TRANSFER OF O&M RESPONSIBILITIES OF IRRIGATION TO BENEFICIARIES – GLOBAL PERSPECTIVE

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1.0 BACKGROUND

Agriculture is by far the largest user of the world's water, soil and biodiversity. It accounts for 70% of the total water withdrawals of the globe. The requirements of water are bound to increase due to population growth and increased demand for food. In addition, there is a tremendous pressure to meet water requirements for other purposes such as drinking water, industrial use etc. There is thus unabated competition between the water used in the agriculture sector vis-à-vis other water users. This competition for water resources has led to the agriculture sector having to review, and adjust accordinly, its share of water.

The centralised states across the globe have invested in irrigated agriculture and have historically held the authority for operation and maintenance of the irrigation systems as well as for distribution of water. It is generally recognized that the rate of economic return assumed during the design of the project is not always achieved. Quite commonly, persistent gaps exist between the assessed irrigation potential and the actual potential that has beenput to use, crop yields targeted and the crop yields achieved per unit of water used, cropping intensities projected and the cropping intensities obtained, and irrigation efficiency planned and the irrigation efficiency realized. Many reasons are ascribed for this situation. In some cases, the amount of water assumed during design is not available. In others, farmers prefer crops different from those planned because of market price conditions. In several cases, farmers are reluctant to pay full irrigation fee charged for their use of the system. In many systems, the fees collected have not been sufficient to cover expenditure for operation and maintenance. Since the policy of irrigation development and management usually precludes opportunities of farmers' participation, the government has been overburdened in carrying out operation and maintenance (O&M). Under these circumstances, investment in O&M has slowed down which has resulted in deterioration of the physical infrastructure, poor service performance of the system and unsatisfactory management of the system. The poor physical status and performance of the irrigation systems seem to be the symptom of institutional inadequacies and ineffectiveness.

Irrigated agriculture, though practiced only on about 20 percent of the world's total cultivated land, accounts for more than 40% percent of the total food production while the rained agriculture on 80% of the cultivated land supplies only 60% of world's food. On an average, yields per hectare under irrigated agriculture are 2.3 times higher than those from rainfed areas. In India, the irrigated area accounts for about 45 per cent of the cultivated area and about 70 percent of the total food production. Therefore, the irrigated agriculture holds a high stake in the socio-economic paradigm of the countries across the globe. Obviously, policy makers, planners and international donor agencies justifiably express concern over the poor performance of the irrigation systems, especially in the context of growing population, increasing scarcity of land and water resources, and fewer opportunities for investment in new irrigation development. The current assessment in several countries, particularly in Asia, reveals that the most economical advancement in irrigated agriculture can be achieved by improving the performance of the existing systems rather than creating new ones. Moreover, since better sites have already been developed, new projects in the future will have lesser chances of their feasibility with even greater difficulty in achieving effective returns. One way of meeting the additional demand for food is by increasing cropping intensities in the face of shrinking land and water resources availability for agriculture. This necessarily implies improved performance of the existing irrigation systems and more efficient use of available water.

The irrigation system management holds the key to improving irrigation system performance. The management hierarchy of the surface (canal) irrigation system comprises the main system which conveys water from the head works to secondary canals and the tertiary system which distributes water to field-level canals. The field level canals below the outlet is termed as the quaternary system which comprises quaternary canals (water course and field channels), field drains and larger drains. Because of the inter-relatedness of the canal hierarchies, the canal set up requires an overarching management system in which the process of management is required to be

organised into hierarchy of needs of the main, secondary, tertiary and quarternary systems and the responsibility is required to be assigned on the legitimacy of the management capacity compatible with canal hierarchical needs.

