Advisory Committee of MOWR
Non statutory clearances:		
i.	Exploring the possibility of conjunctive use of surface and groundwater	CGWB, CGWA
ii	Suggesting proper cropping pattern	MOA
iii	Land availability for infrastructure facilities	SGs.
iv	Financing aspect of the project	DOEA, FAs
v	Watershed development	SGs, SGWB, CGWB
vi	Drinking water provision	SGs, MOUD, MORD

CGWA – Central Ground Water Authority
CGWB – Central Ground Water Board
CWC – Central Water Commission
DOEA –Department of Economic Affairs
FA – Financial Authorities
MOWR – Ministry of Water Resources
MOCoal – Ministry of Coal
MOD – Ministry of Defence
MOE&F – Ministry of Environment and Forests
MORD – Ministry of Rural Development
MOTA – Ministry of Tribal Affairs
MOUD – Ministry of Urban Development
SEB – State Electricity Board
SGWB – State Governments Water Board

Appendix 5
Other PPP Case Studies in the I&D and Allied Sectors

A. PPP in the Energy Sector

One of the infrastructure sectors where PPPs have met with some success is the energy sector. While the reforms in the sector initially focused on the privatization of energy generation, it was later found that there were more pressing concerns at hand that needed to be addressed—the transmission and distribution (T&D) system was plagued with problems and faced high losses. The government of Orissa made an attempt to privatize power distribution, but that ran into rough weather because of the resistance to higher tariffs, as well as higher T&D losses than anticipated. The joint venture of the government and private sector in Delhi for the distribution business has also met with mixed results; North Delhi Power Limited, one of the privatized distribution companies in Delhi, had achieved very impressive reductions in the aggregate technical and commercial losses over the four years after privatization had been introduced. Motivated by the potential for efficiency improvements that can be realized by the introduction of private sector participation, several state governments and private investors/operators are now considering new options for PPP in the urban distribution business.

Energy distribution reforms in west Madhya Pradesh: In the year 2000–2001, the average T&D losses in Madhya Pradesh[1] were estimated at 40–50%. This, among other markers, was attributed to unmetered agricultural supplies and pilferage. Also responsible was the weak enforcement and active collusion by the utility employees in allowing theft. In order to reduce losses, the state-owned distribution company, Madhya Pradesh Paschim Kshetra Vidyut Vitran Company (MPPKVVC) took certain initiatives within a few of its circles and divisions.[2]

To begin with, the MPPKVVC launched the reform program in the Burhanpur division of the Khandwa circle, and in the Indore-city circle. In Burhanpur, almost all connections were installed along with electronic meters in place of electro-mechanical meters. This was followed by the mapping of the distribution network by indicating each and every consumer connected to the pole, feeder, and distribution transformer. In order to detect bypassing or tampering of meters (which was essentially done in connivance with the linesmen), the meter reading function was outsourced to individuals on a contractual basis, and these individuals were rotated across the areas in order to prevent their collusion with consumers. Organizational changes were made at the division level and rewards announced to the clerical and other staff for revenue enhancement and loss reduction. Consumer grievances were redressed in a timely and efficient manner. These initiatives resulted in increased revenue demand and collections in the division rose from $0.29 million (Rs13.1 million) in November 2001 to $0.44 million (Rs19.67 million) by November 2002, which further increased to $0.50 million (Rs22.4 million) by June 2003. An analysis of the domestic consumers on different consumption slabs in March 2002 and in October 2002 revealed an increase in the number

[1] Pandey, Ajay and Sebastian Morris. 2004. The Beginnings of Distribution Reforms in Madhya Pradesh: A Report. *India Infrastructure Report: 2004: Ensuring Value for Money*. p. 84.

[2] Circles and divisions are part of the administrative setup of the engineering department.

of consumers in the higher consumption slab. This indicates that the changes in metering and other charges oriented towards theft reduction were clearly yielding the desired results.

In the Indore city circle, the T&D losses were reported at 46.12% by the end of March 2001. Among other measures, the division conducted an energy audit; line metering and jumpers were installed. This resulted in the identification of six high-value and 16 high-loss feeders in the network. Of the total 3,449 distribution transformers, 40 were converted into model transformers with metering. Other initiatives include the online monitoring of high value consumers, detecting pilferage and recovering dues, and improvements in customer services. These initiatives resulted in major gains in terms of the reduction of losses and increased revenues to the utility.

The successes of Burhanpur and Indore demonstrated how even minor interventions like cross-checking by multiple persons can help reduce pilferage, and replace the outsourcing and physical cross-checking of meter readings, while the review of meter diaries at various levels may eliminate possibilities of collusion. Energy audits and metering help in identifying the nature of losses and facilitate the appropriate combinations of corrective actions.

The response of the private sector to this initiative has been very encouraging. In the case of 19 projects, private operators offered to pay upfront for the road concessions. In fact, in one particular stretch between Mumbai and Vadodara, the government received a negative grant of $200 million (Rs9 billion). Even among the projects which opted for support under the Viability Gap Funding (VGF) scheme, the grant component, on an average, accounted for only 8% of the total project cost (as against a capping of 40%).

B. PPP in the Road Sector

Another infrastructure sector where PPPs have been successful is the road sector, where a large number of private sector contracts have already been awarded by the National Highways Authority of India (NHAI). This success can be attributed to the structured project development which incentivized private players to participate in the process. Major risks involved in a highway PPP project usually include the procurement of right-of-way, environmental risks, and risks involved in the construction, operation and maintenance, volume of traffic, collection of tolls, competing roads, political intervention (policy reversals), inflation, forex (in cases involving foreign currency financing), and force majeure. Of these, the risks related to time and cost overruns during the construction phase as well as traffic volume and user fees (tolls) are of particular significance from the perspective of the private operators, as they are normally expected to absorb these risks. In cases where private operators do not undertake the construction on their own, this risk is mitigated by selecting an Engineering, Procurement, and Construction (EPC) contractor through a bidding process, and entering into an agreement with suitable incentives and penalty clauses.

The traffic risk, on the other hand, is usually handled in two ways. Under the toll-based BOT projects, it is borne by the private operators (and investors financing them). An important variant of this approach is shadow tolling, whereby private partners do not collect tolls from the road users but nevertheless bear traffic risks, as they are paid on the basis of the actual volume of traffic. In contrast, in the second approach, the government or its agency absorbs the traffic risk and the private partner is paid for making the specified level of road service available, regardless of the extent of traffic, e.g. BOT-Annuity projects—these are also known as availability-based projects.

In India, the central as well as a few state governments have successfully harnessed private sector partnership in road development. At the central level, this was done as part of the first and second phases of the National Highways Development Project (NHDP), a flagship program which required an estimated investment of $50–60 billion (Rs2,250–2,700 billion) over the next five years; 66 projects (42 toll projects and 22 annuity projects) with a total value of about $6 billion (Rs270 billion) were implemented through the BOT program by 2007. Although they constituted only 10% of the projects in the first two phases of NHDP, the government is now convinced of the merits of partnering with

the private sector and has decided to implement all NHDP projects in future through BOT, and limit the item-rate contracts approach to those stretches which do not attract private participation. In order to draw the private sector towards projects that are not commercially viable but considered essential, the government has established a VGF mechanism to provide a grant of up to 40% of the project cost, half of which is provided during the construction phase and the rest spread over the O&M phase.

The recent Model Concession Agreement approved by the government allows for grant funding and government guarantees, which are high on transparency, and address the principal concerns of lenders, such as land acquisition and protection in the event of default.

C. PPP in the Water Sector

1. Tirupur water supply (Industrial and domestic water supply project)

In the textile town of Tirupur in Coimbatore district, the government of Tamil Nadu launched an ambitious project under a BOT contract for 30 years to a private operator. In 1995, the government, in collaboration with private companies, established a special purpose company known as the New Tirupur Area Development Corporation Ltd. (NTADCL). The project was formally launched in February 2006 at an estimated cost of $227 million (Rs10.23 billion). It envisaged the improvement of existing water systems and the supply of bulk water to Tirupur Local Planning Area (TLPA) from river Bhavani, at a distance of 55 km from where the ULB would take over and distribute water to the citizens. It also included the provision of water supply to nearly 700 industrial units in the area, as well as 16 villages and two other municipalities, en route to the TLPA. This project, however, is not considered entirely successful, mainly due to the following factors:

- The unwillingness of local leaders to allow water connections for people living in unauthorized localities, despite the fact that nearly one-third of the population resides in such localities;
- Irregular water supply to consumers with regular connections;
- The lack of improvement in water supply service delivery; poor people continued to depend on private suppliers and had to pay nearly Rs0.50 per pot of water;
- Many industrial units would opt for water from private tankers that would charge $0.66 (Rs30) per kiloliter (kl) as compared to the NTADCL rate of $1 (Rs45) per kl;
- Increase in the water rates charged by the Tirupur Municipal Corporation from $0.13 (Rs6) per kl to $0.22 (Rs10) per kl for commercial establishments, and from $0.09 (Rs4) per kl to $0.13 (Rs6) per kl for domestic consumers; while domestic consumers in the rest of the Coimbatore district were paying $0.08 (Rs3.50) per kl.

2. 24x7 urban water supply project for Nagpur city

In order to upgrade the existing network and carry out the O&M of the water supply system, the Nagpur Municipal Corporation entered into a contract with a private operator by the name of Veolia in 2005, for the provision of around 10,000 connections in a period of five years. The objective was to make available for the customers uninterrupted water supply at the desired pressure, reduce pilferage and unaccounted water to 15% by mitigating leakages and unmeasured supply, along with 100% metering, improved billing mechanisms, better attention to customer grievances, and providing better services to the urban poor. The operator was required to take up this work in a phased manner and benchmarks were provided in the contract, which the operator needed to fulfill in order to be eligible for a bonus.

