Participatory Approach of Water Management and Evolution of Organization in Japan

Nobumasa HATCHO and Yutaka MATSUO

Kinki University, Department of International Resources Management
3327-204, Nakamachi, Nara, 631-8505, Japan.
Phone: 81-742-43-1511, Fax: 81-742-43-1593
E-mail: hatcho@nara.kindai.ac.jp, matsuno@nara.kindai.ac.jp

ABSTRACT
To improve irrigation efficiency, past development placed high priority on engineering and structural aspects. However, it has become clear that without appropriate operation and management system in place, no system can achieve good performance. Participation of the local resources users is inevitable to achieve good system performance and long-term sustainability, which suits to the local environments.

In Japan, community based water management with participatory nature has evolved into a modern legal entity of Land Improvement District (LID), to undertake O&M and rehabilitation/modernization works. However traditional community based management system for managing and allocating water still remains in a peripheral area of a large irrigation scheme, which is the prototype of modern LID. This paper discusses the history and practices of water development and management in Japan and identifies the processes of organizational evolution and draw lessons for effective participatory management.

[key words] irrigation, water management, land improvement district, community based organization, participatory management
1. BACKGROUND

Until the early 1900s, the majority of irrigation systems in the world was developed by users and managed through a participatory manner. Irrigation area has increased from 40 million ha in 1900 to 100 million in 1960 and more than 267 million in 1997. Most of these newly developed areas were constructed through government initiatives using the fund of a nation or donor/colonial government. Similarly management of irrigation systems has moved from the hands of local users to government agencies. In addition, these developments have not been accompanied by the similar increase in operation and maintenance (O&M) financing. As a result, over the past two decades, O&M funds per ha in real terms have declined, hampering the performance of government developed and operated irrigation systems.

Not all problems can be attributed to the lack of participation, but it is recognized to be one of the most important issues in improving irrigation performance. What are the problems of irrigation and how are they related to the lack of participation? Problems associated with irrigation management are many; inadequate water availability at the lowest outlets, poor condition/maintenance, lack of measuring devices and control structures, inadequate allocation for O&M, inequitable water distribution, lack of incentives for water saving, and poor drainage. Many of these problems can be improved by enhancing the participation in all aspect of irrigation development and management.

In the past development activities, the needs of development were assessed from the government side (top-down approach), not from the local resource users. In addition, emphasis was placed on the development/construction aspects, and no due consideration was given to the operation and management as well as required organizational set-up of managing the system. As a result, the performance of the constructed system was poor and the system deteriorated progressively due to poor maintenance and management.

Japan, over the long history of paddy field irrigation, adopted participatory or communal approach of managing water resource. Many of the irrigation system construction was initiated by farmers and management followed. Instead of seeking individual profit or benefit, the maximization of communal benefits was prioritized, which necessitated the long-term perspective of managing resources. People have accumulated their experiences and learned that they could only survive in harmony with nature or within the limit of environmental capacity. Through such processes, the rules of resource use and associations for utilization have evolved, which is now called Land Improvement District (LID).
2. HISTORY OF IRRIGATION DEVELOPMENT AND MANAGEMENT

2.1 Historical Development of Land and Water Resources.

Rice irrigated agriculture has started more than 2500 years ago in Japan by importing technology from China and/or Korea. The paddy field area reached to about 800 thousand ha at 600 with the yield level of 1 ton/ha (see Figure 1). Management and development of land, irrigation facilities and other infrastructures were the responsibility of the Government during the first stage of state formation.

![Figure 1: Historical development of paddy fields and population](source: Nagata(1994), Tomiyama (1993), Yamazaki(1996))

It is estimated about 1.1 million ha of land had been developed until the end of 1500s, and at the time of land tax reform by Meiji government in 1871, there were more than 2.6 million ha of paddy field. The enormous expansion achieved during Tokugawa period was brought about by the continued efforts of strengthening economic base of feudal lords. It was this 300 hundred years when massive development was carried out in the downstream reaches of large rivers. The development was realized through the advancement of civil engineering technology related to mining and castle construction during the period of civil wars. With
the advancement of large-scale irrigation system, small isolated irrigated system dependent on a tank had been integrated into the river irrigation system. This allowed the feudal lords to control peasants by directly controlling the flow of water. Irrigation infrastructures and management as well as customary water use were established during this period and formed a prototype of present irrigation system in Japan.