While considering the hierarchical needs, it is understood that the physical infrastructure of the main system involves measurement and control of discharge at several points which requires a high level of technical expertise during the construction, operation and maintenance phase, necessitating large financial resources. Obviously, the government agency should have the source of legitimacy to manage the main system. The physical infrastructure of the tertiary system involves measurement and control of the discharge only at the head point and the system has only temporary or semi-permanent control devices. The beneficiaries who have direct stake in the outcome of the irrigation enterprise through the tertiary and quaternary systems, and are always in contact of the local system by virtue of being in near vicinity, have legitimacy to be partners in the management of these systems. Even otherwise, the management of the quaternary irrigation and drainage infrastructures has traditionally been within the domain of local farmers. It, however, needs to be pointed out that the above hierarchical regime is pertinent in large irrigation systems pervaded withinherent complexities such as in India.

There are large number of irrigation systems existing in many countries where farmers themselves control the irrigation enterprise including control of access to water from a natural source. Though these systems are generally small in size, their vast number collectively makes them a significant factor in agricultural production in many countries.

There are several management typologies of partnership in irrigation system management such as Non-Government Organization (NGO), private sector or public-private sector entity. The NGO type of partnership is unusually mediated through the association of Irrigation Water Users Association (IWUA). By and large, it would appear that the local-level partnership singly or in combination of various management typologies can be an important means for improvement of irrigation systems and their performance.

2.0 OVERVIEW OF FARMERS' MANAGED IRRIGATION SYSTEMS ACROSS THE GLOBE

Historical literature contains numerous references to irrigation systems managed by local communities. Some of these systems date back to hundreds of years and have well established institutions for managing operation and maintenance. In South India and Sri Lanka, numerous systems, perhaps as many as several thousand, distribute water from tanks replenished by water harvested from a catchment rather than from a river diversion. Locally managed *Karez* irrigation systems are found in many countries around the world, with a major concentration in Iran, Afghanistan and Pakistan. These systems tap the water bearing alluvial fans at the base of mountains and lead it through gently sloping tunnels, sometimes many miles in the plains.

Locally managed systems were largely ignored during the period of rapid construction of new systems presumably because their small size and simple construction did not invoke much interest. However, since the mid 1970smany developing countries initiated major changes in their economic policies, including reductions in the size and budgets of the Government, especially under agriculture sector. These strategies started mounting pressure on agriculture sector to become more efficient in terms of management in order to recover the investments made by the government.This led to increasing financial difficulties in maintaining the irrigation systems. The only route that was conceived is the introduction of Irrigation Management Transfer (IMT), which involves the process of devolvement of authority and responsibility from government agencies managing systems to non-government entities (often IWUA).

The IMT, introduced since the mid-1970s, peaked up in the early 1990s. Today, more than 57 countries across the five continents have embarked upon some type of irrigation sector reform that invariably has IMT as one of its important ingredient. The IMT has been applied to fit diverse reform needs in respect of area covered (pilot areas of afew hundred hectares to large schemes of a few hundred thousand hectares), hydraulic hierarchy (quarternary and tertiary to main system) and institutional arrangement (NGO, private sector, public-private sector). The typical objectives of IMT programmes include:

- Eliminating or reducing recurring government expenditures for operation and management of irrigation systems.
- Establishing financially self-reliant water service providers to replace the public agency in the management of systems.
- Reversing the deterioration of physical infrastructure

- Providing transparency in management and accountability of the service provider to water users.
- Finally, achieving improvements in the performance of irrigated agriculture sector, including productivity as well as financial and physical sustainability.

In dealing with IMT issues, an inter-related concept, referred to as Participatory Irrigation Management (PIM) is in currency. Normally, this refers to the increased involvement of water users in irrigation management along with the government. Thus, while the IMT concept intends to replace the role of the government, the PIM concept seeks to strengthen the relationship between water users and government in overall management of the irrigation system. PIM is widely used in many circumstances and context that largely correspond to the concept of IMT.