The project has been entirely successful, with uninterrupted water supply, as opposed to the earlier four and a half hours of intermittent supply. The water line pressure has also increased from 2–5 m to 10–12 m, which has enabled consumers to save energy as the water now directly reaches the overhead tanks. The continuous pressurized network prevents contamination of water due to leakage. The average

unaccounted water has reduced to 9% from the earlier 33%. Customers have the phone numbers of the area in-charge and can register complaints, which the operator must resolve within 48 hours.[3]

3. Water supply and waste water management project, Salt Lake, Kolkata

This project, which falls under the purview of the Kolkata Metropolitan Development Authority, is being implemented at the Nabadiganta Industrial Township by a consortium of Jamshedpur Utilities and Services Company Ltd. (JUSCOL) and Voltas, under a BOT contract and with an estimated capital investment of $15.1 million (Rs680 million). Comprising of both water supply and waste water management, the project has been approved by the JNNURM and is expected to meet a water demand of three million gallons per day (MGD), with 24x7 water supply. The contract also provides for 30 years of O&M by the private operator, with an obligation to carry out billing and collection activities. The critical concern is that the private operator is expected to bear the commercial risks of the project.

4. 24x7 urban water supply project, Latur

Under a management contract, the private operator, a consortium of Hydro Comp Enterprises, Subhash Projects and Marketing Limited (SPML) and UPL Environmental Engineers Ltd. has set up a Special Purpose Venture (SPV) known as the Latur Water Management Company to implement the project on PPP basis. According to the contract signed in June 2008, the private operator needs to ensure 24x7 water supply in the city of Latur, for an estimated population of 0.45 million comprising of 50,000 consumers. During the 10-year contract period, the operator is responsible for the O&M of the water works, and needs to invest in metering, and undertake billing and collections activities. The existing assets that require O&M include three water supply schemes, six pumping stations, 95 km of transmission pipelines, three water treatment plants (WTPs), and two master balancing reservoirs. The operator is also expected to undertake institutional strengthening and the implementation of the Management Information System (MIS). The government is responsible for meeting the capital investment towards metering system and fixing water tariff. To begin with, the tariff has been fixed for a period of 10 years. In addition to the 24x7 availability of quality water, the benefits of the project include increased coverage, 100% metering, regularization of illegal connections, reduced losses, and the imposition of an optimal tariff structure in order to enhance the financial viability through enhanced operational efficiency.

5. Water treatment project, Sonia Vihar, Delhi

In 2005, as a first step towards privatizing various activities under the water supply system, the Delhi government attempted to hand over the Sonia Vihar WTP to private sector players. The plant had the capacity to treat about 530 million liters per day. The project was estimated to cost $177.8 million (Rs8 billion), and was to involve the unbundling of various activities to different companies and ultimately, to allot zone-wise distribution rights to them. The private operators were expected to supply water round the clock. Delhi Jal Board was made accountable for the supply of water at bulk point on a continuous basis. When a Delhi-based NGO called Parivartan filed an application under the Right to Information Act, the conditions of the draft contract between the government agency and the private sector became public. It was then found that the conditions heavily favored the private sector. The contract also provided that the water tariffs were to be gradually increased in order to enable the private operator to recover his investment costs. After these conditions were revealed, the issue elicited adverse media publicity and resistance to the project by the general public. Finally, the Delhi government decided to stall further work on the project.

[3] http://www.indiaurbanportal.in/bestpractice/national/BP-Cities/maharashtra/Nagpur%20Pilot%2024X7%20water%20supply%20Project.pdf

6. Desalination plant in Chennai (Water treatment project)

Stated to be one of the largest in India, the desalination plant located in Chennai, Tamil Nadu, was inaugurated in August 2010. It draws water from the Bay of Bengal, uses reverse osmosis technology and supplies purified water to the city of Chennai. The Rs600 crore plant is spread across 60 acres of land and can process and supply 100 million liters of water per day; an amount that could cater to the needs of around two million people out of a population of nearly 4.5 million. The plant has been set up and is being managed as a joint venture between IVRCL Infrastructures and Project Ltd. and Befessa of Spain. The facility is to supply water to the government-run Chennai Metropolitan Water Supply and Sewerage Board at a cost of Rs48.74 per 1,000 liters for the first 25 years.

D. Irrigation Sector

1. New Zealand (Irrigation reforms)

The success replacement of government management of irrigation with privately-run schemes in New Zealand has set an interesting precedent for private participation in the sector. There are more than 20 privately run community irrigation schemes in the country, covering 300,000 of the 500,000 ha of irrigated agricultural land.

Until 1988, most community schemes were developed by the central government through the Ministry of Works and Development. In the late 1980s, these were sold to the community groups of farmers who were using them as part of a series of agricultural reforms. Since then, several new schemes have been developed in the country, largely on a commercial basis. One of these is oriented towards getting the farmers to contribute financially towards the development of an identified scheme. For instance:

- If a project is expected to be financially viable, and is approved by the regional council, the farmers make an equity contribution to a cooperative company. This company is given the responsibility for implementing the project, usually by raising finances to cover up to 50% of its investments.
- Respective shares in the cooperative company correspond to the rights to draw water from the scheme, and are tradable between farmers as needs change or as new farms seek to join the scheme.

Private sector based schemes in New Zealand have consistently provided quality service, allowed further expansion in community irrigation, and resulted in increased innovation in the scheme design. Experience shows that such arrangements have proved commercially successful and evidenced significant increases in the share prices of the farmers over a period of time. For example, the share price of a community scheme in the Opuha area increased twentyfold over the first five years of its operation.

The deal structure in New Zealand is such that it is not easily replicable in the Indian context, as it depends on the participation of well-educated, well-capitalized farmers who generally own large commercial enterprises. Nonetheless, it does support the premise that private sector participation can successfully drive reliability, innovation, and efficiency in irrigation provision.

2. Companie d'Amenagement des Coteaux de Gascogne, France (Project with user participation)

The Compagnie d'Amenagement des Coteaux de Gascogne (CACG) is a leading private sector French company with 50% ownership of the public shareholding owned by the local governments. It is run as a private company while simultaneously fulfilling a public mission—rural development through hydraulic works. The sustenance of CACG is protected by a 75-year long term lease.

For a long time CACG operated on public subsidy. This changed in 1972 when a policy was established whereby all operational subsidies were to be removed within the next 10 years. This caused the CACG to alter its working and reduce both

costs and risks, for instance, by leaving small scale irrigation development to farmer-initiated Water Users Associations (WUAs) and also by changing the concession model—placing emphasis on the willingness to connect and engage with a water user committee to discuss the required service and price. The CACG has been a successful state concessionaire in that it has achieved equitable water allocation, full cost recovery, and transparency through the participation of water users in decision-making.

In some areas (outside its concession), CACG has also established itself as a service provider to WUAs. On the basis of an agreement with the irrigators, it assists the establishment of WUAs, implements—on behalf of the WUAs—irrigation improvement projects based on a Design, Build and Transfer model, and in some cases also undertakes maintenance on contract basis.

Finally, CACG operates the Nestle System—providing irrigation to 51,000 ha of irrigated land and domestic water services to 200,000 inhabitants. The users enter into a concession contract with CACG, which in itself is ruled by a concession agreement with the state. The success of this arrangement (with services being provided by a professional third party) can be gauged from the fact that the river flow has been kept above the minimum acceptable level for all but one day and there is now a shorter waiting list of irrigators.

Appendix 6
Types of PPP Contracts

Service contract: Under a service contract, a specific (discrete and clearly defined) service is contracted out by the public agency to a private operator. Such services could include channel/ asset rehabilitation, emergency repairs, design, engineering, and administrative tasks such as billing and collection. Payment is usually on fee per task basis. Service contracts are subject to frequent competition and usually last a year. It is also common to give out separate contracts for different parts of the system to more than one operator, thereby enabling comparative competition.

Management contract: Under such a contract, the private operator assumes the responsibility for core activities like operations and maintenance of the production units in a specific geographical sector or at a defined level of responsibility. Public entities legally remain the owners of the assets and bills are collected on their behalf. A private company may agree to take on the responsibility of managing a service to specified standards, while using the staff, equipment, vehicles, and buildings of the public entity. In such a situation the private company would bring in its own management expertise.

Affermage contract: Under this arrangement, the private lessee carries out all routine O&M activities as in the case of a management contract, but with the difference that part of the financial risk could be borne by the lessee. The public entity involved remains the owner of the assets, and is generally responsible for providing the major capital expenditure and making investment decisions. The private operator is responsible for maintenance, renewals, and rehabilitation works.

Concession contract: Here, the private operator is expected to bring in new investment for the assets/network facilities over the life of the contract. The assets are nominally owned by the public entity; however, the private operator takes on the responsibility of managing assets, creating new assets where required, raising finance for new investments, providing services, operations and maintenance, and taking care of billing and the collection of charges. In concessions, payments can take place both ways: the concessionaire pays to government for the concession rights and the government may also pay the concessionaire, which it provides under the agreement to meet certain specific conditions. Such contracts may apply in the case of commercial operations that are owned by an urban authority, where the user charge either covers or represents a substantial proportion of the total cost.

Cooperative arrangement: With a cooperative arrangement, the focus is on establishing a partnership between self-governing, voluntary organizations and a public agency. Cooperatives serve the interests of their own members or their members are encouraged to undertake specific activities to achieve the overall objectives of the cooperative. All members have an equal vote with which they express their priorities.

Appendix 7
Summary of the Financials for the Nira Deoghar Irrigation Project

The summary of P&L statements, cash-flows and calculation of IRR for the Nira Deoghar irrigation project is provided in the following Table AN-7.1.