2.2 Evolution of Organization and Management Practices

Japan has a long history of applying participatory approach in irrigation development and management. Local initiatives in development and management of resources played quite important roles. Through the history of irrigation development, community based management organizations were merged into larger organization and rules of settling water disputes were established. As the development and water use advanced, disputes on land and water uses became unavoidable within and among villages. However, the accumulation of experiences with similar disputes gradually brought about the consent and agreement to consolidate them upon rules for land and water sharing to avoid repetition of conflicts. Thus the basic pattern of water management for irrigation was gradually formulated at the village level first (see Figure 2).

*Federation of Water User Associations
*Irrigation Association Law 1908
*Land Improvement Law 1949

**Figure 2 Evolution of water user association and LID in Japan**
At about 14th century, the power of locally dispatched government officials became so strong that they actually administered and owned the province or the manor where they had been assigned or stationed to. They grouped the local warriors and small landowners as their subordinate, and became the federal lord at the provincial level. Provincial lords had started to compete and fight with each other for controlling better land. Under such circumstances, self-reliant cooperative attitudes gradually were formulated in rural villages, and autonomous village institutions called "So" were established. Under this system, communal management of water resource and forest/grass land (Iriai) gradually evolved. Iriai system allowed villagers from different villages to utilize the same piece of land for collection of fuel woods and grass for animal feed and for manure.

Progress in communal use of water and forest led to the development of communal paddy cultivation system such as transplanting and harvesting with mutual help of community members. This system of farming in collaboration eventually led to the formulation of basic pattern of rural communities in Japan. In addition to farming in cooperation, farmers built their irrigation and drainage facilities together, operated, repaired and managed them by themselves in an autonomous way. Without mutual help and cooperation, water delivery could not be secured and the paddy farming system could not be maintained. The prototype of the paddy farming system unique to Japan had taken shape between 9th and 17th century with 1) land development and administration by landlords, 2) water management at terminal level by autonomous villages, and 3) self-supply of compost for farming.

In spite of fighting among landlords, the water management system at communal level was not much affected by these conflicts and agricultural production continued to flourish. The village self-governance became even stronger and autonomous water management by villages and/or by their federations intensified at the terminal level of irrigation systems. The autonomous water management system thus formed at the terminal and village level had continuously been strengthened and institutionalized in rural communities.

During the Edo period (1603-1867), the feudal lords used rice as a form of land tax, and tax was imposed on a village basis, not on individual basis. Thus the entire village was required to work together to manage the system properly and increase rice production. The villager also worked together to build reservoirs and canal systems, and cooperated to maintain the system in an effective working condition. Village was a territorial community, and within the community the village-based water user group was formed, which was the lowest level of political structure in those days.

Above the village level, the Federation of Water Management Associations was organized to carry out; 1) operation and maintenance of major water use facilities, and 2) water
distribution/allocation and water use coordination. Farmers from concerned villages were mobilized to carry out the operation and maintenance of major facilities such as headworks, main canals, division structures, etc. Minor facilities at the tertiary and on-farm levels were operated and maintained independently by the communal water user groups. The communal water user groups carried out three major tasks, 1) operation and maintenance of terminal water use facilities, 2) ditch cleaning in the spring, and 3) weeding/grass-cutting in the summer. The provision of labor for these tasks was mandatory for the villagers. Even today residents in the rural communities are asked to contribute their labor for several day a year for the management of local resources and common properties in the community.

Although the entire country has been rapidly westernized as a result of modernization after the Meiji Restoration in 1868, it is worthwhile to note that traditional culture and rules of rural communities have been intentionally or unconsciously preserved in Japan. The basic framework of Japanese society started to take shape on the self-help and self-governing management water system developed in the feudal periods.