The process of implementing IMT/PIM involves preparatory actions and implementation steps. The preparatory actions for water users to take over management of irrigation schemes are:

- Holding dialogues and negotiations with farmer groups
- Public awareness campaigns
- Stake holder consultations
- Pilot projects
- Workshops
- Organising assistance from national/international sources
- Adoption of privatization policies and legal frame work that support IMT/PIM.

The potential steps of implementation include:

- Creation of IWUAs
- Democratic selection of IWUA leaders
- Essential technical and physical improvements in irrigation systems with farmer participation.
- Technical training in Operation & Maintenance (O&M) as well as the finance and administration for IWUA leaders.
- Training for irrigation agency staff for new functions including finance and administration.
- Farmers' contribution to cost of repairs/rehabilitation works (in terms of money, labour and/or materials).
- Formation of programme steering/coordination committee.
- Planning and review meetings with farmers' participation.
- Legal support for dispute resolution.
- Support services for :

- Credit for IWUA and farmers
- Agricultural extension, agri business and marketing.

The results of IMT based on the review of worldwide efforts by FAO (2007) are abstracted as under:

- In general, IWUAs have the potential to perform their basic water delivery and canal maintenance functions but they need sustained training, support services and proper legal basis in order to function effectively.

- Water charges have been the main source of revenue for the IWUAs. Majority of the IWUAs have been able to raise adequate amounts of fund and labour to perform their irrigation management duties. There is, however, a general need for IWUAs to add revenue and diversify their financing sources beyond what they can obtain from only water charges and dues from members.

- The rate of collection of water charges has generally increased. The financial sustainability of a transferred scheme is inferable from the rate of collection of water fees to cover O&M costs, and the change in the amount of resources allocated for O&M costs after transfer.

- The amount allocated per se for O&M is not so significant; the principle of not deferring maintenance should prevail if schemes are to be sustainable.

- There has been a positive change in timeliness and equity of water delivery in all the regions surveyed. A clear improvement in these two indicators is itself a sufficient reason to advocate the direct involvement of farmers in the management of irrigation schemes.

- There has been an increase in irrigated area associated with an increase in cropping intensity. Under irrigated conditions, an increase in crop yields may not be distinctively the effect of improved irrigation management since several other production factors (adoption of improved varieties, agricultural practices and other technological changes) may be interfacing. Most countries have, however, reported larger irrigated areas, increased crop yields and increase in farm income.

- Notwithstanding the foregoing positive outcomes, there are also cases of neutral or negative outcomes since the things have not evolved according to the anticipated features of the IMT process owing to heterogeneity of irrigation schemes and varied intensity and complexity of the managerial requirements. This underlines the necessity of recognizing the distinctiveness of an irrigation system, its operation and maintenance requirements, the needs of capacity building in the IWUA, the advance actions needed to prepare the IWUA for taking up the management responsibility and the type of external supportneeded after the IMT so as to establish the potential of the IMT under different circumstances.

  From the above overview of the farmers' managed systems, it would appear that a tremendous resource of experiences for operating and maintaining irrigation systems is available with respect to the IMT concept in which the role of the government in irrigation management has been replaced by the IWUAs. The PIM concept presents a partnership role with shared responsibilities compatible with the capabilities of the government agency and the farmers in irrigation management. Since PIM concept seeks to strengthen and harmonise the relationship between the water users and the government, it has higher acceptability in the prevailing circumstances in India in view of largeand complex irrigation systems.

  In the succeeding section, a case study is presented, highlighting the success story of the PIM in Bihar (India) which typifies the laggard situations with respect to the socio-economic scene, hydraulic features of the irrigation system and the functional effectiveness of the government agency so as to understand the strength of the local management potential under PIM when the government becomes a willing partner in the system improvement.