Table AN-7.1: P&L statement and IRR calculations for the Nira Deoghar irrigation project

(All values are in Rs crore)

	Operation years	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Year 6*	*Year 7*	*Year 8*	*Year 9*	*Year 10*	*Year 15*	*Year 25*	*Year 35*	*Year 45*	*Year 55*
A	Revenues															
1	User charges/Water rates								1.89	2.37	3.13	4.3	6.3	8.4	11.1	16.3
2	Revenues from fisheries								0.34	0.35	0.36	0.4	0.6	0.8	1.0	1.4
3	Sale of extra water available								2.00	2.09	2.19	2.7	4.3	6.8	10.7	16.9
4	Tourism								3.95	4.07	4.19	4.9	6.5	8.8	11.8	15.8
5	Revenue from commercial space								–	–	–	–	–	–	–	–
	Total revenue – Operations								8.19	8.88	9.87	12.3	17.7	24.7	34.7	50.5
B	Operational grant								–	–	–	–	–	–	–	–
	Total revenues								8.19	8.88	9.87	12.3	17.7	24.7	34.7	50.5
B	Expenses – Operations								–	–	–	–				
1	O&M Costs for Command Area Development (CAD)								4.31	4.43	4.57	5.3	7.1	9.6	12.9	17.3
2	Maintenance of dam								13.48	13.88	14.30	16.6	22.3	29.9	40.2	54.1
3	Research, training, surveys, Improvements, etc.								1.49	1.54	1.58	1.8	2.5	3.3	4.5	6.0
4	Direction and administration								4.82	4.96	5.11	5.9	8.0	10.7	14.4	19.3

	Operation years	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Year 6*	*Year 7*	*Year 8*	*Year 9*	*Year 10*	*Year 15*	*Year 25*	*Year 35*	*Year 45*	*Year 55*
	Total Expenses – Operations								24.09	24.82	25.56	29.6	39.8	53.5	71.9	96.7
	Total Expenses								24.1	24.8	25.6	29.6	39.8	53.5	71.9	96.7
C	EBITDA								(15.9)	(15.9)	(15.7)	(17.3)	(22.1)	(28.8)	(37.2)	(46.2)
1	Amortization								1.0	3.0	3.0	3.0	–	–	–	–
2	Interest								184.4	176.2	168.0	127.1	45.1	0.0	0.0	0.0
3	Depreciation								5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40
E	EBT								(206.8)	(200.6)	(192.2)	(152.8)	(72.6)	(34.2)	(42.6)	(51.6)
F	Tax								–	–	–	–	–	–	–	–
G	PAT								(206.8)	(200.6)	(192.1)	(152.8)	(72.6)	(34.2)	(42.6)	(51.6)
	IRR calculations															
A	Outflow															
1	Capital expenditure	79.8	204.4	328.7	347.6	282.2	218.2	111.3								
2	Equity	25.2	65.8	108.4	119.9	105.5	90.7	61.7								
	Total outflow	79.8	204.4	328.7	347.6	282.2	218.2	111.3								
B	Inflow															
1	EBIDTA								(15.9)	(15.9)	(15.7)	(17.3)	(22.1)	(28.8)	(37.2)	(46.2)
2	Tax								–	–	–	–	–	–	–	–
3	Interest								184.44	176.24	168.04	127.06	45.08	0.00	0.00	0.00
C	Repayments								58.55	58.55	58.55	58.55	58.55	–	–	–
	Total inflow								(15.90)	(15.93)	(15.69)	(17.30)	(22.10)	(28.79)	(37.22)	(46.19)
	Net flow (Project)	(79.8)	(204.4)	(328.7)	(347.6)	(282.2)	(218.2)	(111.3)	(15.9)	(15.9)	(15.7)	(17.3)	(22.1)	(28.8)	(37.2)	(46.2)
	Net flow (Equity)	(25.2)	(65.8)	(108.4)	(119.9)	(105.5)	(90.7)	(61.7)	(258.9)	(250.7)	(242.3)	(202.9)	(125.7)	(28.8)	(37.2)	(46.2)

EBITDA Earnings before Interest, Taxes, Depreciation, and Amortization
EBT Electronic Benefit Transfer

Project IRR & Net Present Value (NPV)

(All values are in Rs billion)

Year	*Project*		*Equity*	
	NPV	*IRR*	*NPV*	*IRR*
10	(9.98)	Negative IRR	(6.06)	Negative IRR
15	(10.15)	Negative IRR	(8.38)	Negative IRR
25	(10.32)	Negative IRR	(9.87)	Negative IRR
40	(10.40)	Negative IRR	(10.09)	Negative IRR
55	(10.42)	Negative IRR	(10.11)	Negative IRR

Key Assumptions for Commercial Facilities

Tourism related activities: It is assumed that two amusement/water parks will be developed by the private developer, if the requisite land is provided and tourism activities are allowed. A summary of the key assumptions is provided in Table AN-7.2.

Table AN-7.2: Key assumptions for tourism related activities

Parameters	*Value*
Total cost of one amusement park	Rs300 million
Construction period	3 years
Total visitors per annum	0.2 million
Escalation in no. of visitors for first 15 years	5 %
Escalation in the no. of visitors for the remaining period	3%
Ticket price per visitor	Rs500
Other revenues per visitor	Rs100
O&M expenses as % of revenues	30%
Escalation in ticket price for first 15 years	5 %
Escalation in ticket price for the remaining period	3%

Providing land for commercial activities: It is assumed that the land will be provided by the government agency to the developer on lease, without any rentals (or with minimal rentals), and that the private developer would further sub-lease it to the commercial developers. The lease rentals are estimated on the basis of the average of existing lease rentals in rural parts of the country. A summary of the key assumptions has been provided in Table AN-7.3.

Table AN-7.3: Key assumptions for providing land for commercial activities

Parameters	*Value*
Lease rentals	Rs135,900 to 185,250 per ha
Annual escalation in the lease rental	3 %

Appendix 8
Financial Analysis of a Sample Major Irrigation Project

This section presents the financial analysis of a sample major irrigation project. The project cost and other technical inputs have been taken from the Detailed Project Report (DPR), which was prepared in March 2007.

A. About the Project

This major irrigation project envisages the supply of irrigation water to a total area of 38,500 ha, and additionally, the supply of water for domestic purposes. The project involves the construction of:

- An earthen dam across river A (stipulated length of the dam: 2,214 m, length of the concrete spillway: 85 m);
- An earthen dam across river B (length of the dam: 2212 m, length of the concrete spillway: 57.5 m);
- A barrage in the downstream of the dam across river A (length: 173.6 m);
- Two main canals originating from a reservoir across river A: 'left bank main canal-1' (LBMC-1) and 'right bank main canal-1' (RBMC-1) (total length of the canals: 73.78 km, CCA: 10,700 ha);
- Two main irrigation canals from a reservoir across river B: 'LBMC-2' and 'RBMC-2' (total length of the canals: 56.3 km, CCA: 9500 ha);
- A canal from the barrage: 'LBMC-3' (total length: 79.6 km, CCA: 18,300 ha); and
- Distribution channels, field channels, and other On-Farm Development works.

B. Project Cost

The estimates are based on the DPR of the irrigation project. The key assumptions for the financial assessment are provided in Table AN-8.1 below.

The capital cost assessment is carried out on the assumption that the private developer is implementing the project.

The estimated costs for the project components are provided in Table AN-8.2.

The total project cost is estimated at Rs14,957.7 million. The interest during construction (IDC) contributes to approximately 18% of the project cost.

C. Project Financing

The project is estimated to be financed through a debt-to-equity ratio of 70:30 by the private developer.

It is assumed that the loan tenure is 30 years, and the interest rate is 14%.

D. O&M Costs

1. Maintenance of major structures in the irrigation system

The O&M costs are assumed at 1% of the capital cost annually, for dams, barrages, and main and distribution canals. The capital cost for the dams and

Table AN-8.1: Key assumptions for a model major irrigation project

Parameter	*Assumption*	*Description*
First year of model	2010	The financial year ending March 2010, has been taken as the first year for the financial model
Construction period	7 years	The time period is based on the identification and quantification of major activities, assuming mechanized construction and two-shift operation.
Time horizon for assessment	55 years	The project is expected to provide benefits for around 100 years, but since the initial years would have major impact on the financials, 55 years has been considered for analysis.
Inflation rate	5%	The assumption is based on the average inflation rate for last few years and the estimated future inflation rate for the next few years.
Pre-operative expenses	4% of capital cost	Includes cost of obtaining necessary clearances, land related costs, audit and account charges, etc.
Contingencies	3%	As the detailed estimations have been done for the project cost, only 3% of the capital cost is taken as technical contingency.
Receipts and recoveries	Rs29 million	The revenues would come from recovery on account of resale or transfer of temporary building (@15% of the building cost), revenue from house rent of residential buildings, and re-sale of special tools and plants. The total estimated value is expected to be Rs29 crores.

Table AN-8.2: Summary of capital costs for a model major irrigation project

S. No.	*Components*	*Total Cost* (Rs million)
1	Dam	4822.9
2	Barrage	1401.9
3	Diversion Channel and Canals	3068.3
4	Distribution channels	1275.1
5	Field channels	604.5
6	Devices and Equipments	113.4
7	Receipts and Recoveries	–29.5
A	Total Cost of Part A	11256.7
B	Technical Studies and Master Planning	112.6
C	Pre-Operative Expenses	450.3
D	Contingencies	337.7
	Total Project Cost without financing charges and IDC	12157.2
E	Financing Charges	112.6
F	Interest During Construction (IDC)	268.8
	Total Project Cost	**14957.7**

Table AN-8.3: Summary of project financing for a model major irrigation project

Parameters	*Value* (Rs billion)
Total project cost	14.96
Debt (@70% of the project cost)	10.47
Equity (@30% of the project cost)	4.49

barrages is considered as the cost of head works. The escalation in the O&M costs is assumed at 3% annually.

O&M costs for Command Area Development: As per estimates in the DPR, the average O&M expenditure on CAD works would be Rs1,000 per ha.

2. Miscellaneous costs

Miscellaneous costs are meant to cover activities like technical tests, research, training, surveys and improvements, etc.

Direction and administration costs: The average direction and administration costs for all the irrigation projects are in the range of 20% of the total O&M costs. The same assumption is used to estimate this component.

The summary of the annual O&M costs is provided in Table AN-8.4.

E. Revenues

Revenues are assumed on the basis of the following components:

- User charges/Water rates,
- Revenues from fishing related activities,
- Sale of surplus available water, and
- Tourism related activities.

Table AN-8.4: Summary of annual O&M costs for a model major irrigation project

S. No.	*Components*	*Unit Assumption*	*Total Cost* (Rs million)
1	O&M costs for CAD	Rs1,000 per ha.	38.5
2	Maintenance of dam	1% of capital costs	48.2
3	Maintenance of barrage	1% of capital costs	14.0
4	Maintenance of canal including distribution channels	1% of capital costs	49.5
5	Research, training, surveys and improvements, etc.	0.1% of capital costs	11.3
6	Direction and administration	20% of the total O&M expenses	40.4
Total O&M expenses			**201.9**

Water rates/User charges: For the purpose of analysis, the water rates have been considered at Rs450 per ha. The collection efficiency is assumed at 40% in the initial year, gradually increasing to 75% in the fifth year of operation. It is assumed to remain constant afterwards.

