Land Improvement Districts and Sustainable Water and Land Management in Japan: Lessons for India

Mamata Swain

CSIRD Discussion Paper: 4/2005

November 2005

Centre for Studies in International Relations and Development (CSIRD)
167-B, S. P. Mukherjee Road, Kolkata 700026, India
Phone: (9133) 24630884, 22483769, Fax: (9133) 22483769
Email: csirdindia@yahoo.co.in, Website: www.csird.org.in

Land Improvement Districts and Sustainable Water and Land Management in Japan: Lessons for India

Mamata Swain*

Abstract

In Japan recently many changes have come about in the countryside like: increase in non-paddy area, increased number of part-time and weekend farmers, increased age of farmers, disinterest in farming by younger generations, increase in non-agricultural population, increase in water demand for non-agricultural purpose like recreation, usage of irrigation channel as sewers, increased land idling and land rent, potential increase of farm scale and contract farming, less precipitation, increased water pollution. In such a changing context, the Japanese Government is reorienting its water and land management policy by redefining the role of the Land Improvement Districts (LIDs) in ensuring sustainable use of water and land resources. The LIDs are now required to undertake multiple functions, which include preservation of the land and water environment, establishing sound water circulation system, providing beautiful landscapes, and creation of resident-friendly countryside. Such socio-economic transformations in rural areas are also taking place in developing countries like India. In this paper, based on Japanese experience, some pre-conditions necessary for the success of the recent Participatory Irrigation Management movement in India for sustainable and integrated water and land management have been outlined.

1. Introduction

In the recent era of liberalization, privatization and globalization, in reforming the irrigation sector a lot of emphasis has been placed on Participatory Irrigation Management (PIM) as a befitting strategy to ensure efficiency in water use, equity in water allocation among water users and sustainability of the irrigation system. Therefore, in many developing countries like India, Pakistan, Sri Lanka, Bangladesh and Nepal, profound reform measures have been undertaken to restructure the irrigation institution by decentralizing irrigation management. The farmers are encouraged to form Water Users' Associations (WUAs) and to take up the responsibility of operation and maintenance of tertiary segment of canals and minor irrigation projects, distribution of water among water users and collection of water rates. In countries like Japan, Philippines, South Korea such irrigation institutions have been in operation since long. These countries have gained sufficient experience in decentralized irrigation management. Specifically the operational efficiency of Land Improvement Districts (LIDs) of Japan has recently drawn the attention of policymakers and irrigation planners of developing countries as successful example of Participatory Irrigation Management and integrated water and land management (Mitra 1992). An analytical study of functioning of LIDs highlighting its strengths and weaknesses will show the road map and appropriate strategy of PIM to other countries including India, who are undertaking such institutional restructuring of irrigation sector.

* Professor and Head, Department of Economics, North Orissa University, Baripada, Orissa 757003, India, Tel: 06792-256906, Fax: 06792-255127, Email:mama_swain@hotmail.com

In India irrigation is included in the state list. Therefore, the irrigation policy, laws and programmes differ from state to state. During the last decade most of the states of Indian sub-continent namely Gujarat, Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Bihar, Madhya Pradesh and Orissa have initiated far reaching reform measures in irrigation sector under the economic restructuring programme mostly under the mandate of donor agencies like World Bank, Department for International Development (DFID), United Kingdom; European Commission, Japan Bank for International Cooperation (JBIC) etc. These states are putting emphasis on farmers and local participation in irrigation management and encouraging the farmers to form Water Users Association (WUA) or Pani Panchayat (PP). The state governments are implementing the Participatory Irrigation Management Programme in a mission mode. Internationally also many countries all over the world are broadbasing their PIM programme. Pioneers in PIM are The Philippines, Mexico, China, Japan, Egypt, Turkey, Sri Lanka, Chile, Columbia, Morocco (Meinzen-Dick et al.1997; Johnson et al. 2002).

An analysis of the path of irrigation development in India unfolds that after independence and up to 1980s irrigation has been mainly considered as a technical enterprise aiming at construction of hardware like dams, reservoirs, weirs, barrages and canals. The irrigation projects have remained mainly state owned, state funded and managed bureaucratically by government department personnel mostly irrigation engineers in a top down manner. The software component or the socio-economic aspects and management part of the system with farmers participation has been grossly neglected. Mere provision of irrigation facility to land does not ensure enhanced agricultural production. The productivity impact of irrigation is critically dependent on the way water is applied and utilized. The quality of irrigation service in terms of adequacy, timeliness, equity, dependability and convenience in its supply remarkably affects the yield from irrigation commands. For obtaining optimum yield, water should be provided in adequate quantity and on time according to the crop water requirement of plants at its various growth stages, as water stress affects crop yield adversely. Irrespective of the location and size of the farm, water should be allocated equitably among the head end and tail end of canals and also among large and small farmers. For proper crop planning, farmers need to know in advance the timing and quantity of water supply. Water should be provided in a dependable, predictable and convenient manner without any uncertainty in its quantum of delivery and timing. Quality in irrigation service should be maintained over time and should be stable and sustainable in the long run. In the new agricultural technology, proper water management holds the key to increase agricultural productivity.

To establish such an improved water delivery system and for optimal utilization of scarce water, new trends advocate much more active participation of the water users in all aspects of irrigation water resource development and management, which include planning, design, construction, operation, maintenance, on-farm development, rehabilitation, modernization, water distribution, financing, resource mobilization and collection of water rates (Wade 1987; Chambers 1988; Ostrom et al. 1993, Meinzen-Dick et al.1997; Baland and Platteau 1996; Vaidyanathan 1994; Brewer et al. 1999 and others).

Now there is a worldwide consensus based on experience, experimentation and research studies that for long-term sustainability of irrigation infrastructure, crafting appropriate institutional arrangement is as important a job as is good engineering. It is stressed that the water users have an important role in water resources management more importantly at the tertiary or downstream part of the canal system. Specifically the water users can better manage the operation and maintenance of canals, distribution of water among farmers and collection of water rates as they have comparative advantage in local knowledge and skill in managing irrigation systems, which are in fact common property resources and not public utilities as wrongly perceived by the water users.

In the era of liberalization, the impact of delicensing and decontrol (started in India since 1991) on irrigation sector is obvious. There is a growing realization that the unnecessary bureaucratic control in management of irrigation system at tertiary levels should be reduced to improve irrigation efficiency and to check corruption and rent seeking behavior. As the farmers have better knowledge of their eco-environment and field conditions, they can manage the irrigation system more efficiently and effectively which is truly a common pool resource. Usually the farmers believe that the canals belong to the government and they are the beneficiaries of the system. They do not have any role and responsibility in upkeep of the physical structures. In the changed institutional context irrigation will be considered as a common pool resource and will be managed by the farmers community (Sengupta,1991; Singh,1994) and its maintenance and sustainability will be the responsibility of the WUAs.