3.0 CASE STUDY OF PIM IN PALIGANJ DISTRIBUTARY IN BIHAR (INDIA)

3.1 Physical Context of the Distributary before PIM

The Paliganj distributary originates at 74 km from the head of the Patna Canal of the Eastern Sone System, which is an old canal system. It is designed to serve a command area of 12000 ha in 76 villages through outlets from the distributary and its two sub-distributaries. Before the advent of the PIM regime in 1989, the distributary encountered several serious constraints typical of the state-level canal irrigation paradigm. Some notables features are the following:

i) The canal infrastructure had considerably deteriorated due of lack of maintenance consequential to severe state-level financial crunch.

ii) The farmers in upperreaches usually breached and blocked the canal, depriving the lower-reach farmers of the legitimate water supply.

iii) The rural populace was socially fragmented because of pronounced social tension arising from caste divides and tenure-related issues which precluded the cooperation of farmers in bringing about improvement in the physical infrastructure of the system.

iv) The poor performance of the canal system caused wide-spread apathy among farmers, obscuring contact and overtures of the officials of the Water Resources Department (WRD) for functional improvement of the canal system.

3.2 Operational Context of the Distributary before PIM

The WRD through its hierarchical organizational structure (Chief Engineer, Superintending Engineer, Executive Engineer, Junior Engineer and work supervisors) held the authority for O&M of the system. Because of the severe financial crunch coupled with the institutional inadequacies, the maintenance of the system was poor which resulted in sub-optimal performance of the irrigation system in terms of:

- lower than designed discharge being received at the head point of the distributary;
- area irrigated being much less than the area planned for irrigation;
- tail-enders receiving much less water than the stipulated water supply;
- irrigation schedules being irregular;
- collection of irrigation fees being much less than the chargeable fees since the farmers were unwilling to pay the fees for the reason of poor irrigation service;
- crop yields being much lower under, the traditional agronomic practices than the yields which were anticipated to be obtained by adopting improved agronomic practices.

3.3 Imperatives for System Improvement through PIM

The magnitude and nature of the problems faced in relation to management, operation and maintenance of the system presented a dismal scene which was unacceptable in the face of pressing socio-economic demands for improved canal system performance. The state government faced growing financial constraint to make available funds for operational expenses. Revenue from irrigation fees was far less than the O&M expenses. Between 1986 and 2002, the revenue collected was far below the cost of collecting revenue, what to say of meeting the actual O&M costs. Under these precarious conditions which were common across the various irrigation schemes in the state, the canal irrigation system in the state faced the imminent danger of collapse. In such a grim situation, PIMseemed to be only redeeming option to the state government which was firmed up in the backdrop of the National Water Policy (MOWR, 1987) which stipulated: *"Efforts should be made to involve farmers progressively in various aspects of management of irrigation systems, particularly in water distribution and collection of water rate. Assistance of voluntary agencies should be enlisted in educating the farmers in efficient water use and water management";* and the Report of the Second Bihar Irrigation Commission (1994) which recommended; *"Farmers' participation in irrigation management through better involvement in operation, maintenance, assessment and collection of water rates is essential not only for the betterment of farmers' economy, rather it is a must for the survival of the system as it would meet the aim of both the farmers and the managers"*. As the state faced the desperate financial situation, it became an overriding reason for the government to take a decision at the highest level to carry out and monitor an experiment in irrigation management transfer on the Paliganj distributary of the Sone Canal System.

The ground work for brining an attitudinal change in the minds of distributary level farmers and the WRD officials for irrigation management transfer was thoroughly carried out since 1988 by the Water and Land Management Institute (WALMI), Patna, through its Action Research Project, supported by the USAID. The preparatory actions involved extensive dialogue and discussions with the community leaders across the socio-economic divides and capacity building activities, which resulted in the formation of the Paliganj Distributary Farmers' Committee (PDFC). A Memorandum of Understanding (MOU) was signed in 1989 between the PDFC and the WRD which contained the following key provisions:

- Guarantee by the WRD for delivery of a fixed proportion of available flow in the Sone River at the head of the Paliganj distributary.

- Guarantee by the WRD to undertake major repairs of the distributary and the sub-distributaries in case of an emergency.