Revenues from fishing related activities: The total area available for fishing related activities is 2,315 ha (1,400 ha in reservoir-A, 900 ha in reservoir-B and 15 ha in the barrage pond). As per the estimates provided by the state department of fisheries, the total income from fish farming is Rs22,141 per ha. It is assumed that 50% of these revenues will accrue to the private developer.

Sale of surplus water: The drinking water requirements have been estimated with regard to a projected population of around 5.7 lakh in the command, and assuming a per-capita requirement of 100–125 liters per day. The total estimated annual requirement of drinking water is calculated to be 23 million cubic meter. The sale of water is estimated at Rs6.6 per cum.

Tourism related activities: It is assumed that an average of 100,000 tourists will be visiting the reservoir spots (as these fall within the existing tourist circuit). The estimated annual earnings from the sale of boating rights are assumed at Rs1.5 million and the revenues from tourist visits are assumed at Rs45 for each tourist.

A summary of the estimated annual revenues in the first year of operation is provided in Table AN-8.5.

Table AN-8.5: Summary of annual revenues for a model major irrigation project

A	*Revenue heads*	*Amount* (Rs million)
1	User charges/Water rates	6.9
2	Fishing related activities	25.6
3	Sale of surplus available water	152.0
4	Tourism related activities	6.1
	Total Revenue	**190.7**

F. Viability Assessment:

The viability of the project is assessed in terms of the IRR and Net Present Value (NPV). The estimated values of the same are provided in Table AN-8.6.

Table AN-8.6: Summary of financial viability for a model major irrigation project

Years	*Project NPV* (Rs million)	*Project IRR*
20	(7577.3)	Negative IRR
25	(7563.7)	Negative IRR
30	(7553.3)	Negative IRR
40	(7528.4)	Negative IRR
50	(7508.2)	Negative IRR
55	(7501.0)	Negative IRR

As shown in the table above, the project is not financially viable as the expectation of the private developer in terms of IRR is around 15%. Also, the estimations of the yearly cash flows indicate that the revenue is not sufficient to repay the interest payments and debt repayments. The profit and loss statement, cash flows, and IRR calculations are provided at the end of this Appendix.

G. Scenario Analysis:

Keeping other estimates constant, the Viability Gap Fund (VGF) (as % of capital costs) and user fees/ water charges were calculated to achieve the desired return of 15% from the project and the findings of this analysis are provided in Table AN-8.7.

The levels of VGF, water charges and annuity in the table above are not realistic or possible to achieve practically. Therefore, PPP is not financially viable for this hypothetical irrigation project.

The viability of the project has been analyzed with respect to the following commercial activities.

- Providing land for commercial development, and
- Allowing tourism related activities (like water parks) near the irrigation area.

Table AN-8.7: Summary of scenario analysis for a model major irrigation project

S. No.	*Parameter*	*Current value*	*Value at which desired returns from the project are achieved, keeping the other variables as constant*	*Remarks*
1	Viability gap funding	0% of the project cost	more than 95% of the capital cost	This is not a practical option. It is equivalent to awarding an Engineering, Procurement and Construction (EPC) and O&M contract.
2	User fees	Rs450 per ha.	Rs135,000 per ha.	Increasing the user charges to such a high level is not practical as the farmers would not be able (or willing) to pay the same.
3	Annuity support	No annuity support assumed	Rs3050 million/annum	Not practical
4	Rate of sale of extra water	Rs6.6/cum	Rs124.3/cum	Rs124.3/cum is very high compared to the average rate of sale of water in India.

The summary of the sensitivity analysis is provided in Table AN-8.8.

Table AN-8.8: Summary of sensitivity analysis for a model major irrigation project

S. No.	*Activity*	*Key parameters*	*Value at which desired returns from the project are achieved, keeping the other variables as constant*	*Remarks*
1	Providing free land for commercial development to the developer	Extent of land	With expected average value of lease rental to be between Rs135,900 to 185250 per ha, the private developer needs to be provided with 22,500–16,500 ha of land for the development for 55 years	Not practical due to land acquisition issues and delay in acquisition (may take few years) and insufficient demand for such a large piece of land.
2	Tourism related activities: water parks at two locations	No. of visitors	The number of visitors: 4.4 million/year	Not practical. This is more than the capacity of amusement park/water park. However, with a practical assumption of 0.2 million visitors/year per amusement park, the viability of the project would increase marginally.

A typical major irrigation project:

Table AN-8.9: P&L statement and IRR calculations for a sample major irrigation project

(All values are in Rs crore)

	Operation Years	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Year 6*	*Year 7*	*Year 8*	*Year 9*	*Year 10*	*Year 15*	*Year 25*	*Year 35*	*Year 45*	*Year 55*
A	Revenues															
1	User charges/ Water rates								0.7	0.9	1.0	1.6	1.8	2.2	2.5	2.9
2	Revenues from pisciculture								2.6	2.6	2.7	3.2	4.2	5.7	7.7	10.3
3	Sale of extra water available								15.2	15.9	16.7	20.9	32.9	51.8	81.7	128.6
4	Tourism								0.6	0.6	0.7	0.8	1.0	1.4	1.8	2.5
5	Revenue from commercial space								–	–	–	–	–	–	–	–
	Total revenue								19.1	20.0	21.1	26.4	40.0	61.1	93.6	144.2
B	Expenses – Operations								–	–	–	–	–	–	–	–
1	O&M costs for CAD								3.9	4.0	4.1	4.7	6.4	8.6	11.5	15.4
2	Maintenance of dam								4.8	5.0	5.1	5.9	8.0	10.7	14.4	19.3
3	Research, training, surveys and improvements, etc.								1.1	1.2	1.2	1.4	1.9	2.5	3.4	4.5
4	Direction and administration								4.0	4.2	4.3	5.0	6.7	9.0	12.1	16.2
	Total expenses								20.2	20.8	21.4	24.8	33.4	44.8	60.3	81.0
C	EBITDA								(1.1)	(0.7)	(0.4)	1.5	6.6	16.3	33.4	63.2
1	Amortization								0.7	2.6	2.6	2.6	–	–	–	–
2	Interest								143.4	137.0	130.7	98.8	35.1	(0.0)	(0.0)	(0.0)
3	Depreciation								3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
E	EBT								(149.1)	(144.2)	(137.4)	(103.7)	(32.3)	12.4	29.5	59.4
F	Tax								–	–	–	–	–	4.8	8.9	17.8
G	PAT								(149.1)	(144.2)	(137.4)	(103.7)	(32.3)	7.6	20.7	41.6

	Operation Years	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Year 6*	*Year 7*	*Year 8*	*Year 9*	*Year 10*	*Year 15*	*Year 25*	*Year 35*	*Year 45*	*Year 55*
	IRR calculation															
A	Outflow															
1	Capital expenditure	53.3	152.8	252.3	277.4	213.0	180.1	98.0								
2	Equity	16.8	49.1	83.0	95.2	79.8	73.5	51.4								
	Total outflow	53.3	152.8	252.3	277.4	213.0	180.1	98.0								
B	Inflow															
1	EBIDTA								(1.1)	(0.7)	(0.4)	1.5	6.6	16.3	33.4	63.2
2	Tax								–	–	–	–	3.4	6.4	13.7	31.3
3	Interest								143.4	137.0	130.7	98.8	35.1	(0.0)	(0.0)	(0.0)
C	Repayments								45.5	45.5	45.5	45.5	45.5	–	–	–
	Total inflow								(1.1)	(0.7)	(0.4)	1.5	3.2	22.7	47.0	94.6
	Net flow (Project)	(53.3)	(152.8)	(252.3)	(277.4)	(213.0)	(180.1)	(98.0)	(1.1)	(0.7)	(0.4)	1.5	3.2	22.7	47.0	94.6
	Net flow (Equity)	(16.8)	(49.1)	(83.0)	(95.2)	(79.8)	(73.5)	(51.4)	(190.0)	(183.3)	(176.5)	(142.8)	(77.3)	22.7	47.0	94.6

Project IRR and NPV:

(All values are in Rs billion)

Year	*Project*		*Equity*	
	NPV	*IRR*	*NPV*	*IRR*
10	(7.60)	Negative IRR	(4.58)	Negative IRR
15	(7.59)	Negative IRR	(6.24)	Negative IRR
25	(7.56)	Negative IRR	(7.23)	Negative IRR
40	(7.53)	Negative IRR	(7.31)	Negative IRR
55	(7.50)	Negative IRR	(7.28)	Negative IRR

Appendix 9
Market Perception of PPP in the I&D Sector

This section summarizes the market perception of private sector companies on participating in PPP projects that fall within the I&D sector.

A. Outlook of the I&D sector

With the increasing uncertainty of rain water and steady diminishing of groundwater, there is a growing need for a constant source of water. Irrigation water greatly helps farmers and there is a need for more I&D projects. However, given the limited resources and poor cost recovery in the sector, the government is forced to limit the number of projects that can be taken up. The same constraints, in addition to social issues, limit the participation of the private sector to Engineering, Procurement and Construction (EPC) contracts or O&M contracts. Given that the role of the private sector needs to be enhanced, the problem of cost recovery must be resolved in order to invite investments by private players in the PPP projects of the sector.

B. Key constraints for the private sector

The key constraints faced by the private sector in this regard are summarized in Table AN-9.1.

Table AN-9.1 Key constraints faced by the private sector

Key constraints	*Description*
Limited revenue sources	With the limited ability of farmers to pay the user charges and the government regulation of the same, private sector needs other source of revenues to recover huge costs of any I&D project. Other identified revenue sources are tourism and fishing related activities and sale of surplus irrigation water. However, as shown in the financial analysis chapter of this report with the help of two examples, these revenues are not even sufficient to cover the O&M costs of the project. The government is now evaluating different options of revenue sources like: 1) providing nonfunctional canal land in urban area to the developer for commercial usage, and 2) providing land parallel to the canal to the developer for building toll roads in case sufficient traffic is expected. However, until sufficient sources of revenues become available with reasonable certainty throughout the project period, private section participation in I&D projects will be limited.
Availability of data	A comprehensive database of key details of the projects in the I&D sector is not available. The key data required from government agencies are seldom available in proper shape and data across various government agencies lack uniformity with respect to the classification method and nomenclatures. In a PPP project, for effective surface water management by the private sector, data and analysis of inter-basin/interstate/international treaties and agreements for transfer of water and the utilization of available surface storages become crucial for the assessment of water availability.
Legal framework	A typical irrigation project generally covers more than one state. With different state legislations and regulatory frameworks, there is a need to provide an enabling legal and statutory framework to the private sector for PPP projects.