2.3 Water Disputes

Water disputes had been the continuous and annual events in Japan, where water is the source of life for producing paddy rice. Although Japan has relatively abundant rainfall, the seasonal and annual fluctuation caused water shortages, leading to repeated water disputes, which even ended into violence. To dissolve these conflicts, the political system of feudal lord was not quite capable, since the situation was quite complex and was difficult to understand.

To overcome these difficulties, the customary rules of water allocation were established based on the principle of "priority on older paddy fields". Newly developed paddy fields had to suffer serious damages during drought years. However, the upper stream areas could take water easily, and the principle "priority to upper stream users" was also applied. These two principles do not necessarily match, and water disputes resulted. Eventually, Water User Association at the highest level took the task of resolving water disputes, and customary rules were approved as a customary water right in the former River Law enacted in 1896. The disputes continued until about 1960s when large-scale water resources development started and sufficient water supply was secured. In the early 1900s, water disputes still persisted and more than 72 thousand water disputes were recorded in 25 years between 1917 and 1942.

2.4 Traditional Practice of Managing Irrigation System

In spite of merging and integrating irrigation systems, there still remains traditional communal management system in a peripheral area of a major irrigation system. An example of
traditional management system in the terraced paddy field area in Nara is described to show how the system is still managed and operated in a traditional manner. The area is about 8 ha (originally 10 ha) with diversion from a small river and a main canal of about 4.8 km. The system has been managed and operated in a sustainable manner for more than 500 years (the original construction period is not known and can even go back to more than 1,000 years since its construction).

The present system of management is by a team of six rice-cultivating farmers, whose responsibility is rotated among farmers every year. Responsibilities of this management team include the operation of the head gate and turnouts in main canal for water intake and prevention of overflowing, and the supervision of rotational irrigation at the time of water shortage. Maintenance and cleaning of main canal is carried out once a year before the start of irrigation season in April. Every rice-cultivating farmer needs to contribute his/her labor for cleaning and weeding.

The original main canal was earth, and about 40 years ago it was lined with concrete. Between 1986 and 1988, the concrete lined canal was replaced with U-frame by the prefecture project with the total cost of 80 million yen. Farmers paid about 35% or 28 million yen of the total project cost, and central and local governments subsidized the remaining cost. Cultivating farmers have to pay operation and maintenance costs, including labor cost (6,000 yen per day) for 6 operating farmers, and repair cost if needed. Operation and maintenance cost for 2003 was 17,000 yen per ha, but it fluctuates each year.

Due to the decrease of rice-cultivated area (about 80% of the original area), no water shortage has been encountered in recent years. When water is not sufficient, rotational irrigation is adopted. The management team supervises the water delivery and allocation from the lower portion of the main canal so that everybody gets the equal share of water. It was very laborious work since it sometimes took three days to irrigate all the area.

2.5 Government Involvement in Resource Management in Modern Period

In the modern period, rules of water management system were similar to those of the former communal irrigation system and have been modified according to the needs of new environment. Ordinance on Water Management Association was enacted in 1890 to provide legislative recognition for water user organizations, following the reforms of the Meiji restoration in 1868. With the reform, private ownership of land was recognized and individual landowner was required to pay tax. An Irrigation Association was established to carry out operation and maintenance of water use facilities, with the membership of individual landowners, different from the former water user group based on village unit. However, at
the village level the traditional system of managing water persisted under water user associations, which were not included in newly formed Irrigation Association.

In 1909, the Ministry of Agriculture and Commerce enacted a Land Consolidation Act, which authorized the formation of Land Consolidation Association to implement land improvement projects, including irrigation and drainage works. Thus the construction was carried out by the subsidy from the Ministry of Agriculture and Commerce, while Irrigation Association that was under the jurisdiction of the Ministry of Internal Affairs carried out the operation and maintenance. The dual system of construction and management continued until the post-war establishment of Land Improvement District (LID).