- Responsibility of the PDFC for O&M of the distributary and the sub-distributaries.

- Responsibility of the PDFC for collection of irrigation fees of which 70 percent to be utilized by the PDFC for O&M and 30 percent to be used by the WRD to cover costs of O&M of the main system.

The objective considerations for the PIM are:

- Participation of farmers in irrigation water distribution, irrigation scheduling and maintenance of the system at micro level so as to improve irrigation system performance as well as water use efficiency, imbibing a sense of equity and economy in water use amongst the water users.

- Delineation of responsibility of water distribution and maintenance of the system as per the hydraulic hierarchy for attaining high serviceable standards of the system.

- Entrusting community responsibility to the farmers for collection of water charges and payment to the government as per the stipulation in the MOU.

- Developing and sustaining harmonious partnership between the managers and the water users in the entire operation and management of the system.

The PDFC is supported by Village Irrigation Committees (VICs) in overall management of the system. The VICs comprise 5 to 9 members each and one person from each VIC is on the PDFC which comprises 35 members. The PDFC and the VICs have undertaken canal maintenance and water management tasks with fair sense of responsibility and have brought about discernible improvement in the system performance. The impact of the PIM on irrigation performance of the Paliganj distributary has been studied in 1994 and 2005 which is presented below in terms of some selected parameters:

Sl. No.	Parameter	1994	2005
1	Water received in canal	3.70 cumec	5.10 cumec
2	Number of days of water receipt in July month	20	30
3	Area irrigated	3850 ha.	5050 ha.
4	Irrigation water available to tail-end farmers	0-2 times	5-6 times
5	Government expenditure on irrigation management	Rs. 0.80 million	None
6	Quality of seeds used for sowing	Home seeds	Hybrid
7	Production technology adopted	Traditional	New
8	Paddy yield	2500 kg/ha	5000 kg/ha
9	Wheat yield	1000 kg/ha	3300 kg/ha

Buoyed by the improved performance of the Paliganj distributary system, the state government has felt confident of further success and provided legal support to the PIM through the Bihar Irrigation Act, 1997 and also created a PIM cell in the WRD to coordinate PIM activities in the state. These steps have strengthened and expanded the concept of PIM in the state.

3.4 Salient Aspects of Success of the PIM in the Paliganj Distributary

Notwithstanding the laggard situations existent in the state which are generally considered unfavourable for PIM, there are some salient aspects of the success of the PIM in the Paliganj distributary which need to be underscored:

- The WALMI played a proactive role in motivating the farmers for participation in irrigation management and in creating the institutional framework in the form of PDFC by induction of right leadership in the PDFC, particularly by identifying highly committed persons for the posts of President and Secretary, whose sincerity of purpose inspired high confidence among the farmers. This has been themost crucial content of the PIM experiment right at the beginning.

- The financial support from the USAID provided a strong financial base to the WALMI to carry out the capacity building programme activities quite effectively, which centred on improving skill for operation and maintenance and for transfer of technologies with respect to improved water application methods and improved agricultural practices for enhanced agricultural productivity. The programme also included supporting activities such as decision-making, accounting, communication and conflict management.

- Substantially increased collection of irrigation fees enabled better maintenance of the irrigation infrastructures which resulted in improved availability of water and also in more equitable distribution of water because of judiciousness in water distribution. Under these conditions, farmers were induced to adopt modern crop production technologies which included the elite System ofRice Intensification (SRI) technology. The resultant effect was improved water productivity consequential to increase in yield of crops per unit of water utilization, reduction in various outflows (seepage, percolation, and drainage) as well as more effective use of rainfall and soil-stored water.

- There has been a bane on a account of the government not fulfilling a primary condition of the turnover of the management of the physical system and making it fully functional by repairing or replacing dilapidated structures. Since a good deal of time was lost while waiting for the WRD action which did not materialize and

also in resource mobilization by PDFC to carry out the repair works, the functional take-off was on a slow trajectory and the impact was somewhat subdued. Had the physical system become functional from the beginning, a more prodigious impact would have been obtained.