It is contemplated that democratization and decentralization of irrigation management and empowerment of water users will undoubtedly bring about improvement in irrigation service by substantially reducing transaction costs of getting accurate information, negotiation and enforcement of contract cost (Baland and Platteau, 1996). Moreover, in the changed decentralized irrigation management system the irrigation executives and technocrats can devote their time for effective management of main canal system and other technical matters in which they have competence and comparative advantage.

As a matter of fact, in agriculture cooperative efforts are necessary, as there are several externality effects. If farmers at head reach use excess water, tail-enders face water scarcity; if there is pest attack in one's field, the neighboring field is affected. Therefore, a rational economic response is to internalize such externalities by making coalition or forming an association. As irrigation is a common pool resource characterized by non-excludability and rivalry in its consumption (Meinzen-Dick et al. 1997), rational action on the part of each water user in isolation will give rise to free rider problem and will result in Hardin's (1968) 'tragedy of the commons'. Therefore, there is a need for forming Water Users' Association for efficient, equitable and sustainable use of water.

The benefits and costs of participation to two major stake holders i.e. farmers and irrigation agency have been indicated by many authors (Singh 1991; Maloney and Raju 994) Most of the empirical studies have recorded the benefits of PIM in terms of improved O&M, increased production and farm income, equity in water distribution and better water rate collection. The costs of PIM in some projects include higher water rates, more time and effort by farmers, devolution of corruption to WUA office bearers etc. However, most of the empirical evidences suggest that the benefits of PIM outweigh the costs. Therefore, it is well accepted that PIM is a win-win strategy for both the farmers as well as the irrigation agency and should be encouraged to improve quality of irrigation service

Experiences in PIM internationally suggest that the PIM strategy is context dependent with respect to time and space. With changes in socio-economic conditions both spatially and temporally, the PIM policy also needs reorientation. Recently many changes have come about in Japan countryside, which have attracted the attention of social scientists and irrigation planner, policy makers and executives. These changes include: increase in non-paddy area, increased number of part-time and weekend farmers, increased age of farmers, disinterest in farming by younger generations, increase in non-agricultural population, increase in water demand for non-agricultural purposes like recreation, usage of irrigation channels as sewers, increased land idling and land rent, potential increase of farm scale and contract farming, increased water pollution, less precipitation etc. (Ounvichit and Satoh 2002). Therefore Japan Government is rethinking to change its water resources development and management policy to ensure financial viability and sustainability of irrigation systems by redefining the role of LIDs in water and land management. This paper tries to evaluate the operational efficiency of

LIDs in ensuring sustainable water and land management in the changing context as outlined above. In particular, the major objectives of undertaking this study are as follows.

(i) To evaluate the operational and managerial efficiency, financial viability and above all the functioning of LIDs in Japan in facilitating efficient water use, equitable distribution of water among water users, sustainability of the irrigation system and preservation of land and water environment;
(ii) To examine the second generation problems faced by the LIDs in the changed context and the measures taken by Japanese Government to overcome such problems ;
(iii) To draw some policy implications for reorienting the water and land management policy in India in the light of assessment of strengths and weaknesses of LIDs in present day Japan.

This paper is divided into 8 sections. The introductory section mentions the importance and objectives of the study. Section 2 gives an outline of the genesis and evolution of LIDs in Japan. Section 3 deals with the organizational structure and functions of LIDs and discusses the cost recovery aspects and fixation of water rates in Japan. Section 4 deals with the strengths and weaknesses of LID as an irrigation institution. Section 5 highlights the second generation problems of LIDs in the changing context. Section 6 deals with the role of LIDs in establishing a sound water circulation system in Japan. Section 7 emphasizes the changed role of LIDs due to changes taking place in the Japanese countryside. Section 8 is the concluding section, which draws lessons for India from LIDs experience in Japan.

2. Evolution of LIDs

Japan is basically a rice producing country. Nearly two thousand years ago Japanese learnt rice cultivation from China, and it quickly spread all over Japan. Rice farming formed the backbone of Japanese economy and society. At present, there are about 3 million hectares of paddy fields and 2 million hectares of up-land fields. As rice is a water-intensive crop, irrigation is a basic requirement for rice farming. Therefore, many irrigation and drainage projects, land development projects were constructed in Japan to enhance paddy yield. These projects were also modernized and rehabilitated from time to time, which supported the development of Japanese economy. In Japan almost all paddy area is irrigated.

The history of irrigation development in Japan reveals that, long time back during the Tokugawa period (1600-1868), many irrigation schemes were established in Japan by the feudal lords and the schemes were managed by the farming community (Azumi 2005). In Japan land is operated by each household as a unit. Water is managed by communities. Therefore, it is said that land management unites the household; water management unites the community (Beardsley et al. 1980). In 1868 there was Meiji restoration and modern government was installed. During 1880 land based irrigator associations were formed and the leadership role was played by the county president and village elders. In the year 1897 Water User Associations were formed based on enacted Water User Association Law. But these associations were basically landlord oriented. During 1949 Japan lost many of its colonies from which it was importing plenty of food grains. This caused food shortage. The Government thought seriously to increase agricultural production and productivity through improved irrigation management, development of water resources and land reclamation. In the post-World War II period, the three foundations of rural poverty reduction were (Azumi 2005): (i) Land Reforms (1947), (ii) Agricultural Co-operatives (1947) and (iii) Land Improvement Districts (1949). In 1949 the Land Improvement Law was legislated to encourage farmers to invest in land and water infrastructure organizing their associations. The Law envisaged a new legal framework for irrigation associations and aimed at integration of irrigation, land consolidation and land reclamation institutions.

Until the end of World War II, irrigation was operated and managed by WUAs based on village communities. During that time, there were a number of conflicts over irrigation water distribution between upstream and downstream (Tanaka and Sato 2003). Because of the locational advantage, the upstream WUAs were using excess water without paying any attention to the water deprivation caused to the downstream users. This kind of upstream superiority was a serious problem, and it often led to conflicts among WUAs (Tanaka and Sato 2003). However, in 1949, the enactment of the Land Improvement Law transformed the system of irrigation management; Land Improvement Districts (LIDs) were established, and the rights of irrigation management were transferred to LIDs from each WUA. Under the definition in the Land Improvement Law, an LID is an organization created for the purpose of undertaking the construction, improvement, and management of irrigation/drainage facilities and land improvement projects including farmland consolidation within the boundaries of the district. As a result, conflicts between WUAs within the boundary of an LID decreased. Also, in the post-war period, due to land reform measures there was a significant decline in the number of tenants from nearly 50 per cent to less than 10 per cent (Ounvichit and Satoh 2002). The owner cultivators took interest in land development and irrigation. They formed LIDs, so that they could get government support in improving their land, irrigation and drainage system.

Since the war the management of irrigation infrastructure above the tertiary level has been done by the Land Improvement Districts according to the Land Improvement Law. The irrigation communities are getting linked to district, prefecture and national level government for construction of major and multi-purpose dams. Thus in the post-war period both local irrigation communities and high level of government are involved in irrigation development particularly dam-building and major projects (Beardsley et al. 1980).