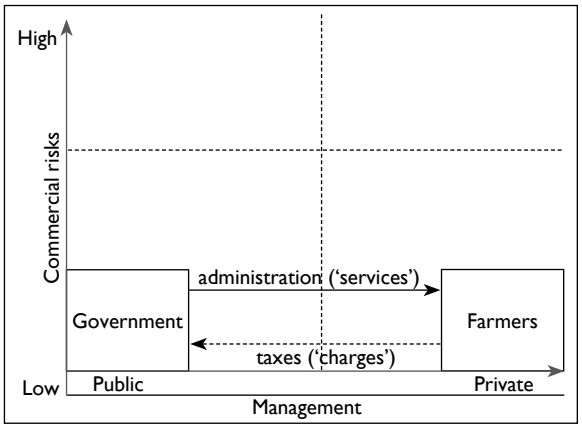
Key constraints	*Description*
Standardization of tender documents	It is essential that the tender documents for the sector are standardized by the government and made available to various implementing agencies for use. Providing standard conditions for PPP would help the private sector in evaluating the projects and this would help build their trust in terms of participating in the sector.
Need to educate farmers	In many parts of India, irrigation water supply is perceived as a free service and there is wide resistance to paying for water user charges. Not enough efforts are being made to educate the farmers on the need for user charges for continuation of better service delivery for a longer period in an irrigation project.
Inclusion of stakeholders	Inputs of all the stakeholders needs to be taken in a systematic way at the planning stage itself for the success of a PPP project in the sector. Availability of key details, for instance, farmers' willingness to pay user charges, is essential for the private players' decision to participate in the project.
Finalization of implementation framework under PPP	PPP in this sector is limited and there is a need to design a standard well-balanced framework for implementation under PPP.
Raising funds for the project	Lending for a PPP project in the irrigation sector has not yet been tested and there may be resistance on the part of financial institutions to fund the project due to many reasons. Some of these include lack of expertise to evaluate projects in this sector, wide uncertainty regarding the generation of revenue, various political and social risks associated with the project, and the lack of an enabling statutory and legal framework.
Lack of clarity in project specifications	Most of the projects in the I&D sector undergo design changes. The key specifications of the project are not well-defined and made available for the private sector for evaluation of the project.

Appendix 10
Brief Description of PPP Models

The PPP models under the I&D setup described below are those suggested by the World Bank, considering different scenarios (WB-2007).

A. Model 0: The typical pre-reform situation (continued)

The government—an irrigation ministry or department—has built the I&D system with its own public funds or funds taken mostly from bilateral or international donors, largely in the form of grants or soft loans. Farmers own small plots (a maximum of 1 ha per family), and cropping patterns have either been recommended or made mandatory in order to simplify water delivery planning and operation. Typically, when a scheme or project is selected by a government department, the Detailed Project Report (DPR) is prepared by the department, sometimes with the assistance of consultants. After obtaining the requisite financial sanction, tenders are floated by the department as per procurement guidelines and contractors are selected for carrying out the construction/repairs of the assets. The management of assets is carried out by following handbooks/ guidelines that have little to do with actual water needs.



Farmers are asked to contribute part of the OMM costs of the system. Water service fees are usually based on irrigated area (ha) and sometimes on the duration of access to water (hours). The fee is essentially a flat rate irrespective of the quality of water service delivery. Water fees are far too low for covering the cost of water service delivery. There may be no real knowledge of the actual cost of water service, and the collection rate is poor, with no incentives to improve it. The government budget transfers to make up the shortfall are inadequate and erratic. Tight money prevents adequate daily upkeep, much less the constitution of a long-term maintenance fund for heavy repairs.

Results include chronic degradation of assets, decreasing water service quality, and deteriorating agricultural production. Breaches in equity also occur, because the more powerful farmers can arrange to get more water, often through unfair means. The economic performance of farmers does not encourage payment of water service fees.[1]

B. Model 1: First changes between well-identified partners

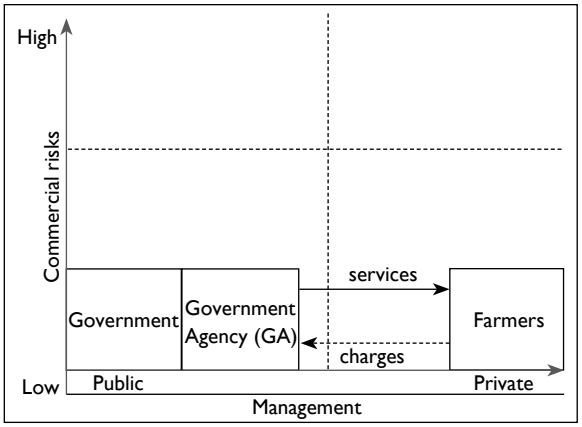
In this minimal but decisive change, both partners identify themselves better. The government wishes to separate its role in irrigation management (OMM function) from its public responsibilities (policy

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

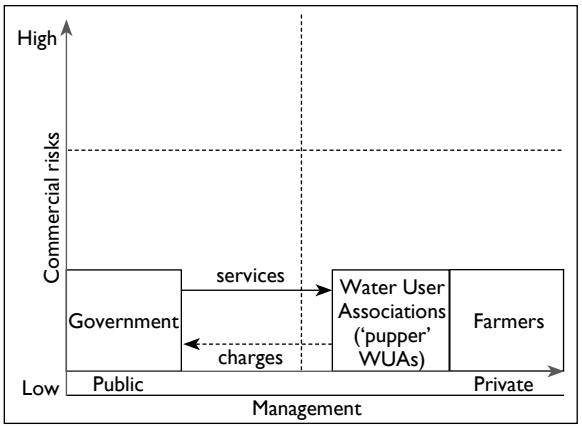
making and governance) by creating a management agency. However inefficient the resulting body may be, it is nevertheless distinct from the government and identifiable. This is a first step toward accountability. For the farmers, the creation of Water Users Associations (WUAs) raises their awareness of their own collective strength. The WUAs help farmers share problems and solutions, and prepare them for further quasi-corporate behavior.

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

On the government side: hiving off



On the farmer's side: creation of WUAs



Collective agricultural and irrigation equipment is sometimes turned over to farmers. At first, things seem to improve. The governmental agency genuinely wishes to provide farmers with quality services, including non-water services like agricultural extension. Farmers are happy to see someone in charge. The improvement does not last long. If civil servants initially feel more inclined to improve the quality of water service, the lack of dedicated management and proper incentives brings them back to their previous routine. Farmers complain: "We're back to square one!"

WUAs are set up based, theoretically, on social reality and economic willingness, stemming from farmers' initiative and positioning themselves as partners to the public agency. However, WUAs are in many cases creatures of the government or the governmental agency, which, under pressure from donor institutions, push for reform without believing in it and with little enthusiasm from farmers.

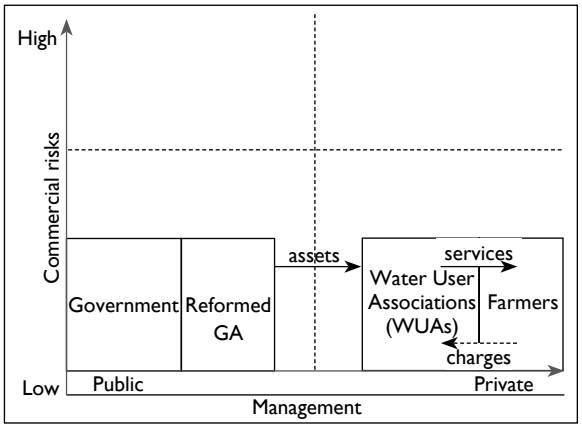
The main purpose of these "puppet" WUAs[2] is to collect water fees at a higher rate than before so that asset maintenance can be improved. However, some WUAs have several thousand members, and their lack of social reality and cohesion does not make for success.

C. Model 2: Irrigation management transfer to empowered WUAs

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

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

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



better part of its activity (OMM), the governmental agency has itself to adapt to its smaller, higher-level role of head-work's management and capacity building for WUAs. The crucial issue here is the much needed downsizing, reallocation, and retraining of personnel, which, typically, is problematic, considering their age, lack of enthusiasm, and increasingly irrelevant experience. Two examples of partial reallocation can be found in Turkey (retraining for other functions or other I&D systems) and Tunisia (from Commissariat Régional de Développement Agricole, Regional Office for Agriculture Development to Association d'Intérét Collectif).

WUAs take care of the transferred assets, collect water fees to cover their maintenance and operation costs, and manage water efficiently and equitably. Such empowered WUAs become real service providers to their members, going as far as hiring personnel to operate and maintain the system. For instance, the Maharashtra Management of Irrigation Systems by Farmers Act, 2005 provides for statutory formation of WUAs in all command areas served by canal irrigation. Under the Act, the state and the WUA enter into an MOU that fixes a volumetric quota for the WUA and the actual quota for any year is determined on the basis of reservoir filling and availability of water. The Memorandum of Understanding (MoU) provides a definite binding that the water charges be related to the quantum of water delivered to the WUA rather than to a localized crop pattern and area based charge. As a result, the WUAs are free to plan their crop patterns on the basis of the volumetric supply they receive and the need for spurious double accounting of water, which created many avenues of corruption, is now minimized. Similarly, Karnataka Government by amendments to the Karnataka Irrigation Act, in the years 2000 and 2002 introduced provisions for the empowerment of farmers through Water Users Cooperative Societies and their Federations or WUA in irrigation water management. They were vested with the responsibility to control, maintain, and monitor the irrigation works.[3] The water users society are also empowered to levy water charges and to stop supply of water if violation of cropping pattern is found. The power to stop water is also given where the users fail to make payment of water charges.