4. ISSUES OF CONCERN

From the foregoing overview and case study, a few issues of concern emanate that need intervention for sustainable PIM. These are as under:

i) System rehabilitation prior to IMT

The system rehabilitation should be a precondition for IMT. It has to be a mandatory requirement to carry out canal rehabilitation works to bring the entire system to design discharge levels prior to IMT. There are also questions pertaining to who will be responsible for systematic improvements and what can be the role of the government. There are successful examples of incremental improvements where financial responsibilities have been shared between government and farmers according to their financing capacity. Policies and legal frameworks must be clear about this issue in order to prevent relapses into deferred maintenance.

ii) Sustained Capacity Development of IWUAs and Irrigation Agencies

Intensive awareness campaign targeted at farmers for their endorsement and acceptance of IMT and capacity building programme for strengthening of farmers' and government institutions are important elements for sustainable PIM. While capacity building of the office bearers of IWUAs and leading farmers is crucial during the initial years, irrigation agencies also need substantial and prolonged capacity building. Training and other complementary capacity building activities should be a part of long-term programme that eventually evolves into a consultative, problem-solving process.

Sustainability of irrigation is not just a physical characteristic. It depends greatly upon the effectiveness of concerned institutions, comprising committed office bearers who may be motivated through comprehensive capacity building programme. Performance responsiveness need not be limited to achieving the routine stereotyped targets from the irrigation system or the irrigated agriculture. It shall also be assessed in terms of the performance of individuals in their capacity to set the objectives, fulfill the targets and be realistic about their own inputs to the management process. This implies a greater focus on Human Resources Development (HRD) aspect. Training courses dealing with leadership development, financial management, irrigation system management and improvement of efficiency of irrigated agriculture need to be developed.

iii) Financial Autonomy and Viability

Financial autonomy is a necessary condition for a strong linkage between irrigation fees and efficient irrigation service provision, and can be expected to be an increasingly important feature of irrigation management strategy under PIM.

In general, the irrigation fees collected by the IWUAs are the only or the major source of funding. Even the enhanced fee collection may not be adequate to operate and maintain the schemes properly, and this may be further accentuated when the IWUAs are required to make contributions for repair and rehabilitation works of the higher hydraulic hierarchy. Diversification of the financial resource base is a plausible option. The possibility for IWUAs to make profits by way of engaging in agri-business may be explored. Recognizing the importance and potential of this option, a graduated approach can be adopted in view of the capacity limitation of newly created IWUAs. The new IWUAs may concentrate on activities related only to irrigation system management for a certain period in order to ensure the necessary organizational capacity and thereafter can be allowed to enter into diverse areas.

Even otherwise, for making the reform process more comprehensive, provision needs to be made for functional diversification to include other agricultural service-based functions within the managerial domain of IWUAs such as supply of inputs, facilitation for storage and marketing etc. along with performing water user-based functions. The legal framework should provide for the IMT programme to be flexible and adaptive to accommodate these diverse tasks that have functional legitimacy and support of farmers.

iv) Policy and related Legal and Institutional Issues

The IMT is usually accompanied with legal definition of the rights and responsibilities of IWUAs and government agencies. In order to facilitate the process of social adaptation to changed circumstances, more comprehensive opportunities need to be offered to the community for irrigation development and management associated with development of irrigated agriculture through the optimal and efficient use of resources in harmony with the environment. Pollution of water resources, particularly of groundwater from irrigation runoff and return flows has become a source of growing concern, as a result of the increasing use of pesticides and fertilizers for the production of food and fibre. Legal responses to this problem need to be aimed at cultivating land towards non-polluting or less-polluting practices based on technical know-how and do-how generated from Research and Development (R&D). All these will require nuanced approach for devising legal mechanisms aimed at building appropriate institutional framework.