LIDs are more democratic based on membership of all the water users. At present in Japan there are nearly 6800 LIDs covering an area of 3.0 million hectares with some 4.5 million members with average 470 ha. LIDs of less than 100 hectares account for a little less than 50 per cent, while those of 1,000 hectares or more constitute a little less than 10 per cent. In terms of district members in number, districts with less than 300 members account for a little less than 60 per cent while those with 1,000 members or more constitute a little over 10 per cent or so. As for the business activities of LIDs, nearly 55 per cent are engaged exclusively in Operation, Maintenance and Management (OMM), 36 per cent are involved in both OMM and construction, and 7 per cent are concerned with construction only.

Irrigation in Japan is principally meant for rice fields, which occupied 55 per cent of the total cultivated lands in 2001. Japan has a problem of overproduction of rice for the last three decades (Watanabe and Ogino 2003). One of the reasons for the overproduction is considerable reduction of rice consumption since the 1960s, due to adoption of new nutrition habits. Another reason is the increased yield rate of paddy due to agricultural infrastructure improvement projects, which were widely implemented after the World War II by the government, including farmland consolidation and irrigation and drainage systems improvement, with the well-established institutions in the rural society. The surplus rice production could not be exported given the high price of Japanese rice compared to that produced by any other country. Since the early 1970s, the Japanese government has been requesting farmers to convert about 20-25 percent of their paddy areas to another crop or to leave them fallow. After the acceptance of terms and conditions of World Trade Organization, it is difficult on the part of the Japanese Government to set the domestic price of rice at artificially high level at its own will. The Japanese Government has sustained the high price of rice through acreage control programme, which is of course is not in the interest of the nation (Fujiki 1999). To compete in the world market reduction in price of rice is necessary and this can be achieved by reduction in cost of cultivation. Japanese Government is also encouraging contract farming to reduce production cost and price of rice.

3. Organisation and Functions of LIDs

At present, the annual total quantity of water used in Japan is estimated at about 90 billion cubic meters (INPIM 2004c). Of this, agricultural water use is about 60 billion cubic meters. Of this amount, 40 billion cubic meters of agricultural water use are managed by LIDs, which means that 44 per cent of all water use in Japan is controlled by LIDs. This demonstrates the importance and public role of LIDs in Japan.

3.1 Formation of LIDs

The Land Improvement Law, drafted under the principles of transparency, efficiency, equality and effectiveness, provides a procedure for LID establishment and operation as follows (Ounvichit and Satoh 2002).

- The initiation to establish an LID must come from at least 15 cultivators, who want to construct, operate, maintain, and/or improve irrigation and drainage facilities. State functionaries cannot directly initiate a project, even if they see physical potential or have financial availability.
- A project plan, indicating a clear boundary based on the extent of the project benefits, main facilities, activities and set of regulations, must be prepared and publicized.
- Such plan must by approved more than two-thirds of cultivators within the specified boundary before being submitted to the executing agencies of state or local governments to seek professional expert opinions on the plan.
- The revised plan will then be announced to allow negatively impacted people to voice their objection.
- If there is no objection, all cultivators in the area shall become project members despite their earlier disagreement to the plan. However, in most cases, 90 per cent of popular agreement is obtained through meetings and discussions on project outline or designs in *muras* (traditional Japanese village) before further project progress. This is the time when the tail-end irrigators negotiate for their leverage as head-end irrigators are in need of their concurrence.
- Project members are required to share the project costs, donate parts of their land for construction of common facilities, and bear the full operational costs. These financial issues must be discussed and agreed based on the majority rule. LID fund is subsidized by local and national governments in various ratios such as 100:0:0, 25:75:0, and 30:20:50. An LID that is short of fund can borrow from the state-run Agriculture, Forestry and Fisheries Finance Corporation and repay within 25 years with 10-year-grace period.
- The establishment of the LID must be approved by the prefectural governor.
- The final plan must be submitted to the Ministry of Construction or local government as the case may be. Generally, the former takes up a larger or more technically complex or trans-prefectural projects, while the latter or cultivators take up projects of a lesser scale.
- Further public consultations continue until the definitive plan is issued.
- The construction and operation and maintenance work can be implemented by the state agencies, local governments (prefecture, city, town and village) or LIDs depending on the LID boundary, the scale and the complexity of the facilities.
- LIDs can be dissolved or merged by the General Assembly and the prefectural governor. Illegal operation and mismanagement can lead to LID dissolution by the governor. Its reports and accounts are open to inspection by government agencies.

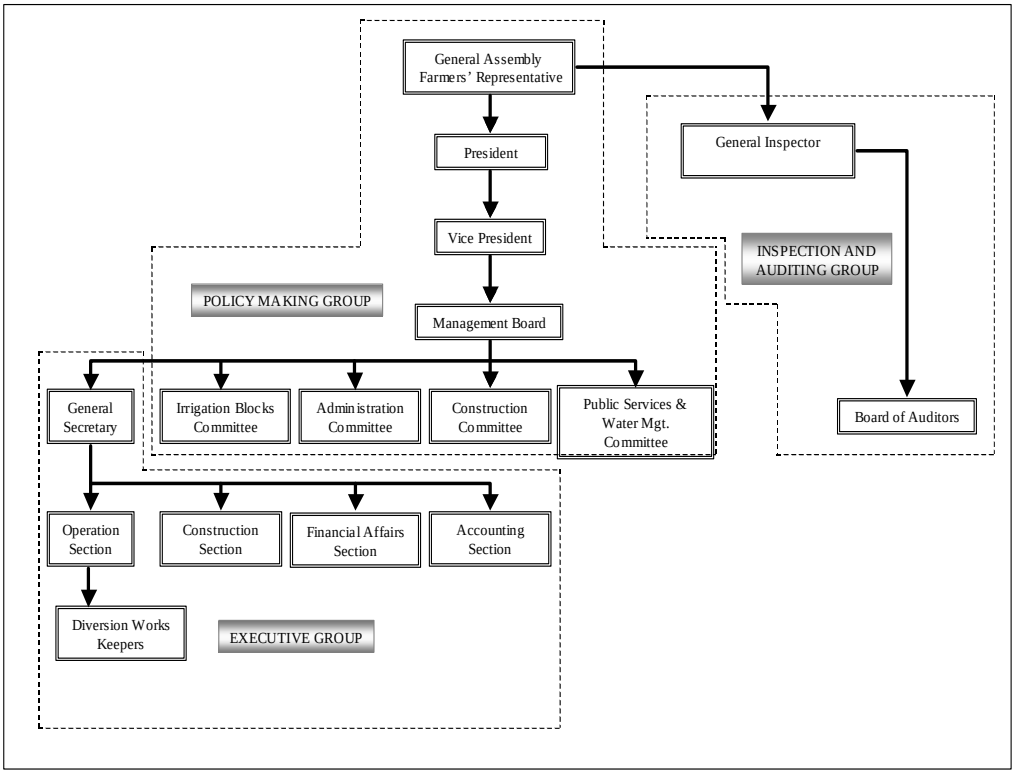
Thus, the LIDs are established on the initiative of the farmers through a democratic, consultative and participatory process. It is very often claimed that LIDs are in fact farmers' projects and government participates.