D. Model 3A: Service or management contracting

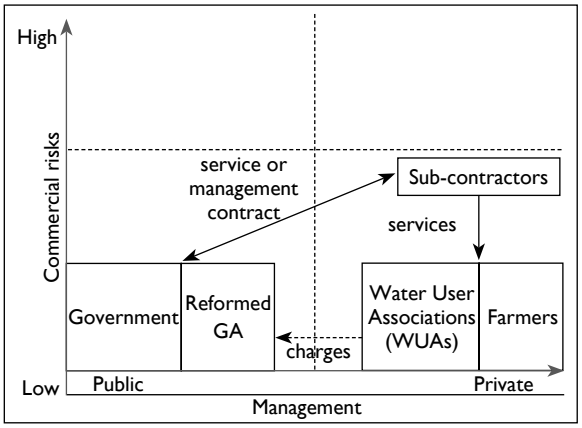
At this stage of reform, WUAs have begun to feel the benefits of managing at least part of their own water service but also have experienced difficulty in fulfilling all OMM functions without support. At this point, either partner may want to bring in a professional third party by contracting out one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

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

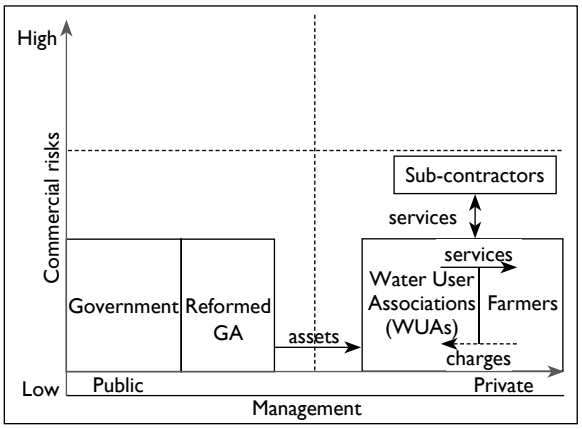
On the part of the WUAs, this level is hard to conceptualize unless assets are transferred through irrigation management transfer. Empowered WUAs think in terms of outside support when confronted

[3] Section 4 of the Karnataka Irrigation Act, 1965

As seen by government



As seen by WUAs



with life-size OMM problems that they cannot handle entirely on their own. In either situation, many questions have to be tackled before outsourcing. Which function should be outsourced first? Should all functions that can be delegated be contracted out? What control should be exercised over subcontractors?

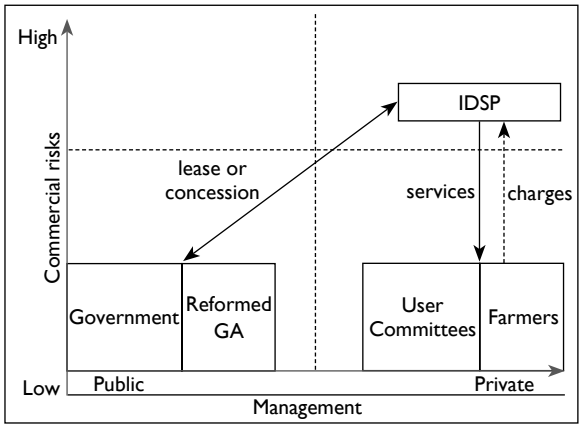
Most of the time, the absence of competent local service provider acts as the critical constraint. Calling on international bidders is never easy or cheap—especially for a WUA—nor does it guarantee service quality or sustainability.

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

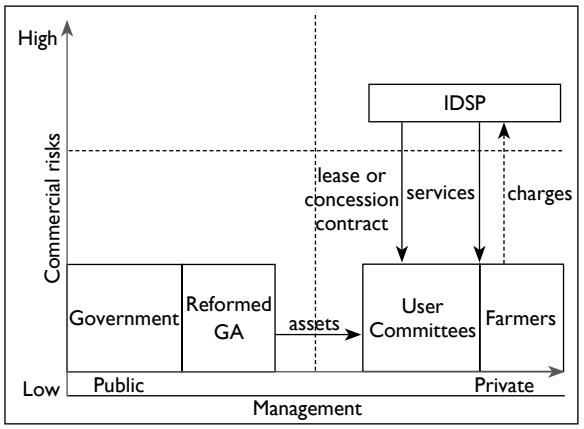
E. Model 3B: Public service delegation

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

As seen by government



As seen by WUAs



IDSP – Integrated Disease Surveillance Project

For the government, this option may be attractive where a private provider can take over investment and management functions retained by government, or where there are doubts about the capacity of WUAs for IMT. Thus government may choose, instead of IMT, delegation of all public service to a service provider. The WUA is then turned into a user committee. The empowered WUAs' decision to contract out all OMM functions is often prompted by the feeling that things are "getting out of hand". Usually, however, it comes about as a result of WUA members' preference to go back to concentrating on their professional job, i.e. farming.

The choice of an I&D service provider (I&DSP) is crucial. Two-stage competition is usually employed, with prequalification and then negotiations with shortlisted candidates. In a lease contract, the existing I&D assets are let-out to a service provider for a long period (8 to 15 years) for a yearly rent (lump sum). Although the service provider theoretically bears no responsibility for investment, it is responsible for major maintenance, and sometimes also for rehabilitation works.

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

Appendix 11
Pilot Projects for PPP in the I&D Sector in Maharashtra and Andhra Pradesh

As a part of the terms of reference, the possibilities of initiating PPP in the I&D sector were to be explored through discussions with the officers in the states of Maharashtra and Andhra Pradesh, on identifying at least two possible pilot projects which can be taken up in order to gauge the interest levels of the private sector. Based on discussions, two proposals were identified from the two respective states. A brief summary of the objective, scope of work, details of the manpower to be engaged, indicative scope of the work for the pilot projects, terms of reference for the consultants, and associated costs for the two projects are mentioned here.

A. Pilot Scheme in Maharashtra

The first pilot project identified as an option is an ongoing irrigation project in Maharashtra which offers the possibility of including service/management components that can generate additional revenues. A number of alternative revenue generating streams that could be explored to make the multi-objective composite project viable and made available to the investor by the state government need to be thoroughly examined to make the project attractive for PSP.

1. Introduction, objective, and scope of work for the study

There are over 1,000 ongoing I&D projects in Maharashtra, most of which have not been completed due to budgetary constraints. Ever since the formulation of the State Water Policy in 2003, the government of Maharashtra (GOMaha) has been seriously considering the implementation of projects through the PPP mode. In July 2003, the GOMaha issued guidelines for involving the private sector in the completion of irrigation projects on BOT basis and decided to identify a pilot project in the Krishna basin for completion through PPP mode on pilot basis. Based on the experience so far, GOMaha is considering revising the guidelines to make them more meaningful and effective.

In order to identify the project to be executed under a PPP arrangement, the International Finance Corporation (IFC) provided advisory services on PPP in March 2008, while the state government posed a few projects to the IFC for preliminary review. The latter submitted a preliminary investigation report on strategic options in October 2008 and identified two potential projects. However, the payouts to the private investor by the government were very high; therefore, the two projects were not pursued further. It was felt that the PPP model must look for revenue streams from sources other than the state budget or establish viability with viability gap funding provided by the government. It is not possible to formulate a generic PPP model applicable to all projects; the focus should thus be on evolving project specific solutions. The Maharashtra Krishna Valley Development Corporation (MKVDC) is presently engaged in identifying likely options for generating additional revenue through the involvement of private investors, and is shortlisting the potential projects to be taken up on pilot basis.

The objective of the pilot study is to review the feasibility of an ongoing standalone irrigation project to make it economically viable, revenue generating and lucrative from the PPP perspective, after making it a composite, multi-objective project and incorporating other revenue generating components in it. The techno-economic feasibility of the multi-objective project is to be established not

only by including the irrigation components such as dams, canals, distribution networks, etc., but also by carefully studying the possibility of integrating additional components that could generate additional revenue. For this, a number of alternative revenue streams could be considered in the water, agriculture and allied sectors, that are viable as well as attractive to the investor; some of the options are: (i) service contracts for distribution and revenue collection from WUAs/bulk users, (ii) hydropower through micro stations, (iii) tourism around the water body of the reservoir, (iv) fishing rights over project reservoirs, (v) agro processing industry with backward linkages with farmers in the command, (vi) agro service centers to provide assured inputs with extension activity in the command, (vii) project based market yards for agricultural products, (viii) brokerage from trading in water between user groups, (ix) commercial development by provision of additional land, and (x) toll roads along the canal. There could be several other possibilities, depending on the local conditions. In Maharashtra, the sale of surplus water or deemed water saved through efficient practices is also considered a source of revenue.

While examining the feasibility of a multi-objective project, it is essential to ensure that all the principles, guidelines, policies, rules and regulations in force are adhered to, the sub-objectives of each sub-component are met—and all this while ensuring an overall positive impact on the environment, ecology, society, culture, and heritage. The project must be acceptable to society at large, as well as to the various stakeholder groups involved; it must also comply with the terms set by all relevant approving bodies and regulatory authorities.

While evaluating and establishing PPP oriented, composite, and techno-economic feasibility, the related institutional and policy matters also need to be reviewed, and appropriate suggestions made. The study must also examine the regulatory setup required for executing similar composite natured PPP projects in the irrigation sector in future and briefly suggest relevant policy revisions and institutional reforms. The composite project should also address the current difficulties faced by the irrigation project. The scope of work should culminate in a report followed by a detailed techno-economic feasibility study of such a composite project.

The various steps, from project identification and delineation of requirements to arriving at the appropriate framework, involve a number of activities, which are listed below:

- Technical, financial and legal pre-feasibility studies: Technical and financial experts need to be involved in order to carry out the technical and financial due-diligence of the identified project(s). This stage calls for the involvement of national experts in the fields of water resources management, hydrology, agriculture, agriculture economy, irrigation, environment, social sciences, finance and economy, and legal and safeguards aspects.
- Project structuring, legal documentation and bid process management: The structuring of a project by itself encompasses various steps such as: (i) defining the objectives and scope; (ii) defining the most attractive mode of PPP; (iii) assessing the Net Present Value (NPV) from the private sector perspective, i.e. financial analysis; (iv) if the project is not found viable, defining, and reviewing possible alternatives; (v) analysis of cost-effectiveness; (vi) incorporating stakeholders views; (vii) summarizing the results; (viii) developing a regulatory mechanism; and (ix) defining inputs and conditions for the tender document.
- Based on the project structure, bid documents need to be prepared, and the appropriate bid process carried out. This stage requires the involvement of transaction advisors.