Besides the above, there are policy and related legal and institutional issues of particular significance such as the following:

- **Cost Recovery**
  Financial obligation based on the cost principle is arguable on the ground that the officially reported cost figures for irrigation are much higher than the level that the users could be expected to pay. Basing financial obligations on level of benefits is a more acceptable principle. Ceilings can be placed on the maximum amount which can be charged for the capital cost of new projects and for their O&M. Basically, a legal mechanism to levy, collect and enforce charges for the cost recovery has to be in place. Associated with it, the mechanism should be worked out to plough back the revenue to the system for its O&M and for sustainable irrigation management.

- **Legal status and degree of authority with respect to Irrigation Infrastructure**
  The IMT should clearly address the authority over irrigation infrastructure and the responsibility for maintaining the irrigation system. It may entail transfer of the ownership of the physical assets or the government retaining ownership of the assets while their O&M for use of the system is transferred to users. There may be a need for transfer agreement between the IWUA and irrigation agency. Farmers should have sufficient authority to make rational decisions about maintenance and repairs.

- **Security of Water Rights**
  The security of water rights has several connotations. The first concern of water users is the reliability of a dependable flow of water. As water resources have tended to become polluted, concern for dependable flows has been coupled with a concern for the quality of water reaching the user's head gate.

  The entitlement of water users for dependable flows of water of usable quality needs to be clearly defined. A policy consideration needs to be given to the mobility and transferability of irrigation water rights to water users. It has a direct bearing on saving of irrigation water by water users, including encouragement for investment in water saving techniques on farm. Saving in irrigation water consumption at farm level is encouraged if the user can dispose of the water he saves for on-farm or off-farm use. The special bondage which tends to bind irrigation water to designated irrigated land may, however, be relevant under the conditions of water scarcity. A clearer legal status with respect to water rights be given to IWUAs and farmers. Farmers may need greater confidence in their water rights before they will be willing to take up the responsibility of O&M of the system and make investments to ensure the productive and sustainable use of the infrastructure as well as of agricultural inputs.

5.0 CONCLUSION

The effect of irrigation development on the performance of agriculture has been remarkable. But as the conventional policies limited the farmers' opportunities of participation in irrigation management and the government felt financially constrained in carrying out the burden of O&M, the ensuing deterioration of the physical system and the system performance has adversely affected water productivity. It is being increasingly realized worldwide that the poor performance of the irrigation systems is not affordable in the face of rising demands of food and fibre under the imminent threat of scarcity of water for agriculture, and also in view of the forces on agriculture related changes such as technological development, commercialization of agriculture and environmental concerns (rising water table, salinization of irrigated lands and chemical contamination of ground water).

Under the emerging worldwide scenario, development of irrigated agriculture is getting oriented towards greater commercialization using appropriate technology and complemented by capacity building through Human Resource Development (HRD) targeted to farmers. The key principles of farm-level technology are to improve water application efficiencies and agricultural productivity of individual farms by efficient scheduling and application of irrigation water, adopting suitable crops and cropping systems to match available resources and environments, harnessing interactions between water and other inputs like nutrients and tillage, and manipulating crop behavior genetically to suit given conditions.

Given the above situation, irrigation sector reform is now necessary and IMT is the only viable approach for irrigation reform with the potential to improve the sustainability of irrigation systems. The closer involvement of IWUAs usually results in increased accountability, transparency and responsibility and its potential benefits are so obvious that few countries can afford to disregard them. There is, however, a need to design and implement the IMT/PIM in a more comprehensive manner in order to enable the sustainable financing of irrigation system management.

Financial viability is an important element of sustainability of transferred schemes. Often the rate of collection of water fees to cover O & M costs is used as an indicator of the financial sustainability of a transferred scheme. However, the amount of water fee collection may not be adequate enough to carry out rehabilitation involving heavy repair works, particularly in the higher canal hierarchy. Therefore, financial diversification can be expected to be an increasingly important feature of irrigation management organization.