3.2 Organisational Structure

A General Assembly comprising all water users/members within the hydraulic boundary of the LID is the decision making body of the LID (INPIM 2004a). The General Assembly meeting is held at least once a year. If the membership of an LID exceeds 200 persons, a Board of Representatives may be established in place of the general assembly. Representatives are elected every 4 years. The LID's implementing bodies are the Board of Directors and the Board of Auditors. The number of Executive Directors should be more than 5. They are elected at general meetings and their term is 4 years. The number of Auditors should be more than 2. The Secretariat office implements LIDs daily work through different staff members in charge of water distribution, maintenance, land control, water charges, etc. A Committee, which acts as an "Advisory Organization" is also created to help the Board of Directors on decisions pertaining to general affairs, land survey, operation of main and branch canals, construction of projects, etc. Farmers belonging to an LID may also be members of other types of "associations", e.g., agricultural cooperatives and/or rural, city, town, or village communities.

Associations of LIDs are established under the Land Improvement Law at both the Prefectural level and at the National level. These associations promote the common interests of their member LIDs. At present there are 47 associations at the prefectural level, and a single national federation. Within the government, oversight of the LID associations is done through the Ministry of Agriculture, Forestry and Fisheries (MAFF) or the respective Prefectural Governor. The organizational structure of an LID is shown in Figure 1.

Figure 1: Typical structure of a Land Improvement District in Japan



Source: Watanabe and Ogino (2003)

Land Improvement District in Japan usually works in close collaboration with a governmental organization like a regional office of prefecture government. When LIDs form a federation in a prefecture, it may work in cooperation with the prefecture government itself. Also the national federation of Land Improvement Associations keeps good relationship with the Ministry of Agriculture, Forestry and Fisheries, which has the jurisdiction over irrigation and drainage policy and administration.

3.3 Functions of LIDs

The primary activities of the LIDs are to undertake works such as new construction/improvement of irrigation/drainage facilities, and the subsequent operation, management, and maintenance of these facilities. LIDs also aim at integrated water and land management. Therefore, LIDs undertake land consolidation, rural road construction and land reclamation for the preservation or utilization of farm lands. LIDs may also undertake projects, which are closely linked to land improvement projects, such as rural community sewerage projects, small-scale hydro-power generation projects, fish culture, and cultivation of headwater conservation forests.

The unique feature of LIDs is that the irrigation projects are constructed on the initiative of farmers and the potential beneficiaries in fact plan and design the project keeping in view their water requirements. The LIDs recover the O&M cost and a part of the fixed cost of the project from water users by charging appropriate water rates. The traditional village associations act as sub-structures of LIDs and undertake the O&M of tertiary and quadric canals. These water users' associations are usually very old village organizations being existent for about a century and are informal. But the LIDs are legal entities. The LIDs construct irrigation projects with subsidy and long-term loans from national and prefecture government and farmers' contribution. The LIDs' activities are demand driven and based on 'beneficiary pays' principle.

The LIDs have become successful in resolving conflicts among water users by their impartial attitude to all the farmers (Tanaka and Sato 2003). They remain neutral in arbitrating disputes between farmers and try to ensure organizational transparency. The LIDs attach importance to local customs and fairness of outcome as well as procedure. They mostly rely on self-governance system of villages.

3.4 Cost Recovery and Water Rates

LIDs believe in 'beneficiary/user pays' principle. The water fee for members is composed of two components: (i) 100 per cent of the construction costs of projects implemented by the LIDs, of the LID portion of the costs for prefectural or national systems, and (ii) 100 per cent of the operations and maintenance costs. Since land improvement projects are very costly, the costs of construction are usually shared among the government, prefectures, municipalities, and the concerned LIDs. Even with a capital subsidy from the prefectural or national governments, farmers can hardly pay their share of the burden at one time. For this reason, LIDs have the right to receive long-term and low-interest loans from the government.

Water fees are charged on acreage basis at the rate of US$ 435/ha/year (INPIM 2004b). In Japan this is equivalent to 0.25-0.30 tons of paddy or 3 per cent of paddy yield. In general, the level of expenditure assumed by farmers for money invested in O&M of irrigation systems is less than 5 per cent of the income generated by the cultivation of farmland. In addition to the "service" fees, farmers are also required to share a part of the monetary burden of facility construction costs and LID operational expenses.

In recent years however, due to various socio-economic changes in rural regions, the proper O&M of the systems have been bringing great benefit not only to farmers but also to local

communities as a whole. For this reason, although a considerable portion of the cost incurred in the O&M of the irrigation systems falls upon the LID farmers, local governments and municipalities are increasingly bearing at least a part of the monetary burden. Furthermore, there are systems by which the national government subsidizes part of the cost necessary for the periodic repair and management of facilities that meet certain criteria. In recent years the aim has been to gradually expand these government subsidy systems.

The subsidy amount for different types of irrigation schemes differentiated on the basis of served command area from different levels of government such as national, prefecture or district is mentioned in Table 1.

Table 1: Stratified Project Scheme with Different Subsidies

Eligible Organ	Command Area	C.A. below the tailend	National subsidy
National	> 3000 ha	> 500 ha	2 / 3
Prefecture	> 200 ha	> 100 ha	1 / 2
District	> 20 ha	> 5 ha	45%

Source: Minami 2003.

In fact the projects are approved only if the potential water users agree to bear the cost of construction stipulated as LID's share and the O&M costs of the projects. Water rate collection is as high as 95-100 per cent of the assessed amount.

4. Strengths and Weakness

The strengths of LIDs have been highlighted by many authors (Azumi 2005; Hiroo and Yamachio 2004). It is highly acclaimed that LIDs are demand driven created on the basis of farmers' initiative. The beneficiaries of the LIDs bear the O&M expenses and also a part of the construction cost. The LIDs are established on 'beneficiary pays principle' and 'pay as you go' motto. The salaries of the LID staff are paid from the collected water fees, which ensures accountability of the staff to the LID members. All decisions regarding water management and development are taken through iterative discussions and redesign till the farmers agree and sign. However, currently LIDs are facing many problems as follows (Azumi 2005; Minami 2003).

- Most of the LIDs are small in size and have weak financial base.
- Financial health of LIDs is weak due to unviable irrigated agriculture.
- Alteration of farmlands after Projects due to the high shadow price of farmlands;
- Uneven relationship between farmers and government: Delay in construction and cost escalation solely due to government management;
- Drive towards new projects, vulnerability to political interference, and high transaction costs;
- Red tapes require large bureaucracy and cause distortion in the Project design;
- Urban sprawl and adverse economic circumstances undermine the viability of Districts;
- The communal value and organizations, on which Districts rely, are disappearing;
- Calls for the conservation of farmlands are ever increasing for their multi-functionality.