GOMaha has expressed willingness during discussions to explore various options for PPP in the I&D sector, including the completion of an ongoing project under a PPP arrangement, on pilot basis. Three or four such projects were reportedly shortlisted. One of them can be considered for a detailed study on pilot basis. It is assumed that the Detailed Project Report (DPR) is available, which will be reviewed to incorporate information and analysis covering PPP aspects. The

scope of work and terms of reference (TOR) of the consultants are delineated below:

2. Indicative scope of work and terms of reference of the consultants

Since the work requires multidisciplinary expertise, services of six national level technical consultants with indicative man-months (MM) of engagement are provided in Table AN-11.1. These consultants need to review past reports and records and meet officials of various departments, private participants/ partners industrialists, stakeholders as well as prominent WUAs. In addition, they must compile secondary information, analyze, and report findings and provide suitable suggestions. Meetings will also be organized with the Maharashtra Water Resources Regulatory Authority (MWRRA), IRD/WRD and allied departments, stakeholders and prominent investors, and their views given due consideration.

Table AN-11.1: Consultant requirement with man-months of engagement

Consultant discipline	*MM*
a. Hydrology, DSS (mathematical modelling) cum water resources management/Integrated Water Resources Management (IWRM) consultant and team leader	2
b. Irrigation planning, investigations and design consultant	1
c. Agronomy/Agriculture consultant	1
d. Environment, ecological impact assessment cum social expert	1
e. Agriculture economist/Financial consultant	2
f. Legal advisor for PPP related matters	2
Total (mm)	9

The scope of services expected of each consultant are outlined here:

a. Hydrology, DSS (mathematical modeling) cum water resources management consultant and team leader

The services expected of an IWRM consultant include:

- Overall coordination of the work performed by all consultants;
- Review of all secondary and tertiary data, related reports, and other documents in consultation with other consultants and finalizing the scope of the study at its inception stage;
- Review of programs, policy and institutional framework, including guidelines, SWP, acts of all water related departments, reports of past irrigation projects and other sub-projects; the review of technical data generated including project performance, canal scheduling, optimization of irrigation, and other water demands, etc.;
- To study all available data on concerns and available options in the water and allied sectors and incorporate these in the study; examine areas where PPP can be introduced;
- Review of PIM policy, issues related to inequity, inefficient water distribution, inefficiency of water use, low production/productivity rates and livelihood issues, holding consultation processes for the improvement of water scheduling and distribution services, exploring the possibility of involving PPP in the services area, and hold stakeholder views;
- Review of groundwater data/reports and suggesting effective conjunctive use policies;
- To review and guide the performance of each consultant and analyze each of their reports;
- Review of hydrological data related features of the project, associated concerns and available options;
- Review of water availability, water demands and suggesting a release pattern for different uses; review operation policy, operation schedules, and suggesting a likely DSS model structure for operation, with particular attention to how it will address the issues and incorporate the available options; performing preliminary level simulation and addressing the guidelines for operation;
- Review of the environmental consequences related to floods and droughts, if any;
- To suggest how PPP involvement could be encouraged under the existing/revised DSS guidelines for real time operation;

- To study the role of regulatory authorities in the case of each sub-component of the composite project; and
- Documentation of all information and preparation of the final report.

b. Irrigation planning, investigation, and design consultant

The services expected of an irrigation, investigation, and design consultant include:

- Review of DPR with emphasis on related project planning, investigations, and designs of dam/ weir, spillway, diversion structures, canals;
- Review of irrigation design features, canal and farm operation, and management policies and schedules, suggesting canal modernization aspects related to volumetric assessment and distribution, suggesting improvements in existing canal systems;
- Examining how conveyance systems can be modernized with PPP efforts, assessing water charges, O&M, and other administrative issues, suggesting how PPP can improve services, and additional revenues can be generated;
- Review of technical data generated including project performance, canal scheduling, optimization of irrigation and other water demands, etc.; and
- Documentation of results.

c. Agronomist/Agriculture consultant

The responsibilities of the agronomy/agriculture consultant shall include:

- Review of relevant data on agricultural practices prevalent in the region, crops grown, input and extension services presently available, markets, mandis presented in the DPR;
- Review of the proposed cropping patterns, crop calendars, estimated crop water requirements, and seasonal irrigation demands;
- Review of issues related to the agriculture and horticulture sectors, animal husbandry, fisheries, allied SHGs, etc., examining the available options, addressing the possibilities of PPP involvement in the sector;
- Review of suggested cooperative/PPP models in the agriculture, and allied sectors and exploring possibilities of improving agriculture farm efficiency, improving each component in the value added chain as well as likely revenue generating systems without adversely affecting the economically weaker sections of society; and
- Suggesting PPP involvement areas and documentation of results.

d. Environment, ecological impact assessment cum social consultant

The scope of services expected of an environment and ecological impact assessment consultant include:

- Review of data/reports/acts/rules/guidelines, environmental and ecological issues and concerns faced by the project, past issues on rehabilitation concerns, suggesting available options, recommending any additional studies to be performed in this regard;
- Reviewing the development of the basin/region, its land use, social and economic structure of the rural and urban masses within catchment and command;
- Suggesting ways and means to uplift the poor, children and women, assessing if the PPP project will affect the masses and stakeholders;
- Devising guidelines for the regulation of services, reviewing the role of regulatory authorities in this regard; and
- Documentation of results.

e. Agricultural economist cum financial consultant

The services required of an economic/financial consultant include:

- Collection, compilation, and analysis of relevant financial data related to all costs and revenues;

- Reviewing the relevant economic data on water charges, O&M, agricultural practices prevalent in the region, crops grown, input and extension services currently available, markets, mandis presented in the DPR, reviewing the proposed cropping patterns, crop calendars, estimated crop water requirements, and seasonal irrigation demands;
- Evaluation of the strategic objectives of the authority in relation to the project and advising on the commercial and capital structuring, especially with reference to applicable laws;
- Reviewing and finalizing the projected revenues in consultation with the technical experts and government stakeholders;
- Assisting the authority in identifying project risks and allocating them in an efficient and economic manner;
- Estimating the financial impact of the project on government resources;
- Developing various possible alternatives for revenue maximization and preparing a revenue model for the project; and
- Preparation of a consolidated list of approvals/ consents/clearances required from government instrumentalities.

f. Legal advisor for PPP related matters

The legal advisor will advise the authority on all legal matters associated with the successful implementation of the project. The advisory services to be provided include:

- Evaluation of the strategic objectives of the authority in relation to the project and advising on the legal, commercial, and corporate structuring, especially with reference to applicable laws;
- Reviewing the relevant titles of the authority and the approvals obtained by it;
- Reviewing existing laws/statutes with a view to enable private sector involvement, authorizing/ delegating certain services, etc., suggesting amendments, if required. The actual drafting of the amendments and other legal papers is beyond the scope of this engagement; and
- Assisting the IRD/WRD, MWRRA in identifying project risks and allocating them in an efficient and economic manner.

3. Tentative cost estimate

The tentative cost associated with the pilot project in Maharashtra is provided in Table AN-11.2. It is estimated that the preparation of a PPP proposal for the pilot project will require approximately $63,000 (Rs2.84 million).

Table AN-11.2: Cost estimates and financing plan

Item	*Cost* ($'000)
A. Asian Development Bank	
1. Consultants	
Remuneration for 8 national level experts (9 man months) @ $5000/month	45
Air/local travel (2 months)	8
2. Workshops and/or conferences 1 no.	2
3. Miscellaneous (Secretarial/administrative)	4
4. Contingencies	4
Total	63
B. Government of Maharashtra will provide support to GOMaha for the following costs:	
1. Office facilities and administrative support	
2. Equipment/computers	
3. Counterpart staff	
4. Conveyance/local travel by counterpart staff	
5. Contingencies	

B. Pilot Scheme in Andhra Pradesh

1. Introduction, objective, and scope of work

On the basis of discussions with the officials of the Irrigation and Command Area Department (I&CAD), and the Government of Andhra Pradesh (GOAP), three alternatives have been identified for possible pilot studies in the state:

(a) Development of an integrated model for demand side management of agricultural

energy use (AgDSM) through the replacement of energy inefficient pumps by efficient ones, and the management of groundwater and cropping patterns in order to regulate the much exploited groundwater abstractions. The unrestricted proliferation of private investment in groundwater extracting devices for irrigation has placed enormous pressure on groundwater as well as energy. Analysis of data for the state indicates that the number of pumps for irrigation has increased by 14 times from 0.185 million to 2.5 million, and this is associated with an almost 38 times increase in the consumption of electricity, from 0.394 billion units (BU) in 1970–1971 to more than 15 BU during 2006–2007. At the same time, the power consumption for irrigating 1 ha of land has increased by about 10 times, from 560 units to 5,431 units, which is the real and immediate cause of concern. The primary reasons for this trend may be: the inefficiency of pumps, extraction from deeper aquifers on account of unabated use of groundwater—sometimes beyond sustainable levels—and the adoption of water intensive crops. The benefits of implementing AgDSM include savings in energy consumption and power purchases, reduction in the state subsidy for agricultural power consumption, and earnings through carbon credits, thus making the project viable for private sector participation.

(b) Another area where PPP can be explored in Andhra Pradesh is the integrated development of lift irrigation schemes (LISs)[1] to provide water for irrigation, special economic zones (SEZs), and power projects. SEZs will be developed with major emphasis on agro-based food processing as well as exporting units and gas-based power projects in order to meet the power requirements of the LIS and the SEZ. This is expected to create synergy among all three components of the PPP project. Such a project would require coordination among all the various stakeholders.

(c) Yet another area where PPP could be encouraged is the modernization, development and management of the command areas of a large number of irrigation projects, a majority of which are plagued with inefficiency and low productivity. M/s NETAFIM have conceptualized pressure systems that use zero or very low energy costs, and ensure environmental sustainability by adopting agro-economically suitable crops for the appropriate soil and agro-climatic conditions, user friendly design and operation, and low maintenance costs. The scheme involves zero to low energy systems (for elevations below 6 m), which virtually do not require any electrical systems or sumps, no land acquisition, and no civil costs. It also ensures savings in energy and water use as well as energy, which can be used in alternative high water/energy return areas, thereby reducing the need for subsidies in the irrigation sector. The scheme requires elaborate joint ventures with CAD authorities, and takes on interested private sector entrepreneurs and WUAs as partners. One of the areas that the private sector could explore for revenue is agribusiness value chain activities.