After the World War II, the land reform was carried out during the period of 1946-1950, releasing the tenant farmland of 1.93 million ha to 4.75 million farm household. Private property system was established and tenant lands decreased to about 10 percent of the total farmland. With the change of land ownership, the Land Improvement Law was enacted in 1949 to abolish the previous land improvement system based on land owning classes. Under the new law, LID was created with the membership of cultivator-farmers, in contrast to the old Irrigation Association or Land Consolidation Association composed of only landowners.

LID is a legal entity, which is in charge of performing the operation and maintenance of land improvement facilities. LID is different from the village-based water user groups, because it has the legal rights to carry out its required tasks. Major characteristics of Land Improvement Law is as follows:

1. A legal status was assigned to government operated irrigation and drainage works.
2. LID is to be set up with farmer cultivators as the members. With the application of 15 or more farmers who want to implement a land improvement project, the Governor can approve the establishment.
3. For the implementation of a land improvement project, an application is required with the agreement of two-thirds or more of potential beneficiary farmers. When the project is approved, even dissenting farmers are obliged to participate in the project. The collection of service and general expense fees can be mandatory like a tax.
4. Government subsidy is provided to the project according to the public nature (size, importance), and the beneficiary farmers must repay the remaining cost of construction.

LID has two major functions: 1) promotion of land improvement projects (rehabilitation, modernization), and 2) operation and maintenance of constructed facilities. The number of LID increased rapidly from 6,302 (3,139 were newly established and the remaining was
reorganized from old associations) in 1958, 11,664 in 1970. But after that the number decreased to 8,224 in 1989, and 7,681 in 1996 due mainly to merging of small LIDs. With these integrated functions of construction and operation/maintenance, the participation of farmers has improved in a large manner. Under the present system of Land Improvement Law, farmers can participate in design, formulation, construction, and O&M in an integrated manner, because they are the focal points.

3. LESSONS FROM THE JAPANESE EXPERIENCES

User oriented approach of resource management in Japan proved to be quite successful in maintaining and managing local resources in a sustainable manner. The success of Japan in sustaining paddy irrigated agriculture and managing local resources can be attributed to the long-term evolution of organizations, through which internal rules and coordination mechanism has been established. It has always been the local initiative that promoted such processes and government role were limited to only supportive nature.

3.1 Cycle Oriented Resource Use

During the Edo period, farmers skillfully managed local resources by joining the natural resources of paddy fields, dry fields, commons, rivers, and the surrounding mountains. Forest was very important for their living as a source of fertilizer, fuel and building materials. It was the complex system of production, combining available resources, and was based on material cycle as shown in Figure 3.
The paddy field cultivation in the delta areas of large rivers created different farming practices from the one in hilly areas, where community forest and grassland provided materials for home made manure. However, in low lying areas farmers had to rely on fertilizers such as oil cake, powdered fish, and herring. It is interesting to note that farmers paid to collect human waste from houses in Edo, which was used as fertilizer. Highly cycle oriented system was already in use during Edo period. In other words, such system was necessary to maintain the production level under limited resource availability. As such those who abused resources or violated community rules had to face severe punishment such as ostracism in the village or even death.

3.2 Technology Extension

Small repairs and maintenance of water and flood control facilities were undertaken by community groups, and small scale development works were gradually carried out by wealthy and powerful farmers and local resident warriors. In addition, from the middle years of Tokugawa, wealthy farmers and merchant formed a group to invest in new land development. Investments were recovered during tax concession window of 10 to 20 years, and additional benefits were obtained in the form of rents and tax-exempted lands. Some land owning class farmers or merchant learned the flood control and irrigation technology, and a professional engineering group was even formed to take on civil engineering works.
In the beginning, planning, design and implementation was the job of engineering bureaucrats of central government or feudal lords. But in the latter period, resident warriors and upper class farmers implemented irrigation and flood control as well as reclamation works. Through the involvement of farmers in the construction and rehabilitation works, the capacity of farmers to manage the system improved and the applied technology became more locally adapted.