The following remedial measures are required to revamp the functioning of LIDs.

- The government undertakes the management role of key facilities
- More support by local governments and non-farm communities
- Survival by servicing municipalities and industries
- Debates towards the water right trade to save rehabilitation costs and remove over capacity

5. Second Generation Problems

During the process of high economic growth and increased urbanization in Japan since the 1960s, there has been a visible trend of decreased number of farmers due to progressive rural depopulation caused by outflow of young people to cities. At the same time the number of part-time, weekend and aged farmers is increasing in rural areas (INPIM, 2004). As a result, the nature of Land Improvement Districts has substantially changed. The LID members are predominantly part-time farmers with a small number of full-time farm households.

The original Japanese irrigation institution is highly participatory but socio-economic changes are calling for participation sustaining measures. The Japanese farming sector is confronted with several second-generation problems due to the changes taking place in rural areas. The problems that should be looked into while taking measures for sustainability of LIDs are mentioned below (Ounvichit and Satoh 2002).

- Decline of paddy area (65% of cultivated area in 2001)
- Increased part-time farmers to 85% of total (Rural Development Planning Commission 1992).
- Voluntary community management more difficult resulting in increased burden of LIDs.
- Increased age of farmers (above 60)
- Disinterest in farming by the younger generation
- Need for a new water distribution pattern to cater to needs of both part-time farmers and weekend farmers as well as new crops
- Water and non-water demand of non-agricultural population in the irrigation area
- Shrinkage of farmland
- Usage of irrigation channels as sewers
- Deterioration in water quality
- Non-viable irrigated agriculture: increasing membership fees difficult, which further increases the burden of LID
- Weakening financial viability of LIDs
- Sale of water by the irrigation LID to cities for domestic and industrial consumption
- Need for integrated water resources management.
- Increased work volume for LID staff, higher operational cost, and less possibility of system improvement at the LID's own initiatives
- Questionable direct personnel and financial support from governments
- Alienation of farmers by LID manipulation
- Increased land idling and land rent
- Potential increase of farm scale and, possibly tenants in the long run
- Need for new farm management and entrepreneur skills
- Potential of farming contract by farm machine operators
- Land use zoning and fee to LID for converting farmland for other use
- Vulnerable to political interference

The above trend observed in Japanese countryside has aroused differences in opinion about the management of the irrigation facilities and has also undermined the voluntary spirit of cooperation within the LIDs. The urbanization raised the number of weekend farmers and non-farmers in rural areas. The expanding peri-urban areas have introduced mixed residential areas where farm and non-farm households co-exist. The non-homogenous habitation pattern has changed the local social system and has decreased the community spirit. Non-agricultural water demand and needs for safety has increased. Due to increase in part-time, old age farmers and non-farmers in rural areas, maintenance work is suffering due to less number of volunteers for maintenance and repair work, while maintenance requirement is increasing because of more wastewater, silts and trashes in the channels. Inadequate maintenance increases the management cost and adds workload to the LID staff. Change in management style e.g. computerization or pipe irrigation may need to be introduced. Water quality is a particular problem, as municipal wastewater and refuse are allowed to flow into irrigation canals managed by the LIDs.

Newly constructed LIDs, as well as newly modernized LIDs, require sophisticated management technologies including water management/control equipment for rationalized management and labour saving. The necessity to properly and safely manage such large-scale and advanced irrigation/drainage facilities poses a problem for the management systems of the LIDs; there is a new need for highly trained technical staff, including dam management engineers, electricians, and other technical personnel for daily checking and maintenance.

Financial viability of farm enterprises poses another set of challenges. While farm incomes are declining with the internationalization of agriculture and liberalization of farm products including rice, the expenses of constructing and managing land improvement projects and the operation costs of the organizations have steadily increased. Under such circumstances, small-scale LIDs, which still account for an overwhelming majority of cases, are merging to benefit from economies of scale. Both the national and prefectural governments are subsidizing some of the expenses of the LIDs in preparing master plans and strategies for responding to these new circumstances.

Multiple uses of irrigation facilities, especially the recreational use of storage reservoirs, increases the risk of accidents such as falls at dam sites, on headworks, or along irrigation/drainage canals. This highlights the necessity of strengthening safety management measures while ingeniously utilizing irrigation/drainage facilities as recreational areas.

The management of land improvement facilities is the responsibility of each LID; however, these facilities provide support to agricultural production and the entire populace of the Japanese economy are benefited. In this sense, LIDs also constitute a type of public good, and it is imperative to properly manage them. The Government has taken a variety of measures to ensure this, including:

- Unification and merger of LIDs
- Subsidies for advanced technologies needed to manage large-scale irrigation/drainage facilities
- Subsidies of the LID's management systems, consolidation/repair of land improvement facilities, enhancement of management engineers' technical skills, etc.
- Local allocation taxes are allocated to prefectural and municipality governments as a measure to provide the source to fund the costs for shouldering land improvement facility management.

The on-going government promotion of LIDs unification and reorganization to lessen the burden of operational costs and to unify the power to negotiate for more government support is not sufficient. Currently, governments provide subsidy for LID mergers and have expanded

their role in irrigation management, claiming that the irrigation systems also provide water for other purposes e.g. fire protection, waterfront environment, drainage channel, groundwater conservation, flood control, traditional rural scenery and culture. There is an apprehension that if people do not come forward to take up the core role in formulating regional water use system through coordinating and reviewing the utilization of irrigation water, the increasing complexity in water control due to inter-connectedness of hydrological regions and inter-sectoral water allocation may lead to inadvertent centralization.

6. Establishing Sound Water Circulation System

In Japan, besides the quantity of water resources, a lot of stress is put on the notion of a sound water circulation system (ICID 2000). This section draws heavily from ICID (2000). The attempt to establish a sound water circulation system started with the constitution of a Liaison Committee comprising members from concerned Ministries and Agencies in order to obtain consensus. The LIDs are expected to play a major role in preserving the water circulation system by maintaining irrigation facilities, and checking misuse, excess use or abuse of water. A sound water circulation system means that quantity and quality of water are secured when the water is used by recycling among rivers, underground and the places where people live and work. Because of the trend of less precipitation in recent years and difficulties of developing new water resources, the water system cannot meet demand, so existing water resources must be reorganized to use water more effectively. The problem of water pollution in agricultural water, public water areas and groundwater has arisen due to various types of waste water from households flowing into agricultural canals, improper treatment of livestock excrement, improper use of chemical fertilizers and agrochemicals, and others. Natural recycling, which is a core function of agriculture, should be promoted by restructuring the recycling system.

A sound water circulation system can be established by ensuring the various functions of forests and farmland including the stable flow of rivers, cultivation of water resources and ground water, and water purification; stable use of water by developing and maintaining water resource facilities; treating water pollutants caused by production and living activities and preserving biota, the natural environment, and landscape.