Officers in the GOAP feel that there is a need for a pilot project that employs an integrated farm management model on the pattern of option (c) suggested above, as this would require virtually no Visibility Gap Fund (VGF). Various technical inputs, resource supply and financing options for implementation of the efficient on farm management schemes could be dealt with in the following ways:

- By a group of farmers, independently or through WUAs, to shift to pressure systems and diversification to high value crops;
- By irrigation departments ensuring timely supplies in the case of surface water schemes and respective groundwater departments in providing information on the quantity and quality of groundwater;
- By WALAMTARI/CADA and extension agencies to promote such a scheme to the advantage of the farmers by ensuring all technical knowhow (through adaptive trials) related to the nutritional health of soils as well as supply of timely and

[1] 31 LISs have been proposed in the state at an estimated cost of $26.5 billion (Rs1,192 billion), to irrigate 2.6 mha utilizing 22.2 BCM of water, which will require 8494 MW of power.

quality inputs such as seeds, fertilizers, pesticides, etc.;
- By Distribution Companies (DISCOMs) which can ensure the supply of energy and thereby help save energy costs;
- By banks, which can provide loans to the private sector; and
- Private sector partners who could sponsor projects and borrow to fund the input supplies to farmers and get benefits by way of retaining part of the water charges and lifting quality produce for agro-processing, storage, retailing, etc.

The NETAFIM proposal could not be pursued further for want of funds. The GOAP has been considering involving the three primary stakeholders—the state government, the farmers and the private sector—through the formation of a Special Purpose Venture (SPV) as a viable option. As for the financing procedure for the project, funds could be made available to the SPV by the state government as per an annual action plan. The SPV would identify the commands to be reworked on pilot basis.

The identification of a project, delineating the project requirements, and arriving at the appropriate framework would involve a number of project development activities which include:

- Technical, financial, and legal feasibility studies: Technical and financial experts need to be involved in order to carry out the technical and financial due-diligence of the identified project(s). This stage requires the involvement of international/national experts in the fields of water resources, agriculture economy, finance, and legal and safeguards aspects.
- Project structuring, legal documentation, and bid process management: The structuring process encompasses various steps such as: (i) defining the objectives and scope; (ii) arriving at the most attractive mode of PPP;
  (iii) assessing the NPV from private sector perspective i.e. financial analysis; (iv) if found unviable, defining and review alternatives; (v) analyzing value for money; (vi) summarizing the results; (vii) defining a regulatory mechanism; and (viii) defining inputs for tender documentation.
- Based on the project structure, bid documents will need to be prepared and the appropriate bid process carried out. This stage requires the involvement of transaction advisors.

2. Indicative scope of work and terms of reference of the consultants

The multidisciplinary nature of the work demands the services of six national level technical consultants; the specifics of this requirement are suggested in Table AN-11.3. These consultants are expected to review past CADA records, and meet officials of various departments, private participants/partners industrialists, bankers, stakeholders, progressive farmers, and WUAs. They need to compile secondary information, analyze and report the findings, and provide appropriate suggestions.

Table AN-11.3: Consultant requirement with man-months of engagement

Consultant discipline	*MM*
a. Hydrologist/Geo-hydrologist, DSS (SW/GW modeling), IWRM consultant, and team leader	2
b. Mechanical engineer with expertise in groundwater and pressure irrigation planning, investigations and design of other groundwater structures including community based groundwater schemes	1
c. Agronomy and micro-irrigation consultant	1
d. Electricity sector expert	1
e. Economic/Financial consultant	1.5
f. Legal advisor for PPP related matters	1.5
Total (MM)	**8**

a. Hydrologist/Geo-hydrologist, DSS (SW/GW modelling) and IWRM consultant and team leader

The scope of services expected of a Hydrologist/Geo-hydrologist, DSS (SW/GW modelling) cum IWRM consultant includes:

- In consultation with CAD Department, selecting a suitable command area for an irrigation project as well as identifying clusters of standalone groundwater commands;

- Overall coordination of works to be performed by all consultants; review of all secondary and tertiary data, related reports and other documents, and finalizing the scope of the study at the inception stage;
- Review of land use, existing groundwater structures, census of groundwater structure data, water pump population, etc., within the state and within identified commands;
- Studying all available data on concerns and available options of groundwater quantity and quality; review reports of central and state irrigation departments/groundwater board on surface water and groundwater availability in the identified project commands, issues related to water scarcity and degradation, excessive pumping, etc.;
- Examining the available cultivated land and the scope for shifting to pressure systems;
- Studying the types and nature of pumps that are being used extensively as well as the associated pump efficiencies, and suggesting changes in extraction patterns for future use in the light of changing agriculture trends;
- Suggesting how PPP involvement could be encouraged under the pressure system culture;
- Reviewing the PIM policy as well as issues related to inequity, inefficient water distribution and water use, low production/productivity, livelihood issues, and holding consultation processes for the improvement of water scheduling and distribution services (in the case of surface water). This also includes suggesting ways and means to promote conservation, energy savings and conjunctive use, and exploring the possibility of PPP involvement in the services/ water delivery area in consultation with stake holders;
- Reviewing the groundwater data/reports and recommending effective conjunctive use policies; and
- Documenting and compiling the views of all the consultants and preparing the final report.

b. Mechanical engineer with expertise in groundwater and pressure irrigation planning, investigations, and design of other groundwater structures including community based groundwater schemes

The scope of services expected of the irrigation, investigation and design consultant includes:

- Review of the geological aspects, topographical and soil maps, and studying the extraction patterns and their impact on the groundwater table in the state in general and the project area in particular;
- Recommending changes in the nature and type of pressure systems and pumps most suitable for the region;
- Suggesting reforms in water management practices in the light of revised cropping patterns, with the possibility of shifting to micro-irrigation;
- To help improve the management of conjunctive use;
- Estimating the number of pumps that need to be replaced within a stipulated time frame in the canal command as well as standalone groundwater command, and projecting the same at the state level; and
- Documentation of results.

c. Agronomy and micro-irrigation consultant

The scope of services expected of an agronomy/ agriculture consultant includes:

- Reviewing the relevant data on agricultural practices prevalent in the region—crops grown, input and extension services presently available, markets, *mandis*—presented in the DPR, assessing the proposed cropping patterns, crop calendars, estimated crop water requirements and seasonal irrigation demands;
- Examining the issues related to the agriculture and horticulture sector, animal husbandry, fisheries and allied SHGs, etc., analyzing the available options including those in water conservation and micro-irrigation, and addressing the possibilities of PPP involvement in the sector

in the form of Energy-saving Companies (ESCOs) and/or SPVs; and
- Conducting a survey and analysis of the suggested cooperative/PPP models in agriculture and allied sectors, and consulting the stakeholders on shifting to energy efficient pumps and on available financial options.

d. Electricity sector expert

The scope of services expected of an electricity sector expert include:

- Reviewing the data, reports, acts, rules, regulations, guidelines, and other existing literature relevant to energy generation and distribution in the rural sector in general, and the project area in particular;
- Assessing the energy demand and supply patterns in rural segments, the associated subsidies in the agriculture sector, the impact of a shift in favor of improved water pumps, and the additional changes necessary for improving supply and ensuring equitable distribution among farmers in the commands being studied;
- Studying and suggesting the most suited models for the reformed system (ESCO/SPV), especially from the ensured supply angle;
- Holding discussions with DISCOMs, pressure system manufacturers, pump manufacturers, and regulatory bodies, and incorporating their views; and
- Documentation of results.

e. Economic/Financial consultant

The scope of services expected of an economic/ financial consultant include:

- Collection, compilation, and analysis of relevant financial data related to all costs and revenues;
- Evaluation of the strategic objectives of the authority in relation to the project and providing advisory functions on the commercial and capital structuring, especially with reference to applicable laws;
- Reviewing the projected revenues and finalizing them in consultation with the technical experts and government stakeholders;
- Assisting the authority in identifying and effectively allocating the project risks;
- Estimation and quantification of the financial impact of the project on government resources; and
- Development of various possible alternatives for revenue maximization and preparing a revenue model for the project.

f. Legal advisor for PPP related matters

The legal advisor shall advise the authority on all legal matters associated with the successful implementation of the project. The services to be provided include:

- Evaluating the strategic objectives of the authority in relation to the project and advising on the legal, commercial, and corporate structuring, especially with reference to applicable laws;
- Reviewing the relevant titles of the authority and the approvals obtained by it;
- Assessing existing laws/statutes with a view to enable private sector involvement, power to authorize/delegate certain services, etc., suggesting amendments if required. The actual drafting of the amendments and other legal documents is beyond the scope of this engagement; and
- Assisting the authority in identifying and allocating the project risks in an efficient manner.

3. Tentative cost estimate

The tentative costs associated with the Andhra Pradesh pilot project have been provided in Table AN-11.4. It is estimated that a sum of approximately $58,000 (Rs2.61 million) would be required to prepare a PPP proposal for the pilot project.

Table AN-11.4: Cost estimates and financing plan

Item	*Cost* ($'000)
A. Asian Development Bank	
1. Consultants	
Remuneration for 6 national level experts (8 MM) @ $5000/month	40
Air/local travel (round trip)	8
2. Workshops and/or conferences 1 nos.	2
3. Miscellaneous (secretarial/administrative)	4
4. Contingencies	4
Total	**58**
B. Government of Andhra Pradesh will provide following support at GOAP cost	
1. Office facilities and administrative support	
2. Equipment/computers	
3. Counterpart staff	
4. Conveyance/local travel by counterpart staff	
5. Arrangement field visits	
6. Contingencies	

Exploring Public–Private Partnership in the Irrigation and Drainage Sector in India
A Scoping Study

In spite of substantial investment by the Government of India, the country's irrigation and drainage sector finds itself plagued with numerous concerns. The current productivity and efficiency levels, as well as economic returns, are all lower than expected. In light of the growing stress on natural resources and the threat of climatic change, meeting the needs of its growing population poses a huge challenge. To enhance the sector's performance, the central and state governments of India are now looking to decentralize the sector's management and seek collaboration with the private sector.

This report is the result of a scoping investigative study initiated by the Asian Development Bank to explore the potential for public–private partnerships in the irrigation and drainage sector in India. It identifies the areas where private sector participation can be envisaged in consonance with the current national policy framework; examines the legal and institutional status, and presence of national and international best practices; and suggests PPP models appropriate to Indian conditions.

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