In modern period after Meiji restoration, introduction of engineering technology from the West was encouraged through hired foreign engineers. Consolidation of paddy fields for intensified production and development of irrigation facilities were carried out by the government initiative. Although modern engineering technology was imported from the West, the application of the technology was adapted to the local social and institutional environments in Japan.

Throughout the development and management of resources in Japan, elite engineers or government technocrats did not monopolized engineering technology. Rather it was extended to local people and adapted to local environments, which in turn allowed establishing long-term sustainability and the system of managing local resources.

3.3 Government’s Roles

The government’s role in irrigation and drainage projects has always been limited to assisting the construction of irrigation systems as well as legislative supports, and the role of management and operation has always been handed to farmers and their organizations. Land Improvement Law specifically stipulates that all land improvement projects will be initiated by farmers and managed through Land Improvement Districts.
Major stakeholders in irrigation development, LIDs, Government/technocrats, and policy makers, are united under the Land Improvement Law for the common objectives of enhancing agricultural production and improving farmers’ living standard. These stakeholders reinforce the function of each other to assist the development and management of irrigation systems in Japan. LIDs were formed into the national federation, and irrigation engineers were grouped into national association as well, and give pressure to policy makers to support their activities as it is shown in Figure 4.

3.4 Incentives and Enforcement of Rules

Farmers need sufficient incentive to work together and manage local resources in a sustainable manner. Without guaranteeing certain prospects of improving their livelihood by participating and organizing themselves to undertake management responsibilities, sustainable management of local resources would be difficult to realize. It was heavy tax burdens in Nara period that brought about the collapse of central control system of land and water. Incentive is not only the availability of water or the increase in production, but overall economic environment and farmers’ living conditions surrounding irrigated agriculture that needs to be improved.

Many of the environmental problems related to land and water resources are caused by inappropriate uses of these resources by users who cannot see any prospects of improving their living conditions or can only survive with unsustainable uses. Participatory management and supporting association can only be sustained when local resource users realized the benefits and their future prospects.
4. DISCUSSION AND CONCLUSIONS

Background of participatory approach of managing resources and its characteristics were first described in a historical perspective. Japan has created efficient resource management system based on the participatory approach over the long history of irrigation development. Paddy field irrigation necessitates the cooperation and mutual help among resource users. The peculiar characteristics of this paddy irrigation farming prompted the participatory approach of management, which maintain internal mechanism of re-distributing water at the time of drought in a rational manner.

In addition, it has been the constant efforts and initiatives of the local people, together with the support from the government or local leaders, which enabled the establishment of present irrigation network and related management institutions, namely LIDs. Legislators and government officers assisted the initiatives of local farmers, and established a framework of law and institutions. Present system of rural development and LID, with supports from politicians and government, is a good example of participatory management, particularly in smallholder and subsistence type of irrigated agriculture.

However, cooperation or participation cannot be automatically attained. To ensure the sustainable management, it seems important to view the management of irrigation schemes from wider perspective of irrigated agriculture. As such, the performance assessment of irrigation scheme should cover wider scopes including overall living standard and multiple roles of irrigation, rather than focusing too much on irrigation efficiency or economic returns.

In addition to managing resources by farmers, the secret of sustainable paddy farming over several thousand years comes from the material cycle mechanism inherent in paddy irrigation. Instead of applying excessive amount of external inputs, it would be important to enhance the capacity of material cycle of paddy farming. Over the history of development in Japan, the harmony with nature, and cyclic uses of resources have always been the basic approach, represented by forest conservation against drought or reuse of sewage water and human waste for irrigation and fertilization. Sustainability of paddy farming should be reestablished taking account of historical approach of managing resources.

Enhancing the capacities of farmers and inducing institutional change and technological innovation are very important but time-consuming process that would even require social and cultural changes. For technological innovation and extension, it would be important to share available technology and know-how with resource users and work together with them. With such efforts, we might be able to accelerate the process of these required changes.
REFERENCES