In order to build a sound water circulation system, it is essential that the ministries and agencies concerned and those living in catchment areas (irrigators, inhabitants and so on) recognize the role of forests, farmlands and agricultural activity in the water circulation system. It is necessary to quantify the circulation of irrigation and functions of cultivating water resources in each catchment area. Furthermore, it is also necessary to promote awareness that irrigation is not merely using/consuming water for agriculture but also creating it by recycling and recharging.

Each catchment area has its own topography, social and economic conditions, and historical background of water. So, not only water use but also the types of water circulation vary among catchment areas. Sound water circulation is achieved through sound economic and social activities by the people who live in the area. An independent approach by the inhabitants is required. For these reasons, the construction of a sound water circulation system should be approached as a problem for the local people; a consensus is required among the stakeholders, including those who use directly water in the catchment areas, fishermen, and other interested parties. It is neither sound to regulate by national standards, laws and regulations, nor to use compulsory administration. Therefore, an autonomous approach based on local and farmer participation in the catchment area is the basis of a sound water circulation.

Sound production and living activities support sound water circulation. Therefore, the attitude and water management practices of those who actually use water are important. It is necessary

to form a consensus and common objectives for actions among water users. The administration (central and prefectural governments) should neither mandate these objectives nor regulate, but should cooperate with water users and the local people. The administration should also deal with the issues that cannot be addressed by water users and the local people, and should support the self-governing activities in catchment areas by listening to the needs of these people. Local initiative based on local knowledge of water environment and water users' participation will go a long way in establishing a sound water circulation system.

Moreover, close cooperation is needed among private water users, the local people, and the "public" municipal governments. But, a sound water circulation system cannot be built through cooperation with the private and public sectors alone. The role of community based LIDs is very important. LIDs have gathered much know-how about how to manage the environment in Japanese traditional farm villages. But due to the critical situation facing agriculture and farm villages including low prices for agricultural products, urbanization and farmers and non-farmers living alongside in agricultural and rural communities, depopulation and aging, the financial health of LIDs has weakened.

On the other hand, with the progress of urbanization and farmers and non-farmers living alongside in the community, irrigation management must play an ever-greater role, including dealing with larger inflows of sewage from households, and providing water areas for recreation. Therefore, municipal governments are increasingly becoming involved in the management of irrigation facilities. However, in districts where farmers and LIDs are not strongly positioned, it is difficult to reach agreement to receive support from the municipal governments. Therefore, LIDs should prepare themselves to play the broader role of managing the environment and resources in the community and should not think themselves merely an entity for managing agricultural water. It is also necessary to restructure the community in the region where farmers and non-farmers live together, and to build a system that they can manage by themselves in coordination with the LIDs. Private farmers and non-farmers, community based LIDs and public municipal governments must share the roles and cooperate with each other. Since irrigation supports a sound water circulation system, preservation of the environment of agricultural villages should become a nationwide movement by people including city-dwellers, with LIDs taking the lead role. The active management of local resources and environment must be considered carefully.

Thus, in near future the LIDs will have to play the challenging role of controlling water pollution by recycling use of water resources and propagating pollution-abating water and land management practices, preserving agricultural land and the eco-system by maintaining harmony with natural environment.

7. Role of LIDs in the Changing Context

Urbanization has increased spectacularly in Japan along with economic growth since the 1960s. Even within rural communities, the number of part-time and week-end farmers and non-farm houses has increased significantly. At present, farm houses account for as low as nearly 16 per cent of the total households in respective communities to which they belong. As already discussed in previous sections the changes that have come about in the Japanese countryside are: increase in non-paddy area, increased number of part-time and weekend farmers, increased age of farmers, disinterest in farming by younger generations, increase in non-agricultural population, increase in water demand for non-agricultural purpose like recreation, usage of irrigation channel as sewers, increased land idling and land rent, potential increase of farm scale and contract farming, less precipitation, increased water pollution (Ounvichit and Satoh 2002). Therefore, the LIDs are to undertake multiple functions like preservation of the national land and water environment, establishing sound water circulation system, providing beautiful landscapes, and creation of resident-friendly countryside. Due to the change of rural communities, irrigation facilities are gaining new roles. In addition to the

original function for irrigation and drainage, they also have a more public role such as preventing flooding of urban areas, and providing amenities in the form of clean streams of canal water through urban areas for recreation, use of irrigation channels as sewers etc.

According to the Meteorological Agency (2002), in Japan due to emission of green-house gases, the ground temperature is rising by 1.3 per cent for every 100 years, a rate higher than the global average of 0.6 per cent. As a result, precipitation is gradually decreasing, while fluctuation is widening. This is becoming apparent from the abnormal weather in recent years (concentrated heavy rainfall and drought), which is likely to become a greater concern in the near future as the situation becomes more serious. As a result of these effects, water supply is predicted to decrease while demand will increase due to higher temperatures and climatic aberrations.

Under the above circumstances, new measures should be undertaken. As a matter of fact since 2001 the Japanese Government has been working on the "21st Century Land Improvement District creation movement" by integration and improvement of LIDs. It is observed that the number of LID has decreased by merger of LIDs every year as shown in Table 2. The number of LIDs has decreased drastically from 7681 in 1995 to 6559 in 2002.

Table2: Change of the number of LID

Year	1995	1996	1997	1998	1999	2000	2001	2002
The number of LID	7,681	7,573	7,414	7,297	7,137	7,004	6,783	6,559

Source: Sakura et al. (2002)

LID has some important roles such as agricultural development, a stable supply of food and agricultural country environmental preservation through the management of farmland and irrigation institutions. Therefore, the projects to strengthen and activate LID are very important. The Japanese government is planning to economize agricultural water management by these measures.

In the changing context the LIDs are required to strengthen their structural and financial basis and expand their role to become not only organizations for irrigation management but also the focal bodies for overall water and land development, management and their sustainable use in their regions. To take up the challenging activities of establishing a sound water circulation system and preserving the eco-system support from the government will be necessary as LIDs take on an even greater public role. At present, the Government is reconsidering the framework of agricultural policy and will be formulating a new Agricultural Law in the near future. One of the main elements of this agricultural policy will be to enhance the operation and management of LIDs. The LIDs are expected to play multi-functional roles which include preservation of the national land, water and the environment, providing beautiful landscapes, creation of resident-friendly countryside, etc. The LIDs should aim at community development and not just rural water management (Azumi 2004)

The Japanese Government hosted the Ministerial Conference, on the occasion of the 3rd World Water Forum, in March 2003. The Ministerial Conference considered possible international cooperation on water issues, in coordination with civil society and the private sector, for implementation of necessary actions. As one of the outcomes, the Ministerial Conference announced the Portfolio of Water Actions (PWA), a compilation of concrete actions submitted voluntarily by governments and international organizations either individually or collectively with their partners (Japan 2003). A total of 501 actions were presented by 43 countries and 18 international organizations by March 2003. The Ministerial Declaration adopted at the Ministerial Conference clearly states the following as to follow-ups

to the PWA: "We welcome the proposal to establish a new network of website to follow up the Portfolio of Water Actions that will publicize actions planned and taken on water-related issues by countries and international organizations in order to share information and promote cooperation." Japan volunteered to manage this network during the initial stage in cooperation with relevant international organizations as the host of the Ministerial Conference. Japan intends to introduce its 91 concrete actions to other countries through the network.