While the laws and institutions related to irrigation management organizations may vary with the prevailing circumstances of a country, the basic policy and the related legal and institutional issues pertaining to security of water rights, security of land tenure, financial autonomy and conflict resolution will have a good deal of commonality.

Political support is an important element in the success of the IMT/PIM process since it enables proper funding of the reforms and provides a legal base for carrying out reforms. There are many successful examples when the government agency becomes a willing partner in the irrigation reform process, in order to enhance the functional effectiveness of the PIM.

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Shri R.K.Gupta graduated in 1980 in Civil Engineering from Regional Engineering College, Kurukshetra. Shri Gupta completed his Post Graduate Diploma in Structure Engineering from Punjab Engineering College in 1985. He is Masters in Business Administration (MBA) with specialization in Human Resources Management. He joined Irrigation Department, (Govt. of Punjab) in 1981 and WAPCOS Ltd. in 1989. Working in various capacities in WAPCOS for the last 22 years, Shri R. K. Gupta has spearheaded Strategic Planning, Marketing/Business Development, Brand Building, Human Resources Management, Financial Management and Projects Implementation.

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Shri Gupta is Chairman of Indian Section of Federation of Indian Chamber of Commerce and Industry (FICCI) India-Cambodia & India-Laos Business Forum; Co-Chairman, Task Force on Infrastructure and Power Sectors of Africa Committee of Confederation of Indian Industry (CII); Member, Indo-Bhutan Empowered Joint Group for Development of 10,000 MW Power in Bhutan and has been a Member WG-WATS, International Commission on Irrigation and Drainage.

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The Profitability and Net Worth of the Company has increased by 155.12% and 67.14% respectively during the last two years of his tenure as CMD, WAPCOS.

Hon'ble Prime Minister presented Top Performing CPSEs "MoU Excellence Award". The Award is instituted by Department of Public Enterprises, Government of India. The Company has also been conferred "Water Award 2011-12" under the category of "Best Consultancy Company". The Award is supported by UNESCO, PHD Chamber of Commerce, ET Now and Water Digest.

Shri A. K. Agrawal graduated in 1978 in Civil Engineering from I.I.T. Roorkee. Shri Agrawal completed his Post Graduation in Structural Engineering from I.I.T, Delhi in 1981. From 1979 to 1984, he worked in CEA for design of ash and coal handling systems of Anpara Thermal Power Station. From 1984 to 2000, he was involved in planning, design, appraisal and monitoring of various water resources projects in CWC in various capacities.

In 2001, he joined WAPCOS Ltd. and has since been working as a Project Coordinator / Team Leader for various irrigation and water resources projects, besides business development activities in India and abroad.

Shri A. K. Agrawal, Chief Engineer, WAPCOS Limited, a Govt. of India Enterprise under the aegis of Union Ministry of Water Resources, has over 32 years experience in planning, design and development, preparation, identification, appraisal, monitoring and performance assessment of Water Resources Development projects in India and Abroad. He has executed more than 30 engineering consultancy assignments relating to irrigated agriculture, water supply, flood management spread over 14 states awarded by State Govts., Public Sector Undertakings and private companies.

He has worked in Central Electricity Authority and Central Water Commission in various capacities for a period of 22 years, followed by 11 years of services in WAPCOS Ltd. Some of the areas of special interest and fields of specialization of Shri Agrawal are as under:

- Integrated Water Resources Management
- Irrigation and command area development
- Participatory irrigation management
- Monitoring and performance evaluation
- Flood Management

A Civil Engineering alumni of the prestigious Engineering College, IIT, Roorkee, Shri Agrawal completed his Post Graduation in Structural Engineering from IIT, Delhi.

Shri Agrawal is a Life Member of Indian Water Resources Society, Indian Society for Construction Materials and Structure and Indian Geotechnical Society.