The experience for the water environment management in Japan are applicable to other countries, so that Japanese government has taken the effort to disseminate the experiences through various programmes e.g. joint research, exchange of specialists, acceptance of trainees, loan and grant assistance. As one of the PWA, the Ministry of the Environment of Japan proposed "Water Environment Partnership in Asia (WEPA)" at the Third World Water Forum as a new initiative in developing a platform for strengthening water governance and capacity building to solve water environmental problems in the region. The main activities of WEPA are development of databases that will serve as a common information platform on water environment. The databases will be made public through Internet among the relevant stakeholders including government officials and NGOs as a common asset. Thus Japan can show the road map of participatory irrigation management for sustainable development and management of land and water resources to other countries in Asia.

8. Concluding Observations and Policy Options for India

Since 1990s most of the state governments in India have been implementing Participatory Irrigation Management in a mission mode under economic restructuring programme with financial assistance from World Bank, European Commission, Department for International Development and Japan Bank for International Co-operation or under state initiative. The farmers are organized to form Water Users' Association and take up the functions of O&M of tertiary segment of canals, water allocation among water users and collection of water rates. Thousands of WUAs have been formed and the above responsibilities have been turned over to WUAs in many states like Andhra Pradesh, Orissa, Karnataka, Madhya Pradesh, Maharashtra and Gujarat. For the changing role of farmers from passive clients or customers of water service to active managers of water resources, appropriate amendments have been made in existing irrigation laws or new Acts have been legislated defining the role, responsibility and functions of WUAs and the Water Resources Department.

A careful analysis of recent PIM movement in India and the age-old irrigation institution of LIDs in Japan reveal that there are many differences as mentioned below.

LIDs in Japan

- Projects are constructed on farmers' initiative and thus demand driven and need based.
- Meticulous prior agreement between government & farmers with respect to cost sharing, government subsidy and loan component
- Farmers' contribution in project cost is clearly spelt out before commissioning the project
- Projects are finalized after a series of discussion and consultation with the beneficiaries
- Government participates in farmers' project
- Mandatory membership
- Operate and maintain irrigation systems above tertiary level and WUAs operate below tertiary level

- Approach is integrated water and land management including development and management of irrigation system, land reclamation, land consolidation, rural roads etc.

WUAs in India

- Investment decisions in irrigation projects are taken by the Government with advice from irrigation technocrats and executives
- No prior agreement between Government and WUA before construction of project
- Farmers do not contribute in project cost
- No discussion with the beneficiaries regarding plan, design of the project
- Farmers participate in government's project
- In most of the states membership is voluntary
- Operate and maintain tertiary irrigation systems and below at the field level
- Approach is irrigation management without regard to land consolidation and land reclaimation activities

Conditions for Success of WUA in India

Though several state governments in India have taken policy decision to encourage farmers' participation in irrigation management and attempts are under way to motivate farmers to form WUAs, the farmers' response in this regard is not up to the satisfaction. The success of such organization depends on some fundamental factors as mentioned below (Swain and Das 1999; Swain and Kar 2000):

(i) Felt needs
(ii) Common interest
(iii) Collective effort
(iv) Effective leadership
(v) Bureaucratic commitment of the agency involved
(vi) Political will of the party in power
(vii) Financial viability
(viii) Enabling policy and legal environment
(ix) Effective role of change agents
(x) Agriculture is the major source of income and commercialised
(xi) Land tenure security
(xii) Benefits due to participation are tangible, substantial and guaranteed
(xiii) Existence of indigenous community organizations

Some of the above factors are also highlighted in review of world-wide experience with water users' organizations (Meinzen-Dick et al. 1997; Johnson et al, 2002) as critical factors that influence the likelihood of success of devolution programmes.

It is often argued that state sponsored programmes meet with failure due to its top down approach to solve localized grass-root problems. The local problems in natural resource management like water and land should be resolved through local initiatives and peoples' participation. In case of irrigation management the farmers should themselves feel the necessity of forming an organization or association to improve the situation. There should not be any imposition from above. The change should be spontaneous and demand driven based on bottom-up approach.

Moreover, the farming community should perceive that the Pani Panchayat / WUA would serve their common interest. There should not be disproportionate distribution of benefits among farmer groups. If the group of water users is small and homogeneous, conflicts are less. It is not

mere felt needs and common interest that will foster WUAs, more importantly majority of water users should strive collectively to set up WUAs. For motivating and organizing the farmers there should be effective leadership. Capable, efficient, honest, trustworthy farmers should be elected as office bearers of Pani Panchayats.

The irrigation bureaucrats should be committed to the cause of organizing farmers to form WUA and to decentralize and delegate power to them. The political party in power should provide all out support for implementing the programme successfully. In Andhra Pradesh and Orissa the success of WUA is solely due to the initiative taken by the ruling party under the dynamic leadership of the concerned Chief Minister.

There should be necessary amendment of irrigation rules and acts to incorporate the role of WUAs in irrigation management. There should be clear policy guidelines to implement PIM. For adjudicating the conflicts within and among WUAs there should be special water courts. Spain has established a special system of water courts for adjudicating water conflicts. Specialized water courts tend to work better than the regular courts, since the former are often clogged with pending cases and unfamiliar with water issues.

Furthermore, the WUA should be financially viable by raising its own resources from different sources. The WUAs need to have reliable sources of income; otherwise they can hardly be sustainable. Different categories of income to WUAs are as follows.

- Sale of water
- Sale/leasing out common property resources
- Fees and contributions
- Commercial operations
- Maintenance Contracts
- Subsidies and grants

The role of change agents in fostering WUAs is very important. Change agents are roles coming from outside the government-service provider-farmer chain of responsibility (Johnson et al., 2002). These include local and international consultants, international banks, bilateral funding organizations, UN agencies, local and international research organizations, NGOs, including WUAs. Acting in this role, change agents bring in new ideas, evidence of successes and failures elsewhere, pragmatic action plan, robust research findings, and perspectives and values that may challenge local orthodoxy and inertia. To be effective, international change agents should collaborate and work with local change agents to provide technical support, new ideas, legitimacy, methodologies and financial assistance for strengthening the restructured institutions steering them in right direction.

In general, the more commercial the agriculture, the easier it is for farmers to pay actual costs of delivering irrigation supplies and to pay for higher quality service. Countries that are seriously interested in institutional reform must also support well-designed agricultural development programmes.

Bardhan's (2000) empirical study of 48 indigenous irrigation communities in South India reveals that cooperative behavior in an irrigation community is by and large negatively related to inequality of landholding, to urban or market connections, and positively to duration of access to water, monitoring by guards, and in some cases to social homogeneity, small group size, proportional cost-sharing rule, and collective hostile relation with other villages over water.

Sustainable WUAs require an enabling legal and administrative environment, strong political will with clarity of objects, accountable partnerships, and incentives. Empowerment of water

users through capacity building, adequate resource mobilisation, appropriate incentives with timely monitoring and remedial actions can go a long way in strengthening the WUAs. The sustainability of a WUA clearly depends upon internal factors: farm size, location, social stratification and heterogeneity; and external factors such as the institutional environment, legal framework, financial and technical assistance, land reforms, agricultural policies and markets. To ensure effectiveness and sustainability of decentralised irrigation management an integrated and comprehensive reform is necessary.

Success of LIDs in Japan is attributed to spirit of mutual help among water users, pressure for conformity and feat of ostracism, lack of class differentiation and conflict resolution through negotiation (Azumi 2004). Community management of water and land is a century old institution in Japan. The land reform measures have created a homogeneous society with no class distinctions.

From the experience of LIDs in Japan in sustainable water and land management, it can be inferred that the following conditions are necessary for success of WUA movement in India.

- There should be a culture of mutual help, conformity, and conflict resolution through negotiation.
- The government has a reasonable degree of governance
- Partnership between government and farmer
- The irrigation agency does not mind assuming new roles even though it meant some loss of power and associated benefits
- There are committed 'change agents'
- Meticulous preparation of prior agreement between government and community
- Once farmer association created, mandatory participation: enactment of law
- Government participates in community's project (not the other way around)
- Strong government patronage
- WUA should honour customary rules of fairness and remain neutral in arbitrating quarrels between farmers and try to ensure organizational transparency to farmers.
- The downstream farmers accepting the upstream superiority of farmers in head reach which is a hydrological truism based on long-term experience of irrigation systems.
- Integrated water and land management not mere irrigation management. Land consolidation, rural road, land reclamation should come under the purview of WUAs to improve irrigation system efficiency
- 'User pay' principle should be followed in fixation of water rate.
- Linkage with corresponding government institution at each level of WUA

References

Azumi, Hatsuya (2004), 'Enabling Sustainable Water User Associations: A Case Study of Japan's Land Improvement District'.

Azumi, Hatsuya (2005), **'**PPP & Japan's Land Improvement Districts (LID)'.

ICID (2000), Country Position Paper, Japan, Japanese National Committee, ICID.

Baland, Jean-Marie and J.P.Platteau (1996). *Halting Degradation of Natural Resources: Is there a Role for* Rural *Communities*? Oxford: FAO and Clarendon.

Bardhan, P.K. (2000). 'Irrigation and Co-operation: An Empirical Analysis of 48 Irrigation Communities in *South* India', *Economic Development and Cultural Change*, Vol. 48, No.4, pp. 847-865.

Beardsley Richard K. and John W.Hall and Robert E. Ward, (1980), 'Japanese Irrigation Cooperatives', pp.127-152 in E Walter Coward (ed) *Irrigation and Agricultural Development in Asia*, Cornell:University Press.

Brewer, J.S., S.Kolavalli, A.H.Kalro, G.Naik, S.Ramanarayan, K.V.Raju and R. Sakthivadivel. (1999). Irrigation *Management Transfer in India: Policies, Processes and Performance:* New Delhi: Oxford and IBH publishing House.

Chambers Robert. (1988). *Managing Canal Irrigation: Practical Analysis from South asia*,New Delhi: Oxford.

Fujiki, H. (1999), 'The Structure of Rice Production in Japan and Taiwan', *Economic Development and Cultural Change*,Vol.47, No.2., pp.386-00.

Gooneratne, W. and S.Hirashima (1990). *Irrigation and Water Management in Asia*, New Delhi:Sterling.

Hardin, Garrett (1968). 'The Tragedy of the Commons', *Science*, No.162, December.

Hiroo Ito and Isao Yamachio, (2004), 'JBIC Strategy for PIM'.

INPIM, (2004a), Overview of Land Improvement Districts.

INPIM, (2004b), Visits to LID.

INPIM, (2004c), Role of Land Improvement Districts.

Japan, (2003), Freshwater Country Profile

Johnson Sam H., Mark Svendsen and Fernando Gonzalez. (2002). *Options for Institutional Reform in the Irrigation Sector*, presented at the international seminar on Participatory Irrigation Management: 21-27 April, Beijing

Maloney C. and K.V.Raju (1994); *Managing Irrigation Together: Practice and Policy in India*, Sage:New Delhi.

Meinzen-Dick Ruth, Meyra Mendoza, Loic Sadoulet, Ghada Abiad-Shields and Ashok Subramanian. (1997). Sustainable Water User associations: Lessons from a Literature Review', in Subramanian,A., N. Vijay Jagannathan, Ruth Meinzen-Dick (eds.); *User Organizations for Sustainable Water Services*, World Bank Technical Paper No. 354.

Minami, Itaru (2002), 'Land Improvements Districts: Irrigation Development and Management in Japan', paper presented in INPIM seminar held at Beijing.

Mitra, A.K. (1992), 'Joint Management of Irrigation Systems in India: Relevance of Japanese Experience', *Economic and Political Weekly*, Vol. 27, No.26, pp. A-75-82.

Ounvichit, T. and M.Satoh (2002), 'Effects of Institutional Set-up on Participatory Irrigation *Management'*, Paper presented in workshop on Irrigation Advisory services and participatory extension in *Irrigation* Management, Organized by FAO-ICID.

Sakura,Yoshistuna et al. (2002) Efficiency Japan's Agricultural Water Use: Consideration of Economic *Measures*, The 6th Keio and Tsinghua Student's Environmental Synposium.

Sengupta, N. (1991). *Managing Common Property: Irrigation in India and the Philippines*, Sage:New *Delhi*.

Singh,K. (1994). *Managing Common Pool Resources: Principles and Case Studies*, Delhi:OUP.

Singh,K.K. (1991)(ed.) *Farmers in the Management of Irrigation Systems*, New Delhi:Sterling.

Swain Mamata and D.K.Das (1999); *Emerging Trends and Reforms in Irrigation in India: A Perspective of Orissa, New Delhi: MD.*

Swain Mamata and G.C.Kar (2000) (eds.); *Farmer and Local Participation in Irrigation Management*, New Delhi: Commonwealth.

Tanaka, Yukio and Yohei Sato (2003), 'An Institutional Case Study of Japanese Water Users *Association*: Towards Successful Participatory Irrigation Management', Paddy Water Environ,Vol. 1, pp.85-90.

Watanabe T. and Y. Ogino (2003), 'Role of District Level Organization in Decentralized Arrangement of Irrigation Management: Lessons from Land Improvement District in Japan', Paper presented in fourth forum of the series on Water Demand Management, held in Cairo, Egypt on February 2-4, 2003.

Vaidyanathan, A.(1994);`Better Resource Management for Poverty Alleviation', *Economic and Political Weekly*, Vol.31, No.23, June 8, pp.1397-1404.

Wade Robert, (1987), *Village Republics: Economic Conditions for Collective Action in South India*, *Cambridge*: University Press.